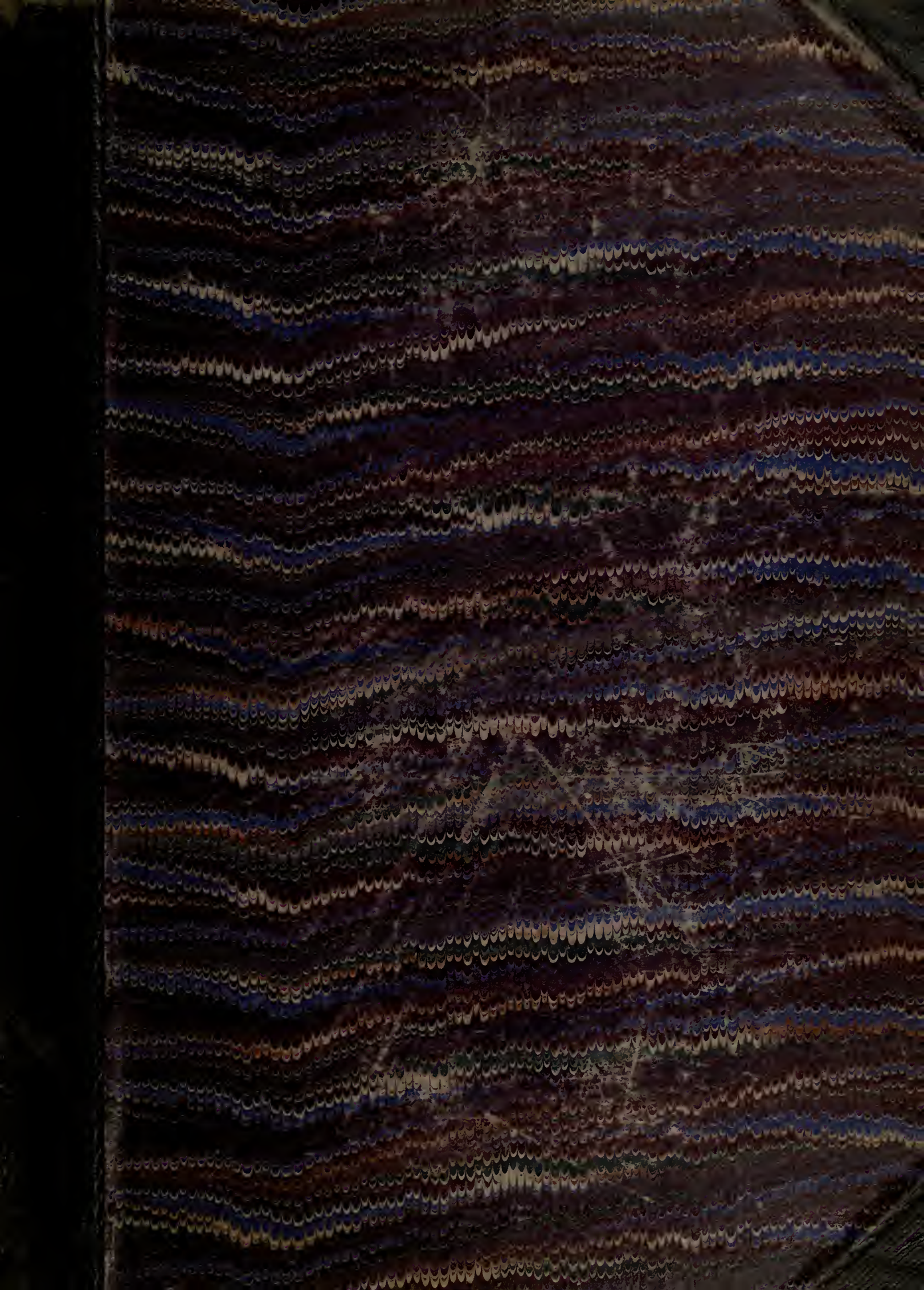


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The Engineering Record's Twenty-fifth Anniversary.

With this issue The Engineering Record enters upon its twenty-sixth year, and while maintaining our steady progress in recording the achievements of engineers and men in allied professions, we utilize this twenty-fifth anniversary number to present some brief reviews of progress in the particular fields in which this journal has endeavored to narrate contemporary occurrences. With this purpose in view, The Engineering Record has secured from gentlemen well known in the profession suggestive reviews of progress achieved in fields of engineering activity with which their names and efforts have been conspicuously identified. Besides these, we have obtained from Mr. Henry C. Meyer, the founder, and until within two months, the conductor of The Engineering Record, a contribution which is the first that has appeared over his signature in this journal. It seemed fitting that, since he has retired from active journalistic work and has no longer any financial interest in the publication he founded, that he should tell the story of the paper's work and development. We anticipate that his article will prove interesting to our readers. The enviable record of the journal's first twenty-five years' work will prove a stimulus and example to those now responsible for its management; whose constant aim it will be to increase its value to its readers and enhance its influence in promoting the material well-being of the public through the agency of the engineering profession.

Beton Fretté.

French engineers have for some time taken an active and leading part in the experimental investigations of reinforced concrete and in the application of this compound material to engineering structures. Recently M. Considére, while conducting a series of investigations at the laboratory of L'Ecole des Ponts et Chauseés, was lead to believe that the compressive resistance of concrete could be very greatly increased by reinforcement with steel in the form of rings or hoops embedded in the concrete near its surface when used in the form of columns or similar members of structures. After many and careful experiments upon specimens of considerable size he has reached certain conclusions upon which he has based rules for guidance in practical design embodying the use of concrete reinforced with hoops or spirals of steel rods or wires, to which he has given the euphonious French name Beton Fretté. The results of his studies have just been published in European journals and the first translation of them published in America is being printed in The Engineering Record. Two portions of the treatise appeared in preceding issues and other parts will follow in succeeding numbers. Some of the results are so novel and important that we deem it worth the while to call the attention of our readers to these articles.

M. Considére has found that the first forms of reinforcement used for increasing the compressive resistance of concrete following, as they did, the precedents of reinforcement for tensile stresses in using bars parallel to the direction of the stresses, were insufficient, for such use of the metal simply adds its resistance to the crushing resistance of the concrete without strengthening the latter. Various applications of steel in planes transverse to the stress, in the forms of radial and intersecting rods and netting likewise did not give as high results as were desirable. Furthermore, it was learned experimentally that the longitudinal rods embedded in concrete which was allowed to set in the air were subjected to very high initial stresses by the shrinkage of the concrete, sometimes even exceeding the elastic limit of the steel. In the ordinary methods of design these stresses have heretofore commonly been wholly neglected, probably because their existence was either hardly suspected or else their magnitude was greatly underestimated by engineers. That this is not safe practice will be evident after a perusal of the statements given in the article, unless the quantity of material used is uneconomical. Besides, concrete prisms reinforced in this way broke as suddenly and with as little warning, upon attaining their ultimate load, as unreinforced prisms.

The hooped concrete, on the other hand, was found to possess a property comparable to ductility of metals so that it could endure sharp flexure and severe overloading with evident signs of distress before its final collapse, thus giving a timely warning. This behavior of Beton Fretté makes it reasonable to use a much smaller factor of safety for it than for ordinary masonry or even for other forms of reinforced concrete. Although the elastic limit is capable of considerable change by manipulation, it is well established by the experiments that it is much below the ultimate strength, in which respect this form of reinforced concrete resembles the structural metals.

The very high unit resistances developed by the experimental prisms suggest the possibility of using smaller sections for members built of this material than for those of other kinds of concrete-steel. It is pointed out that connections, as for example between posts and girders, can be very conveniently and efficiently made with this style of construction, involving no weakening of the parts at the joints as is the case with steel construction requiring holes for rivets or bolts. Columns can be made at once in the desired architectural forms, and need no covering of metal lathing and fireproofing to make them safe and presentable.

Initial application of pressure on hooped concrete raises its elastic limit to that pressure. Therefore the value of the elastic limit is not important for structures made of members subjected to test loads exceeding the working load, and it is proposed to subject such members to a sufficient preliminary pressure before erection. This can be readily and economically done by simple means if the members be manufactured in a shop, and has several manifest advantages.

Steel is manufactured with great care from judiciously selected stock, comparatively high-priced skilled labor being employed. Likewise, the steel shapes are carefully cut, punched and riveted in shops fully equipped with machinery intelligently designed to accomplish work attaining a high degree of perfection. All of these processes in mill and shop are carried on under surroundings made as favorable as possible and subject to careful superintendence and inspection. Why should not concrete columns, beams and floor slabs, for example, be similarly made in suitably equipped shops and transported to the structure ready for incorporation in it just as steel work now is? Then the many elements of the fabrication of concrete and concrete-steel which have been shown by careful experimentation to materially affect the quality of the finished product could be carefully controlled and thoroughly inspected. Instead of using comparatively unintelligent labor for making concrete of this class as well as of other classes, as is now so generally the case, skilled men could be trained to accomplish uniform and reliable results. This would leave, then, only the connections and similar details to be constructed and inspected in the field under less favorable conditions. It would seem possible to accomplish these parts of the work, however, with the desired degree of perfection, and, besides, they could readily be given such additional strength as needed.

The Monongahela Bridge.

Character of Bridge.—There is now being constructed in Pittsburg a bridge to carry the double track of the Pittsburg, Carnegie & Western Railroad Company across the Monongahela River near its confluence with the Allegheny. It will probably be put in service within six months, and will be notable for having the longest truss span yet completed on this continent, and the third longest of that class in the world. It is proportioned for very heavy train loads occupying the whole of both tracks, and the stresses thus produced and multiplied by the great dimensions of the bridge have occasioned the use of massive members; and there are special and interesting details both in the superstructure and substructure, as well as in the methods and operations of construction. The type is a through pin-connected cantilever with vertical trusses and suspended center span, subdivided panels and inclined top chord. Simplicity of arrangement and detail is noticeable and the members and connections conform to the generally accepted modern standards for high class heavy bridge work, with such modifications as have been designed to meet the special conditions of size and stress due to the magnitude of the structure.

The foundations of the four main piers have been sunk to solid ledge rock on timber caissons and within cofferdams by the pneumatic process and support piers, two of which are of monolithic concrete and two of concrete with ashlar facing. The piers have a maximum height of about 80 feet above extreme low water, and include some special features in masonry and concrete work. The outlines of the truss and the elevations, coursing and arch work in the substructure have been studied with a special regard to harmonious effect and suitable appearance.

The location of the bridge is between the Smithfield Street bridge which, a few years ago, replaced one having several spans suspended from long cables continuous from shore to shore, and the famous Point bridge which is an example of long span link suspension bridge.

Comparable Spans.—Of the great bridges which in character and magnitude are comparable with this the first is the Forth bridge, in Scotland, which has two cantilever spans of 1,710 feet each. These have inclined trusses, with enormously long panels, which support a secondary system of longitudinal floor spans. The spans weigh 11,575 tons each, and the bridge, 5,330 feet long, cost about $16,000,000; and required several years to build. Its design is radically different from this bridge, in that all of the connections were field-riveted and involved enormous connection plates with indeterminate stresses in them, and that the principal members were of tubular cross-section built piecemeal in position by an elaborate plant established at the site.

The Monongahela bridge, on the contrary, is built entirely of standard materials and with members adapted to the general practice in American shops. All of the members are entirely completed at the shop, are shipped whole and will be assembled together with the usual erection apparatus which is provided for on heavy bridge construction. The total cost of the bridge will be about $800,000, and it is expected to be put in service within 18 months after beginning foundation work.

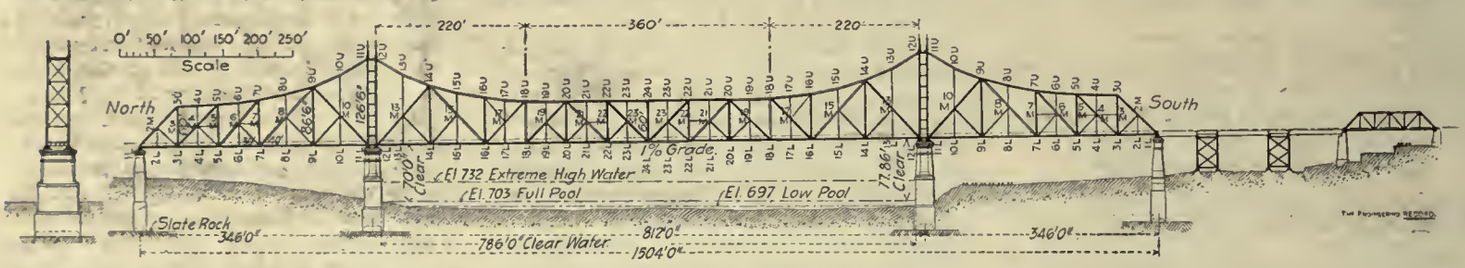
The Lansdowne bridge in India has a channel span of 820 feet, and is also a riveted truss through cantilever which was built in England. It has inclined trusses with special members varying widely in character and dimensions. Some of them were shipped in sections to the site and laboriously built up on falsework; others were assembled whole and the erection involved an elaborate combination of systems and apparatus which produced tedious and costly work, and required considerable alteration and adjustment.

The Memphis bridge across the Mississippi River has over the channel single-track through pin-connected cantilever trusses, of 790½ feet span. This design conformed to standard shop practice and was erected by a combination of the falsework and cantilever methods. The single-track bridge across the Colorado River, at Red Rock, Arizona, has a channel span of 660 feet, and is also built with pin-connected through trusses which, like those of the Memphis bridge, are in vertical planes.

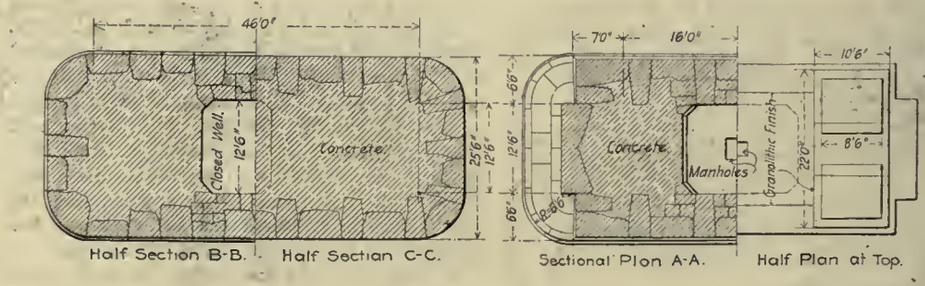
The other largest spans yet built have been suspension or arch bridges, the longest being the 840-foot highway arch across the Niagara River, and the 1,600-foot suspension bridges between New York and Brooklyn. A bridge now under construction across the East River at Blackwell's Island, New York, will have three pin-connected cantilever spans of 630 feet, 894 feet and 1,184 feet respectively, and, being proportioned for six lines of track, two roadways and two sidewalks, will be of enormously heavy construction.

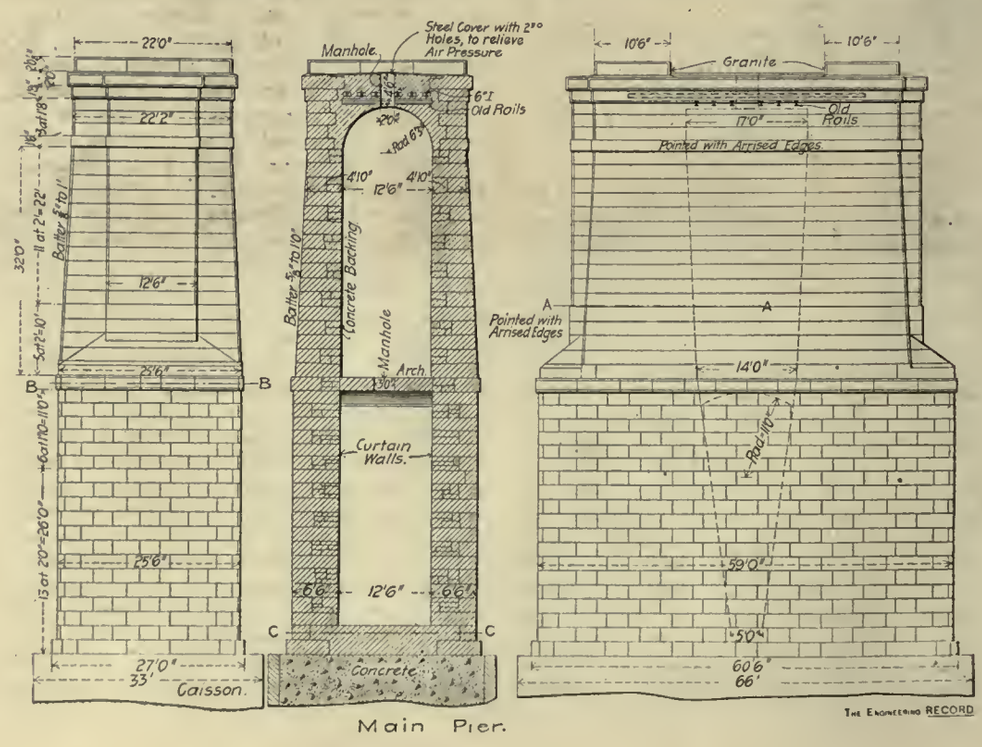
Another double track bridge across the St. Lawrence River, at Quebec, will have a channel span of 1,800 feet. It is now under contract, and the main substructure is substantially completed; but no work has been done on the superstructure and it will probably be two years before it is in service.

Piers.—The four piers are about 110 feet high from the footings to the tops of the bridge seats. The two piers which support the main vertical towers of the superstructure are located 812 feet apart on centers, at the opposite edges of the low water channel, and are called shore piers. They are seated 2 feet below extreme low water on caisson foundations which extend about 42 feet further to the solid rock. They are 27x60½ feet at the bottom and 22x34 feet on top of the coping. Each pier was practically built in two stories, the first being 39



GENERAL ELEVATION.





feet high and terminating with a slightly projecting belt course just above extreme high water mark. It has ashlar face masonry and is backed with concrete built with a central well as shown. The well is covered with a concrete arch which forms a solid top for the pier and is reinforced by a layer of 6-inch I-beams parallel to the bridge axis just above the arch, and by another tier transverse to the bridge axis which are bonded into the concrete by lug angles riveted to their webs. The well is not provided with a permanent ladder; but is accessible through an upper manhole having a steel cover perforated with 2-inch ventilation holes.

The masonry throughout is of first class rock-faced, sandstone ashlar, in courses about 2 feet high backed with concrete of three grades.

Portland cement, furnished by the Atlas Portland Cement Company, was used, and was required to have a tensile strength of 400 pounds for neat cement seven days old; 200 pounds for 1 to 2 mortar seven days old; 175 pounds for 1 to 3 mortar seven days old and to show a gain of 33 per cent. in strength after twenty-one days longer exposure under water. Pointing mortar was made 1 to 1, all other mortar 1 to 2 mixed dry. Concrete was made from gravel dredged from the Allegheny River. It was made in a cubical mixer with the cement and sand mixed dry and water and gravel successively added. No. 1 concrete was proportioned 1 cement, 2 sand, 4 of fine gravel not larger than pea size. No. 2 was 1 cement, 2 sand and 5 gravel. No. 3 was 1 cement, 3 sand and 5 gravel. No. 3 concrete is used for the hearting throughout the lower story of the pier, that is: for a height of 39 feet, to the top of the twentieth course. Above that level No. 2 concrete is used up to the coping, except underneath the pedestal stones at each end of the pier where No. 1 concrete is used.

The two anchor piers are smaller than the shore piers, and of entirely different construction, each of them having two separate and independent monolithic concrete towers supported on a single caisson foundation and united just below the coping by a concrete arch wall 7½ feet thick. The south anchor pier is 62.15 feet high above the top of the caisson, and the north one is somewhat lower. The external corners are shown angular; but were rounded to a radius of 3 inches. The reaction platforms and the lower set of anchor bars are built in the concrete. The upper lengths of the anchor bars are pivoted for longitudinal displacement around their lower pins as centers and are accessible in vertical shafts with horizontal entrance tunnels on the inner faces of the piers about 28 feet below the coping.

The facing above the ground is No. 1 concrete built irregularly into the hearting, so as to secure a good bond. No. 2 concrete is used for the lower 3 feet directly under the reaction girders and also to enclose them, and for the remainder of the piers above the bottom of the well hole. The rest of the concrete is No. 3. The top of the pier is stiffened by two sets of twisted square steel bars embedded in the concrete as shown in the drawing, and the coping is finished with a monolithic sidewalk surface. Throughout the hearting of both the anchor and the shore piers, one-man flat stones are bedded in the concrete.

Caissons and Cofferdams.—The anchor pier caissons were 14 feet high. The cofferdams 33½ feet high were made in two removable sections bolted to continuous vertical timbers which were built into the walls of the caisson. Both caisson and cofferdam were built mainly of 12x12-inch timber, and the former was sheathed with two thicknesses of coursed 2-inch planks. The cutting edge was of special construction as shown in the detail, and had a lower horizontal face 8 inches wide made with the back of a channel countersunk bolted to the timber. The caissons were sunk until their tops reached a level 2 feet below low water. The caisson walls extended 5 feet above the top of the roof to the working chamber and thus formed an open crib which was filled with No. 3 concrete to sink the caisson.

The two 33x66-foot caissons for the main piers are 44 feet high, and correspond with those for the anchor piers in general design and details,



STRESSING AND CONCRETING LOWER SECTIONS OF ANCHOR BARS.



LOWERING REACTION GIRDERS.



CONCRETING UPPER PART; MOLDS AND ARCH CENTERING.



CAISSON AND MORAN AIR LOCK.

MONONGAHELA BRIDGE, NORTH ANCHOR PIER.

the principal difference being that the cofferdam is a single crib covering the whole area of the caisson instead of being divided in two separate parts with a space between as in the anchor piers. The walls of the cofferdam are of 3-inch horizontal plank secured to 6x6-inch vertical timbers bolted to them about 7 feet apart and to the main timbers.

Concreting.—For the north anchor pier and both the main piers the caissons were carried down to the slate rock, which was excavated to sound hard strata and leveled to receive them. Under the cutting edges of all caissons No. 1 concrete was rammed. The remainder of the working chamber was filled with No. 2 concrete up to within 6 inches of the roof, which was filled with No. 1 concrete. The contract was made with classified prices for the removal of existing piers, excavation and back filling, pneumatic caissons in place and their fillings, foundation concrete masonry for anchor piers, shore pier masonry complete, shore pier coping, monolithic coping of anchor piers and granite bridge seat stones.

The caissons were each supplied with three 36-inch shafts; the center one was used for materials only and had two quick-opening hinged doors. The two at the ends were surmounted by the Moran patent air locks with horizontal sliding doors operated by pneumatic pressure and were used for both men and materials. The accompanying picture of the north anchor caisson was prepared from a photograph taken July 14, 1902, and shows the lower section of the cofferdam with vertical posts projecting above it to receive the upper section. The derricks handling the pier masonry had 50-foot, 10-ton booms operated by Lidgerwood hoisting engines and swung by bull wheels at the feet of their masts. They were seated near the ground level close to the piers and finished them from the original positions.

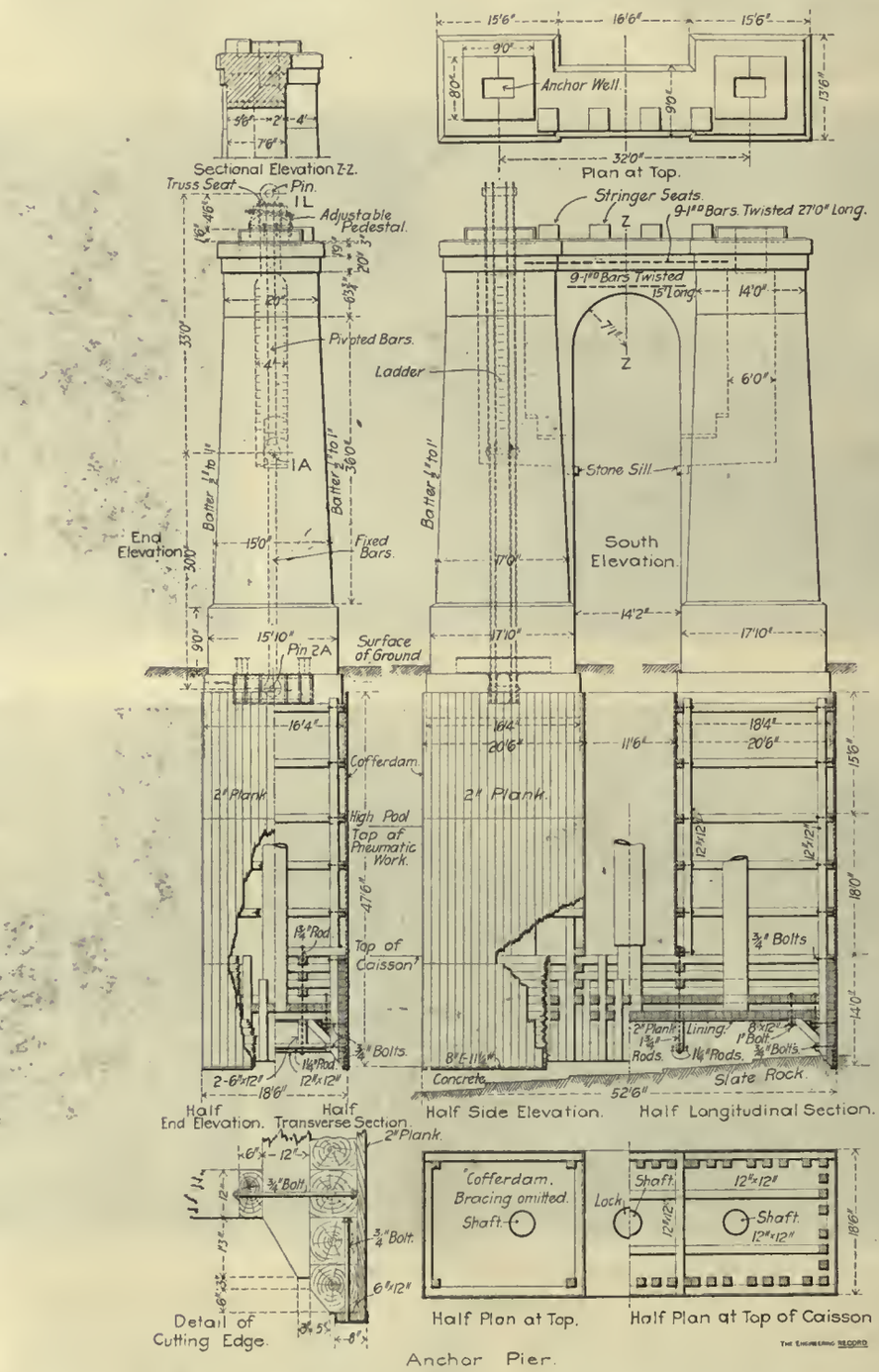
The reaction girders which received the lower pins of the anchor bars were shop-riveted together and each set, weighing about 12,000 pounds, was lowered to place in the well formed by the concrete mould, as shown in the illustration of the east anchor pit, made from a photograph taken September 2, 1902. After being set, the interstices between and around these girders were easily filled with grout and concrete, but the long box girders which rest across them, and constitute the reaction platform on which the upper part of the pier is built, could not be concreted in their horizontal position. Therefore, they were temporarily placed vertically outside the concrete forms for the pier, as shown in the illustration, and were then filled with thin wet concrete rammed in at the top, as pipes are cast in a foundry.

Before concreting, an ingenious device was resorted to to put the bars under an initial vertical tension and hold them firmly in place. This was accomplished by connecting the upper bars to the lower ones, and then supporting the former intermediately on the cap of a falsework trestle set near the lower eye-bars which were carefully adjusted in their final position. The upper eye-bars were thus set horizontally at right angles to the lower ones, and formed cantilevers with an upward reaction which was resisted by the vertical bars and placed them under sufficient tension. The fulcrum of the horizontal bars being nearly in the middle, additional stress was secured by building a small horizontal platform on the outer ends and loading it. The two piers at each anchorage had the upper parts of their forms connected by wooden trusses which supported the centering and forms for the connecting arch, as shown in the illustration of the north anchor pier, made from a photograph taken November 2, 1902. The rounded corners of the pier were produced by concave fillets placed in the forms. When the forms were stripped off, the concrete was found smooth and hard with the surface filled out everywhere, except in small patches where cement plaster could easily be supplied. The surface is not dressed or tooled; but will be washed with grout to give complete uniformity of color and texture.

Conditions of Loading.—The bridge has a total length of about 2,100 feet, extending from near the portal of a tunnel on the south side of the river to a point in Water Street, Pittsburg, where it will probably be connected with a curved viaduct, the location and character of which has not yet been determined. Besides the main cantilever structure, 1,504 feet long between centers of end pins, there is, at the south end, a curved approach viaduct 600 feet long. The main span was designed so as to have its shore piers beyond low water mark, and to give a minimum clearance of 70 feet above ordinary high water, or full pool.

It was necessary to erect the channel span without obstructing navigation in the river, which always sustains a large traffic, and is liable to be filled with long and unwieldy fleets of soft coal barges pushed down stream by flat-bottom stern-wheel steamers.

The anchor and the lever arms of the cantilevers are unequal, and are so proportioned that under dead load only, the reaction at the anchor piers is reduced nearly to zero. In the suspended span and at the ends of the cantilever arms, the panels are uniformly 30 feet long, but where the truss is deeper, near the shore piers, the panels are increased to 40 feet so that the main diagonals cross the two panels throughout at a nearly uniform inclination of about 45 degrees and the difference in panel lengths is not noticeable. As the stresses in the main vertical posts over the shore piers are very large, it was deemed advisable to make each post in two parallel halves, which were separated 12 feet on centers and connected by horizontal longitudinal braces without diagonals, thus making a sort of narrow tower which is more easily constructed, and permitted a reduction of stress in the pins, more convenient connections for the assembled members, and a better distribution of the loads on the masonry.



The axis of the bridge is on a tangent between anchorages and the floor and trusses were built with only sufficient cambre to allow for dead load defection, so that normally the lower chord is a perfectly straight line which becomes slightly concave upwards under live loads.

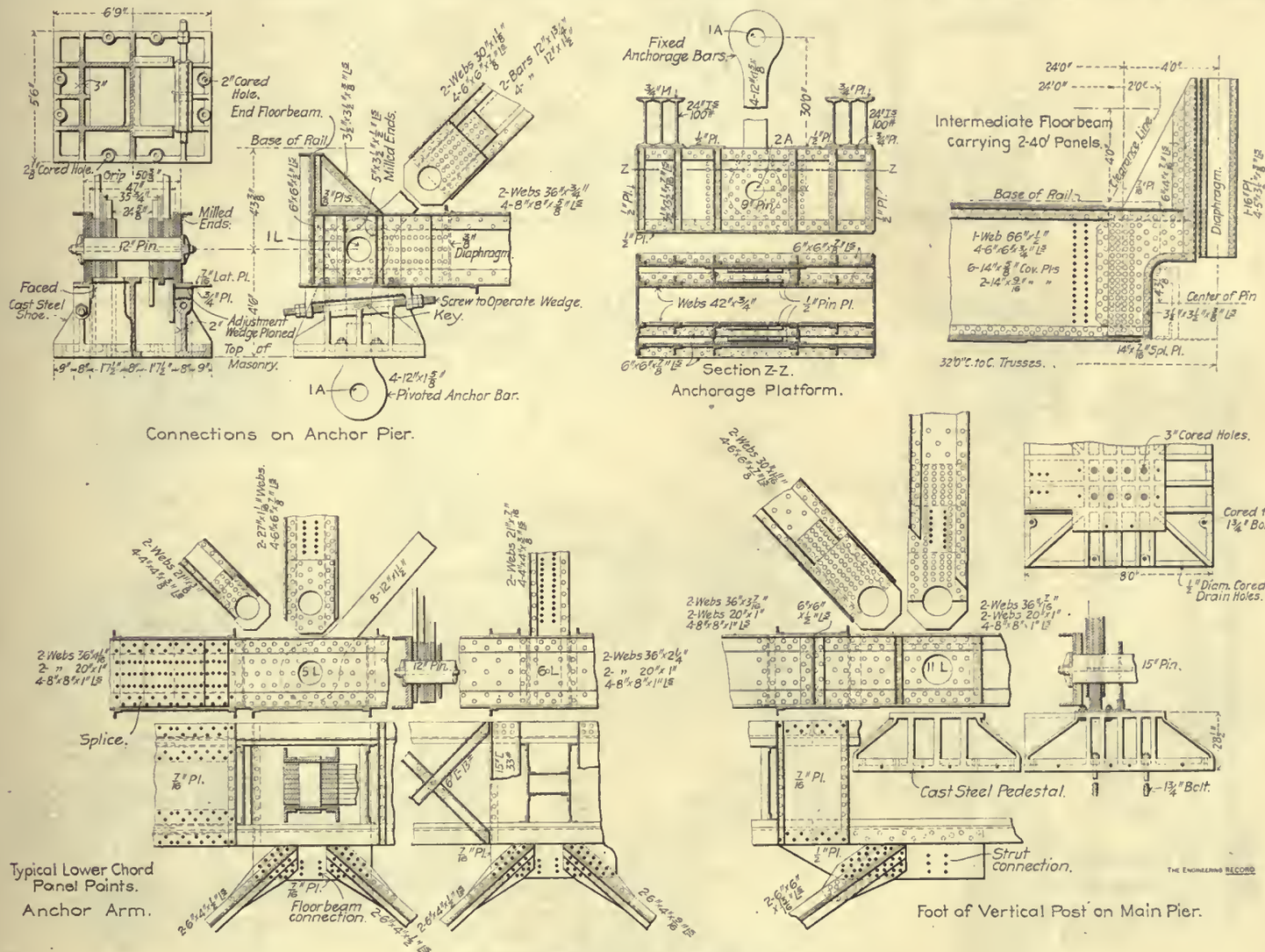
The intermediate vertical posts being made perpendicular to the lower chord, are inclined 1 to 100 from the vertical; but the main posts over the shore piers are made truly vertical and a slight difference is thus produced between the lengths of the adjacent panels of top chord. This, however, is not noticeable in the side elevation.

Loading. The floor system is proportioned for a live load consisting of two locomotives followed by a train load of 4,500 pounds per lineal foot on each track. Locomotives are of the Consolidation type and weigh 284,000 pounds on a total wheel base of 48 feet, there being 40,000 pounds on each of four pairs of drivers. The trusses are proportioned to carry the exact amounts of dead load at each panel point, and a live load on each track consisting of 4,500 pounds per linear foot of train load plus two panel concentrations of 36,000 pounds, placed 2 panels apart. Allowance was made for a wind pressure of 30 pounds per square foot on the exposed vertical surfaces of the structure and on a train of cars extending the full length of the bridge. A percentage allowance was made for impact in the floor system. Under these assumptions, the pier reaction at the anchorage was computed to be 887,100 pounds maximum live uplift less 28,900 pounds dead pressure equals 858,200 pounds dead uplift. The maximum live pressure is 830,600 pounds plus 28,900 of dead pressure gives a maximum of 859,500 pounds total. The reaction at *L*11 on the shore pier is 1,742,600 pounds for live load plus 1,835,200 pounds for dead load, equals 3,577,800 pounds total.

Calculation of Stresses. In preparing the stress diagram, it was found most advantageous in time and energy to first compute what was called a unit stress sheet. To do this, a single load of unity was placed at each panel and the resulting stresses calculated by graphical diagrams for every member of the truss. These diagrams were then reduced to their simplest form, and being continued through from one end of the truss to the other checked the records when they closed. The stresses were then scaled off and tabulated, as shown in the sample lines of the accompanying Table I. The same process was repeated for unit panel loads at all of the other panel points in the bridge. After this table was derived, the remaining computations were evidently all arithmetical since no matter what the load is at any panel, the stress in any member can be found by multiplying this load by the proper constant factor for the member as found in the table. As the dead load of this span varies greatly in different panels, it was necessary to make several preliminary approximate stress sheets in order to determine the actual dead load, and these trial computations were, of course, greatly accelerated by the use of the fixed unit stress sheet table. The work required only the simplest arithmetical calculation, and not only actual stresses but the positions for maximum stresses are shown by inspection of the table.

It is believed that this is the simplest method of computing the stresses in a structure of this character having chords with a different inclination in each panel. The method of taking moments around any point would involve a great deal of mathematical work, and the positions for maximum would be very difficult to keep in mind if any other method were employed. The method resembles that of "influenced diagram" which is used by many computers; but is believed by the designing engineers to be simpler than that method. Complete final results were written in Table II, which contained forty-one lines, one for each member, but only the maximums for the principal members are here reproduced as illustrations.

Formulae for Cross-Sections. The sub-verticals and sub-diagonals from the intermediate



ANCHORAGE AND TRUSS DETAILS.

points, 2M, 3M, etc., are considered as secondary members. The chords and main verticals and diagonals are considered as main members. For plates and shapes, the allowed tension per square inch for main members is 10,000 pounds live load and 20,000 pounds dead load; for secondary members, 9,000 pounds live and 18,000 pounds dead; for bars for main members, 11,000 pounds live and 22,000 pounds dead. The compression allowed per square inch is, for main members, 12,000 pounds minus 40 l÷r for live load and 24,000 pounds minus 80 l÷r for dead load; for members of which the length is less than 40 times the radius of gyration, 10,500 pounds live and 21,0000 pounds dead; for secondary members 10,500 pounds minus 40 l÷r live and 21,000 pounds minus 80 l÷r dead. For rivet bearing and shearing 16,000 pounds and

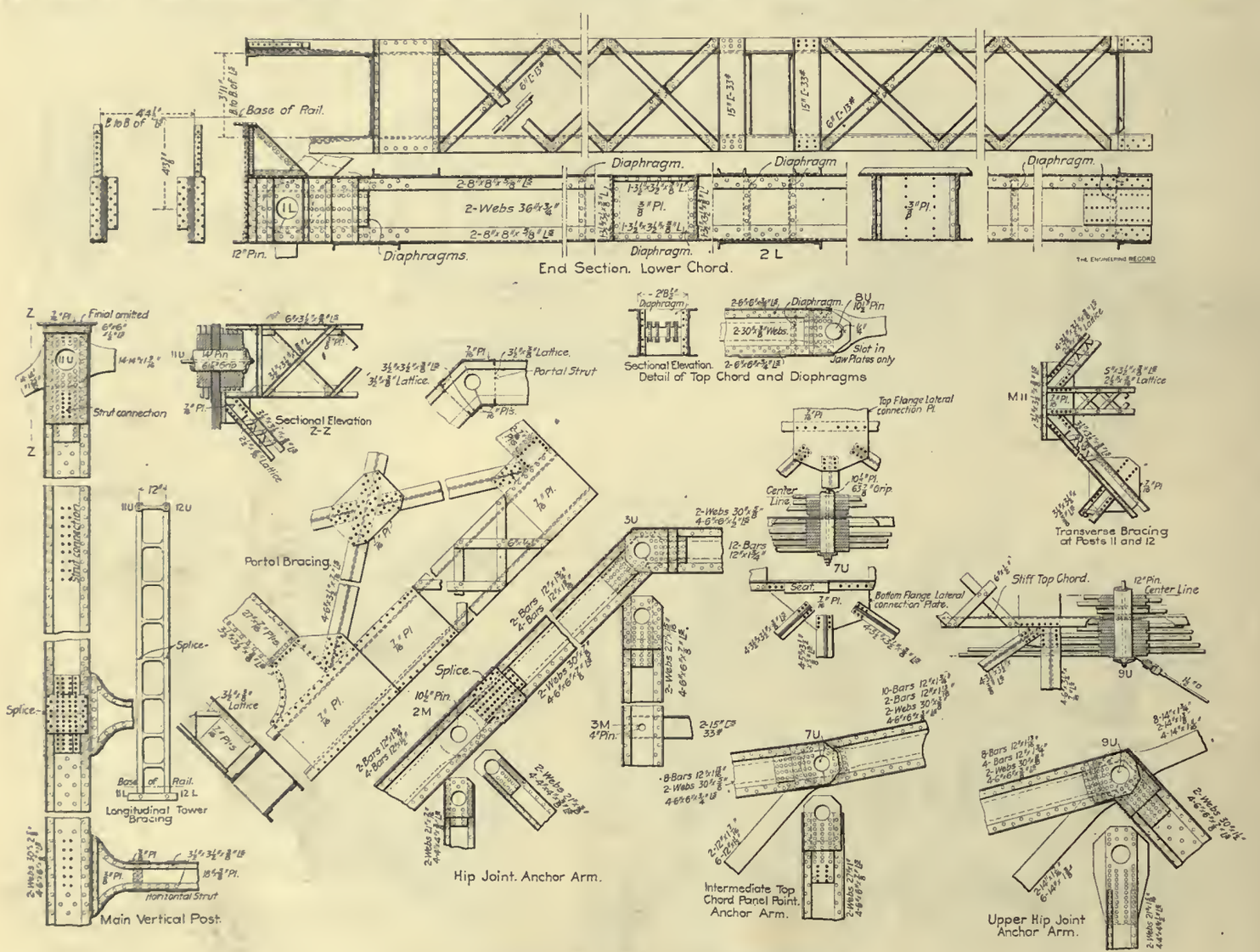
10,000 pounds per square inch respectively was allowed. From these data a strain sheet was made out containing the complete data of maximum, minimum, direct and reverse stresses and their combinations for different conditions of loading, together with the unit stresses they required, compositions of members, weights, etc., as shown in the accompanying selections from that table for the maximum members of each class.

Details and Connections of Anchor Arm. The trusses are 32 feet apart on centers and have a maximum height of 126½ feet over the shore piers, and a minimum height of 60 feet throughout the suspended center span and at the hips of the cantilever arms. The floor is carried at the lower chord level and contains a lateral system with compression diagonals having

In the lower chords of these trusses, the wide tie plates have their edges stiffened by 3x3-inch angles, and the narrow ones consist of 15-inch channels. Close to each side of the panel points, and at intermediate points, the webs of the lower chord are stiffened by vertical transverse diaphragms. The splices are made with inside and outside web plates, and top and bottom flange plates. The pins are mostly 12 inches in diameter, and the sub-verticals are field-riveted to the diaphragms which are shop-riveted in the chords. All other web compression members are pin-connected to the lower chords with jaw plates and both they and the eye-bars are, in all cases, packed inside the lower chords. The anchor end of the chord at 1*L* has longitudinal bearing plates riveted to the lower flanges. These

channels and are shipped loose so as not to interfere with the riveting of the sub-vertical posts to the diaphragm plates. The compression members of the top chord, 30 inches deep and 43 inches wide over-all, are made with two built channels latticed on the top and bottom flanges with flat bars and tie-plates. All of the ends are beveled to correspond with the changes in direction at the panel points where they have ½-inch clearance and are reinforced for full bearing area on the main pins which are 10½ inches in diameter, except at 9*U*. One pair of pin plates at each end of each chord length are made long enough to receive full pin holes and act as jaw plates to lock the chords together; other pin plates have only half holes.

Part of the eye-bars are packed inside the



TOP CHORD PANEL POINTS OF ANCHOR ARM.

riveted connections and proportioned to receive two-thirds of the wind pressure on the trusses and all of that on the train surface. A similar but lighter X-braced lateral system is provided in the planes of the top chord and transmits the horizontal stress to the piers through the inclined end posts. A clearance of 28 feet horizontally and 22 feet vertically is provided for trains, above which there is a system of transverse sway bracing between the trusses with horizontal struts at the intermediate points *M*2, *M*3, etc., and single panels of rigid X-bracing between these struts and the top lateral struts, except in the main vertical posts where there are three panels. At the hips 3*U* and 9*U*, the tops of the inclined posts are braced by portal struts of ordinary construction having top and bottom X-bracing.

plates are planed on top to correspond with the 1 per cent. roadway grade, and on the bottom are planed to match the inclined top flanges of the cast steel pedestal, over which they lock and upon which they are adjustable by screws with lock nuts which enable the vertical position of the pin 1*L* to be varied so as to bring it to exact bearing in the unloaded anchor bars, and allow for the inevitable inaccuracies of building the masonry and setting the reaction girders.

At panel points the lower flange tie-plate projects beyond the inner edge of the chord and is wide enough to receive the lateral diagonals and floor beam connection, and is field-riveted to the chord. At the sub-panel points the transverse channels which replace the tie-plates are field-riveted to the top flanges of the

top chords. These eye-bars are shipped separate from the compression members; but at the site they are assembled with them before erection. The webs of the top chord channels are stiffened at the ends and intermediately by transverse diaphragm plates field-riveted to vertical stiffener angles which are shop-riveted to the channel webs.

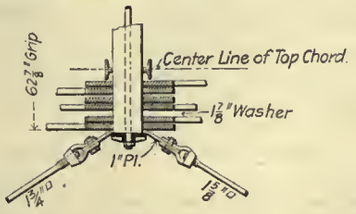
Each diaphragm consists of an upper and a lower plate, with several inches clearance between them, notched to receive the eye-bars and act as spacers for them, as shown in the special detail. In the field the chord section is placed horizontally with its webs vertical and the lower parts of the diaphragm plate are riveted in place. The eye-bars are then set in them in the proper position and the upper parts of the plate are slipped over them and riveted to the chords.

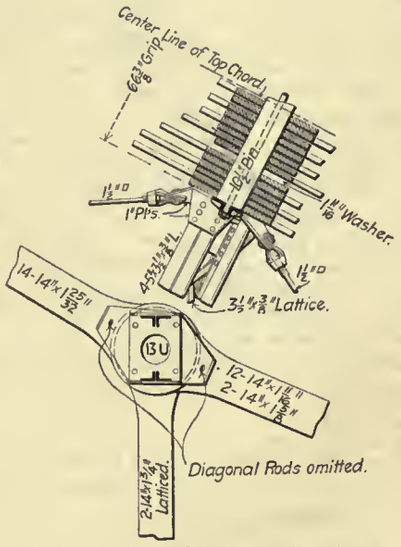
These hold the eye-bars securely in position, while the chord sections are hoisted to place and connected; the latter operation being facilitated by the elongation of the field holes in the jaw plates which are slotted ¼ inch on the projecting ends, so as to give full clearance for driving the pins. The top flange tie-plates at panel points are field-riveted to the chords and project beyond the inner flange to form jaw plates receiving the riveted connections of the top lateral transverse struts and X-bracing, each of which is made of two pairs of angles latticed to form I-shaped cross-sections. The lower jaw plates for these connections are made with plates riveted to the inner flanges of the chords, both top and bottom jaw plates being slightly bent to conform to the angles of the chord.

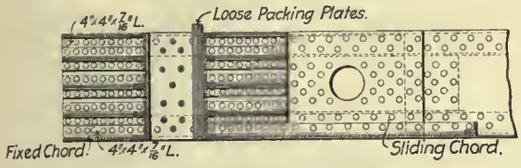
The horizontal strut 3*M*-4*M* is pin-connected at both panel points; but projects 2 feet beyond 4*M*, where the webs of its channels are field-riveted to jaw plate splices with the webs of strut 4M-5M, which is pin-connected at 5M to strut 4*M*-5*M*, which is pin-connected at 5*M* to the vertical post. The other horizontal strut 6*M*-7*M* is pin-connected at both ends. All truss pins under 9 inches in diameter have 1½-inch holes drilled through their axes to receive 1¼-inch bolts with nuts bearing on pressed steel discs which engage the ends of the pins and are flanged over them for bearings on the eye-bars or compression members. Pins 9 inches or more in diameter have 2-inch holes and 1¾-inch bolts.

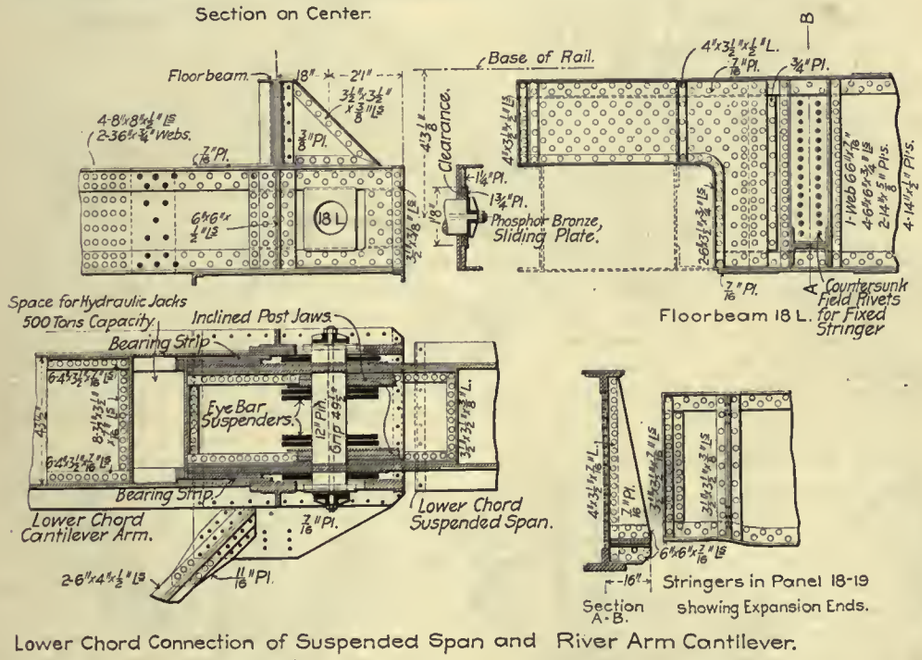
The sway bracing between the trusses at 5*U* and 7*U* has diagonals, each composed of two pairs of 3½x3½-inch angles back to back; latticed together in I-shaped cross-section. At their intersection one of them is continuous with a large web plate extended beyond the flanges to receive the field-riveted connections of the intersecting diagonal, as shown in the detail. The upper ends of the diagonals are field-riveted to vertical transverse web plates which are engaged between their flange angles, and are field-riveted to the lower flange connection plates of the top laterals and to the faces of the vertical posts. The portal bracing at 9*U*-10*M* corresponds to that at 3*U*-2*M*, excepting that it is made with two panels of X-bracing and an intermediate horizontal transverse strut which, like the top strut, is made with four 3½x3½-inch angles and two 18-inch web plates in the planes of the flanges of the inclined posts. The top chord 9*U*-11*U* is composed entirely of eye-bars 14 inches wide and is stiffened laterally by a horizontal transverse strut which connects the trusses at 10*U*. This strut has an I-shaped cross-section made with two pairs of angles riveted together back to back and latticed. At each end of the strut there is a *U*-plate riveted to its flanges and bored to engage the top chord pin. The plate has also side wings in approximately vertical planes, and these have pins engaging the clevises on the ends of the diagonal rods which X-brace the tension panels between the hip and the top of the main post, as at 13*U* in the river arm.

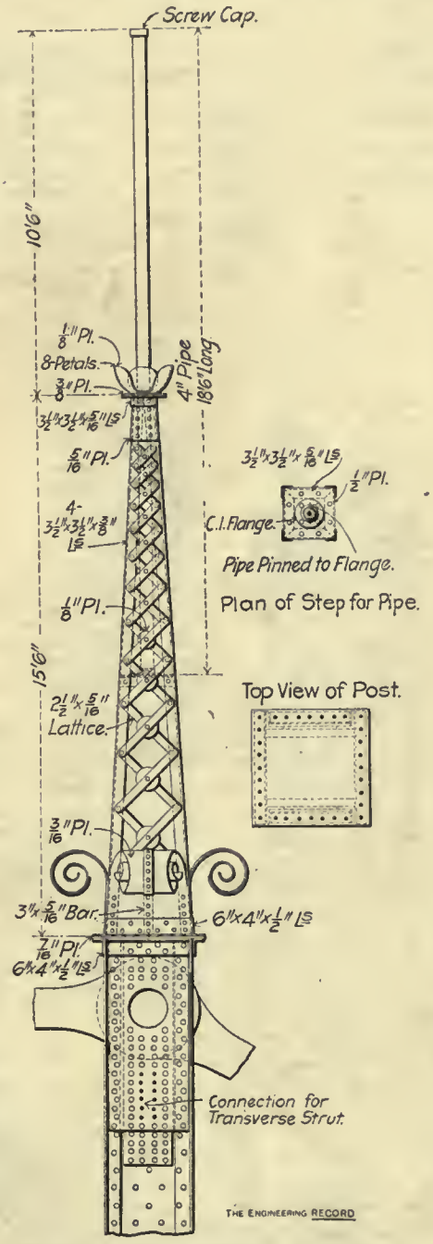
Anchorage. The vertical anchor bars 1*L*-1*A* are 30 feet long and are connected at their lower ends to the tops of the corresponding bars 1*A*-2*A*, which are also 30 feet long on centers. The bottoms of these bars are connected to the horizontal transverse pins through the webs of the reaction girders shown in the drawing of the anchorage platform. The concrete pier is built on and around these girders, and reaches to a height of about 50 feet above the tops of the











DETAILS OF RIVER ARM CANTILEVER.

TABLE I.—UNIT STRESSES IN ANCHOR ARM FROM UNIT PANEL LOAD AT EACH PANEL POINT (Derived graphically).

Load at	3U-4U	4U-5U	5U-6U	6U-7U	7U-8U	8U-9U	1L-3L	3L-5L	5L-7L	7L-9L	9L-11L	1L-2M	2M-3U	3U-3L	3L-4M	4M-5U
2L.....	— 0.41	— 0.41	— 0.31	— 0.31	— 0.21	— 0.21	+ 0.91	+ 0.32	+ 0.21	+ 0.09	+ 0.08	— 1.29	— 0.58	+ 0.40	+ 0.13	+ 0.14
Total...	— 4.37	— 4.37	— 6.51	— 6.57	— 6.35	— 6.46	+ 4.86	+ 7.06	+ 6.85	+ 4.12	+ 3.82	— 6.88	— 6.17	+ 4.28	+ 0.40	+ 0.42
															— 4.26	— 3.52

TABLE I.—(Continued.)

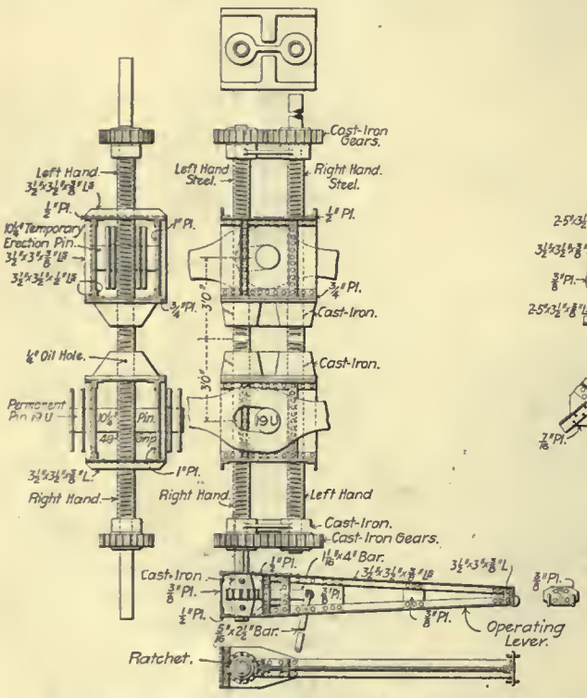
5U-5L	5L-6M	6M-7U	7U-7L	7L-8M	8M-9U	9U-9L	9U-10M	10M-11L	2M-3L	4M-5L	6M-7L	8M-9L	9L-10M	4U-4M	6U-6M	8U-8M
— 0.10	+ 0.15	+ 0.16	— 0.12	+ 0.17	+ 0.19	+ 0.01	— 0.12	— 0.12	— 0.71	— 0.01	— 0.02	— 0.02	...	— 0.01	— 0.02	— 0.02
— 0.30	+ 1.46	+ 1.68	— 1.28	+ 3.59	+ 4.38	+ 2.29	— 4.97	— 5.64	— 0.71	— 0.80	— 0.95	— 1.07	— 0.68	— 0.14	— 0.43	— 0.52
+ 2.31	— 2.01	— 1.28	+ 0.70	— 0.48	— 0.18											

TABLE II.—STRESSES AND CROSS SECTIONS FOR ANCHOR ARM.

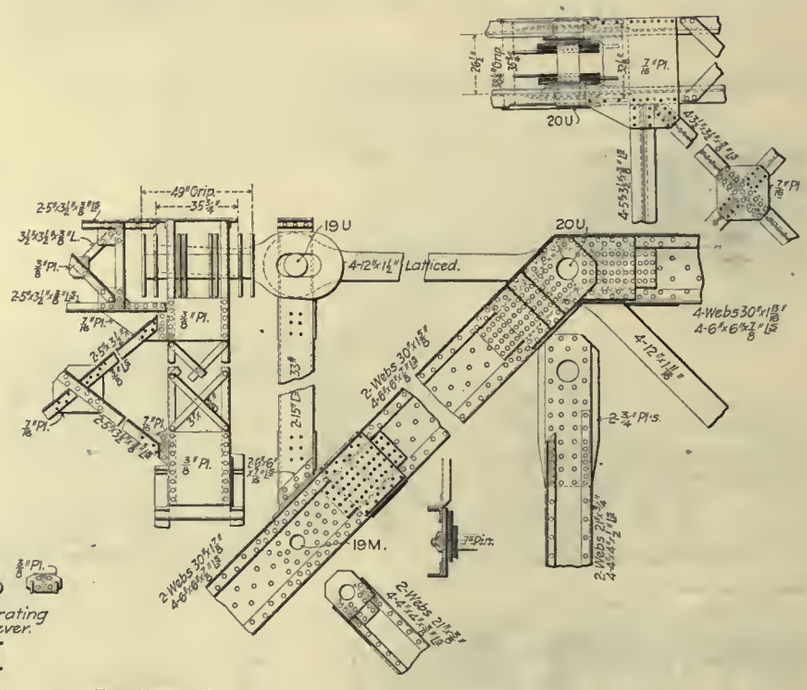
Member.	Live uplift.	—Live on anchor arm.— Uniform.	Concentrated.	Total live.	Dead uplift.	Dead on anchor arm.	Total dead.	Live added to ½ dead.
3U—4U	+ 887,100	— 632,500	— 53,300	+ 887,100 — 685,800	+ 705,000	— 657,600	+ 47,400	+ 910,800
10U—11U	+ 2,746,100	.....	.....	+ 2,746,100	+ 2,183,000	.....	+ 2,183,000	+ 3,837,600
3L—5L	— 1,738,700	+ 1,035,900	+ 91,100	— 1,738,700 + 1,127,000	— 1,381,700	+ 1,122,100	— 259,600	— 1,868,500
9L—11L	— 2,829,900	+ 621,700	+ 51,100	— 2,829,900 + 672,800	— 2,248,800	+ 751,900	— 1,496,900	—3,578,400
1L—2M	+ 1,250,800	— 988,900	— 83,900	+ 1,250,800 — 1,072,800	+ 994,000	— 986,000	+ 8,000	+ 1,254,800

TABLE II.—(Continued.)

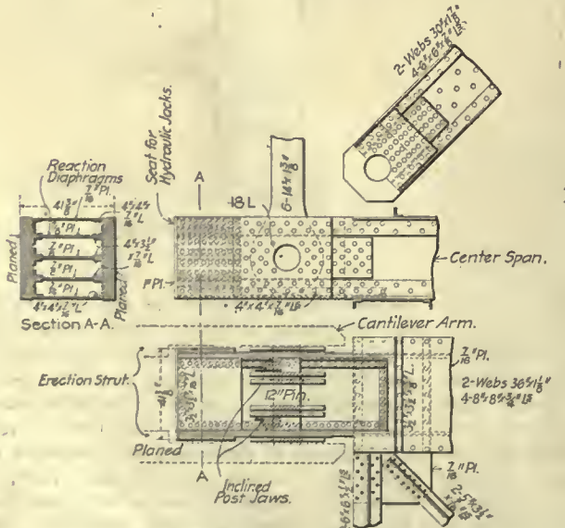
Max. reverse stress.	Unit stress.	Area required. Square inches.	Section.	Weight per linear foot.	Linear feet.	Weight of members.	Weight of compression details.	Total weight of truss members. One arm.
	+ 11.000	+ 82.8	4 bars, 12x1¾ = 84 net	285.6	73	20,849	.....	20,849
— 638.400	— 10.500	— 60.8	2 webs, 30x⅝ = 37.5 4 Ls, 6x6x½ = 23.0 } 60.5 gross	205.7	60	12,342		
.....	11,000	+ 348.9	10 bars, 14x2½ = 350.0	1190.0	106	126,140	.....	126,140
+ 867,400	— 10,500 + 10,000	— 178.0 + 86.7	4 Ls 8x8x1 = 60.0 2 webs, 20x1 = 40.0 2 webs. 36x1 1/16 = 76.5 } 176.5	600.1	118	70,812	.....	.....
.....	l—480 r —11.55 — 10.340	— 346.1	4 Ls. 8x8 x1 = 60.0 2 webs, 20x1 = 40.0 2 webs, 36x3 7/16 = 247.5 } 347.5	1181.5	159	187,859	.....	.....
— 1,064,800	+ 11.000 — 10.000	+ 114.1 — 106.5	4 bars, 12x2¾ = 114.0 2 webs, 30x1⅛ = 67.5 4 Ls, 6x6x⅞ = 38.96 } 106.46	387.6 362.0	98 91	37,985 32,942	.....	37,985



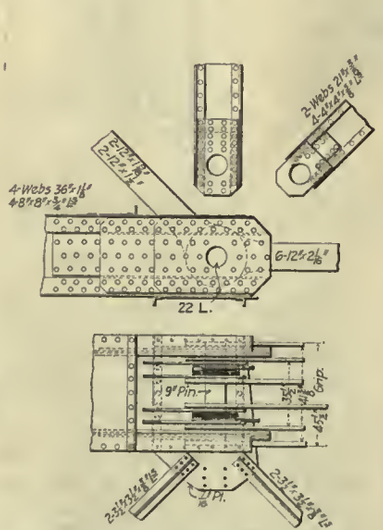
Toggle Apparatus for Top Chord Erection Adjustment.



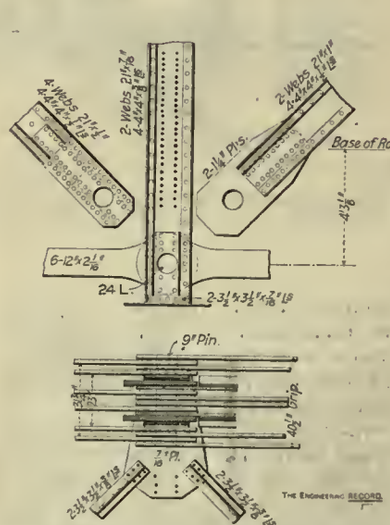
Top Chord Expansion Joint and Center Span Hip.



Suspension of Center Span.



End of Center Span. Eye-Bar Chord



Center Panel Point Suspended Span.

SUSPENDED CENTER SPAN AND ERECTION TOGGLE.

platform beams, thus affording a dead load of about 1,500,000 pounds on each platform to resist the possible maximum upward pull of about 858,000 pounds in the eye-bars.

The floor beams are all plate girders with 66-inch webs, four 6x6-inch flange angles and 14-inch flange cover plates. Some of them support the ends of stringers in two 30-foot panels and one in one 30-foot and one 40-foot panels, and the thickness of material and number of flange cover plates corresponds to these variations of loads. The end lower flange is field-riveted to the lateral connection plate across the bottom flanges of the lower chord of the main truss. This plate reaches to the floor beam web splice where it abuts against the end of the first flange cover plate, and the joint thus formed is spliced by a second plate 18 inches long, which covers it and meets the end of the second flange reinforcement plate.

Main Vertical Posts. The main vertical post 11*U*-11*L* is made in four sections, each over 34 feet long and each weighing about 30,000 pounds. The cross-section contains four 6x6x⅞-inch angles and eight 30-inch web plates ⅝ or ¾ inches thick. It is latticed with 6x7/16-inch bars and the webs are stiffened by diaphragm plates at the ends and middle of every section. Joints are spliced with cover plates on all sides which have all of their rivets field driven. The top of the post has a horizontal cap plate which serves as a base for the ornamental finial 26 feet high, which is shown in detail. The corresponding posts of the two trusses are braced transversely by three panels of horizontal and diagonal struts having their details and connections shown in the views at 11*U*. These struts are all made with two pairs of angles riveted together back to back and latticed to form I-shaped cross-sections. Their connections to the faces of the vertical posts are similar to those described for the sway bracing at intermediate panel points.

The 15-inch pin 11*L*, which connects the foot of this post with the bottom chord and inclined post 9*U*-11*L*, is seated in the semi-circular bearing of the two webs of a riveted steel shoe, which is shown in half cross-section at the point 11*L*. This shoe is entirely concealed within the chord and has no base plate; but the lower edges of its web plates and the bottoms of its flange angles and channel are planed and seated on the top of the cast steel pedestals which receive the lateral diagonals from both anchor and channel arms of the cantilever, and transmits all stress and pressure to the top of the masonry pier upon which it has a 7x8-foot bearing.

River Arm Cantilever. This arm corresponds to the anchor arm in arrangement of its members and in the details of corresponding connections; but differs from it in several respects, especially the length, in that the top chord has no stiff members and in the connections at the outer extremities of the top and bottom chords. At 16*L*, where there is a heavy horizontal component of the stress from diagonal 18*U*-16*L*, the pin has a center bearing 6 7/16 inches wide on an intermediate vertical diaphragm which is riveted in the usual way to the top and bottom flange plates, and is further stiffened and connected to the webs by a horizontal diaphragm on the center line. The connections at 18*L* are made special to provide for the erection and adjustment of the sliding joint with the lower chord of the center span, and to provide for the transmission of lateral stress from the center span to the cantilever arm.

Suspended Center Span. The center span, 360 feet long, is suspended from its end lower chord pins by vertical eye-bars to the top chord panel points 18*U* of the cantilever arms. It is a single intersection, pin-connected Pratt truss with subdivided panels about 60 feet long and 60 feet high. The corresponding members and connections, and the character of the details are similar to those in the cantilever arms, excepting that the top chord is horizontal throughout and is composed of compression members only.

The horizontal strut 21 *M*, 22*M* is pin-connected at 21*M* and field-riveted inside the main vertical post webs at 22*M*. The bottom chord corresponds to that in the anchor arms from 18*L* to 22*L* and from 22*L* to 22*L* and is composed entirely of eye-bars. At 23*L* and 24*L* the vertical posts project below the bottoms of the eye-bar heads and have field-riveted to them horizontal connection plates receiving the lower lower flanges of the floor and the pairs of angles which form the diagonals of the lower lateral system. At other points the lower laterals and their connections correspond with those in the cantilever arms. The members of the top lateral system and their connections to the top chord correspond with those from 3*U* to 9*U*, and the transverse sway bracing is similar to that already described for the anchor arm. The portal bracing on the inclined post 20*U*-18*L* corresponds to post 18*U*, 16*L*. The eye-bars which connect the hips at 20*U* with the extremities of the top chords of the cantilevers at 16*U* have slotted pin holes at 19*U* to allow for temperature variations, and are supported there on a sub-vertical which engages their pin and has a beveled flange riveted in the field to the inclined post at 19*M*, as shown. The ends of the lower chords are made special to correspond with those of the cantilever arms and allow for the erection, adjustment and temperature variations of the trusses.

Throughout both cantilever arms and the suspended span, all members are made of medium open-hearth steel. All web rivets in chord members are 1 inch in diameter and all other rivets are ⅞-inch in diameter. All rivet holes are punched 3/16 inch small and reamed to finished size, except for the tie-plates, lacing and diaphragms. Rivet holes in shapes 1-inch thick are drilled from the solid. Holes for field-driven splice rivets are reamed to cast-iron templates. All other field rivet holes are reamed after the connected members are bolted together and matched marked. All rivet holes are slightly filleted for the rivet heads. All sheared edges of plates and angles are planed off ¼ inch, except for tie-plates, lacing and diaphragms which are sheared only. In all compression members the lengths of the tie-plates are about ⅔ of their widths. For the top and bottom chords and end posts, the tie-plates are 7/16 inches thick, elsewhere they are ⅜ inches thick. Where permanent diaphragms cannot be placed in the chords, temporary ones are bolted in to preserve them from distortion in shipment. Where compression and tension members are used together, the compression members are bored 1/32 inch longer than the tension members.

Connection of Cantilever Arm and Suspended Truss. The center truss has a total maximum weight of about 6,400,000 pounds including live and dead load and, as before stated, is suspended from its end lower chord pins by vertical I-bars to the extremities of the cantilever arms. The numbers 18*U*, 20*U* and 16*L*, 18*L* are not, strictly speaking, parts of the chords of the trusses; but are needed for erection and to preserve the continuity, to stiffen the structure and to complete the lateral systems, and are more conveniently referred to as variable members of the respective chords. The top chord bars at 19*U* have overlapping slots engaging the pin through the sub-vertical post, and receive no live or dead load except in the erection of the bridge. The true lower chord in the suspended span extends 4 feet beyond its support at 18*L* and has the outsides of its vertical webs planed for bearing against the inner faces of the false chord section 17*L*, 18*L* in which it slides. The 8x8-inch flange angles have their horizontal legs cut off to clear the false chord, and where this is done, the web plates are re-enforced by inside horizontal angles near the lower edges.

At the projecting end of the chord, the webs are connected by five horizontal diaphragms having their outer edges planed to bearing on a vertical transverse plate, like a diaphragm, which closes the end of the chord and affords a seat for the hydraulic adjustment jacks. The end of chord 16*L*-18*L* engages the projecting extremity of 18*L*-19*L*, which has just been described, and slips into it telescopically between the webs and top and bottom tie-plates, as shown in the horizontal cross-section. Narrow vertical bearing plates are riveted to the insides of the webs of 16*L*-18*L* to engage the sliding chord, and the webs themselves are connected by five horizontal diaphragms and have vertical transverse plates like those already described, to form an opposite seat for the 500-ton hydraulic jacks used in erection. The two chords are thus held accurately both vertically and transversely; but are free to slide upon each other longitudinally.

The 12-inch pin 18*L* is fixed in the lower chord and inclined end post of the center truss and in the vertical suspension eye-bars. It takes bearing in the fixed lower chord 16*L*-18*L* of the cantilever arm through a square phosphor-bronze bushing plate 1¾ inches thick. It has a tight fit in this plate and the plate itself has its upper and lower edges planed to fit a rectangular slot in the web of the cross-section. The edges of the plate have small flanges engaging the face of the web and are locked to it by the discs on the ends of the pin which prevent them from moving outwards. The slot is 7 inches longer than the phosphor-bronze plate and thus allows the pin itself to move back and forth for that distance in the cantilever chord which is fixed relative to the center truss.

The upper lateral system of the suspended span transmits its stresses from 20*U* through the inclined end post to 18*L*, and the stresses of the lower lateral system are also concentrated at this point, where the lower chords are rigidly connected by a horizontal transverse strut independent of the floor beam. The shearing stress is, therefore, transmitted through the transversely rigid joint between the sliding and fixed sections of the lower chord through the extremity of the lower lateral system in the river arm of the cantilever. The regular lower lateral system is connected to top and bottom flanges by plates on the fixed chord which encloses the sliding joint at 18*L*. and receiving this stress from the center span, transmits it in the regular manner to the masonry of the shore piers. The single floor beam at 18*L* is made special, as shown in the elevation and is seated with a drop end on the fixed lower chord 16*L*-18*L*. The cantilever arm stringers are riveted to it, and the suspended span stringers slide freely in pockets riveted to its web.

Erection Adjustments. Between the shore piers the superstructure of this bridge will be erected entirely without false work, the panels being built out successively from the anchor arms to the center of the channel. The semi-trusses of the center span will be built continuously from the extremities of the cantilever arms and will also be erected by the cantilever method. All members have been designed to withstand the temporary erection stress, and in order to provide clearance for the final sections in the middle panel of the suspended span, semi-trusses will be assembled

with their chords inclining upwards from the extremities of the cantilever, so that they can readily be lowered to the required position for the finished structure.

The apparatus for raising and lowering the center spans and adjusting their position longitudinally will be temporarily placed at panel points 19*U* and 18*L*. At 18*L* it will consist merely of a set of special hydraulic jacks engaging the reinforced vertical transverse diaphragms at the end of the fixed and sliding chords just beyond the sliding pin on the shore side. The operation of these jacks will force the sliding pin towards the river end of the slot in chord 16*L*-18*L*, and the weight of the center span will force it in the opposite direction when the jacks are released. When the trusses are assembled, the diaphragms will be separated by jacks or fillers so far that no further extension will be necessary and the only effort required will be that which is needful to release them.

At 19*U*, the sub-vertical posts will not at first be connected and the eight bars meeting at that pin will be separated into two sets, one set containing two outside bars 19*U*-20*U* and two outside bars 19*U*-18*U* connected together with the regular permanent pin. The other set will consist of the two pairs of inner bars connected with a shorter temporary erection pin. Each of these pins will engage the webs of separate riveted yokes temporarily enclosing the heads of the bars. These yokes will be connected by a pair of vertical steel screws 7 inches in diameter and about 16 feet long, as shown in the detail marked "toggle apparatus for top chord erection adjustment." The screws will take bearing in cast-iron nuts on the upper side of the lower yoke and on the lower side of the upper yoke, and will be connected at both ends by transmission gears. Long operating levers will be connected with a ratchet and pawl to the lower end of one screw and the upper end of the other screw. These levers will be operated by hand to separate the two sets of bars which can be made to diverge about 10 feet or approach to a minimum distance of 6 feet from each other and thus form a very powerful toggle joint by which the panel points 18*U* and 20*U* can be pulled together. The extension of the toggle joint from 6 feet to 10 feet will draw these points 6 inches closer together and will exert a pull of 907,000 pounds in the top chord of the cantilever arm. It is intended to set the toggle at first so wide that it will require to be releasd rather than extended, and thus necessitate only the application of enough power to overcome the friction.

The superstructure, weight 14,000,000 pounds, and the substructure were designed, and their inspection and construction supervised, by Boller & Hodge, Consulting Engineers, to whom acknowledgment is made for the data from which this article has been prepared. The designs and specifications were approved by Mr. J. W. Patterson, chief engineer of the Pittsburg, Carnegie & Western Railroad Company. The substructure was built by Arthur McMullen & Company, of New York City, who modified some features of the caisson and cofferdam construction to meet the approval of the designing engineers. Mr. George T. Barnsley was the resident engineer in charge of the substructure and superstructure work. The American Bridge Company, Mr. Paul L. Wölfel, chief engineer, was the contractor for the superstructure which was built at their Pencoyd shops. Robt. W. Hunt & Co. were the inspectors of steel work; and the erection will be done by the American Bridge Company, of New York. Mr. S. W. Mitchell, chief engineer, and Mr. H. A. Greene, manager, eastern division.

The Alsen's American Portland Cement Works.

The plant of the Alsen's American Portland Cement Works is located on the west bank of the Hudson River, in New York State, at West Camp, a few miles below the village of Catskill. The property on which the works are located contains a practically inexhaustible supply of cement rock and clay, both of excellent and uniform composition. The outcrop of the rock forms an almost continuous cliff or range of hills running parallel with the Hudson River and between the two, a distance of about half a mile, is a rolling country, the surface of which is clay. That upon the Alsen property is in places over 100 feet deep, and borings have shown it to be exceedingly uniform and free from foreign substances. The tracks of the West Shore Railroad extend along the foot of the cliff on the river side, and the plant is located on the river side of the tracks. When the river is open, coal can be brought to the plant and cement taken to the market in boats at a great saving in freight. When the river is frozen over, shipments can be made by rail. Water for the boilers is obtained by pumping from the river and water for condensing purposes by means of a cooling reservoir.

The buildings are as nearly fire-proof as is possible to make them. A general view of them is shown in one of the photographs, which was taken from the cliff mentioned, looking toward the river. From this and the plan of the mill building an idea of the arrangement of the plant can be had. The buildings are of brick, resting on concrete foundations. The roofs are of Ludovici tile supported by steel roof trusses and purlins. The machinery foundations and floors are of concrete, for the making of which over 50,000 barrels of Alsen's cement were imported from Germany. Expanded metal was used in the foundation work. Above the ground the floors are of concrete and expanded metal. The buildings are three in number, the main mill, the power house and the cooper shop, all separated. The main mill is in the shape of the letter T.

A leanto constructed against the south wall of the stock house is divided so as to provide room for a chemical laboratory, bath and toilet rooms for the office staff, lavatories and shower baths for the mill hands and also a room for the latter which can be used at noontime as a lunch room.

The raw stone is quarried by means of Marvin drills operated by electricity. The rock is loaded on a Hunt tramway running on tracks on the trestle shown in the photograph and passing over the West Shore Railroad. The quarry is in the side of the cliff and the loaded cars run on a slight down grade to the third story of the raw material building. The track is double with a loop at each end, the cars being drawn by an endless rope driven by an electric motor. The cars are clamped to the cable by a grip which is released by a workman when the cars are to be dumped. Opposite the entrance for raw stone, in the raw material department, is a long inclined belt conveyor which raises the clay from the ground outside to the third floor of the raw material building. The raw stone is dumped from the cars upon the floor and then dropped in hoppers in the floor supplying two Buchanan-Cresson crushers each belted to an electric motor. From the crushers the broken stone falls into rotary dryers, of which there are two, each 4 feet in diameter and 40 feet long. From the dryers a bucket elevator raises the stone to spouts discharging into bins over the ball mills, of which there are four in this department. From these mills suitable conveyors and an elevator finally distribute the rock in the stone bins, of which there are six.

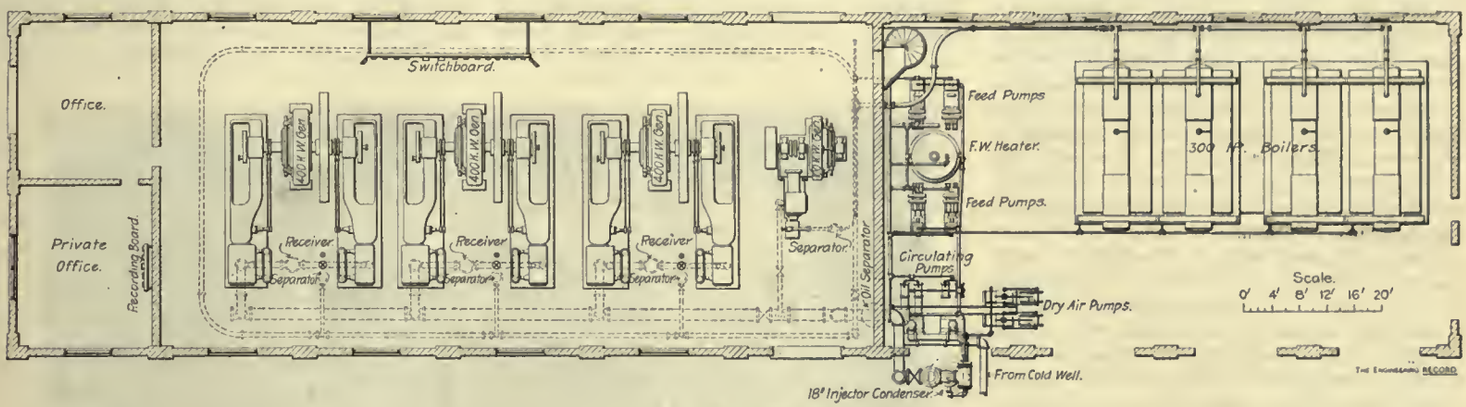


Alsen's American Portland Cement Works.

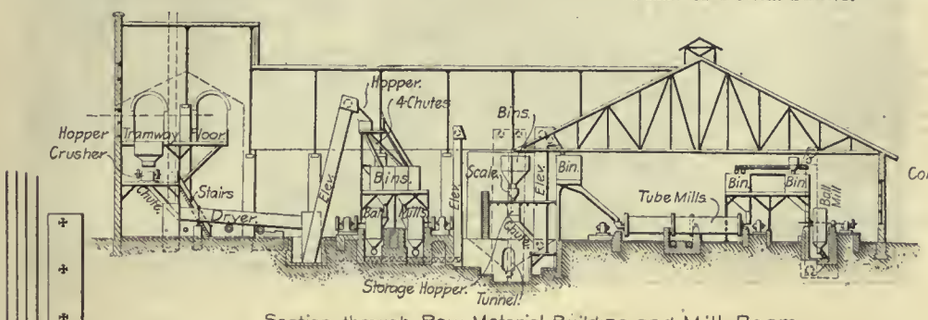
The clay, upon entering the building on the belt conveyor, is chuted into the hopper of a disintegrator from which it falls into either one of the dryers. There is room for an additional dryer and two more ball mills in this department. From the dryers the clay is reduced by two Williams mills, each belted to a motor. The material is then conveyed to the clay bins, of which there are six. These and the stone bins have hopper bottoms, and conveyors and elevators are provided to transfer the raw stone to a smaller stone bin and the clay to a clay bin over Fairbanks weighing scales, where the raw materials are mixed in the proportion that chemical analyses shows to be necessary. The mixture passes to a storage hopper from which it is elevated and conveyed to storage bins over four tube mills, where the two raw materials are further reduced and at the same time thoroughly mixed. They then

pass to any one of 16 storage bins, holding all told one week's supply. Samples are here taken, and if an analysis does not show the contents of any bin to be of the proper composition it is mixed in the right proportion with the contents of another that will produce the proper composition of the mixture. This mixing is done by drawing from the bins in the desired proportion by means of the screw conveyor system that supplies the storage bins over the rotary kilns.

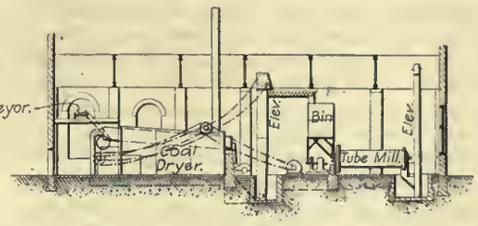
The rotary kilns are nine in number, each 6 feet in diameter and 60 feet long. They were furnished by the Vulcan Iron Works, of Wilkesbarre, Pa., this firm also supplying the rotary dryers for the raw materials and the Corliss engines in the power house. From the dryers the clinker falls into storage pits, of which there is a double row beneath the lower ends of the kilns. The two rows are divided by a tunnel in which trolley cars are run, the clinker storage pits having hopper bottoms so that the clinker can be chuted into the cars by opening sliding doors. The clinker is cooled by a blast of air that is forced up through it by two Buffalo Forge Company's blowers delivering air into a duct carried along under the roof of the tunnel and having branches supplying air to each clinker pit. The air that is used to cool the clinker passes through openings in the pit walls to three smaller blowers supplying the air thus heated to the coal burning apparatus and thus saving fuel by an amount equivalent to the heat subtracted from the clinker. The clinker cars are operated electrically by means of a double trolley. They are run on an electric elevator supplied by the New Jersey Foundry and Machine Company, and by it raised to elevated tracks that extend to storage bins over the ball mills in the finishing department. An extension of the plant now under construction consists of a storage shed for about 40,000 barrels of clinker, located to the east of the kiln room. An extension of the elevated track is run through the latter to the new structure and the cars will drop the hot clinkers on the floor to be again loaded when necessary by a clamshell bucket suspended from an electric traveling crane. There are four tube mills and their output is conveyed and elevated to tanks over the four



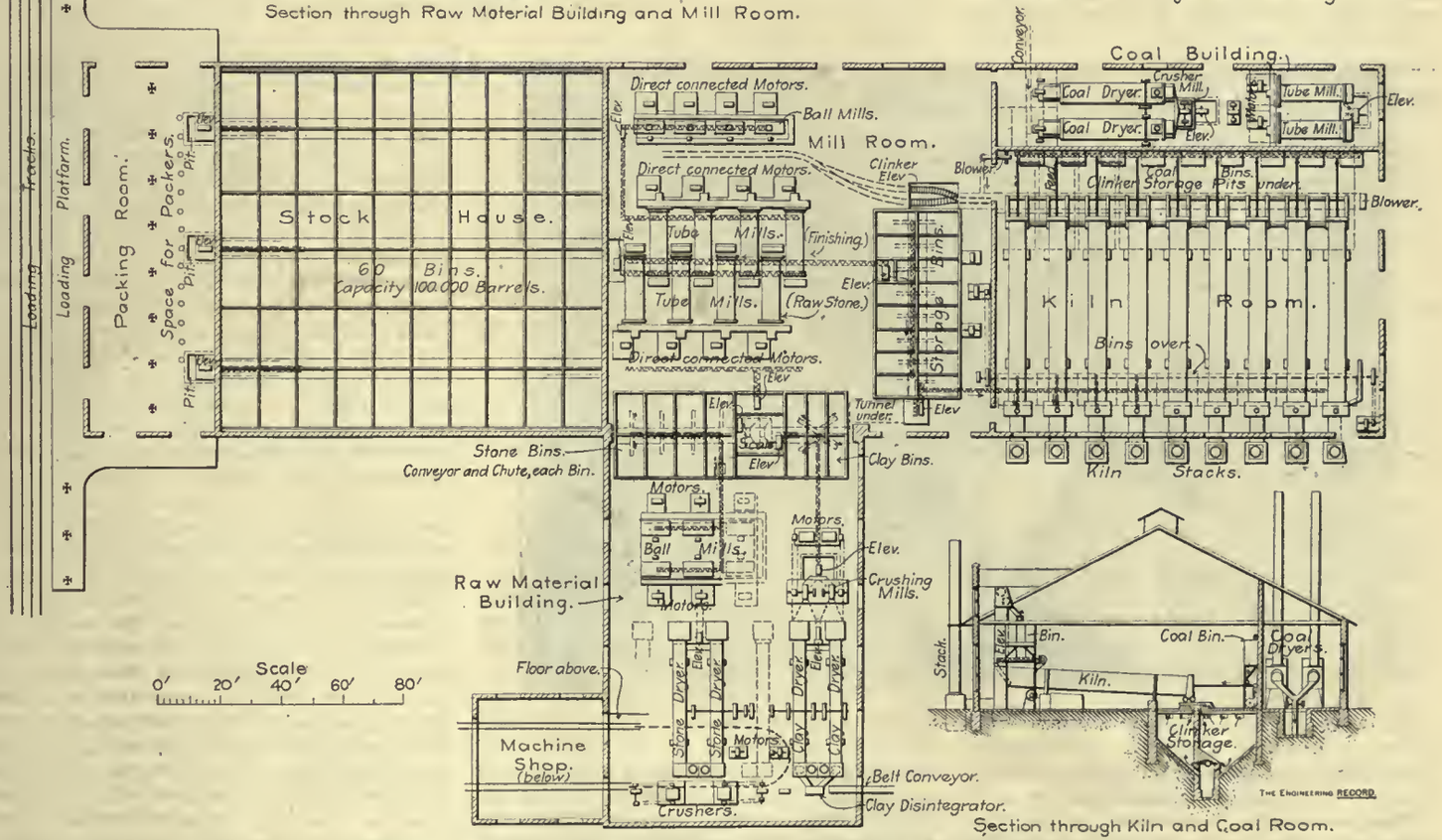
PLAN OF POWER PLANT.



Section through Raw Material Building and Mill Room.



Section through Coal Building.



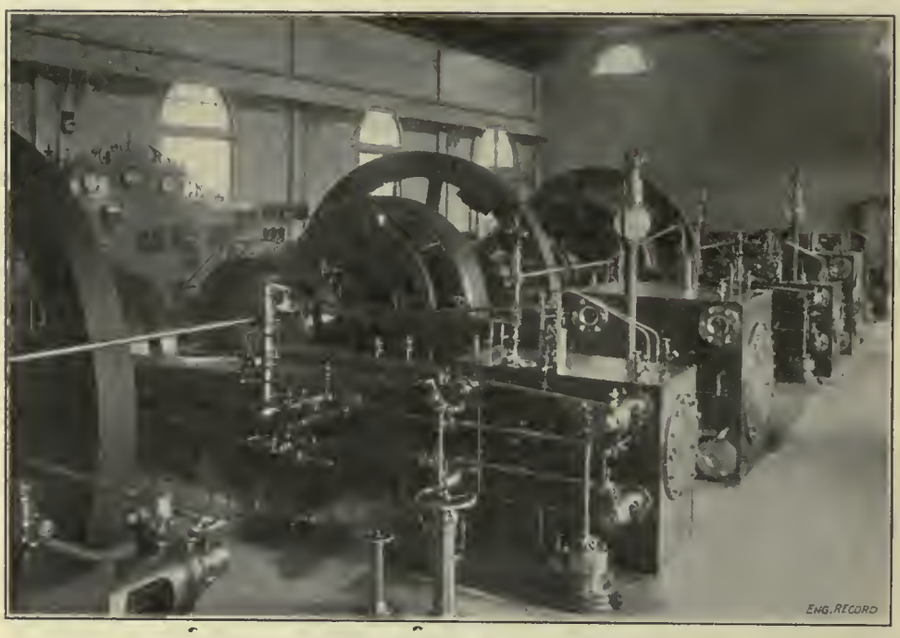
Section through Kiln and Coal Room.

ALSEN'S AMERICAN PORTLAND CEMENT WORKS, WEST CAMP, N. Y.

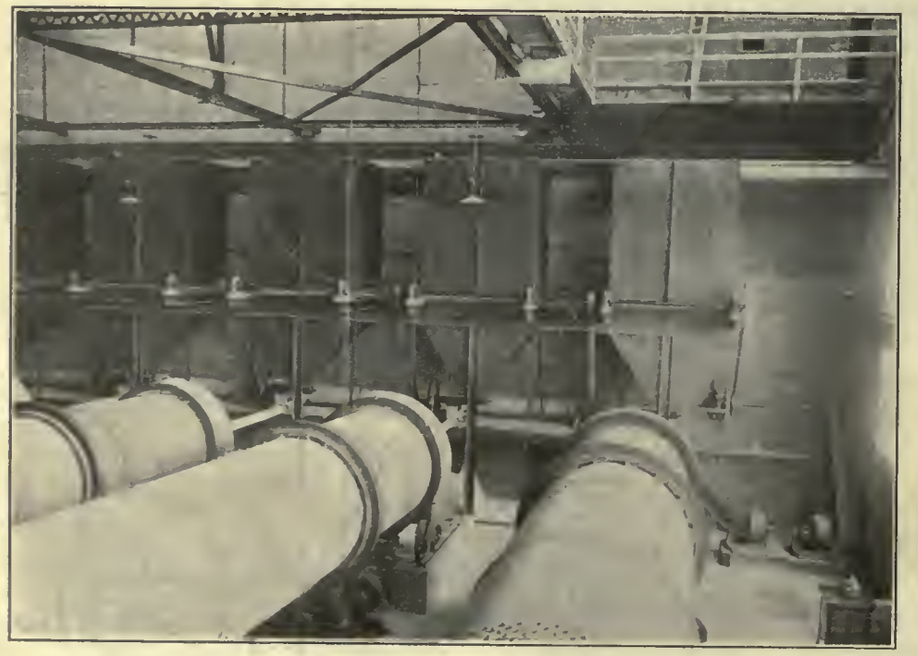
tube mills that accomplish the final reduction. There are four ball mills and four tube mills in each department. The former are No. 8 Krupp mills supplied by Thomas Prosser & Sons, while the tube mills are No. 16 Smidth mills. Each is directly connected to an electric motor.

From the finishing tube mills the cement is elevated to an automatic weighing device that records the amount of cement manufactured. From this it drops into an elevator raising it almost to the peak of the roof, where it is chuted through the walls into the stock house. This contains 60 storage bins, aggregating 100,000 barrels capacity. These bins are arranged in six rows and they are filled by three belt conveyors that extend lengthwise of the stock house, each located over the partition separating adjacent rows of bins. As the cement is chuted in the stock house it either falls directly on the conveyor in the middle or is conveyed by two smaller belt conveyors running laterally to the two others running lengthwise of the building. The long conveyors have a fixed tripper to deposit the cement in any bin beneath them. These conveyors and the one delivering clay to the raw material department were supplied by the Robins Conveying Belt Company, 21 Park Row, New York.

The stock house bins have concrete bottoms in hopper form and between each two rows is a tunnel of concrete in which is a screw conveyor to which the cement is chuted by opening a sliding door. The conveyors connect with three elevators raising the cement to the second floor of the packing and shipping department where the cement is passed through a Bonnot screen to remove any foreign substance. It is then chuted to the Howe barrel packers on the floor below, from which it is shipped.



View of Engine and Generator Room.



Rotary Kilns and Coal-Feeding Apparatus.

Spur tracks from the railroad extend along the platform of the shipping department.

The coal mill is located next to the kiln room and no combustible material of any kind was used in its construction. Coal is run on a trestle in railway cars and dumped on the ground below from which it is wheeled or shoveled into a hopper set in a concrete foundation and chuting the coal on a belt conveyor which raises it to a mezzanine floor in the coal room. From this it is chuted to the dryers of which there are two, somewhat elevated so that the dried coal falls by gravity into a Williams mill, from which it is elevated to hoppers over two tube mills where it is ground. It then passes to coal storage bins over the kilns to which it is supplied by the system that is in common use in rotary kiln practice, the heating of the air as described only being unusual. This equipment was furnished by the B. F. Sturtevant Company.

The power plant is shown in several of the illustrations. As electricity is used for driving everything about the plant outside of the power house, from the electric drills at the start to the barrel packers at the end of the process, it was possible to generate power where most convenient. Consequently a separate building was constructed to the southeast of the mills, so that the prevailing breeze in the summer time, when the windows are open, will not blow the cement dust in the engine room. At the front end of the power house are the offices of the company, next the engine and generator room and in the rear is the boiler room. The engine room is equipped with a Maris hand operated traveling crane. There are four generating units, three of 400 kilowatts capacity and one of 100 kilowatts. The generators are of Crocker-Wheeler make. Each of the larger ones is driven by a Vulcan Iron Works cross compound condensing Corliss engine with cylinders 18 and 36 diameter and 42 inches stroke, with a rotative speed of 90 revolutions per minute. The exhaust and steam valves of each cylinder are driven by separate eccentrics and the automatic cut-off is applied to both cylinders in order that the load will be divided more equally between the two cylinders under all conditions of load. The smaller generator is directly connected to a 12 and 20 by 16-inch tandem compound engine built by the Ball Engine Co., of Erie, Pa. Opposite each engine is a gage board with steam, receiver and vacuum gage. The motors are operated by 220 volt system and the lights through a balanced 3-wire system using a 5 kilowatt balancing transformer to take care of any irregularities that may exist. The switchboard for the control of the current is of marble, divided into four generator, one station and three feeder panels. Each generator panel is equipped with two single pole circuit breakers, a 3-pole generator switch, Weston illuminated dial ammeter and field regulator. The station panel has a Weston illuminated dial volt meter, volt meter switch and a Thomson recording watt meter. One feeder panel contains four switches operating 8 tube mills in groups of two; another has four switches controlling the motors in the kiln and coal grinding rooms. The third feeder panel controls eight ball mills, two Williams crushers, the motors for the raw material crushers and disintegrator; the fourth has switches for the current to the pumping station at the river, the quarry and the packing and cooper shops. Over the switchboard is a clock, and a gage board in the office contains Bristol recording pressure and vacuum gages, watt meter, etc. The electric cables are all carried in ducts built in the concrete floors. At each motor is a starting box about 18 inches square in plan and 5 feet high. They are made of planished or Russia iron suitably stiffened at the corners with light angles. They contain the starting device and over the front, always in sight and illuminated by a lamp, is an ammeter to show the amount of current used by the motor. This is a most excellent arrangement, for it affords means for any one to discover at once when anything goes wrong that causes an abnormal demand for power.

The generator and motor equipment was supplied by the Crocker-Wheeler Company, of Ampere, N. J., and it comprises some 48 motors varying from 5 to 75 horse power. Where electric motors are used in a cement mill it is an interesting problem how far the use of individual motors should be used and how many machines should be arranged in groups each to be driven by a motor. At Alsen's the large reducing machines are driven by individual motors and the conveying machinery serving them is arranged in groups with a motor connected to each group. Each ball mill is driven by a 50 horse power motor and each tube mill by one of 75 horse power. A double reduction in the speed is obtained in each case by means of two sets of spur gears enclosed in a dust proof case. A Cresson flexible coupling is also placed in the drive. Each Cresson-Buchanan crusher is belted directly to a 30 horse power motor and the belt elevator for clay and the clay disintegrator are each driven by a motor.

The rotary kilns are driven by a line shaft extending lengthwise of the kiln room and through the wall to an electric motor placed alongside the raw material bins, the motor being located there to avoid the heat from the kilns and the dust. At the other end of the shaft is a similar motor and either may be disconnected by a friction clutch. The belt driving each kiln is led to a Reeves' variable speed counter shaft from which a belt runs to the kiln driving mechanism. There is, also, a smaller belt to a small Reeves counter shaft connected to the raw material feeding device. By this arrangement any change in the speed of the kiln will cause a corresponding change in the raw material feed, and by means of the second variable speed controller the raw material feed may be varied with respect to the kiln feed. There is a friction clutch on each of the larger controllers. The blowers for the coal feed and clinker cooling are directly connected to motors. Two motors, one acting as a spare, drive a line shaft supported from the steel framework carrying the coal storage bins and a belt from this shaft drives each coal feed through a Reeves variable speed controller. Each of the finishing ball and tube mills is driven in the same manner as those used for raw materials. A motor above the stock bins drives the elevating and conveying mechanism connected with the ball and tube mills and another, located on a platform built on the lower chord of the roof trusses drives the elevators from the tube mills and the belt conveyors in the stock house. The elevators in the packing house, the barrel packers, etc., are driven by a motor in the second floor of the packing house.

In the coal grinding room the Williams mill is driven by a motor and the two tube mills by one each. Another motor drives the dryers and most of the elevators and conveyors. Each tube mill is direct driven and on the opposite end of each is a sprocket wheel connected by a link belt and friction clutch to a line shaft driving the elevators and conveyors from the tube mills to the coal storage bins in the kiln room. The various parts of the power transmitting machinery were furnished by the George V. Cresson Company and the Webster Manufacturing Company.

The elevators, encased in steel, are of unusual design in that they consist of single chains in the form of a belt, with iron buckets clamped to them, passing over grooved wheels at the top and bottom of the elevator. They were supplied by the Link-Belt Engineering Company. All of the screw conveyors are of the continuous flight type made by the H. W. Caldwell & Son Company. Coal is carried around the plant to the dryers by Koppel industrial cars run on narrow gauge tracks. The storage bins for partly crushed rock and clay for reduced raw materials and for the finished cement in the stock house are made of 2x4-inch timbers nailed together with the 4-inch faces lying flatwise. They are provided with hopper bottoms of concrete. All other bins are of sheet steel stiffened by angle irons. These latter were made by the McClintock-Marshall Construction Company.

The boiler room contains four 300-horse power Babcock & Wilcox boilers. Bituminous coal is burned. One boiler is equipped with a Jones underfeed stoker fitted with forced draft supplied by an American Blower Company fan. The boilers discharge their gases into an underground smoke flue leading to a radial brick chimney erected by the Alphonse Custodis Chimney Construction Company. The stack is 8 feet in diameter and 200 feet high. Steam from the boilers is carried in a ring main encircling the engine foundations in the engine room basement. At each engine, branches connecting with the top of this main lead to separators and from them to the engines. Floor stands are used to control the throttle valve and valves in the exhaust pipes; all of the piping being in the basement. The pipes were all covered with magnesia sectional covering by Robert A. Keasbey. The exhaust from all of the engines may be led to the atmosphere, but usually the engines are run condensing, a Worthington central jet condenser being supplied. Two 6x12x12-inch dry vacuum pumps and two 12x15x15-inch circulating pumps are provided for this, the latter drawing water from the cooling reservoir. Four boiler feed pumps are also provided. On account of possible trouble the feed water for the boilers is drawn from the Hudson River, a pumping station being located on the river bank, 2,200 feet from the power house. In it is a 6½x8-inch Deane triple pump driven by a 16-horse power electric motor. This raises the water to a large concrete reservoir of 220,000 gallons capacity and located on a low hill between the river and the power house. The elevation is sufficient to give a pressure of about 25 pounds at the plant. The circulating pumps are arranged to draw water from this tank and supply a fire protection system if ever necessary. The exhaust steam from all pumps is used to heat the feed water in a Stilwell-Bierce & Smith-Vaile open heater.

The consulting engineers of the plant were Messrs. Lathbury and Spackman, of Philadelphia, and Mr. Claudius Peters is chief engineer and superintendent of the works.

The New York Shipbuilding Company's Plant, Camden, N. J.

Most of the great industrial plants in this country, which have installations represeuting millions of dollars each, have been gradually developed so that their present structures and appliances represent the progress, extensions and modifications of several years. In many cases, one great enterprise is the offshoot from some other industry; in others they are established separately on a comparatively small scale and are greatly extended to meet commercial requirements; in still other cases, those plants which have been established the longest have found it necessary to revolutionize their methods of operation, particularly the development and distribution of power and the handling of materials and product. These diverse conditions produce results which have, in most instances, been disadvantageous on account of the difficulty of combining different systems having radical variations in structures and methods.

It is well understood in these days of close competition and narrow margins that the magnitude and consequent capacity of the plant, the continuity and simplicity of its operations, the proportion of work which can be performed without hand labor, economical development and transmission of power, and the efficiency of organization are the great elements of success. It is obviously difficult or impossible to secure these results satisfactorily with a large plant formed by the accretions of many years; it requires a high degree of ability and wide experience to compass the desired ends in installation of a great new enterprise. So many of the features of one very large industrial plant are related to those of another, even when the products are dissimilar, that it is of value to study the general principles of design, arrangement, construction, equipment and operation of a great new plant with relation to its individual characteristics, as well as for their bearing on the engineering problems which arise in all great modern installations.

The New York Shipbuilding Company's plant at Camden, N. J., representing an outlay of $10,000,000 made within four years, was designed and created as one harmonious whole to have a unity of arrangement and operation, with a complete equipment for the construction of all portions of modern steel commercial and battle ships. The plant is designed for a present yearly output of hulls weighing 50,000 tons, and for such extensions as may be required to double this capacity.

A comparative estimate of the magnitude of this plant may be formed from the statement that it has twenty-two acres of roofs, mostly continuous, an area twice as great as that of any other ship yard in this country. The present output is materially greater than that of any other American plant and is fully equal that that of the largest shipbuilding plant in the world. The total number of employees, however, is much smaller than the total forces of any of the other large shipbuilding plants, and is scarcely more than half as large as that of some which are comparable with it and turn out about half as great a tonnage; but it is fair to say that this discrepancy is to some extent due to the different classes of work at the different plants.

This ship yard is equipped with complete service for the distribution of various kinds of power from a central plant to all portions of the works, with comprehensive systems of handling and transferring materials, with improved machinery of great capacity and generally independent action, and with buildings of advanced structural design. It has thoroughly organized technical and mechanical forces. All the features of the enterprise are intended to conform to the most direct and efficient operation of the whole and have been designed after special study of the other most important plants of a similar character in this country and abroad. Experts in the different branches of construction and engineering have collaborated under the direction of the president, Mr. Henry G. Morse, M. Am. Soc. C. E., who previously directed a large shipbuilding plant, besides having had many years' experience in the construction and operation of bridge and structural iron plants.

The company's plant and offices occupy about 140 acres of level, sandy ground on the east shore of the Delaware River, in the southern part of the city of Camden. The property is intersected by an important city street, on one side of which are the enclosed shops and yards, while on the opposite side is the main office building, adjacent to which are two street car lines and two railroad passenger depots. The yards are traversed from north to south by six lines of railroad tracks, each 3,000 feet long, which are connected with the Pennsylvania

and the Philadelphia and Reading railroads. On the west side there is a water front 3,600 feet long and from 1,500 to 1,800 feet from the street which bounds the east side. There is a pier 72 feet wide and 1,200 feet long, and a lumber wharf 500 feet long, where river and ocean freight can be received and delivered, thus giving abundant facilities for the transportation of all supplies and materials. The low tide depths of the water adjacent to the pier and launching ways and in the slips has been increased to minimums of 40 and 30 feet respectively by excavation with a suction dredge which discharged the sand removed from the river bottom over the shore and thus built up a large amount of valuable land. Four pairs of ways with their axes east and west, perpendicular to the shore line, are provided for building and launching ships up to 1,000 feet in length. The southernmost pair of ways are built in the open air, without covering, and are served by ordinary derricks and gantrys. The remaining three pairs are each protected by a steel frame shed 150 feet high, 900 feet long and 120 feet wide in the clear. These sheds are enclosed on the north and south sides, and on the upper parts of both ends; but have no other division between them than is afforded by the steel frame work. The north shed is extended toward the north, beyond the pair of ways, to form a second pier covering, enclosing a wet dock in which two large hulls may lie side by side for finishing and fitting after they have been launched. The east, or shore, ends of these sheds all intersect the plate and angle shops, which have their axles north and south, parallel with the shore line.

Adjacent to these shops, on the east, is the main shop, which contains a machine shop and boiler shop and part of the store house, and is about 1,200 feet long by 250 feet wide. This group of shops and sheds is thus compactly arranged to occupy an L-shaped space about 1,100 feet long from east to west and 1,500 feet long from north to south including, under its continuous roofs, all departments of the shipbuilding plant, except the wood working and paint shops and the power plant. The main shops may be considered as a rectangle 1,200 feet long from north to south and 400 feet wide from east to west composed of five parallel aisles. The two western ones, each 125 feet wide, are overlapped by the shore ends of the ship sheds for a length of about 550 feet. This part of the building is common, therefore, to both sheds and shops, is served by both crane systems, and is used principally for temporary storage of hull material after it is ready for assembling.

All of the shops and sheds have numerous systems of electric girder cranes traveling parallel with their axes, and so arranged as to command all of the ground area and serve most of it with two or more sets of cranes for light and heavy work. All the lines of shop cranes can deliver to the shed cranes, which travel at right angles to them, and thus transfer materials and machinery from the tools to the ships. The standard gauge railroad tracks in the yards have branches which enter the shops at several points at right angles to the tracks of the traveling cranes, and, with the exception of two short lengths of longitudinal tracks on both sides of the main aisle in the boiler shop, these are the only surface tracks in the shops or sheds. The main shops are divided by the four intermediate rows of steel columns which support the moderate span double pitched roofs, but which do not have any partitions or division walls, except the one between the angle shop and the boiler shop which is extended to form the division wall between the east end of the ship sheds and the machine shop. The outer walls are all built of brick with numerous large window panels.

A portion of the north end of the main shops is occupied by the store house, which is about 90 feet wide and projects 200 feet beyond the east face of the building. It is traversed from east to west by a long span unloading gantry which runs on a track extending across the yards and is intersected by standard gauge surface tracks. Plates, angles, shapes and bars are stored here and delivered by cranes and derricks, which move east and west, to those in the main shops, which move north and south, and the tools are so arranged that all operations, excepting some of those in the machine shop, are successively performed and machine work on them is completed and they are delivered to the cranes in the ship sheds, which carry them west and assemble them. The detached buildings of the plant include the template and pattern houses, the joiner shop, the paint shop, the dry kiln, the power plant and the pump house; the former having been separated to minimize the danger from fire.

All the shops are supplied with fire-hydrants and hose, and with automatic sprinkler service. They are heated by the Sturtevant hot blast system and by direct radiation, and their tools are driven by independent electric motors or by hydraulic or pneumatic pressure which is distributed throughout the plant. The only exceptions to this rule are the hammers in the blacksmith shop, which are operated by steam from the central battery, and a few groups of small tools in the machine shop which are driven from line shafts operated by separate electric motors.

Coal is delivered on an elevated siding, from which the cars dump into open hopper-bottom bins which discharge it on to the boiler room floor in the power house. This building is 100 feet wide and 175 feet long with a brick center partition and outside walls. It is covered with a two-span steel truss roof ceiled with non-condensing asbestos board. On one side it contains six Cahall water tube boilers of 2,500 combined horse-power, installed by the Aultman-Taylor Company, and four 500-horse-power Babcock and Wilcox boilers, all in a single row and connected with a 200-foot stack, 8½ feet in diameter inside, built of hollow radial brick by the Alphons Custodis Chimney Company. A Greene economizer has been installed. Either battery of boilers suffices to maintain a pressure of about 200 pounds for orinary service. On the opposite side of the partition the dynamos, engines, pumps and compressors are installed for the power distribution service. There is one 21x34x5½x24-inch Snow pump with a 4-inch discharge; two 16x12-inch compound Barr pumps are coupled with this pump to the R. D. Wood & Co. accumulator which maintains a pressure of 1,500 pounds per square inch for the hydraulic service in the machine and boiler shops. There are two 8x10x10x12-inch compound Snow pumps, which deliver water through a 6-inch main for general distribution through the shops and offices. This water is deriver from eight 6-inch artesian wells from 85 to 120 feet deep. It is used for drinking and washing purposes, and may be connected with the steam boiler supply.

The pneumatic pressure system is operated by two Ingersoll-Sergeant compound air compressors, each with a capacity of 4,800 cubic feet of free air per minute to a pressure of 40 pounds. Their condensers are supplied with a Nordberg air pump. In another room of the power house there are three compound engines made by the Providence Engineering works and direct-connected to 500 kilo-watt Westinghouse generators for both alternating and direct currents. Two of these engines are normally in service and the third is used for a reserve. There is also an Ames Iron Work's electric light engine and dynamo to supply illumination when the main engines may not be running. All the motors for the different tools and machines are of the Westinghouse alternating current induction type.

The fire service is operated by two 20x12x15-inch underwriter Worthington pumps in a separate house. They have two 16-inch suction mains terminating with foot valves in the Delaware River and discharged through a 12-inch main branched to all shops and sheds, to the different parts of the yards, and to a 150,000-gallon steel tank at the top of a 200-foot steel tower which is used to give a gravity pressure for all parts of the automatic sprinkler system which is being installed in all shops. The mains are connected to about seventy-five yard and shop hydrants for which numerous fixed hose reels are provided to command all parts



View of New York Shipbuilding Company's Plant, Looking North.

of the plant. There are besides, several hose wagons in sheds adjacent to different shops; and a special fire department has been drilled for service in an emergency. In order to insure the constant efficiency of the system, the fire pumps are kept in continual operation, running very slowly and maintaining a circulation through the closed mains at a pressure of 110 pounds per square inch, which is automatically increased to 200 pounds per square inch if any outlet is opened.

A fundamental principle in the design and operation of this plant has been the axiom formulated by Mr. Morse that because an operation has always been performed in a certain way it does not follow that this way is the best or most economical one. In accordance with this view, many features and conditions, which have generally been accepted without question by industrial plants, have been the subject of special investigation and comparative estimates which have led to radical changes in construction and operation. For instance, among the minor illustrations is that of the extensive systems of storage skids which, instead of being built as customary with timber beams and blocks, have been made throughout with solid walls of concrete supporting the usual bearing rails on top. The total cost proved to be only slightly in excess of that of the timber construction and the durability is very much greater. Similarly, some of the main floors have been built of concrete at a cost not greatly exceeding plank floor and securing great economy of maintenance.

Probably the most notable departure from established practice has been in the method of marking and fitting the hull materials. The ordinary system of lifting the plates and angles from the frame of the ship itself has been completely abandoned and they are lifted instead from the lines laid out in the mould loft. In this way a system of wooden templates corresponding substantially to those used in high grade bridge construction is provided for every piece of material in the ship's frame, deck, etc., and no matter how complicated the piece is with angles, bends and difficult connections, it is made and finished in the shops ready to be riveted in place and no cutting or fitting is done on the frame of the ship. Besides, this, the usual method of ship building is reversed, and instead of first erecting the frame and then the plates, the plates are first bolted together so as to form the outer skin and then the frames, decks and other interior portions are built on to them and the portions of the ship are completed successively from the bottom up, thus enabling all parts to be advantageously handled by the efficient girder crane service and avoiding unnecessary obstructions and difficult riveting. The equipment is notable in that it is all of the most modern and complete type, and that in the boiler, plate and angle shops, especially, nearly all of the machine tools are new and special, having been designed or modified for the purposes of this plant and including five types of special punches alone, besides some machines which have been imported from abroad, and a number of standard tools of unusual magnitude and capacity.

The New York Shipbuilding Company has its principal office at the plant in Camden, N. J., and another business office in New York City. As before stated, this company was planned and organized by Mr. Henry G. Morse, M. Am. Soc. C. E., who personally directed the entire design and construction, the equipment of the different shops, the detailing of many of the special tools and the structural steel work, and now directs the operation of the plant. His staff includes Mr. DeCourcy May, general manager; Mr. Myron C. Wick, vice-president; Mr. W. G. Randle, treasurer; Dr. Francis Elgar, consulting naval architect; Mr. Samuel M. Knox, secretary; Mr. Chas. S. Hall, purchasing agent; Mr. W. DeW. Dimock, New York agent; Mr. James Donald, naval architect and head of hull department; Mr. L. D. L. Lovekin, chief engineer; Mr. G. M. Andrews, superintendent of machine department; Mr. E. H. Sapp, civil engineer for the plant; Dr. W. L. Robb, consulting electrical engineer. During the construction of the plant Mr. W. F. Gronan, C. E., was the civil engineer in charge of buildings and grounds, and Mr. Julian Kennedy, consulting engineer.



MACHINE SHOP, LOOKING NORTH INTO BOILER SHOP.

(To be continued.)

The Septic Tank: Its Place in the Treatment of Sewage.

By Leonard P. Kinnicutt, D. Sc.

Twenty-one years ago there appeared in the "Cosmos les Mondes" an article describing the Mouras automatic scavenger, which consisted of an air-tight vault with syphon discharge pipe. Abbé Moigno, in describing the process, said that the solid fecal matter which enters the tank is decomposed, fermentation taking place, which results in the formation of a homogeneous fluid only slightly turbid, in which any suspended matter is in the form of scarcely visible filaments; and he suggested that the action by which the solid matter was decomposed, might be due to those bacteria, which, according to Pasteur, seem only to live or act in vessels devoid of oxygen. In this article we have not only a good description of what is now known as the septic tank, but an explanation of what takes place in the tank in perfect accordance with our present ideas.

The article, however, though noted and referred to in many scientific journals, did not receive the attention it deserved, and it was left to Cameron, of Exeter, England, to show that this process could be used to advantage on a large scale. His experiment at Exeter, using a closed tank of 53,800 gallons capacity, is so well known that it is unnecessary to enter into any details regarding it, and it is sufficient to say that the results he obtained convinced sanitary engineers that a closed tank, through which sewage passed slowly, was a means by which not only the amount of suspended organic matter in sewage could be greatly reduced but a partial purification of the sewage brought about, and almost immediately after the publication of Cameron's work, experimental septic tanks were built in many places in England, first closed tanks, similar to the one at Exeter, then open tanks, until now, in England and in this country, septic tanks, closed or open, are recognized as an essential part of modern bacterial purification processes.

Why is this so and what is the function of the septic tank, or, in other words, what place should it take in modern sewage methods? To answer this question we must know the result of so-called septic action on sewage. What does the septic tank do? First: It equalizes the composition of the sewage. Second: It removes from the sewage not only suspended matter, but a portion of the solids that are in solution. Third: It changes the character of the sewage, increasing, as a rule, the amount of free ammonia, and decreasing the amount of albuminoid ammonia. Fourth: It liquefies, or changes into gaseous products, a portion of the suspended matter at the bottom of the tank, thus reducing the amount of sludge. Fifth: It renders, as a rule, the sewage more easily acted upon by nitrifying bacteria.

As to the exact amount of work that the septic tank does in each of the above-named ways, opinions differ. It depends, in my opinion, on the character of the sewage and as general statements, the following, I think, may be accepted: That the total amount of suspended matter removed depends greatly upon the construction of the tank, and that the greatest amount is removed in tanks divided longitudinally into three or more compartments, by walls rising 1 to 2 feet from the bottom of the tank, and by screen boards descending from 6 inches to 1 foot beneath the surface of the liquid. Tanks of this description are now used in England and also in this country. With domestic sewage, using tanks of this kind, the suspended matter which is found in the effluent, is in nearly the condition described by the Abbé Moigno, scarcely visible filaments. The total amount of organic matter removed depends on the character of the sewage and on the construction of the tank, and, as a rule, the stronger the sewage the greater will be the percentage of organic matter removed; more will be removed in warm weather than in cold weather and more from an alkaline sewage that from an acid sewage containing manufacturing waste. Judging from the albuminoid ammonia, in domestic sewage, using a properly constructed tank, the amount removed averages about 50 per cent., with an acid sewage not over 30 per cent.

As to the amount of solid matter liquefied or changed into gas, earlier opinions have been modified. Just after the publication of Cameron's paper the idea was prevalent that the sludge question, the most troublesome problem of sewage treatment, was solved. That the decomposition of the solid matter in sewage was so perfect, that all the solid matter that would remain to be cared for, was the ash or mineral part of vegetable and animal substances in the sewage, and this amount would be so small that it was hardly worth considering. Unfortunately this is not the case; the action in a septic tank is never so perfect but that part of the organic matter still remains in the solid state. The amount that remains depends on the kind of solid matter in the sewage, the character of the sewage, the temperature of the sewage, and the velocity and evenness of flow of the sewage through the tank. If a sewage contains only fecal matter, the decomposition of the solid matter is very complete; if it contains a large amount of cellulose, or fat, substances which are not so easily acted upon by the bacteria in the tank, the amount of solid matter remaining unliquefied, is comparatively large. If the sewage itself is slightly acid, and contains a large proportion of trade waste, the action that takes place in the septic tank is less complete than if the sewage was what is called domestic sewage. The temperature also has a decided effect, and at a temperature of 70 degrees Fahrenheit more complete action takes place than at 50 degrees Fahrenheit. The velocity and distribution of the sewage in the tank also play an important part, and much depends on the careful construction and operation of the tank, as to the results obtained.

From the results obtained, both in this country and in England, I believe the amount of sludge converted into soluble or gaseous substances, with ordinary town or city sewage receiving surface drainage, and under favorable conditions as regards temperature, construction of tanks, and careful oversight, does not average over 40 per cent.; and if the sewage contains large amounts of trade refuse, the amount of sludge destroyed will average nearer 25 than 40 per cent. Further, if, from conditions not as yet fully understood, in place of a sludge forming at the bottom of the tank, most of the arrested matter forms a crust on top of the liquid, the amount of arrested matter that remains unchanged in the tank, may average over 75 per cent. The formation of a heavy crust, and little or no deposit at the bottom of the tank, has been noticed more often in this country than anywhere else. It is partially due, I think, to the absence of heavy material or mineral matter in the sewage, which helps to carry down the suspended matter, and when this suspended matter rises, as it does by the action of the gas formed in the sludge at the bottom of the tank, tends to carry it down again.

Allowing that the changes that take place when sewage undergoes septic action are as stated above, what effect will the septic tank have when used in connection with intermittent filtration beds, contact beds, and percolating filters? Intermittent filtration beds can certainly be used with crude sewage, from which the heavier and coarser substances have been removed by catch-basins and screens. Such beds, however, have to be raked over every few weeks to remove the suspended matter which forms a layer, more or less impervious to water, on top of the sand. In winter, when this cannot be done, such beds will not take care of the same amount of sewage that they are capable of receiving in summer, and very often in winter weather, more or less crude sewage runs untreated, or only partially treated, into the nearest stream. If septic tank sewage is applied to such beds, we are applying a sewage from which the suspended matter, except that which is in a very fine state of subdivision, has been removed; one that contains at the most 70 per cent. of the organic matter that was in the crude sewage, and a sewage whose composition varies only very slightly from hour to hour and the area required can be reduced at least one-half.

On the other hand, the objection to the use of septic tanks in connection with intermittent filtration beds, is the odor that arises from septic tanks and the necessity of caring for the sludge that remains in a solid condition in the tank. As to the odor from a septic tank, I believe that the odor given off is largely dependent on the rate of flow of the sewage through the tank; or, in other words, how far septic action has been allowed to proceed. If septic tanks are properly operated, I believe that with ordinary town or city sewage the odor given off is not of such a character as to be the cause of complaint, unless the tanks are situated in a thickly settled district or close to a main highway. In England certainly very little trouble has been caused from the odor from open septic tanks. As to the sludge there is no question that from time to time the tank must be cleaned out, and in determining the frequency with which this will have to be done, it is well to allow, to be on the safe side, that about 70 per cent. of the total suspended matter arrested by the passage of the sewage through the tank will remain as a permanent deposit or sludge in the tank.

What place the septic tank occupies in the process of purification of sewage by intermittent filtration depends therefore upon local conditions, and in deciding whether or not it shall be used in connection with this process, the sanitary engineer must take into account the character of the sewage to be purified and the cost per acre of properly constructed sand beds, in the locality where the sewage is to be treated. With contact bed and with continuous intermittent filtration methods crude sewage cannot be used; the suspended matter in the sewage must first be removed. The two practical ways of removing suspended matter are chemical treatment and septic action. The objections to chemical treatment are well known from years of experience and at the present time there are very few sanitary engineers who would for a moment consider chemical treatment unless the sewage contains so large an amount of free acid or other germicidal substances as to very much retard or prevent bacterial action. To sum up in one sentence the place of the septic tank in the modern methods of sewage treatment, I should say that in the majority of cases it was a valuable adjunct to the method of intermittent filtration and an essential adjunct in the methods of treatment by contact beds and percolating filters.

Rotary Converters of 2,000-Kilowatts capacity are to be furnished to the New York Edison Company according to a recent contract secured by the Stanley Electric Manufacturing Company, of Pittsfield, Mass. Four of these are to be constructed on the S. K. C. system.

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Twenty-five Years' Work and Development.

By Henry C. Meyer.

The Engineering Record, which has just completed the first quarter of a century of its existence, was founded by the writer on the suggestion that there was need of a journal that should enlighten the public on matters of safe and sanitary building. The illness resulting from bad planning, ignorant and rascally work in connection with the water supply and drainage of buildings then prevailing had caused serious discussion in this country and in England as to the wisdom of relying on the water carriage system for the disposal of household wastes. Hence in its first year dangerous blunders in house drainage were illustrated in The Engineering Record, as well as plans of existing tenement houses in New York City which the law then permitted to be built and in which so large a proportion of the population were obliged to exist. These illustrated articles and the discussions of the conditions revealed promptly appealed to the daily and medical press as directly dealing with problems affecting the public, hence unusual notice was accorded them.

To effect any reform it seemed important that the co-operation of architects and city engineers should be secured. With a view therefore of interesting the former, the architectural competition, of 1879, for plans of improved tenement houses was instituted. Up to that time architectural competitions had been in bad repute. Unless this one could be instituted and carried out on lines different from those hitherto followed, it was felt that the outcome would prove a failure and it would result in alienating the professional class whose co-operation it was so important to secure. The late R. G. Hatfield, an eminent consulting architect of the time, was retained to draft the rules to govern this competition. These were referred to prominent members of the profession, and, as finally agreed on, were published as the terms under which the tenement house competition of 1879 was to be conducted. The Engineering Record, then known as The Sanitary Engineer, was credited with thus being the first to recognize requirements now considered essential in all properly conducted public architectural competitions, namely, expert professional members on the committee of award, the anonymous submission of plans, and precise rules as to method of rendering drawings, in which shading and coloring intended to unduly influence laymen were prohibited.

The results following this competition were greatly beyond expectation. Two hundred and four plans were received and for two weeks publicly exhibited. Much notice was taken of them by the press, two public meetings at the Cooper Institute were held, and the "tenement house evil" was the topic of discussion in churches of the city on an appointed Sunday. Popular interest being thus aroused, a committee was appointed headed by the late Mr. James Gallatin, through whose untiring efforts at Albany, with the aid of the press, the passage of the Tenement House Act of 1879 was secured. This restricted the space to be covered by such buildings to about 65 per cent of the lot, whereas 90 per cent. had been occupied before. The enforcement of this act was placed in the hands of the Board of Health, of which Prof. Charles F. Chandler and Dr. E. G. Janeway were the active members. The struggle to defeat this legislation was most persistent, likewise the effort to have it modified or repealed; but the ability and tact of these gentlemen in this pioneer period secured for the measure the support of public spirited citizens, and attempts of interested parties to break its force met with failure. Its enactment marked an important epoch in the problem of the housing of the working classes and attracted much attention in England. As a further result the services of architects were more appreciated and were, indeed, made imperative in the planning of these buildings under the new conditions.

The following year another competition for public school plans was instituted, the committee of award being Mr. George B. Post, Prof. W. R. Ware, Dr. John S. Billings, Dr. C. R. Agnew and Mr. John D. Philbrick. The design that won the first prize was of a type that secured light and air for the building by means of an interior court which communicated by two archways with the street. This feature was afterwards adopted by Mr. Post in his plans for the Mills office building in Broad Street, and is now often seen in school and office buildings where side walls can have no openings.

To enlist the interest of the city engineers the problems of water supply and distribution, sewerage and sewage disposal also, were dealt with in 1878, and have been since that time. The late Mr. Edward S. Philbrick was the first regular editorial contributor on these subjects. Col. George E. Waring, Jr., contributed a series of articles to show how the mortality rate of English cities had been reduced by the introduction of modern sewerage systems. The discussions and controversies over the scope of the availability of the so-called separate system of sewers soon became prominent, and continued to be instructive during the next 10 years.

The interest of the architects was further sought by discussing the need of providing for the ventilation of buildings and the proper methods of installing steam and hot water heating plants, elevators and the mechanical equipments of buildings. The late Mr. Robert Briggs contributed a series of articles on steam heating in 1878, then the first published, and later articles by Mr. W. J. Baldwin on both steam and hot water heating appeared. Descriptions of current notable work in the United States and Europe have since constituted a regular feature of this journal, and its articles demonstrating the entire feasibility of heating railway cars by steam from the locomotive were used to secure the legislation in New York State which abolished the car stove.

A third competition was instituted in 1890 for designs of water towers and pumping stations, it being held that water companies receiving public franchises should not disfigure the landscape by the erection of the unsightly steel stand pipes then so prevalent. The committee of award in this case included architects and engineers. The publication of the prize and "special mention" designs also exerted a good influence, as is demonstrated by the improvement in design of stand pipes, towers, pumping and power stations and factory buildings. It was, also, with this object in view that the series of European bridges and bridge approaches were published in 1901.

In 1881, largely through the efforts of this journal, a law was passed by the legislature of New York providing that in the cities of New York and Brooklyn all work in connection with the drainage of buildings must be done under rules prescribed by the Board of Health, which when promulgated should have the force of law and the board was made responsible for their enforcement. The rules published by the board in 1881 were substantially on the lines of those laid down in this journal in September, 1878, under the title "Requirements for the Drainage of a House." Substantially these requirements are in the plumbing regulations of all the cities of the United States, modified in recent years in certain details to meet needs of new conditions and local circumstances, although when the first were prepared conditions existing in New York were in mind. With the enforcement of these laws the subject of house drainage was subordinated and city engineering problems made prominent as well as the heating, ventilating and mechanical equipment of buildings. Of the former were water-works construction and management, water waste prevention, care and maintenance of sewers, bridges and docks, the scope of the paper being widened to include the two latter important branches of civil engineering. Hence bridge design and erection have since been conspicuous features.

In 1886 a series of articles under the title, "Builders' and Contractors' Engineering and Plant," were announced, in which it was proposed to publish regularly "illustrated descriptions of methods and plant employed in important engineering works and on notable buildings, preference being given to work in which novel problems are presented and exceptional measures adopted."

In 1885 there was erected in Chicago The Home Insurance Building, from the designs of Mr. W. L. B. Jenny, of that city. These designs were published in The Engineering Record and marked a new departure in the construction of tall buildings. This structure was conceded to be the first of the now familiar steel skeleton type. A series of articles by Prof. W. H. Burr on the design of such buildings was subsequently published. Illustrated descriptions of novel features in the foundations and superstructures of important buildings have since continually appeared. These descriptions, with the plans of notable bridges, secured the interest of those called upon to design or erect modern steel structures, and The Engineering Record has been credited with contributing not a little to the creation of the demand for structural steel, the production of which is now one of the great industries of the country.

Among the other problems with which the city engineer has had to deal, but concerning which the public was ignorant, and hence apathetic and often obstructive, were those of water waste prevention, improved pavements and good roads. Fifteen years ago stone blocks and cobble stones were used for paving streets of cities and dirt roads were the means of communication between towns. It was impossible to properly clean the stone pavements, and the form of rail which street car companies were allowed to put down proved a serious hindrance to all other vehicular traffic. Examination of the methods adopted in the best paved cities in Europe resulted in a series of articles, in 1886, describing the practice there. Prizes were later offered for essays on road building, the committee of award consisting of Messrs. Edward P. North, Francis Collingwood and James Owen, recognized as authorities. In reporting on the essays submitted, these men presented their views of the essential requirements of a good road. This report and these essays, as well as the articles on pavements alluded to appeared in The Engineering Record and afterwards in book form. They also have been credited with exerting an educational influence upon the press and public spirited citizens in various communities so that they were willing to urge that money should be voted to secure the advantages improved pavements would afford, which, aside from the pleasure resulting from their use, directly enhanced the value of real estate on any street thus paved. The demand for better pavements and roads within the past fifteen years has also developed new industries and profitably employed vast sums of capital.

Prior to 1882 a reckless and ignorant waste

of water was the rule in all cities in the United States, with the single exception of Providence, Rhode Island. Any attempt by officials to impose restrictions on those responsible for this waste was denounced as unsanitary and unreasonable, and the popular cry in the daily press and elsewhere was, "water should be free as air." Hence when supplies ran short money was voted to increase pumping capacity and build additional reservoirs, and new and more remote sources of supply were sought long before available supplies were legitimately used. This state of affairs suggested the series of articles on water waste prevention in 1883. In these the experience and practice of English cities was described, and the methods there employed to check this evil, originally first successfully attacked in England by the late Mr. Thomas Hawkesley, F.R.S. Domestic conditions in the United States being different from those in Europe, the adoption of meters proved to be better suited to American cities than the house to house inspection of water-works officials, which was the practice in England. The beneficial results that have already followed the use of meters in the United States during the past fifteen years, and the steady removal of popular prejudice regarding this means of checking waste is well known and is elsewhere referred to.

Steam and hydraulic plants of pumping stations and large buildings were also regularly described in The Engineering Record, hence its scope naturally widened to cover similar plants in large industrial establishments, in which the economical generation of steam, distribution of power and transmission of bulky materials were prime factors in the successful operation of the establishments, and in which the civil and mechanical engineer were employed to secure the best results in design and construction. This explains the conspicuous prominence, during recent years, of the illustrated descriptions of these undertakings, in which cement works, paper mills and power stations have been so prominent.

That the twenty-five years' work of this journal, as here briefly summarized, has had a direct influence in the development of industries created to meet the demand of modern construction will, it is believed, be conceded and should be appreciated. From the beginning the editorial policy has been to endeavor to emphasize the fact that it was true economy, for communities, corporations or individuals alike, to secure trained professional service, such as a properly equipped engineer could render. It has, therefore, been a source of no little gratification that the appreciation of this fact has grown so steadily within the past twenty-five years in the United States. Finally, the press of the country and many of the readers of The Engineering Record have been generous in commendation of its efforts; yet no one but the writer can appreciate how much he has been indebted for advice, which, acted on, brought credit to the paper, and for counsel which heeded prevented mistakes and impairment of influence. He is grateful that he has been so fortunate in the advisers and associates on whom he has relied and glad on his retirement to have this opportunity to make the acknowledgment.

Twenty-five years ago, in the first volume of The Engineering Record, a note was printed stating that "there are over 250 miles of streets in New York to be swept." The most recent quarterly report of Dr. John McGaw Woodbury, Commissioner of the Department of Street Cleaning, states that a force of 2,484 men sweeps 412 miles of streets daily in the boroughs of Manhattan and the Bronx.

Twenty-five Years of Water Supply Engineering.

By J. J. R. Croes, Past President, American Society of Civil Engineers.

Looking forward, a quarter of a century seems a long time. Recognizing the defects and deficiencies in the present condition and methods of operation of any branch of science or the industrial arts, it appears inevitable that innumerable self-evident wrongs must be righted and erroneous methods reformed before the lapse of so extended a period.

In retrospect, however, the advances made during a period of twenty-five years seem at the first glance, to those who have taken part in the struggles for improvement, to have been inconsiderable and altogether disproportionate to the labor expended and the time occupied in securing them. The old evils still exist and new defects have been discovered.

This is very much the case with the water works engineering of the past twenty-five years. When the pioneer journal devoted to the reform of sanitary and economic treatment of the supply and final disposal of water used for domestic and public uses began its crusade against extravagance and filth in 1877, its columns abounded with denunciations of the pollution of sources of supply, the inadequate and shiftless methods of design and construction of works for the supply of water and the reckless waste of the water furnished at great cost to communities. In the columns of the same journal for the year 1902, the same evils are persistently attacked. It looks at first as if but little progress in the abatement of error had been made in all this time.

A careful review of the conditions existing at the two extremes of this twenty-five year period shows, however, that important advances have been made in almost every department of the science and practice of water supply.

In 1877 there were 400 towns and villages in the United States which had a public water supply, fifty of them being places of less than 4,000 inhabitants. In 1902 there are about 5,500 communities supplied with water, and 4,500 of these are towns having less than 4,000 inhabitants.

The rate of increase has been accelerating until now there are about as many new water supplies added yearly as there were works in the whole country at the beginning of the period under consideration, and this rate of growth is nearly constant, and is proportional to the increase of population in the ratio of one new water works to every 3,300 persons added to the population, whereas twenty-five years ago, only one new water works was built for each addition of 40,000 to the population. The water works industry has become fully established and is generally conducted on sound business principles. The primary establishment of this industry was purely a matter of business: an enterprising builder of pumping machinery demonstrated the feasibility of furnishing abundant water supply and protection against fire by pumping directly into mains, without the intervention of elevated reservoirs or lofty stand pipes. The "direct supply system" was strenuously advocated by its originator and also by other rival builders of pumping machinery with the result of a lively competition and consequent rapid increase in works for water supply, both by public officials and corporations which obtained franchises for works. The advantage which resulted from such competition was seen in the improvement of methods of construction in many respects, more particularly in the efficiency of pumping machinery. With the pumping engine built by the best makers of the present day, not more than half of the amount of coal is consumed than was needed to do the same amount of work by the most carefully designed engine of 1877. The collaboration of the scientific student of the laws of heat and combustion, with the designer and constructor of the mechanism, has produced a machine which is efficient and economical to a degree which not long ago was considered impossible of attainment.

In the earlier days of business competition for water works franchises, there were of course many instances of absurd and careless design and construction by insufficiently informed enthusiasts. This is perhaps rather a severe term to apply to the users of the sheet iron pipe lined and coated with cement which was laid for water mains in more than one hundred towns between 1845 and 1885. It had many strong advocates among engineers, but notwithstanding the positive predictions of its durability, which were very similar to those made by the advocates of "concrete-steel" construction at the present day, its life proved to be very limited and the towns which used it have returned to cast-iron as the best material so far known for main pipes. In the manufacture of cast-iron pipe not many improvements have been made and considerable diversity still exists as to the exact requirements needed in specifications to ensure the best results. It seems probable at this time that uniformity of practice will be attained as the result of recent conferences between metallurgists, manufacturers and experienced users of cast-iron water pipe inaugurated by the New England Water Works Association.

For large conduits for the conveyance of water, advances in metallurgical science have made it practicable to construct steel pipes capable of carrying water under great pressure, at a cost much less than is required for masonry conduits which must be laid on a regular grade. The question of the relative durability of the two has yet to be determined. The same is to be said of wooden stave pipes which have also been extensively used for this purpose. Twenty-five years is too short a time to determine that question with certainty, but any innovation in methods and material of construction which enables a large enterprise to be carried out at a materially reduced cost, with the assurance of equal or greater efficiency for a period of fifteen years or more, must be considered an advance in engineering.

In the design and construction of masonry conduits no material advance is to be noted. Taking the Boston Sudbury Conduit which was completed in 1877, as the standard, the only important modification which has been made is the substitution of concrete for rubble masonry in the walls and arch as has been done in the most recent work constructed.

The necessity for the construction of very large storage reservoirs for the utilization of surface water on a more extended scale than had been attempted, for domestic, power and irrigation purposes, became apparent between 1865 and 1875, and the construction of high dams of masonry had been considered by engineers in various countries. In the United States this subject received little attention prior to 1885. In 1877 and for eight years thereafter, the only high masonry dam which existed was that built by the Croton Aqueduct Department of New York at Boyd's Corners in 1867. This is 78 feet high. In 1885, the need of high dams for irrigation reservoirs in California, and for the water supply of New York City, led to a discussion of the proper form and construction of high masonry dams. Few problems of engineering design have been more thoroughly analyzed and discussed than this one has been since 1885, with the result of the definite estab-

lishment of fundamental principles and practice of design and construction, and the construction of numerous structures, notably the great New Croton Dam, 260 feet high. These structures vary, it is true, in detail, some illustrating vagaries of individual opinion rather than established principles, but still marking a decided advance in engineering science.

In the design and construction of reservoir embankments of earth, there has not been any material advance. The building of water-tight earthen banks was as well understood and practiced in 1877 as it is to-day. The knowledge of the correct principles is more widely diffused, to be sure, but that is about all.

One really important advance in hydraulic engineering since 1877 is in the direction of the determination of the amount of water which may be collected and utilized from a given area of water shed and the quantity which can be delivered to distant points through channels of different materials and of different forms. Such determination cannot be made from theoretical considerations alone, nor can it be made from fragmentary isolated observations. A systematic series of observations by skilled observers embracing studies of topography, rainfall, evaporation, discharge of water over weirs, and the frictional resistance of surfaces of varying material, form and roughness, must be analyzed by experts in the art of adjustment of averages, before any reliable result can be obtained. The multiplication of persons qualified to conduct and analyze such observations, by reason of the rapid increase of educational facilities and also the multiplication of opportunities to make observations, has been very great during this quarter of a century and much progress has been made. A great deal yet remains to be done in this direction before water works engineering can be looked upon as at all an exact science. This remark applies with equal force to all branches of construction and of operation and maintenance of completed works. An important factor in the progress toward this end is the association of the men engaged in similar pursuits, in clubs and societies where they can be brought in contact with each other and discuss their experiences and communicate them to their fellows through the medium of the technical press. Such associations have become numerous, and in the fostering of discussions and the dissemination of important information not obtainable in any other way, The Engineering Record has taken a most effective part for twenty-five years.

Next in rank as to the amount of progress made, but really of greater importance to the community at large, is the advance in the sanitary department of water supply engineering. That water furnished for domestic use ought to be pure and palatable, was recognized as well a hundred years ago as it is to-day, but how an impure water could be made wholesome was entirely unknown and unimagined. That turbid water could be satisfactorily clarified by filtration through sand was established about seventy-five years ago, but the nature of the minute organisms which make waters unwholesome, and the fact that their growth could be controlled by simple means and that they could be removed entirely was not discovered until a dozen years ago. On this discovery the control of these organisms became one of the most important functions of the water works engineer. Such control involves the supervision of the water from the time it reaches the earth from the clouds until it issues from the faucet of the consumer. Prevention of contamination must be everywhere striven for and where that is impracticable, removal of the causes of pollution must be effected.

This has become generally recognized and the purification of the water supply is being undertaken in numerous places. The most comprehensive and thorough of such work is probably that done by the Metropolitan Water Board of Boston. Albany effects the purification of its supply by sand filtration just before use, and even New York has taken extensive measures to prevent pollution from entering the streams which feed the Croton River. Philadelphia, which has been pre-eminent in pollution, has taken steps toward thorough purification by sand filtration. Many other smaller supplies are now purified by filtration, either slow as it occurs naturally or accelerated by chemical and mechanical devices.

Water having been collected, stored, purified, pumped and conveyed to the consumer, the final duty of the water works engineer is to see that he uses it in such manner as not to cause injury to health or financial loss to the party who has borne the expense of giving him the supply, whether that party be the public, or a private corporation. An excessive consumption of water in a town indicates defects in the system of mains and service pipes, or defective plumbing in the houses, or extravagant draught by consumers. The first two can be checked by supervision of the managers of the supply, the last only by compelling the consumer to pay for the water he uses, in proportion to the quantity used.

In the rectification of defective plumbing, great advances have been made in twenty-five years, chiefly through the pressure exerted by health officers and the engineering journals on the managers of water works.

In the reduction of waste from main pipes, considerable progress has been made in works recently constructed, by the exercise of more careful supervision during and after construction. In the majority of towns which had water works twenty-five years ago, there is still great loss of water from leaks in mains and services. This is particularly the case in larger cities. There are some noteworthy exceptions to this, but only enough to accentuate the general fact.

The waste of water by consumers is due to lack of appreciation of the fact that water is a costly commercial commodity which should be paid for by each consumer in proportion to the amount he uses, the same as coal or gas or flour is paid for. The only way to check such waste is to measure the water. The old plea that meters are not reliable, is not applicable at this date. The water meter as now manufactured is as accurate an indicator of quantity as the gas meter, the yard stick, the scales or the bushel measure. Its development is a marked advance in mechanical science. For the measurement of the flow through larger pipes, such as street mains and conduits, the invention of the Venturi meter is sufficient to make the last quarter century noteworthy in the annals of scientific progress.

Looking back then on the details of the growth of water-works engineering during twenty-five years, there is no ground for discouragement or for disparagement of what has been accomplished. There has been a steady advance.

The reasons for this advance may be traced to several causes. The generation which during this period has held the controlling influence in scientific affairs, was the first in which the influence of the technical schools was really felt. The leaders of the engineering profession twenty-five years ago were men who had not had the benefit of a thorough technical education. The men who stood prepared to take their places had had such training and the added education of experience under these great men. They were prepared to advance rapidly. The schools themselves had reached the point where the professors began to be worthy of their calling and had learned how to learn as well as teach. This was so in all branches of science, and its devotees had begun to work in harmony in a way they never had done before.

This broadening of technical education, cooperation of scientists, affiliation of workers in societies, and spread of information and discussion by the technical journals, have led to most satisfactory results. It remains to be seen whether the now threatened narrowing of educational courses to special subjects, and their abbreviation in order to enable young men to begin earning a living without experience, will produce as satisfactory results during the coming twenty-five years.

Bridges, Foundations, Docks and Water Fronts, and Canals.

By William H. Burr, M. Am. Soc. C. E., M. Inst. C. E.

Bridges.—A quarter of a century is time enough for many changes, even in a field of activity where precedents have been more respected than in bridge building. As a matter of fact, precedents are scarcely recognized in that field, and there probably has never been any class of engineering work in which the strife for improved forms, more economic methods, or more efficient ways of accomplishing ends has been more intense than in the work of bridge building during the past twenty-five years. At the beginning of that period cast iron details and even cast iron compression members were still being used in new designs. Steel was practically untried except in a comparatively few instances, and where the experiment was made the metal was far higher in grade than would now be considered judicious. The American type of pin connection had been adopted, while the riveted truss also had its strong advocates. Rational draw-bridge design was but beginning to be recognized, and the plate girder had not received all the credit due to its solidity and stiffness. A railroad span four hundred feet long was a marvel, and not one of the fully developed cantilever bridges had then been designed.

The lapse of this twenty-five-year period has brought with it changes that would scarcely have been considered credible at its outset. The adoption of steel, with its displacement of wrought iron and the material advances, both in the quality of that metal and the capacity of bridge shops, made possible the attainment of such structures as the great 550-foot spans across the Ohio River at Cincinnati and Louisville, the Red Rock and Memphis cantilevers in their day, and now the great cantilever constructions recently completed at Pittsburg and the 1,800-foot span being constructed across the St. Lawrence River, near Quebec. The improvements in the manufacture of steel, particularly in the basic-lined furnaces, have enhanced the quality and reduced the cost so that structural steel may be considered an almost perfect structural metal. What the improvements may be from this time on cannot be predicted, but the possibilities involved in the use of such a metal as nickel steel are certainly full of promise.

At the present time the riveted structure appears to have won over its pin competitor up to spans reaching nearly to 200 feet, and the plate girder has pushed out the lattice truss until the latter is comparatively unknown in construction below 90 to 100 feet. The solidity and stiffness of the modern bridge structure has reached the point where no engineman need regard the bridge floor other than as the firmest and safest part of his track.

The efficiency of erection processes has also

been developed within the past twenty-five years, so that now what was once nearly a month's work of erection may be completed within about a tenth of the time.

Probably the most radical advance in bridge design is found in the modern treatment of stiffened suspension bridges. The old theory of the stiffening truss, which was implicitly, if not explicitly, based upon the assumption that the cables carry all the vertical load and that the stiffening structure was simply and only a stiffener, has given place to the correct and rational recognition of the true function of the truss. While vertical loading is mainly carried by the cables, at least a small part of that loading is carried by the stiffening truss in the combined structure. This observation must be somewhat modified when the stiffening of a pair of cables in a vertical or nearly vertical plane is accomplished by a system of web members between them. The general statement holds true, however, that the employment of the method of least work, as in the masterly treatment of Melan, or some other equivalent analytic means, has completely revolutionized the best design of stiffened suspension bridges within the past quarter of a century, so that this class of bridge work can now scarcely be considered of the greatest excellence unless based upon the modern and rational system of computations.

The most prominent instance of modern stiffened suspension bridge construction is the new East River Bridge, at New York City, now approaching completion with a span of practically 1,600 feet, and with a capacity for traffic far in excess of any suspension bridge hitherto built.

Foundations.—The design and construction of foundations during the past twenty-five years has developed chiefly in the perfecting of methods already known and in the improvement of materials and details involved in those processes. Exception to this general observation may be taken in reference to the freezing process of sinking deep shafts or foundations and in reference to open dredging. Some results have been accomplished by the freezing process in this country, but it must yet be considered largely in an experimental state. Although the open dredging method is not new to the past quarter of a century, its applications during that time may be considered to be epoch-making. The first marked use of the open dredging process of sinking deep foundation was that of the Atchafalaya Bridge, at Morgan City, La. The depth of the foundation bed was about 120 feet below high water and 70 to 115 feet below the silt or mud surface. The greatest depth, however, attained by this method in a bridge foundation was reached in sinking the piers of the Hawkesbury Bridge, in Australia, i. e., about 170 feet below water, or 126 feet below the river bed.

The pneumatic method has been advanced in its details and by the improvement of caissons and air locks until it has become one of the standard foundation procedures. The difficulties of caisson disease, induced by working under high pressures, have not yet been entirely solved, although the beneficial effect of elevators, slow changes of pressure, especially in exit, and temperate habits of laborers engaged, have made possible a certain measure of control not before attained.

The greatest depth reached in this country is probably that of the foundation of the Brooklyn pier of the new East River Bridge, i. e., 115 feet below high water, in which case, however, the character of the material penetrated was such as to make the air pressure materially less than that, due to the total head of water above the cutting edge. Careful investigations in connection with compressed air appear to indicate the possibility of reaching depths of 150 to 175 feet below water by the pneumatic method.

One of the most important advances in foundation work, although it is not one that has attracted great attention, is the proper deposition of concrete en masse under water. A considerable number of highly successful works have been accomplished by this simple operation. It has been shown by experience that under proper and easily attainable conditions results of the highest excellence may be accomplished by depositing a comparatively rich concrete below water so as to make a strong and enduring monolithic mass of the best quality and suitable to carry the heaviest loads imposed upon masonry foundations.

An entirely new field of application of the pneumatic method is that of pneumatic caissons for the foundations of modern great office buildings. This particular use of the pneumatic caisson has been brought about entirely during the past ten years, resulting in the most substantial support known at the present time for the heaviest building structures yet designed.

These caissons vary in dimensions from a small cylinder of sufficient diameter only to accommodate one man up to the largest dimensions required in heavy foundation work. This particular field of application of the pneumatic process has yet involved sinking only to small depths, but it is probable that conditions may be encountered requiring depths of foundation not less than the greatest available by the pneumatic method.

Another new development in building foundations is that illustrated by the sub-structures of the new addition to the Mutual Life Insurance building, and of the Stock Exchange building, now approaching completion in New York City. In these cases it was desirable to make the sub-structure continuous around the entire building site so as to exclude water from the sub-basement portions. The pneumatic caissons employed in these instances form parts of a continuous dam around the exterior lines of the sub-structure, the continuity being attained by ingenious devices, stock ramming forming a feature in the case of the Mutual Life Insurance building, and a complete continuity of the caissons attained after sinking in the Stock Exchange structure.

Docks and Water Fronts.—Somewhat similarly to the development of foundation work, progress in the construction of docks and the improvement of water fronts during the past twenty-five years has been characterized rather by extension and wider applications of old processes than by radical departures. Naturally, this field of engineering work and the improvements necessitated in connection with it have been those required by greater dimensions and greater drafts of ships. Twenty-five years ago a length of ship of 450 feet was the maximum, with the single exception of the Great Eastern, 680 feet long, essentially a failure, and not in any way typical of the prevailing steam ships at that time. Development in the lengths of ships from 1877 to 1890 was rather spasmodic than progressive, but since 1890 ship lengths have been augmented until the appearance of the Oceanic in 1899 with a length of 704 feet, followed by others of nearly the same length within the past three years. In harmony with the increase of length, the draft and carrying capacity have also been increased until loaded ships drawing 31 and 32 feet pass into and out of the harbor of New York.

These great and costly marine structures must be operated as nearly continuously as possible in order that the non-earning periods in port shall be correspondingly short. This feature of marine transportation demands water front or dock conditions admitting of the quickest possible handling of great volumes of freight. Obviously the first requirement is a pier not less in length than the longest ship with sufficient depth at low water in the adjoining slip to float the vessel with its maximum cargo. It is further required that the disposition of space and the installation of handling appliances on the pier shall be conducive to the results desired. These particular lines of water front development have lately received tremendous impulse until piers 750 to 800 feet long and 125 feet wide with 250 feet width of slip between have become what may be called the typical improved units on the water front of New York City and of other large cities where the range of tides is so small as not to need enclosed docks. In the latter case corresponding developments of accommodation have been imperative, and the latest masonry dock constructions at Liverpool and other British ports, as well as at those on the continent of Europe, have been made upon a scale adequate to the demands of the greatest ocean steam ships now running between American and foreign ports. Great ranges of tide require many of these water front constructions to be of masonry, in foreign ports. In this country, fortunately, the more economical but admirably adapted timber constructions still serve their purposes well. One or two great water front conflagrations have shown, however, that future designs may be required to involve an essentially fireproof character.

It has frequently been pointed out in engineering quarters that a great, and possibly the greatest defect of accommodations for shipping in this country is the lack of adequate graving or dry docks for the proper care and maintenance of great steam ships, and but comparatively little has yet been done to relieve this condition. There is probably no other great port in the world so lamentably lacking in this essential feature as the port of New York. Indeed, it is literally true that no great steam ship can find docking accommodations in that port, but she must seek them usually abroad or possibly at Newport News or in some other remote domestic port.

This class of water front construction has experienced remarkable development in foreign ports within the past twenty-five years, and they are probably best illustrated by the great New Canada Graving Dock at Liverpool, entirely of a monolithic concrete construction 925 feet long by 94 feet wide, completed about three years ago. This is a remarkable structure and embodies in its design probably as advanced features of material and appliances as can be found at the present time. While great dry docks, approaching 800 feet in length, are being constructed in this country at various points, no effort has yet taken shape to relieve the discouraging lack of this most essential kind of shipping accommodation in the great port of New York.

Canals.—Although this is an age of steam railroads and is rapidly becoming one of electric railroads, and to such an extent as for many years to have obscured almost hopelessly the effectiveness of artificial water ways, during the past quarter of a century there have been more extraordinary advances in canal enterprises, including both canal construction properly speaking and the canalization of rivers, than in any other field of engineering. Twenty-five years ago canals, in this country at least, were considered practically obsolete transportation ways, too slow and too restricted in capacity to be worthy of serious engineering

consideration. It was less than twenty-five years ago when tolls were abolished on the Erie Canal in order to stimulate what was practically a rapidly dying traffic. Yet within this period canal construction and canal traffic have received tremendous impetus wherever the plans and methods of operation have been made adequate to the requirements of the great modern currents of freight traffic. This observation is probably less applicable to the situation in the United States than in Europe, and yet it is not out of place on this side of the ocean. The old Erie Canal, practically abandoned for a number of years, is being stimulated into renewed life, and it is probably safe to state that if reconstructed into a Barge Canal it will play a most important part in the movement of traffic between the Great Lakes and Atlantic tide water.

The successful business conducted by the Canadian canals in connection with the navigation of the St. Lawrence River is an evidence of the field yet to be occupied in this country by a canal navigation adequate to the requirements of the present or future freight movement between the great centers of production in the west and the centers of both foreign and domestic consumption. The greatest actual canal development, however, has been made in the artificial water ways of Great Britain and on the Continent of Europe, chief among which are the Manchester Ship Canal, the Kaiser Wilhelm Canal, the North Sea Canal and a considerble number of other recent canal constructions undertaken in Europe in addition to the canalization of a large number of European rivers. Indeed, the canalization of many American rivers within the past twenty-five years by movable dams and other suitable structures of remarkable excellence and efficiency, constructed under the direction of the engineer officers of the United States Army, indicate what a great development of river traffic such enterprises have made possible, and they are equally a sure indication of no less remarkable developments of the same kind in the future. The St. Mary's Falls canal, with its lock 820 feet long and 100 feet wide, accommodating the greatest canal traffic in the world, should also be regarded as a recent engineering work of somewhat similar character, as it can scarcely be placed in the same class as the Manchester and other ship canals.

The most remarkable canal enterprise, both on account of its magnitude and international interest, is that of the proposed ship canal across the American Isthmus. With its prism 150 feet wide on the bottom and with side slopes suitable for the various classes of material encountered on its line, and with its great locks, having the usable length of 740 feet and width of 84 feet, with lifts exceeding 45 feet in height, it is literally the greatest engineering work contemplated in modern times. This enterprise possesses added interest on account of its practically certain culmination in the immediate future. Its minimum depth of water of 35 feet would accommodate the largest ships now afloat and leave some margin for their future development in size. The problems of water supply, of flood control of natural waters entering the canal, of the design of its great locks and great dams required to maintain its summit level, and indeed of all features of construction and operation have been effectively worked out. There now remains to be formulated some secondary matters of diplomacy before placing the great work in actual progress of construction. Its completion will make the next twenty-five-year period of engineering construction even more remarkable than that which now closes with this issue of The Engineering Record.

Sewerage Work; a Twenty-five Years' Review.

By Rudolph Hering, M. Am. Soc. C. E., M. Inst. C. E.

The development of sewerage engineering during the last twenty-five years probably has been more rapid in America than elsewhere, a fact that was caused by our trying to "catch up" with other countries leading in this branch of engineering, while cities were growing fast in number and size, and by the work of our Massachusetts State Board of Health, which laid a scientific foundation for the subject of sewage purification. Requested to review briefly this growth for the present occasion, I can do it perhaps more conveniently and clearly by dividing the subject into its two component parts, the works for collecting and conveying the foul waters, and those for effecting their proper disposal. I shall designate the first simply as sewerage works, and the second as sewage disposal works.

Sewerage Works.—In the early days of our cities, little or no serious attention was given to this matter. The larger ones were soon obliged to build underground drains to prevent rain water from destroying roads and streets, or making them impassable at times. Incidentally, these drains were used also for the reception and conveyance of sewage. A quarter of a century ago New York already had a well-developed network of sewers. They were well constructed, according to carefully prepared specifications, but the designs were generally crude as regards proper sizes, junctions, ventilation and flushing. Philadelphia was still less fortunate in the design of her works, and decidedly so in their construction. Many sewers, even the largest, were breaking down at a number of points along their course. The smallest sewers built were circular, three-feet in diameter, with a single course of brick, the invert without mortar, and in many places they had become elongated cesspools. Questions of proper size and ventilation were considered quite superficially, and those of proper junctions and flushing not at all. Chicago had a system devised by Mr. E. S. Chesbrough, carefully arranged and built on English precepts, which, as was later found, were not suitable for American conditions of rainfall, nor for our lack of European methods of flushing. Boston was about to construct a system of main drainage, designed by Mr. Joseph P. Davis and resembling somewhat the London plan of sewage interception. Brooklyn had a system of sewers designed by Mr. Julius W. Adams, also based on English experience regarding rainfall, but lacking European methods of artificial flushing. Providence had built a system designed by Mr. J. H. Shedd, also on European lines. The sewers of the latter city, I well remember, were, in some instances, models in the details of construction, and I have not since seen any which were superior in the character of the brick work forming their perimeter. Their capacity, however, being based on English experience, as in the other cities using the same standard, later proved to be too small.

The chief complaints at that time regarding our sewerage works were not only insufficient capacity during heavy storms, but chiefly bad odors arising on many occasions, and, in some cases, also, an imperfect or improper construction. The Memphis yellow fever epidemic in 1878 effected a thorough cleaning up of that city, including also the building of a sewerage system designed by Col. G. E. Waring. This system was built on principles not previously followed in our country. It was a so-called separate system. About the same time the city of Pullman, Ill., built a separate system, designed by Mr. B. Williams and approved by Mr. E. S. Chesbrough. The Memphis system was extensively described and discussed by its designer, and the chief features were subsequently patented by him. It was characterized by the nominal exclusion of all rain water, the ignoring of the manhole and straight alignment principle, and required the placing of an automatic flush tank at the head of every lateral sewer. It was proclaimed as being the best for all cities, and was proposed by Col. Waring for adoption in New York, Philadelphia, Washington, etc.; and quite a controversy began to arise as to the relative merits of the separate and combined systems.

In view of these facts the National Board of Health, then in existence, desired a report on the prevailing sewerage practice in Europe, where both systems were being used, and it was my good fortune to be selected for this task by its vice-president, Dr. J. S. Billings, U. S. Army. After nearly one year's careful study in all cities where light was thrown upon the subject, the results were published in the report of the board for the year 1881. The conclusions regarding the above question then reached and still holding good to-day, were as follows:

"The *combined* system is preferable:

Where rain water must be carried underground from extensive districts, especially where closely built up and where new sewers must be built for this purpose.

Where purification of sewage is not required or is not difficult, and where storm water overflows are not objectionable in polluting the streams.

Where a sufficient amount of water or sewage is available for flushing the larger sewers.

The *separate* system is preferable:

Where rain water does not require extensive underground removal.

Where an existing system of old sewers which cannot be made available for the proper conveyance of sewage can yet be used for storm water removal.

Where purification is expensive, and where storm water overflows would become objectionable.

Where pumping of sewage is too expensive to admit the increased flow from interceptors during rains.

Where it is necessary to build a system of sewers for house drainage at the least possible cost and delay, and where the underground rain water removal can be postponed."

Incidentally, a large number of facts and statistics were collected for this report. Meeting Dr. Burkli-Ziegler, in Zurich, I obtained from him for publication the formula now bearing his name, which he was about to suggest for the amount of rain water reaching sewers in Swiss cities, and which has been of great service in our country for the proper proportioning of sewers. The most perfect and rational sewer design and construction was then found in Frankfort-am-Main and in Munich; the former was designed by Mr. William H. Lindley and the latter by Messrs. J. Gordon and Max Neidermayer. The principles upon which the European sewers were being built had been embodied in an English Government publication in 1878: "Suggestions as to Plans for Main Sewerage, Drainage and Water Supply," by Sir Robert Rawlinson, of London, Chief Inspector of the Local Government Board. To him for his careful thought and observation, his sound sense and industry, is due, I believe, more than to any other single worker in the sewerage field, the development and crystallization of the principles of modern sewerage.

At home, recognition of the fact that both separate and combined systems had their respective places, and that no one kind of treatment fitted all cases, was gradual but firm.

Accordingly, we have since seen both systems proposed and built for a great number of cities, until at present among the larger cities there remain only Baltimore and New Orleans which as yet have no regular system of sewers. New Orleans is on the eve of building one, and Baltimore may soon follow.

In applying European experience to our conditions, several important facts appeared. The European rainfalls are more frequent and much less intense than in the eastern and southern parts of the United States. Therefore, in those sections we need much greater capacities and larger sewers. The sudden showers of great intensity are excellent means for flushing the sewers, which is, I believe, one cause of the neglect in providing means for an ample and systematic artificial flushing, which we find so developed in Europe. Another cause may be the greater dilution of American sewage, which renders the fluid less foul. I believe, however, that the great benefits of a frequent thorough cleaning of our sewers, that is, oftener than is done by heavy rains, and particularly in California, where no rain falls sometimes for six months, will sooner or later be more generally recognized and required. Automatic flush tanks are now faithfully supplied for flushing the upper few hundred feet of laterals, particularly in the separate systems, where 25 years ago perhaps not a single one was used.

The proper ventilation of sewers now also receives more attention than formerly, although not as much as it should receive. The English custom of disconnecting house sewers from street sewers as against the Continental custom of ventilating the latter through the former, is still the prevalent one in our country. A change, however, seems to be taking place. The city of Newton, Mass., about 15 years ago ventilated her street sewers through the house sewers with very beneficial results. A number of other cities have done the same, and thus avoided odors sometimes rising from the manhole cover perforations. Much more attention is now given than formerly to details, such as proper forming of junctions to prevent deposits, smoothness of the wetted perimeter to prevent retention of foul particles, the hydraulic grade vs. invert grade when proportioning for rain water capacity, and to the straight alignment principle by which all sewers can be at all times inspected throughout their length. Progress has also been made in the use of better materials for construction. The requirement for smoothness has demanded the use of a better class of brick and more truly formed pipes than were formerly commonly admitted, and also the modern concrete construction is strongly claiming advantage in this field.

Sewage Disposal.—This subject began to press for attention about 30 years ago, and in 1876 Dr. C. F. Folsom, secretary of the Massachusetts State Board of Health, after a careful examination of European sewage disposal works, made a report to the board which is the best presentation of the subject as known at that time. Prior thereto Mr. E. S. Chesbrough had made studies in Europe for a disposal system for Chicago, and Mr. Joseph P. Davis for Boston. In 1882 the first large area for sewage irrigation was laid out in Pullman, Ill., but prior thereto truck farmers had used sewage for irrigating crops in Southern California. In 1889 the first chemical precipitation plant for a large city was constructed for the city of Worcester, Mass., by Mr. Charles A. Allen, and put in operation in 1890.

In 1886 the commission appointed to consider a general system of drainage for the valleys of the Mystic, Blackstone and Charles rivers in Massachusetts recommended to the legislature that it designate some one or more persons to look after the public interests in connection with the pollution or purity of all waters within the State, and to act as an advisor to local authorities. As is well known, these matters were placed in the hands of the State Board of Health, with ample funds for carrying on the work, and, as later amended, the law provides that sewerage and water supply projects in Massachusetts shall have the approval of the State Board of Health before the legislature grants authority for issuing the necessary bonds. Since that time a number of other States have followed in a measure the excellent example of Massachusetts as respects the conservation of the purity of inland waters.

Among the recommendations of this commission on the specific problems which it had in hand was that of its engineer, Mr. Eliot C. Clarke, to provide sewage filtration works for a part of the North Metropolitan sewerage system of Boston, on the Saugus Marshes. The doubt which arose as to the efficiency of such a system at the selected place was largely instrumental in causing the Massachusetts State Board of Health to inaugurate the experiments which later developed, under the guidance of Mr. H. F. Mills, into the classic series of examinations which marked the beginning of a new era in the practice of sewage and water purification. By a comprehensive study, beginning with the methods and results of recent European investigations on the same subject, and with the installation of the Lawrence Experiment Station for making tests on a large scale, a mass of chemical and biological testimony has been secured and recorded, which is the basis for our present practice in this line of engineering. The studies covered filtration through various kinds of material and by different means of application. They covered also chemical precipitation, and more recently the so-called septic process and the filtration of sewage at high rates through filters of coarse material, which seem destined to command a field in this country wherever neither intermittent filtration through sand nor dilution in rivers is available.

The large rivers in our country make the dilution process of disposal a very common and effective one. It is used by Boston, New York, Philadelphia, Washington, and by the cities situated along the Ohio, Missouri and Mississippi rivers and by many others. On our Great Lakes, dilution in the quietly moving waters is also practiced by all of the large cities, the only exception being Chicago. In 1887 I was requested by that city to make an investigation into the various practicable ways of disposing of its sewage, resulting in the recommendation for the Drainage Canal, which has since been built and carries the sewage of the metropolitan population, after being highly diluted with lake water, inoffensively first into the Desplaines, then into the Illinois, and finally into the Mississippi River.

There are now upwards of 100 plants in this country for the treatment of sewage of cities and towns, more than half of which are constructed so that they should give satisfactory results. Including plants for small places, some of which are very well designed and efficient, the number of purification works reaches several hundreds, as compared with almost none 25 years ago. Intermittent filtration is the most prevalent type of plant. Chemical precipitation works are now seldom recommended. Septic tanks and contact beds for a dozen or more small places have been installed, and for certain large cities, where the local conditions are quite unusual, they are being considered, notwithstanding that these processes are now known to be incapable of fulfilling the extravagant claims made for them some 5 years ago. By far the greatest development in sewage purification works has come during the past dozen years, due principally to litigation arising from the pollution of streams by the raw sewage.

City Engineering Problems.

By John M. Goodell, Assoc. Am. Soc. C. E.

The average city engineer was mainly engaged twenty-five years ago as a surveyor, and in a considerable proportion of American towns and small cities to-day his work is practically confined to giving lines and grades. But it is a characteristic result of widespread technical education, that this apparently simple matter is now managed with a degree of skill and foresight which will soon give the amusing tales of old-time street location a glamor of unreality. Stone monuments properly set in the sidewalk or long iron bars driven into the earth until beyond the possibility of disturbance have replaced the 2-foot wood hub which any adventurous hog could and would root up in the spring. Surveys are now properly plotted and the maps turned over to the authorities for preservation, where formerly all notes and drawings remained the personal property of the surveyor. The surveying itself is done with good instruments and reliable steel tapes, instead of the condemned railroad transit and chain which were too often the equipment for earlier work. But with all the advance that can be noticed in the character of city surveying means and methods, the municipal engineer still finds himself handicapped in the majority of cases by the lack of appreciation of the value of good systems for filing and safeguarding the invaluable records of his office. The constant appreciation in value of urban and suburban real estate renders it imperative to keep all records of street locations in fire-proof safes or vaults. In some cases their loss by fire has thrown the city into perplexing litigation with property owners, in which the latter were invariably successful.

If the methods of locating and marking streets twenty-five years ago left much to be desired, their construction left about everything to be wished for. Outside of a few of the largest cities, the streets were mostly paved with good intentions. Stone blocks with joints big enough for a mouse to get into were the best material in New England, New York was trying little trap-rock dice and squared wood blocks, and Chicago was getting along with round cedar blocks which a sharp heavy downpour would set afloat. Everywhere it was recognized that the conditions must be improved, and Mr. Henry C. Meyer deserves much more credit for bringing this about than has ever been given him. He made a careful study of the best work abroad, and obtained for The Engineering Record's readers reliable data concerning the conditions in foreign cities and the methods by which they were best met. He obtained articles from experienced street pavement builders in this country, and steadily preached the doctrine of good foundations, good materials and good workmanship until it was understood pretty generally that a permanent pavement cost considerable money and demanded engineering supervision in all stages of its construction.

As soon as the intelligence of the engineer became the dominant factor in paving, a rapid improvement in street construction began. It was found, contrary to the makers' claim, that granite blocks could be dressed to close joints after the engineer insisted that this must be done or he would reject them. Then it was learned that some fairly soft stones made excellent pavement material, and there are today probably over a hundred miles of excellent

streets laid with sandstone blocks, which wear flat and do not polish. It is probable that the stone available for such purposes is much more common than is generally supposed, and the investigations of the geologists working for various States may be confidently expected to furnish valuable information on this subject. It was so long an axiom of paving contractors that nothing but certain classes of granite and trap could be used for blocks, that it has been hard to shake off the constraint of this unwarranted prejudice.

The great paving achievement of the past quarter century has unquestionably been the introduction of sheet asphalt. The success of this pavement has proved beyond any doubt that an improved road is a sort of floor, no stronger than its base and no more comfortable than its wearing surface. It was the asphalt pavement which proved to American engineers the necessity of concrete foundations or some equally stable substitute for them, no matter what the wearing surface may be, stone, brick, wood or asphalt. The history of sheet asphalt is one of constant struggle against technical difficulties which it was tedious to diagnose and overcome. Coal tar pavements had previously proved so unsatisfactory as to give any bituminous street covering a bad reputation, and it was difficult to introduce asphalt on any terms. For a number of years the unsuccessful asphalt pavements were apparently as numerous as those which gave satisfaction. Little by little, however, chemists learned the secrets of refining, blending and fluxing the bitumen, and the workmen acquired the necessary skill in preparing and using the materials. To-day, an experienced asphalt contractor can lay a pavement for any kind of traffic in any climate, and guarantee its wearing properties for five years or longer, with as great a degree of certainty as the contractor for any other class of pavement. But to reach this stage of development, great sums have been spent, infinite patience has been exercised, and all the resources of chemistry and engineering have been enlisted.

The very recent introduction of bitulithic pavement must also be noticed, in this connection, for in the brief period of its use, only encouraging reports of its properties have been received. It differs from all bituminous road surfacing previously proposed in that the broken stone and sand are relied upon for strength and resistance to wear, the amount of bituminous cement necessary to bind the mass together being under ten per cent. by volume. To attain this end, the crushed rock and sand are screened, sorted, and then mixed until careful analysis shows that the voids have been reduced to the requisite percentage. This material is then heated and mixed with enough asphalt or carefully prepared tar to fill the voids, and is then laid somewhat like asphalt. The process is capable of many changes to suit the class of pavement which the purchaser is willing to pay for. The rejuvenation of wood pavements is another recent and interesting proof of the ingenuity of American engineers. The old wood pavements are impossible in self-respecting cities, but the new type is very different. The timber is carefully selected, accurately sawed into blocks, treated by a series of preservative and hardening processes, and then laid on a sand cushion on a concrete base. The result is an expensive pavement in first cost, but it is free from noise, easily cleaned, gives a good foothold to the horses, and is laid with such good guaranties that it is not surprising to see the steady increase in favor with which it is regarded.

Another very important achievement of this period has been the brick pavement. A great number of small places where asphalt cannot be used, owing to the limited amount of work to be done making the cost of plant run too high, where not a stone larger than a hazel nut can be found for hundreds of miles in any direction, have been lifted from a slough of mud and freed from a cloud of dust by the paving brick. Like every new product, it experienced its boom and its reaction before settling into its true place among the materials of engineering. Manufacturers had to learn how to make it from the different materials which are found in various places, for its production requires considerable skill and a still greater measure of care. Engineers had to learn by experience the best methods of using it, and for a time there were some costly lessons needed to prove that good foundations must be made. But the day of schooling is past, and since the advent of brick, there is no place now anywhere in this country which has any excuse other than lack of funds for being without some kind of improved pavement on its leading streets.

Broken stone or gravel paving of one class or another has not experienced so much change in the last quarter century as to merit mention. The same principles which were in vogue twenty-five years ago among skilled road-builders still govern, although roads have gradually become thinner, and greater latitude is allowed in the selection of rock. The principal advance in such work must be sought in the grading, rolling and carting machinery for the use of road builders; its introduction has considerably lessened the cost of such roads while improving their character.

The construction of roads is but a part of their engineering significance; their maintenance and cleaning are almost as important and have proved to be as difficult problems. Asphalt maintenance, being mostly in the hands of wealthy contracting companies, has been carefully studied and its methods are well-known. Comparatively few cities, however, have ever taken the trouble to figure out the expense of letting their brick and stone streets fall into bad condition. In a few cities this has been done carefully, and it is surprising how uniformly the reports prove that any kind of a street costs much less in the long run if all defects are repaired as soon as they are noticed. These little details are likely to be considered unimportant and trivial but in no branch of professional work is it easier to see the truth of the saying, "engineering is largely detail."

It was reserved for the late Colonel Waring to demonstrate the engineering importance of street cleaning and refuse disposal. Up to his time, the work was considered the lowest grade of unskilled labor. But he made a man out of the bum put on a broom on the streets for political purposes, he introduced the methods of the engineer into every detail of the work of municipal house-cleaning, and his example has had a deep effect in and out of the United States. To-day street cleaning is in a transition stage; new machinery is waiting for trial, its merits compared with hand cleaning and the older machines must be ascertained, so that to each may be assigned the work it will do best.

Refuse disposal likewise is in a transition stage. The problem begins at the refuse pail or barrel of the householder and ends at the clinker heap of the crematory or the grease barrels and bags of fertilizer base of the reduction works. To neglect one step is to run into the danger of entire defeat. The last twenty-five years have seen the construction of many plants where refuse was treated with fair success. But the claims of the owners of patents on these processes have been so extravagant, their condemnation of rivals so fierce, and their neglect of all features of garbage disposal not covered by their patents so pronounced, that the entire subject has been befogged. Of course there have been among these men exceptions who have been conservative and broad-minded; unfortunately, their influence has been overpowered by that of their less competent rivals. It was reserved for the city of Trenton to solve the problem in the only proper manner. Last year, this place retained the services of an engineer who has made a careful study of garbage disposal for many years. He investigated the problem in the same way an engineer investigates a sewerage or water supply subject, and submitted a report based on facts collected in a rational manner and discussed in a scientific spirit. This, the first American case of engineering consultation on the whole problem of garbage disposal, reflects great credit on the New Jersey city and sets an example which must be followed if this subject is to be solved in a fashion its hygienic and financial importance demand.

The great advances of the quarter century in sewerage and water supply are discussed elsewhere by engineers who have been largely instrumental in bringing them about. Aside from the achievements in the design and construction of works, which those writers explain, there are certain matters which the municipal engineer has learned to consider equally important; these relate to the maintenance of the works. In no class of municipal work is the adage "out of sight, out of mind," so likely to be true as in respect to sewers. Except when they stop nobody thinks of them; when, through long neglect, they finally break down or clog up, serious trouble may result. It is by no means unusual for old sewers to cave in, letting a horse break his leg or doing other injury, while the reports of cellars flooded with sewage are too frequent to arouse interest. To guard against such unnecessary incidents, the municipal engineer with a properly organized office must have a sewer inspection department which will make systematic examinations of the entire sewerage system. If the sewers cannot be inspected, lamp holes should be inserted at frequent intervals, because, sooner or later, they will be needed, and in time of peace it is best to prepare for war. It is also necessary for the engineer to organize a sewer and catch-basin cleaning department and see that it is equipped with the necessary tools, for makeshift apparatus will run up the cost of such work considerably. Time spent in such work at the outset will mean time saved in the end, and the same is true in training men to supervise all connections of buildings with the sewers. These connections must be properly made. The necessity of such little details of management has been learned in the last twenty-five years, and The Engineering Record deserves credit for its pioneer instruction in such matters, at a time when they were considered of no importance or left entirely to plumbers.

In the management of the water-works system, the engineer has again need for the exercise of his professional skill. The maintenance of pumping machinery, of distribution pipes, hydrants and the like, there is no need of discussing. The maintenance problem above all others is that of water-waste prevention, which has come into its present prominence during the life of The Engineering Record, and received its first careful study in America by Mr. Meyer. New York was threatened with a shortage of water, so he visited the leading British cities and ascertained on the spot just what they did to keep the waste down. His articles on the subject are as useful now as then. He shows that the greater number of fixtures in American houses and the different character of municipal employes render the stamping of

fixtures and house-to-house inspection more costly and less satisfactory than a rational use of meters.

The problem to-day is so great that it is highly disconcerting to remark what little attention is given to it. The average condition in this country is about as follows: The water-works when built were large enough for a greater population than then took water and were ample for fire protection. There being plenty of water, people wasted it freely, let their fixtures leak, and otherwise acquired unthrifty habits in this respect. When the number of consumers grew to a certain point, the fire department experienced trouble in obtaining satisfactory streams and had to buy engines, or thought so, at least. A few years later, the consumers in the higher parts of the city had to put up with less water. Finally nobody could get enough water, the underwriters put up insurance rates, and eventually the works had to be extended at a great expense. All this is taking place because the engineer is not given authority and facilities for measuring accurately all the water used in the city and for checking waste by a meter whenever he detects it. The use of more than 50 gallons per capita daily in American cities, where manufacturing does not call for exceptional supplies, means a waste which is causing serious trouble now and must produce far more trouble in the next twenty-five years. In the writer's opinion the useless waste of water in American communities affords the most serious problem confronting the municipal engineer to-day. The carelessness of consumers is only equalled by the short-sighted greed of house-owners, who will put off the payment of $10 for repairing fixtures and pay more than that in increased taxes and water rates. The wasted water must be paid for in one way or another. The time is approaching for many cities when, no matter how the public may feel, waste must be curtailed or there will not be enough water to answer even reasonable domestic and manufacturing demands.

Progress in Hydraulic Power Development.

By J. T. Fanning, M. Am. Soc. C. E.

The first great water power development was made in New England. Hydraulic mechanisms in small units, such as are termed current wheels, were familiar to the Chinese on the Yellow River and the Hamites on the Nile and Euphrates fully 3,000 years ago. The crude undershot wheel, so long used, maintained its prominence until the genius of John Smeaton touched it, about 1759, when he showed that the wheel, as then used, gave but 30 to 35 per cent. of the theoretical power of the water, and, further, that if the bucket wheel was resolved into the overshot form the useful efficiency might be increased to 60 per cent., and later that if changed into the high-breast form the useful efficiency might be increased to about 70 per cent. The power that turned these long armed current wheels was usually a rapid in a river though sometimes it was the rush of tidal water into or out of an estuary. The old tidal mill on Mill Creek, in Boston, in 1631, was among the earliest mills of the American colonists.

Parallel with the development of water powers of any marked magnitude came also the development of that embodiment of skill and inventiveness known as "Millwright," who was usually possessed of mechanical skill and adaptive ingenuity and could accomplish practical results such as the needs of the early times demanded. The millwright saw that the bucket wheels on horizontal shafts were well adapted to operate vertical saws, for they could give to the saw frames their vertical motions when connected by pitmans to cranks on the horizontal wheel shafts. Thus was evolved the typical American saw mill that has been universally adopted and even now not wholly displaced by the band saw mill. Mill stones that ground the corn operated best when run horizontally on a vertical shaft. A bevel gear at first changed the revolving motion of the horizontal to that of the vertical shaft. The ingenious Colonial millwright then conceived that if he made his bucket wheel short he could set its shaft on end vertically and construct the water chutes so that the water would impinge on the buckets or paddles at one side. The running stone was then attached to the upper part of this vertical shaft and a simple and useful corn mill was the result.

This was a pronounced step forward in the millwright's vocation and produced the typical New England grist mill. Many modifications of this water wheel then followed in which the paddles, at first radial, were successively inclined to the radial line or curved or made spoon shaped. Then a small arc of the circumference of the wheel was enclosed to confine the water closer to the radial buckets, and vanes were placed to guide the water against a greater number of buckets. These radial buckets stood generally in vertical planes parallel with the shaft. The fertile brain of the millwright then conceived the idea of inclining the paddles around the circumference of his water wheel, so that while still substantially radial they were at an angle of about 40 degrees from the vertical; and the water was made to impinge on the buckets from above and pass vertically through them instead of horizontally as heretofore. Crude water wheels having characteristics similar to the above seem to have been previously devised by several peoples when they had made advance toward permanent village domestication.

As early as 1804, buckets were fitted spirally within a wooden cylinder attached to a vertical shaft and the flow of the water was downward through these curved buckets. This last wheel was a meritorious invention, and was a progenitor of parallel flow turbines. Later, vanes were applied to this wheel to guide the water into several buckets at the same time, and still later a square or cylindrical flume covered all these vanes and supplied water to all the buckets at the same time. As early as 1819, on the Susquehanna River, water wheels were in use, having vertical shafts and horizontal wheels, each with a row of buckets on its circumference which discharged the water horizontally and outwardly, constituting reaction turbines. Around the shafts of these wheels and within the line of buckets was a cylindrical wooden flume that supplied the water to the wheel buckets through apertures in its circumference adjacent to the bottom of the cylinder. The shaft passed up through the central flume.

After the passage of the first United States patent laws, in 1790, various turbine designs began to be filed in the public archives, showing occasionally a new fundamental idea, and then numerous improvements of detail based thereon; but new *type* inventions have been rare and are still few in number. The details of the best types of turbines have, however, been gradually brought to most excellent mechanical perfection. Previous to the year 1820, the millwrights of America were rarely well versed in mathematics and were rarely technical experts. Their new turbine wheel designs were not based on detailed mathematical analyses and were not described before technical societies, hence the literature relating to them is scarce. The records of the Patent Office testify to the marked natural abilities of the early millwrights.

Abroad, Smeaton gave valuable mathematical analyses of the under and overshot wheels before the Royal Society; Fairbairn and Rennie made them in iron and improved them by introducing ventilated buckets; M. Morin and M. Poncelet tested with dynamometers and analyzed the mechanics of the downward and outward flow water wheels termed in France "Jonval" and "Fourneyron" turbines and presented the results to the Academy of Science at Paris; James Thomson analyzed the inward flow or "vortex" turbines and described them before the British Association, and Whitelaw gave the arms of the reaction or "Barker-Mill" class their Archemedian curve. In America, Elwood Morris, a cultured engineer, took up the technical examination of the elements of turbine water wheels, and then Uriah Boyden, at first a studious blacksmith and ingenious mechanic and later also a railway and hydraulic engineer and scientist, improved the outward flow turbine. Boyden, by means of his skilful design and skilful workmanship, produced the most efficient turbine then known, and, by the year 1844, had given it standing as a leading type of iron turbine water wheel.

In the further technical and mechanical perfection of turbine wheels and in their introduction for the driving of large cotton mills, James B. Francis exerted an important influence. Parallel with this improvement of outward flow turbines went the improvement of inward flow turbines, especially the scroll wheels, which for a time, up to 1860, outranked all others in numbers for small water powers. In 1859, A. M. Swain introduced a combined inward and downward flow turbine which was remarkably efficient and which has influenced the designs of most of the best turbines subsequently introduced. The primitive American water wheels with vertical shafts that preceded the Boyden and improved scroll wheels were generally wooden constructions. Wing dams and short canals or flumes generally led the waters from the streams and gave the available fall of water upon the wheels. Such typical constructions indicate the state of practical hydraulics and millwrighting up to the war of 1812, when about one thousand small water powers were sawing the lumber and grinding the corn of the settlements along the Atlantic Coast. From 1815 to 1820 was a period of severe commercial depression, following the war.

In 1821 there came brighter prospects and an industrial revival. Until then the wives were spinning their wool and cotton yarns in their houses, but an experimental mill had been built on a Charles River water power that successfully spun cotton into yarn and wove the yarn into cloth. The textile industry was destined to expand rapidly and the water power of the streams was its supporting ally. Under this influence the first great water power was developed on the Merrimack River in 1822, where subsequently the city of Lowell became a great cotton manufacturing center. Near Lowell there were soon developed the equally prominent water powers on the Merrimack River at Manchester, in New Hampshire, and Lawrence, in Massachusetts. These developments had each capacities of from 10,000 to 12,000 horse-power, and each was chiefly devoted to the manufacture of cotton goods, as were the water powers of Cohoes (1828), in New York, and Lewiston (1849), in Maine. The Connecticut River water power at Holyoke (1848) was largely devoted to the manufacture of paper, as, later, were the Fox River powers in Wisconsin. The water powers on the Genesee River at Rochester, N. Y. (1856), and on the Mississippi River, at Minneapolis (1857), were largely devoted to the manufacture of flour.

The pioneer large water power at Lowell was

laid out with a system of canals with moderate fall from one to the other and then to the river below the falls. The powers at Manchester and Holyoke had similar systems of parallel canals. These were typical examples of the early developments of powers for the cotton and paper industries. These powers were specially adapted to the use of the overshot or high-breast water wheels, which, constructed largely of wood, were long and high and occupied much valuable room, but maintained their prestige for large powers until 1841.

The new Boyden turbine of 1844 showed on test at the Appleton Company's cotton mill, in Lowell, an efficiency exceeding 80 per cent. This result closed the era of overshot water wheels in America and fully opened the era of the turbine water wheel in iron construction and with rapid revolutions. This result closed also the era of parallel canal, or subdivided head, developments of water powers. A competitive trial in 1860, at the Fairmount works, by order of the Council of the City of Philadelphia, gave an impetus to the improvement of the design and workmanship of turbine water wheels, and the competitive tests at the Centennial Exposition in Philadelphia, in 1876, further stimulated along the same line, and at the same time retired into oblivion forms of wheels that were not in accordance with the true theories of design.

The attachment of riveted metal draft tubes below the running wheels was a conspicuous improvement leading to the excellent modern water wheels. The dynamometer tests of turbines at Lowell and later the testing flume experiments at Holyoke were powerful factors in placing the design of turbines on sound scientific bases.

The evolution of the turbine that had led up to the iron bucket wheel in a water-tight iron case and with an iron feeder pipe made possible the easy developments of water powers with high heads. The high water-falls and canyons in limestone formations gave opportunities for a high head type of power. The Genesee Falls, at Rochester, N. Y., present an example which dates from 1857. These turbine wheels were operated under heads of 90 feet, and, in consequence of the large aggregate of power developed there, Rochester became a noted flour manufacturing center before the wheat belt had traveled westward into Minnesota and Dakota. The old hydraulic canal power at Niagara village and one at Montmorency, near Quebec, are other examples of this type, and many others might be cited.

Another type of high fall development is that of the Willamet Falls, near Portland, Oregon, where each turbine and its electrical generators revolve horizontally on the same tall vertical shaft. The modern Niagara power plants are of this type. The water power on the Mississippi River at St. Anthony Falls presents another type of development. The head at the upper fall is about 48 feet. The bed of the river at the crest of the fall is a stratum of blue limestone about 12 feet thick. This limestone rests upon soft sandstone termed St. Peter sandrock. The power had its first large development in 1857 for operating several large saw mills. The saw mills were founded on the limestone rock of the river bed up-stream from the crest of the falls and their turbines were sunk through holes in the lime rock to wheel pits in the sandrock at the lower water level. Tunnels extended horizontally from below the fall, through the sandrock to the wheel pits, and discharged the tail waters from the turbines. This tunnel tailrace type of development was adopted also for the wheel pits of the flouring mills of Minneapolis that now manufacture eighty thousand barrels of flour per week. This tunnel tailrace system was later adopted by the Niagara Falls Power Company, the Canadian Niagara Power Company and the Ontario Power Company.

The diversion type of development of water powers presents examples of considerable magnitude. The Penobscot River is, in part, diverted from its course, at the head of a series of rapids, and turned nearly at right angles into the Millinocket. The latter stream is a branch of the Penobscot, and near the confluence flows parallel with the main stream in a lower valley. A dam in the main stream diverts the water; from the bluff of the lower stream the water is conveyed in flumes and penstocks to the turbine wheel pit with a head of about 110 feet, and there gives power to operate a pulp and paper mill with capacity to produce daily 200 tons of newspaper. A second example is the diversion of the St. Lawrence River, in part, from the head of the Long Sault rapid to the Grasse River near Massena, in New York State, with a head of 35 feet. This last diversion canal is large, giving possibility of a great water power.

The special mechanical improvement that, more than all others has opened the possibilities of the prominent recent water power constructions has been the perfection of double wheels on horizontal shafts with a draft tube common to each pair of water wheels. The germ of this, but in crude form, is seen in the Parker Brothers' patent in 1829. Now, one two and three pairs of turbine wheels are placed on the same shaft in open flume, as at the Minneapolis plant on the Mississippi, or in a cylindrical steel flume for higher heads, as at the Helena plant on the Missouri River, and their combined powers aggregating 1,000 to 6,000 horse-power per shaft unit are driving large electrical generators, which transmit the powers electrically to works 10, 50 and even more than 100 miles away from the water power source of energy.

The pairs of horizontal turbines in steel cases and having steel penstocks make possible a further development of the high head powers which are conspicuous in our mountain States as in Ogden, Utah, where the mountain stream, high up in the canyon, is gathered in a flume and wood stave pipe of 6 feet diameter and contoured along the hillside to the canyon's outlet and then is dropped in a steel penstock with 446 feet effective head to the turbines and electrical generators. Another example is the Bay Counties power, in California, that has its waters similarly gathered from the melting snows and contoured along the rocky steeps to where they can be dropped 700 feet to turbines driving generators of large capacities. These are examples of water powers generated for long distance electrical distributions and, in the second, the electrical current is sent more than 200 miles down the Sacramento valley to San Francisco and other cities beyond, and nearly 100 miles up the valley. A form of impulse water wheel known in type three centuries ago has recently been improved to remarkable efficiency and adapted by several manufacturers for use in connection with jet streams from these high head water powers for large power units.

The increasing use and value of power is bringing into prominence that type of water power development that includes the conservation of the flow of the stream in its relation to its whole watershed. An example on moderate scale is the Massabesic Lake power that pumps the water supply for the city of Manchester, N. H. In this case the dam was built on the stream a quarter of a mile below the natural outlet and the dam was high enough to flow the lake and control nearly the entire flow of its watershed. Another example is the Helena power, previously mentioned, where a high dam creates a natural lake of sufficient area to conserve the 24-hour summer flow of the Missouri River so that the power of its entire daily flow may be converted into electrical current during ten hours of each day and transmitted to distant ore mining and smelting operations.

The most conspicuous example of this class is the recent power development at Sault Ste. Marie, where a broad canal, nearly 2½ miles long, leads the waters of Lake Superior from its natural outlet, parallel with the rapids, to a power house one-quarter mile in length. Controlling dams and sluices at the outlet of the lake have for their purpose the conservation of the water from a watershed of 82,552 square miles area and making Lake Superior, of 33,000 square miles area, a magnificent mill pond, with its terminal wheel pits constructed for the development of 48,000 net horse-power.

In Lowell, the first great water power industrial city, the 10,000 horse-power of the Merrimack River was necessarily used within the limited area to which the shafts and belts could transmit the energy from the turbines and the power was necessarily subdivided among many power houses because of the limiting conditions of its use and its type of development. Through the evolution in power types leading up to the great modern developments, as of 100,000 horse-power connected with one tailrace at Niagara, it has now become possible to concentrate powers aggregating ten times that of either of the formerly famous Merrimack River powers, where the respective subdivided utilizations required each a mile of canal for their many small units.

The conspicuous achievement, along hydraulic lines, of the present generation, is the development and utilization of 40,000 to 100,000 horse-power in single power stations, with 4,000 to 6,000 horse-power units, by which great aggregates of energy are first so concentrated that they may then be conveniently distributed over a very broad field to varied industries and may throughout the whole field perform practical works of great usefulness.

The Development of Steam Power Plants.

By Geo. H. Barrus, M. Am. Soc. M. E.

The greatest change in the use of steam for stationary plants, during the twenty-five years' life of this journal, has undoubtedly occurred in the development of the steam engine. When The Engineering Record entered upon its career, some years had elapsed since the leading features of the Corliss engine had been fully worked out. Corliss had applied the principle of releasing valve gear, originally designed by Sickles, to the governing mechanism of an engine in such manner as to make the cut-off automatic. He had introduced first a flat valve and later a rotary valve, substituting them for the poppet valve employed by Sickles, and designing the mechanism so that the valve commenced its opening motion before the ports were open and continued its closing motion after the ports were closed. He had also introduced the air cushion dash pot. The best example of steam engine design at that time was the monumental exhibit of Corliss at the Centennial Exhibition of 1876, which was justly regarded as an object of wonder by engineer and layman alike. The Centennial engine was of 1,400 horse-power "nominal" as it was then called, and consisted of a pair of simple condensing beam engines driving a two-throw crank shaft on which was mounted a large fly-wheel with gear teeth cut in its periphery. Each of the cylinders was 40 inches in diameter and of 10 feet stroke. They were vertical and steam

jacketed. As the rotative speed was 36 revolutions per minute the piston speed was 720 feet per minute; well up to the ordinary practice of to-day. The engine was designed for a steam pressure of only 80 pounds. Each of the working beams was mounted high in the air upon a pair of A frames. The beams were 27 feet long and weighed 11 tons each. The fly-wheel was 30 feet in diameter. It is said that the entire engine weighed about 700 tons. The floor space, exclusive of the platform constructed around it and the inclined stairways leading to the upper platform, was about 47 by 22 feet. Based upon these figures, which, however, are only approximate, the engine would weigh about 1,000 pounds per horse-power and develop about 1.4 horse-power per square foot of ground occupied.

The advance in engine construction during the past quarter of a century may well be shown by comparing the engines designed by Mr. Edwin Reynolds for the Manhattan Railway Company, of New York, and recently set to work, with the engine just mentioned. Each consists of a pair of compound engines driving cranks at opposite ends of the shaft, with two high pressure cylinders lying in a horizontal position and two low pressure cylinders arranged vertically. The double purpose of saving in floor space and saving in wear that occurs in a large cylinder placed in a horizontal position is thus secured. A very important advantage lies also in the fact that this arrangement gives eight crank impulses per revolution, which is of much value when driving alternating current generators. The high pressure cylinders are 44 inches in diameter and the low pressure cylinders 88 inches, both with a stroke of five feet. The shaft makes 75 revolutions per minute, giving a piston speed about the same as that of the Centennial Corliss engine. The Reynolds engines develop about 8,000 horse-power at the most economical rating, and 12,000 horse-power maximum. The floor space occupied is about 1,800 square feet and the weight of the engine, exclusive of the generator, about 700 tons. The output based on the most economical load is about 11.4 horse-power per ton and 7.7 horse-power per square foot of floor space against 2 and 1.4 horse-power respectively, for the original Corliss engine. Were the Reynolds engines of the simple type, with each cylinder operating under the same mean effective pressure as the Corliss engine, the comparison would have been even more in favor of the Reynolds machines. Furthermore, the requirements of the latter engine as regards governing, and the study given to this practice, which is of much importance in alternating current work, have produced results that are most remarkable.

The status of high speed engines has undergone no material change in the past twenty-five years. They continue to be largely employed, though mainly in the smaller sizes. The products of the brains of Porter and Allen, to whom so much is due in the development of high rotative speed, are still extensively used in the engine which bears their name, and in the governor and engine bed of Mr. Porter's design applied to many other engines.

Much improvement has been brought about in the economy of steam consumption, due largely to the introduction of multiple expansion engines and high steam pressure. It was not until early in the eighties that compound engines were used for stationary mill plants in the United States. In 1883, Corliss built a compound engine, said to be the first, for the Nourse Mill, Woonsocket, R. I. Previous to this date compound mill engines were used quite extensively in Great Britain, but American engineers were slow to take up with them. At the present time the compound engine is the rule rather than the exception. The use of triple expansion engines for stationary plants was given something of a set-back about five years ago by Mr. George I. Rockwood, when he obtained remarkable results with compound engines in which the volume of the high pressure cylinder was much smaller in proportion to that of the low pressure cylinder than current practice at the time. These engines used high steam pressure—150 pounds or over—and an unusually large number of expansions—from 30 to 35. Whether the high efficiency that was secured was due to the peculiar cylinder ratio or to the large number of expansions combined with the high steam pressures, experimenters will probably determine in the near future. At any rate, the results attained had no little effect in discouraging for stationary plants the expansion of steam through three cylinders, at least with the steam pressures now used.

Reduction of clearance spaces, better workmanship resulting in less friction, the friction being also reduced in large size engines by employing the vertical arrangement of cylinders and reciprocating parts, and the increase in the number of times the steam is expanded, have all contributed somewhat in bringing the steam engine to the present standard of economy. Steam jackets and reheaters have had their ups and downs. For engines of moderate or high piston speeds it is doubtful if jacketing produces much economy. Reheaters produce less economy than they were formerly held to secure, and their advantage seems to be confined mainly to increasing the available capacity of the engine, by reducing the loss of power in the low pressure cylinder.

Superheated steam can well be discussed along with jackets and reheaters, for all have the same purpose, i. e., the reduction of cylinder condensation. The writer had the good fortune to conduct the Dixwell experiments with superheated steam at the Massachusetts Institute of Technology in 1877, which showed that superheating would reduce the steam consumption of an engine about 25 per cent. How it would have affected the coal pile, the apparatus then at hand made it impossible to determine. Interest in superheating died out for a time until a few years ago when it was again taken up to a considerable extent in Europe. The results there have been so successful that American engineers are now considering the matter, and a number of plants on this side of the water have been equipped with superheating devices. Improvements have been made in the superheaters themselves and several of those in Europe, and in this country also, have been reported to have given excellent results. No difficulty seems to have been met with on the score of lubrication for superheating to temperatures not over 500 degrees Fahrenheit.

No small part of the reduction in the cost of steam power for a few years past is due to the development and improvement of what may be called steam plant auxiliaries. When this journal was founded, mill engines were usually fitted with jet condensers worked by an air pump driven from the main engine. These have given place largely to the independent condenser, which secures greater convenience of operation. The steam which they require, and that exhausted by independent boiler-feed pumps, is employed to warm the feed water for the boilers, or for some manufacturing purpose, and the result of the change has been in every way beneficial. Feed water heaters of the open and closed type, the former of special value when the feed water contains salts that are precipitated by moderate heating, have been improved and they are widely used. Economizers are now employed to advantage in many steam plants. These still further heat the water that has passed through the exhaust steam heaters, utilizing the heat of the waste gases from the boilers. The reduction of the temperature of the flue gases that follows the use of an economizer impairs somewhat the draft of the chimney, and this has led to the introduction and wide use of mechanical draft. Steam jet blowers continue to be employed in the anthracite region to secure the draft necessary to burn dust and refuse coal from the mines. Engineers have been gradually adding to the height of chimneys as the importance and value of ample draft became apparent. A recent development in chimney construction in the United States is the introduction from Germany of the radial brick with curved faces conforming to the circumference of the chimney and vertical holes intended to improve the holding power of the mortar.

The recent development of steam turbines, the high efficiency with which they operate, their simplicity, and their adaptability to the use of superheated steam, has brought them to the front as a strong competitor of the reciprocating engine. The turbine has gone beyond the experimental stage and is now built on a commercial scale not only in small units but in very large ones. It is said that firms engaged in making these engines cannot supply the demand. The steam economy of turbines is not claimed to be as high as in the most economical steam engines, but just what it is has not been fully determined. Neither has its working economy been ascertained, taking into account all the expense of operation, for this is dependent on the showing of a longer period of manufacture and service than the engine has yet been subjected to.

During the last twenty-five years the economy of mill engines has improved from 19 or 20 pounds of steam per horse-power per hour consumed by plain condensing engines at 80 pounds pressure to 11 or 12 pounds consumed by the best class of compound engines working at 175 pounds pressure. In pumping engines the improvement has not been so great, as compound engines had already been introduced. The Pawtucket pumping engine built by Corliss, in 1878, gave a duty of 140,430,000 foot pounds per 1,000 pounds of dry steam. The Reynolds engine at Chestnut Hill, built in 1898, gave a duty of 178,497,000 foot pounds per 1,000 pounds of dry steam deducting plunger leakage, and 173,869,000 foot pounds per 100 pounds of coal, making allowance for coal required for supplying auxiliaries.

Although the efficiency of steam boilers has been improved to a less extent than that of the steam engine, this does not in any way detract from the great talent displayed in the mechanical development of the boiler and the remarkable progress that it has made. Perhaps the fact that a metallic plate will not transmit more heat to-day than it did twenty-five years ago is responsible for the failure of engineers to effect much improvement in boiler economy. It is for the increase in the size of units and the perfection of details of design to meet the severe conditions of current practice that they are to be commended.

Horizontal return tubular boilers were used to a large extent twenty-five years ago and they continue to be employed more widely, probably, than any other type at the present day, although confined to the smaller plants. They give a high degree of efficiency and are of comparatively low first cost, which are points of the greatest importance. They have the objection, however, of limited size, especially for high pressures, and danger of explosion if made of too large diameter. The objections referred to have led to a rapid increase in the number of water-tube boilers installed, especially where

large quantities of power are required, and the enormous steam plants of central power stations of electric railroads and electric lighting plants, which have come into extensive use, are now almost exclusively equipped with boilers of the water-tube type. The Manhattan Railway power house contains 64 of these boilers, each rated at over 500 horse-power, making no less than 32,000 horse-power under one roof.

Mechanical stokers have been widely introduced, but they are applied more often to large than to small plants. Where these are used the greatest advantage has been produced in connection with coal and ash handling machinery, thereby saving the labor of shoveling coal and ashes at the furnace, as well as securing economy of fuel.

The most striking change in steam engineering during the past twenty-five years lies in the introduction and successful operation of extremely large plants. The leading features of these plants are large units, high steam pressure compound engines of medium or slow rotative speed, independent condensers and other auxiliaries with steam exhausted non-condensing through feed water heaters, water-tube boilers with a tendency to superheating attachments, economizers in the flues, high chimneys, and automatic stokers fed by coal handling machinery.

Heating and Ventilating During the Past Twenty-five Years.

By W. J. Baldwin, M. Am. Soc. C. E.

Twenty-five years ago the art of ventilating and heating had made little or no progress, except in a few of the larger public institutions of the country. These were not always urban, but often rural, and many of them confined, not to our eastern States where the greatest progress might be expected, but to what were then the great Middle States. Other countries besides our own were also at a similar stage in the development of the art, with reference to the ventilation of buildings, and there was a need for a radical change in dealing with the problem from what might be termed "toy ventilation" to something that gave more positive assurance of success, particularly with reference to the determination of the quantity of air necessary for habitations. Along with the spread of knowledge as to the requirements and quantities of air necessary for ventilation, there had to be the mechanical development of the means of securing it. This involved the subject of heating, generally by steam or hot water, and the mechanical details of the requisite plant.

Peclet, in France, in the early part of the century, seemed to have had a broader conception of the mechanical details of a system for transmitting steam through pipes for warming, than any other person of his time, and he anticipated much of the present development; but it was not until about twenty-five years ago that even his early efforts were appreciated. More than fifty years after he wrote, the subject which he treated so ably began to dawn on the minds of the people of the nineteenth century, and about 1878 systematic steam fitting and systematic ventilation began to be understood. Thomas Tredgold, a civil engineer of Great Britain, is the next writer that goes deeply into the mechanics of warming buildings. His principles of warming and ventilation appeared in about the first quarter of the nineteenth century, and the third edition of his work beautifully illustrates a hot water apparatus.

In 1837 Charles Hood, F. R. S., etc., produced a treatise on "Warming Buildings by Steam and Hot Water," and like Tredgold, he conducted a great deal of original research, and freely gave his knowledge to the public, going quite deeply into the subject of ventilation. Beyond spreading knowledge on methods of warming buildings in England by hot water, his efforts did not succeed to any appreciable extent, because the journals of his time and the public did not second his efforts. About the same time, General Arthur Morin, director of the Conservatory of Arts and Trades, Paris, produced his work "On Warming and Ventilating Occupied Buildings." His efforts all went in the direction of showing the necessity for ventilation, although he had no scientific data upon which to base his assumptions of the quantity of air necessary for various conditions. It was proven, however, by the experiments of de Chaumont and Pettenkofer that his assumptions were not far out of the way, since he advocated about two-thirds of what to-day is considered good ventilation for hospitals, auditoriums, schools and other crowded buildings.

Wyman, of Massachusetts, contributed considerable to the mechanics of ventilation, and Harris, of New York, was an apostle of the necessity for ample ventilation in tenement houses and elsewhere. All this was previous, however, to the centennial of our national existence; and the public of this country, and, for that matter, of any other country, did not awake to the importance of ventilation and its relation to the public health, until about 1877 and the period of ten years following. Then an awakening took place, in which The Engineering Record took the leading part.

Robert Briggs, C. E., was its first contributor in matters pertaining to the mechanics of steam fitting. He was connected with Mr. Joseph Nason, who may be said to be the father of steam pipe fitting in America. He was also connected with Morris, Tasker & Co., of Philadelphia, at a later period, at which time he developed standards of sizes for steam pipes, fittings and pipe threads, which became known as the "Briggs Standard," and was later adopted by a committee of the American Society of Mechanical Engineers, and it is the universal standard for steam pipes in America. It first appeared in the "Proceedings of the Institution of Civil Engineers" about 1880, in a pamphlet entitled "Steam Heating: an Exposition of American Practice." It is very closely adhered to by all manufacturers, so much so that all threads are practically interchangeable. Standard dies are now made by the Yale & Towne Manufacturing Company, of sufficient accuracy to always maintain the standard; and if American manufacturers at all depart from it, it is in such a slight degree as not to be appreciable. Mr. Briggs was also associated with General Meigs, Quartermaster General U. S. A., in developing the early ventilation system for the Capitol at Washington. They produced a fan, now known as the Nason fan, a modification of the Sür, a European mining fan. It is a solid disk centrifugal fan, made to operate in a hole in the wall and discharge the air at the periphery.

I believe these fans that were constructed over fifty years ago are still in use in the Capitol; the disk being constructed of wood and the blades of iron. Some of them are still in use in the great insane asylum at Kalamazoo, in Michigan, that must be fifty years old. The "housed" blower of the present time is a modification of this fan. Mr. Briggs and General Meigs were among the comparatively few men who fully realized the value of adequate ventilation forty years ago. Their efforts then were not fully appreciated, and to-day knowledge of their work is lost in the whirl of progression, and it is practically unknown among the engineers connected with the great ventilating industries that have sprung up.

Mr. Robert Briggs was one of the first (if not the first) to make use of the exhaust steam from engines in New York buildings. In 1878, at the instigation of the editor-in-chief of The Engineering Record, he designed and constructed an apparatus whereby the exhaust steam was taken from the engine, passed into the heating pipes, and there utilized in connection with a reducing pressure valve. This apparatus is still in use in Cliff Street, New York. For many years, of course, the exhaust steam of engines has been blown through large pipes so as to warm factories, and in this respect this practice is almost as old as the steam engine itself. The writer used it many years before the incident related, but not in connection with a reducing pressure valve.

For about the first four years, therefore, of the life of The Engineering Record, Mr. Robert Briggs edited its department of steam heating. During this same period Dr. John S. Billings was responsible for its opinions in the matter of ventilation, and he was then at work on his valuable book, "Ventilation and Heating," the substance of which first appeared in its columns in 1881, and revised and enlarged, forms to-day the most comprehensive American work we have on the subject of ventilation, and perhaps the most comprehensive work extant, as it goes largely into the mechanical details, giving illustrations of construction, and practical methods of accomplishing results desired.

In the winter of 1881-82, the writer assumed charge of the steam and ventilating department of The Engineering Record, continuing in that position for about nine years. During this period an extraordinary effort was made to spread knowledge on the subject of warming and ventilating buildings. In those days, engineers were not willing to lend plans, or have their work illustrated.

The following incident in the writer's experience fairly indicates the condition of the art in 1869. He had occasion to accompany one of the best known heating engineers in New York at that time into a building, where they had gone for the purpose of determining the sizes of the radiators. The writer was a novice and simply went in the capacity of an assistant. The engineer walked into the room, counted the windows, noted that it was a corner room, and said: "I want 60 square feet for this room." He walked into the next room, found there were two windows in it, and said: "I want 40 square feet for this room," and so on, through the building, making his arbitrary ratings. When the radiators that he desired to use had been pretty well established for the building, he was asked: "How do you proportion your radiators?" With a puzzled look on his face, he said: "Ah! you are in a hurry to learn this business." The writer said no more at that time, but a little later we both visited the basement, or cellar, to see about the boilers, and the engineer said: "Well, we want, for this building, two boilers about 4 feet in diameter, and, well, about 12 feet long. I guess that will make about 40 horse-power each—80 horse-power. We have to take care of a couple of Otis elevators, so that we will want 80 horse-power." I then stated: "You found the radiators and you found the heating surface to be about 4,000 square feet. By what rule did you find your boilers, assuming you have established your radiators by some method that is fairly correct?" His reply again was: "Ah! you are in a great hurry to learn this business." At that time the writer supposed that the engineer had some data, or some method, that approximated a scientific one by which he really

determined the required capacity of his radiators, but a few months later the engineer declared that the whole thing was guessed at; that there was no method, and that he knew of none, except that under about similar conditions he had used similar radiators.

At this period, in buildings that were heated by steam, except in a few private houses where very low-pressure gravity apparatus had been installed, the radiators were supplied by live steam under considerable pressure, and, as a rule, the pipes were so run, generally on an upward grade, sometimes with pockets, that the flow and return of the steam was retarded. The pounding and hammering of the condensed water, as a natural result, was a constant annoyance to the occupants of the building, and by the general public became to be regarded as inseparable from the steam heating system. That exhaust steam, which was then allowed to escape over neighboring property could be collected and utilized for heating, was practically unknown, and not appreciated by steam fitters or engineers; the idea prevailing that a back-pressure on the engine of a couple of pounds would cause such a waste in the engine, that it was better to take live steam from the boiler than to utilize the exhaust. Many of the buildings on lower Broadway, within even twenty years, used practically one set of boilers for heating, and another set for power. The use of exhaust steam for heating resulted in a reduction in the size of the plant by one-half.

The publication of the articles referred to resulted in a change in practice, and a harmony between contractors as to methods. They found that in carrying steam out from boilers, or from any other source of supply, that the water and the steam should always run in the same direction, and, instead of giving the pipes an upward pitch as they extend from the boiler, they began to give all pipes a downward pitch, the same as in the very low pressure gravity apparatus, generally dropping the return pipes on the floor and carrying them back at a lower level. This latter practice was soon found not to be absolutely necessary, although, as a general thing, it gives the best results.

Contractors' methods in fitting up steam heating systems were crude as compared with those now in vogue. Generally only very imperfect drawings were prepared, the pipe was sent to the building by the load, and mechanics cut it there to meet the supposed needs. The radiators were made of wrought iron pipe, with cast-iron tops and bases. Manufacture of cast-iron radiators became general about 1880; their advantage soon became so apparent that various firms began to make them, until, at the present time, one of the leading industries of the country is now engaged in supplying the enormous demand of the United States and Northern Europe. The men actively engaged in this work now had little idea twenty-five years ago of the possibilities of this branch of industrial effort.

To overcome the difficulty of securing plans or information of current work in steam heating at the period mentioned, The Engineering Record, at its own expense, employed experts, when it could not obtain the plans in any other way, to go into the buildings, measure them, and describe the progress of the work; and, in this way, developed the variable methods of a trade into an exact science. When the New York Steam Company began to build its power house and put its underground pipes in the street, no direct information could be obtained of the construction, or the magnitude of the undertaking. A visit to the Department of Buildings disclosed the plans of the power house in Greenwich Street. An occasional visit to the building showed the location of the boilers, etc. As the work progressed in the streets, and as the fittings and the expansion joints and the system developed, it was all examined and an illustrated description published. The great waste of exhaust steam which then existed, and which now goes on to a considerable extent, in New York, was pointed out and editorially condemned.

About 1882 the agitation commenced as to warming railway cars by steam from the locomotive. The railroad companies claimed that they could not warm and draw cars at the same time on account of the weight and speed of the trains. The Engineering Record took up the subject and demonstrated that, as a car lost about four seats for passengers by the old method of stove heating, an ordinary train could do with one less car, if these seats were restored, and that the steam saved by not having to haul this car would more than compensate for the steam required to warm a train of about sixteen cars. The figures were taken to Albany by the advocates of the compulsory use of steam for warming trains and were used in the advocacy and passage of the bill to abolish the car stove in New York State. It was claimed at the time that without these figures the bill could not have been passed. The data bearing upon this point was acquired by the staff of this journal in experiments made on an aparatus put into a car of the Long Island Railroad by the Gold Car Heating Company, where at least the approximate amount of condensation taking place in an ordinary car in very cold weather was established.

At this time, the technical schools had not taken up, nor incorporated in their curriculums, anything on the science of ventilation. When the Massachusetts Institute of Technology added the Walker Building to the group, Mr. Frederick Tudor, of Boston, devised for it an elaborate system of ventilation. This awakened interest in that institution. Professor Woodbridge then took up the subject and made it a part of the school course, using the apparatus at his command in one of the Institute's buildings in which the students could make experiments and note the results obtained. About 1882 the first practical work on steam fitting by the author appeared, whereby an ordinary pipe fitting mechanic could obtain sufficient information to lay out a heating apparatus for a building. This, with the replies to questions in the columns of The Record, proved of undoubted value in teaching the mechanic, since prior to this period nothing had been published on the subject.

Previous to 1885 the plan of warming buildings by hot water had made little or no progress in the United States, except in some of our Government buildings in Washington, where the heating was principally the work of Bartlett, Hayward & Company, of Baltimore. England and Germany had used hot water circulation to warm buildings to a considerable extent, but the foreign systems were not at all suited to this climate, or to American buildings. Mr. Edward Gurney, of Toronto, was early in the field developing an American system of hot water heating, whereby boilers very similar to the American cast-iron steam boilers, and radiators similar to American cast-iron steam radiators were introduced into buildings with small systems of piping. They have proved eminently satisfactory. The Engineering Record promptly illustrated successful installations of hot water heating plants and published articles to teach mechanics in the United States the theory and practice of hot water heating for American conditions. Thus developed an American system of hot water heating that has, within the last five years, been largely adopted in England, whence the art may be said to have come originally, but in a very different form.

It was shown that it was not necessary to run separate pipe circuits from a boiler to a radiator and back again to make a success with small piping, and that it was only necessary to properly proportion the branch piping and pay attention to the methods of alignment and the extraction of the air to operate hot water radiators with piping very little larger and only slightly different from what was necessary for a low pressure steam gravity heating apparatus.

Electrical Distribution of Power in Industrial Establishments.

By Cecil P. Poole, Member A. I. E. E.

When this journal came into existence twenty-five years ago, there was not one electric motor in commercial use in this country and probably not in any other. To-day the number of motors in industrial establishments is so great and increasing so rapidly that it would be impossible to obtain a census of them that would be accurate when the labor of collating and digesting reports would be concluded.

The use of motors in factories, mills, etc., began in a really comprehensive way about 1889, when the works of the old Thomson-Houston Company (since absorbed by the General Electric Company) and those of the C. & C. Electric Motor Company were equipped with motors driving short line-shafts to which were belted the machine tools of the works. Later on in the same year, the factory of the Globe Tobacco Company, at Detroit, Mich., was equipped similarly. In 1893 several of the textile manufactories took up the question, and a few motors were put in to drive certain sections of the plants. A year or so later, one of the representative New England print works put in a motor equipment, and this was almost immediately followed by the introduction of polyphase (alternating-current) motors in the now famous Taftville textile mills. It is scarcely necessary to point out that there is now not a solitary class of industrial machinery to which the electric motor has not been applied, and with a degree of success limited only by the skilfulness with which the application has been made.

In the early days of electric power, some fantastic methods of motor speed control were put forth, with the result that a reaction soon took place, and the simple shunt-wound motor reigned supreme for several years. Largely on this account, but partially because of the natural inertia of industrial plant managers with regard to radical innovations, the application of electric motors in manufacturing plants was for some time restricted to one shunt-wound motor in each department of the plant, the motor driving a line-shaft from which the various machines of that department were belted. Within the past three or four years, however, confidence in the practicability of multiple-speed motors has been fully restored by reason of the development of several worthy systems of speed control. As a consequence, it is now the frequent practice to drive every machine of appreciable size by means of an individual motor built, when the service demands it, for several speeds.

It may be remarked, just here, that the use of individual motors bids fair to be as badly overdone in the immediate future as it was neglected or spurned in the past. It is seldom the case that individual motors smaller than 3 horse-power can be used profitably, and in by far the larger number of cases 5 horse-power is about the economical limit in the downward

direction. As a rule, it will pay better to run a 5 horse-power motor continuously below full load than to operate one of two smaller machines fairly continuously and the other one spasmodically, for the reason that the excess of fixed charges on the two smaller machines over those on the single larger one will cost much more than the excess in their running economy will save. It is obvious, however, that when locating a single machine at a place remote from others with which it might have been grouped will effect a considerable economy in labor or a considerable increase in output, then it will pay to isolate it and drive it with an individual motor; the cost of power, at the worst, being a relatively small proportion of the total operating expense. No generalization can be made, however, that will draw a line with any accuracy; the question of subdivision of power must be intelligently figured out in every case to fit that case.

Concerning the economy obtainable by the use of electric motors as compared with shafting and belting, there is no longer any room for argument in cases, such as machine shops, where some of the machinery is always idle. In a machine shop driven by a single engine through belts and shafting, the latter use up from 60 to 80 per cent. of the total power developed by the engine. Motor-driven shops, on the other hand, will easily show a conversion and transmission efficiency, from engine to machine tool, of 65 to 70 per cent. (loss of 30 to 35 per cent.), when the dynamo is running lightly loaded, and from 75 to 80 per cent. when things are in full operation. The chief merit of the electric motor in factories, mills, etc., however, does not lie in the greater economy of power obtainable, but in the superior ease of operation and regulation, by means of which a much greater output from a given machine is rendered practicable. The present writer knows of one case in which the application of electric motors made it possible to increase the output per man and machine to such an extent as to reduce the cost of the product nearly 30 per cent. Beside such a result, a saving of 40 to 50 per cent. of the power consumption dwindles to insignificance.

Reverting to the question of speed control: there are in wide use to-day three fundamental methods, two of which are nearly always combined, and sometimes all three. One consists of varying the field strength of the motor; another (seldom if ever used alone) is the provision of two windings and commutators on a single armature, which may be connected in series for low speeds and in multiple for high ones; the third consists of providing a plurality of supply circuits each of a different voltage and all interlinked so that the voltages may be added, the motor armature being connected across whichever of the supply circuits will produce the proper speed.

It is usual to combine the first method with one of the others, and the best results are obtained by such combination. For example, a double-commutator motor with finely graduated field regulation can be brought from full speed down, in almost imperceptible increments, to half speed with the commutators in multiple; then throwing the commutators in series and the field regulator back to the full-speed position simultaneously, the motor will continue at exactly half speed, from which it may be reduced gradually to minimum speed by repeating the manipulation of the field regulator. In practice the simultaneous shifting of commutator relations and changing of field strength are performed by a controller requiring the manipulation of but one handle. This method has the merit of maintaining the full power of the motor, down to the lowest speed, the "torque" or turning effort of the armature being increased at the same rate at which the speed is decreased. It has the disadvantage of reducing the efficiency of the motor somewhat at lower speeds, but this is of no moment practically.

The multivoltage system, combined with field regulation, is the most flexible of all methods of speed control thus far devised for direct-current work. As usually installed, there are three circuit wires, the voltage between No. 1 and No. 2 being, say, 80 volts, and the over-all voltage (between Nos. 1 and 3) being 240 volts. This gives a pressure of 160 volts between wires Nos. 2 and 3, so that there are three voltages available, and consequently three ranges of speed each graded by means of the field regulation. Thus, a motor running at a maximum speed of 1,200 revolutions per minute, and having field regulation of 30 per cent., may be operated at from 280 to 400 revolutions per minute on one pair of wires, 560 to 800 revolutions per minute on the next pair of wires (Nos. 2 and 3), and 840 to 1,200 revolutions per minute on the outer wires, Nos. 1 and 3. With this system the motor can develop its full power only on the highest voltage; a motor that will develop 10 horse-power on the outer wires can develop only 6⅔ horse-power on the 160-volt pair and 3⅓ horse-power on the 80-volt pair of wires. Inasmuch as the power required of a stationary motor under most conditions is substantially proportional to the speed of the driven apparatus or machinery, this falling off in power at lower speeds is not often a disadvantage.

For establishments in which the driven machinery must run continuously at a rigidly constant speed, the synchronous alternating-current motor is an ideal driver. So long as the generator that supplies current to the motors is driven at a constant speed, the motors themselves will maintain an absolutely constant speed regardless of load or voltage fluctuations, unless they are greatly overloaded, in which event they will "break down" and come to a standstill. The term "break down" when used in this sense refers merely to the motion of the machine, and does not imply mechanical or electrical disaster. The break-down load point of a good synchronous motor is sufficiently beyond its full load point to constitute no disadvantage whatever when the motor is operated under the condition for which it is best suited —a steady load.

The induction type of alternating-current motor, in its behavior, is a cross between the direct-current shunt-wound motor and the alternating-current synchronous motor. Like the direct-current machine, its speed drops as the load increases; like the synchronous machine, its speed bears a definite relation to the speed of the supply generator and does not vary with the circuit voltage. Also like the synchronous motor, it has a "break-down" point at which it refuses to carry the overload and comes to a dead halt; both machines, moreover, are not susceptible of practical speed control. In industrial plants where a motor can be operated with reasonable continuity and under a fair approach to full load, the induction motor is capable of excellent service; but there is not a set of conditions under which it has any real superiority over the direct-current motor except in a powder mill or other place where the air is likely to be full of explosive particles susceptible of ignition from the least spark, such as the impurities in a carbon brush are likely to produce at the commutator of any direct-current motor.

For intermittent service, requiring frequent starts under load, or even without load for that matter, the induction motor cannot compare with its direct-current mate, while for multiple speed operation it is absolutely impractical so far. In order that the alternating-current system may be placed on an equal footing with direct-current for power distribution within manufacturing plants, or over limited and congested areas, it is essential that an alternating-current motor shall be produced that can be operated at several speeds, started under load from standstill without taking excessive current, and operate at all loads with a power factor at least approaching unity. The last two requirements are not nearly of so great importance as the first one. The chief disadvantage of the alternating-current motor now is the total lack of speed gradation, but it is not too much to hope that this obstacle may eventually be overcome.

The Relations of Electrical and Civil Engineering.

By Thomas Commerford Martin, Past President, American Institute of Electrical Engineers.

It can be very reasonably argued that modern electricity is a city-bred art, born of the necessities of great centers of population and responsive to the requirements of municipal engineering. The statement has been made that the great city of Chicago is the creation of engineering, an idea somewhat contrary to the belief of those who attribute its wonderful development to the handling of grain, beef and pork. In like manner, the work that electricity does for people outside urban limits, in this nation or any other, might be obliterated without any severe loss to the electrical industries and without very severe suffering on the part of the rural communities. That this will always be the case is not likely, for the electrical conquest of the "back country" has already been begun by the trolley, the telephone and the transmission circuit, so that the region lying beyond the stimulating touch of the electric spark becomes indeed remote and secluded. Twenty-five years ago, however, even the cities were without the supreme electrical agencies that meet three of their greatest needs —illumination, communication and transportation—and the whole quarter of a century has been devoted to the perfecting of the methods and appliances which now, upon another cumulative wave of progress, are sweeping over the whole land. At the time The Engineering Record was founded, it may be seriously questioned whether ten of its readers had ever talked through a telephone; whether fifty had ever ridden on an electric car; whether a hundred had ever seen an electric light—all of them things which have since become the commonplaces of civilization.

While these electrical advances had a scientific evolution, it cannot in any sense be said that they owed their origin to precedent methods in municipal engineering. There were, nevertheless, two prior analogies, water supply and gas distribution, both of them the outcome of modern invention applied to filling the wants of contracted areas densely populated, and based upon the fundamental nineteenth century idea of bringing the commodity directly to the very door of the consumer. From the principles of water supply, earlier central station work gained nothing, the source of production being remote; but from gas supply something could be learned, to adopt or to avoid.

In other words, the "central station" was a distinctively new conception in engineering twenty-five years ago, and hence worthy of a good deal of respectful consideration, far as we may have traveled away from it since, in cities, in reaching out for its ideal ultimate; and widely as it may have been imitated in other branches of distribution, such as steam, air, heat, cold, etc. In its first form, central

station practice was based upon high pressure arc lighting. In its next stage it was predicated upon low pressure incandescent lighting. But neither was correct and neither was comprehensive; for neither was universal in its scope, falling, indeed, far below water and gas practice in ability to reach and serve everybody with the same identical article. Even at the present moment, there is a woeful lack of uniformity about electrical pressures, apparatus, appliances and methods, as every civil and municipal engineer knows who is brought up against some question involving the adoption of a plan or a system. Such variety tends, once in a while, to render his life very interesting for a time.

Electrical advances and improvements are anything but orderly or sequential. The march of progress in the art may be compared to that of several parallel columns of an army, in regard to which one is never sure as to their relative leadership or conquest of new territory; and very often one force pushing too far ahead by itself has to wait until the others can come up, bringing forward reinforcing relief and support. You can never govern or determine the course of invention, nor prophesy the arrival of a new genius, who, blazing his own path, will have a whole tribe of sheep-like followers and imitators, but who may, all the same, be himself erratic or misled by wrong signs and fallacious hopes. At the present moment the cross section of electrical advance is a hopeless jumble of the old and new, with the strata of fact and theory, experiment and practice, all mixed up, so that to set down the real position of the engineering art in that domain of applied science is peculiarly difficult. The veteran telegraphers are juggling with the very latest ideas and implements touched by the ether; and investments in submarine cables lying three miles down in ocean ooze are threatened by enterprises three miles up in the sky. Electric railway work, after unparalleled growth and novel developments, harks back to its earliest devices for entrance into the even older field of steam railroading. Electric lighting with equal brilliancy of achievement in the quarter century, is in profound unrest and quite dissatisfied with everything that ought to constitute its chief pride.

Fortunately, the municipal or civil engineer is not much affected by all this seething ferment, of which but one or two illustrations have just been cited. He might be said to begin where the electrical engineer leaves off, having enough problems of his own to deal with after all the varied electro-mechanical ones have been pushed to temporary solution. It is, perhaps, in connection with the streets that the first points of contact are seen, for electrical inventors and engineers have very naturally made their pioneer efforts in the field of transportation. As Mr. Horace Bushnell has said so tersely: "All creative action, whether in government, industry, thought or religion, creates roads," and quite as early as he strung telegraph wires, the electrician in America wanted to propel cars. His pristine attempts at propulsion were rather dismal failures made at the psychological instant when steam "arrived" and triumphed, but now, as between these two competitors, electricity forges ahead on the initial laps of the Twentieth Century. Electric traction presents to the civil engineer four main aspects—the trolley, overhead wire stage; the underrunning trolley, grooved conduit stage; the elevated road, third rail stage; and the tunnel, side, ceiling or bed contact stage. The trolley is undeniably ceasing to plague the municipal engineer in crowded cities; but out in the open he will probably long have to deal with it, so simple, easy, economical is it in operation, so cheap and swift in construction; so flexible and handy in its adaptation to the uncomplex, uncongested conditions of scattered suburbs or straggling rural communities. The civil engineer will be prompt to admit that the slotted conduit method has been a great boon to him and to urban populations, removing ugly poles and obscuring wires from the sidewalks, placing charged conductors underground, and permitting the penetration of electric cars into the innermost confines of the city with safety and comfort for all. Its influence on roadbed has also generally been good, except for the added cutting up of the thoroughfare due to the existence of the slot and its metal guards. But there is no gain whatever without some discounting loss, and the slot is, after all, a slight drawback from which municipal engineering has suffered very little hardship.

On the score of "drawback," the average elevated road has more to answer for, and has inflicted many serious burdens upon the community at large, especially from the standpoint of the architect and the lover of the City Beautiful. One thing is certain, such roads are a great nuisance when operated by steam, and their only hope and recommendation for the future is in the use of electricity. This statement some may impugn after the recent doleful experiences on the Manhattan Elevated in New York City, but it cannot be asserted too strongly that there the fault, if any, lay wholly with the management, and in nowise with the system and apparatus, if properly used. Elevated roads are, in fact, ideal places for electric traction, where the civil engineer can join hands with the electrical in securing for the passengers the utmost degree of speed, comfort, convenience and safety, by night and day; but all the favoring circumstances in the world are not to be presumed on as a chance for slackness and happy-go-lucky working. The third rail is all right, and as to incidental difficulties in regard to sleet or ice coating on its contact head, it is an extraordinary fact that years ago in the old Daft historical trials on the Ninth Avenue line all that has now occurred was shown, with the obvious means of prevention or remedy. The real problem for the civil engineer in the situation, is the ability of the elevated structures to withstand the severe strains due to the greater loads and higher speeds possible under the regime of electric motive power.

It is somewhat late in the day—with Boston, Brooklyn, Chicago, New York, Liverpool and Berlin all running third rail elevated roads—to discuss the engineering success of the method; and so, too, the success of electric traction in tunnels does not require to be dwelt on with particular emphasis. One needs only to point to London, Paris, Berlin and Buda Pest for "confirmation strong as Holy Writ," the New York Central to the contrary notwithstanding. Herein, as a matter of fact, the civil engineer is to enjoy some of his best opportunities, for with all the evils of smoke, steam, gases, etc., removed, and a pure, sweet power substituted, whose ozonizing spark might be compared to the revivifying cologne on a lady's handkerchief, he can perform at his best. He can push his tunnels further and bore deeper. He can locate his terminals strategically and dot his way stations at will. He imposes no new servitude on the crowded thoroughfare, nor need he regard the eccentricities of a street traffic made up chiefly of slow trucks devised before the Flood. Without exaggeration and without fear of contradiction, it can be asserted that the civil engineer, having called electricity to his aid, is endowed with the ability to remake our modern city on scientific lines of development, for the highest welfare of the inhabitants as well as all who desire to visit it. And to-day he is doing it.

Electric lighting in its application is a widely distinct art from electric traction, but its generating methods are now much the same. Possibly they may diverge again, but the practice of the twenty-five years has hammered out a common system of main central station with high voltage polyphase alternating current generation; underground cables to sub-stations fitted up with step-down transformers, rotary converters and storage batteries, and local distribution of direct (continuous) current at low pressure for the consumption apparatus. That is universal and commends itself thoroughly to the municipal engineer, who, in electric lighting, has had slowly to wallow through a painful period of high tension overhead "shoestring" lines; various voltages and ampereages, each good only for a special use; small stations, each grinding out its own brand of lightning; and a general chaos of dangerous and inefficient appliances, out of which the good could only emerge after a severe process of the survival of the fittest. But the advances in the art have been enormous, many of them due to the insistence of the municipal engineer on the feasibility of improvement. Moreover, with the modern centralized "central station," minor objections have disappeared, or are going rapidly, such as the location of large, noisy power plants in business or residential districts, to which coal must be carted and from which smoke is emitted. All the tendencies of the art are, in this sense, physically centrifugal—towards placing huge plants on the urban outskirts, by the waterways, and feeding in to the substations and their networks of circuits.

Associated more especially with electric lighting, although both telegraphy and telephony have had to be considered, has been the creation of the modern subway or pipeway for wires and cables. The municipal engineer has not, perhaps, much to do with the use of current when it gets inside the house or office building, but he is very deeply concerned with what happens while that current is traversing the streets from station to lamp or motor. Under his control, backed by public opinion, have grown up such subways as now exist. They are pretty good as far as they go, but here, as much as anywhere, lies the duty of the municipal engineer in enforcing or carrying out improvement. The manner in which one sees daily the street surface ripped up and the foundation bed destroyed forever to get at a pipe or wire, is nothing short of outrageous. With sufficient subways and adequate engineering, it would be utterly unnecessary, and no arts would benefit more quickly than the electric. We should at once have telpherage for the swift handling of mail matter and quicker distribution of all light packages and freight. We should have thoroughfares where automobiles could live and thrive. We should probably see a curious struggle as between the isolated plants in office buildings, hotels, etc., and the "central station" supply, not only of current, but of other things.

Telegraph circuits never bothered the municipal engineer very much and are never likely to do so; but telephony has had a closer interest for him in many ways. When telephony started, about twenty-five years ago, it was very soon seen that it led up to a bewildering multiplicity of circuits, practically one for every subscriber. This situation is to be credited with the "underground" reform far more than any unbearable evils due to electric lighting, for the early arc circuits were few and far apart, and it was quickly found as impossible to put up overhead, on poles, the massive cop-

per bars for low pressure incandescent lighting, as it would be to support gas mains in the same grotesque manner. Thus the municipal engineer and the telephone engineer were at close quarters while the game was young; and none of the changes in the telephonic art promise any relief as to the number of circuits. On the contrary, the tremendous growth of telephonic business—so that the New York Telephone Company to-day for example, has 100,000 subscribers—has merely intensified the primitive conditions; and the subways exist about as much for telephone cables as for all the other electrical supply services put together. Even the abandonment of the old notion of huge exchanges and the adoption of small scattered ones, only helps to increase the percentage of "trunking" in any telephonic network; and that means more cables again. The decentralization of telephone business is strikingly different from that in electric lighting or electric railway work. The heavy current substation is virtually a reservoir, a recipient, and does little origination. It is a convenient depot for delivering at retail what the main station creates wholesale. But the telephone substation or branch exchange originates a lot of business for itself, and within its own territory is largely autonomous. Hence, one witnesses the erection all over our large cities of telephone exchanges, pretty nearly as big as those hitherto regarded as *the* central; and these buildings are, more and more, architectural models of what their specific purpose requires.

Above are indicated briefly and roughly some of the relationships that have grown up in the past quarter century between electricity and the arts of civil or municipal engineering. But even a bare recapitulation of what everybody knows may sometimes be useful; and it is hoped that this survey may help in cultivating that nearer intimacy which must endure between electrical engineers and their elder brethren, the civils, from whom they have learned much, and to whom in return they proffer new ideas and appliances not to be altogether despised in the future.

Field Construction in Civil Engineering.

By Frank W. Skinner, M. Am. Soc. C. E.

Practical appliances and operations are engineering features of the first importance and keep pace with the advance of design, or, outstripping it, suggest and permit structures which previously would have been impossible. The contractor and resident engineer are usually chiefly responsible for the success or failure of the field construction work, which demands in large measure, skill, experience, invention and correct analysis of conditions, besides coolness and resourcefulness in difficulties, beyond what is required in many other kinds of engineering work where time can be had for deliberation and experiment. Literature concerning it is mostly combined with other technical papers in technical periodicals and reports, and has not been collated, so that an outline of the progress and achievements in this field of engineering is best attained by a review of what has been accomplished in the last quarter century in distinct advance of the previous established practice.

In the preliminary operations valuable improvements have been made in base line apparatus and instruments for surveys; photography has become an important aid, and several systems of soundings and test borings for subterranean and submarine explorations have made it possible to predetermine the character of the soil in advance of important and costly operations. The engineers and contractors for great bridges, buildings and tunnels are thus enabled to design the essential features before excavations are made and test holes 100 feet deep are sunk in the cellars of crowded city buildings to determine in advance the character of new foundations.

Formerly the common engineering structures were of such moderate dimensions that simple foundations, constructed with primitive plant and by obvious methods, sufficed, and the few large structures like towers and long span bridge piers were either located where such foundations could be used, or else they were likely to suffer from inadequate ones. There were very few deep foundations. Those on soft ground were either huge masses of timber or masonry near the surface or were small piles driven with light hammers. Under water, foundations were built on piles, or with difficulty in cofferdams at a depth scarcely attaining 25 feet, or else were imperfectly and uncertainly made by some process of dredging and sinking. Many losses resulted from settling, undermining or scouring. Now numerous massive and absolutely stable foundations are demanded and are practicable chiefly on account of new processes and appliances for constructing them. Wooden piles 130 feet long are driven vertically or obliquely with improved high power steam hammers and cut off with precision at any depth under water; concrete piles are driven with cushioned hammers or are cast in moulds driven in advance with collapsible steel cores; hollow steel and iron piles are sunk with hydraulic jets or are screwed down with hydraulic pistons.

Foundations for buildings are carried down to an indefinite depth through quicksand to hard strata, in open shafts, by the hydraulic caisson process, and foundations supporting immovably the most enormous loads are carried down to solid rock 100 feet below the water line through mud, water, quicksand and any obstacles by the pneumatic caisson process, which was first applied to buildings in 1893. An important modification of this process enables a continuous masonry dam to be carried down to solid rock, through the worst soils, so as to permit the excavation of four or five stories of a great building below ground water level and exclude the water and resist the great hydrostatic pressure on the cellar walls, as in the New York Stock Exchange. Progress has been made with a system of building foundations at great depths under ground in the worst quicksand, in totally inaccessible places, by the injection of grout in such a manner as to form masses of concrete in any desired shape and position.

In bridge work river piers are commonly made by pneumatic caissons which have been sunk more than 100 feet below water level and have been built in almost all parts of the world since the first important one in this country was built for the Glasgow Bridge over the Missouri. Great improvements have been made in sinking crib or open caisson foundations by internal dredging to depths beyond the limits of pneumatic caisson work, and especially in depositing concrete in them by automatic buckets opening under water as for the Poughkeepsie, Omaha and Interprovincial bridges, and by traveling chutes depositing it in continuous layers protected until placed, as for the Charlestown bridge. For sea walls, docks and quays valuable and ingenious methods and appliances have been devised for casting and handling on shore concrete blocks up to 500 or more tons weight and they have been constructed in place weighing up to 5,000 tons by special caissons, as for the Antwerp quay wall and for the Port de Bizert.

Consonant with these substructure constructions has been the underpinning of tall and heavy existing structures, which is usually done when they are in a precarious condition and great skill and experience are required. Old methods were practically confined to the use of wooden needle beams passing through the walls. The twelve-story wall of the Decker building, weighing 76,000 pounds per linear foot was, a few months ago, supported on double tiers of deep steel beams and its footing removed and a new one built and carried down to the solid rock. In other cases the walls have been temporarily supported entirely from the inside or from the outside by elaborate systems of inclined shores and girders or by cantilevers. Piles are driven horizontally under heavy foundations to increase their bases or they are extended by eccentric additions put in equilibrium by cantilever reaction girders, as in the Morse building. The weights of weak or heavily loaded walls are carried down to solid rock on lines of slender columns sunk 100 feet through quicksand or boulders by the Breuchaud process without jeopardizing the stability of the building, entering its cellar or obstructing the adjacent lot. Tipping piers and tall monuments with loads aggregating thousands of tons are underpinned by driving successive tunnels beneath them and filling the tunnels with masonry. The foundations of occupied tall buildings are entirely rebuilt; the superstructures are lifted 20 feet and new stories are built under them; whole fronts are taken out and replaced, intermediate stories are rebuilt or new stories erected above the roof, sometimes supported on outside new foundations, all without materially interfering with the occupants. Large brick buildings are raised or lowered many feet or are moved several blocks and around corners or across large rivers without being vacated or injured.

The safety, rapidity and economy of constructiug tall and heavy buildings in crowded city thoroughfares where there is no storage room and the streets cannot be obstructed has been greatly promoted by revolutionary improvements within the last score of years. The cellars are entirely covered by street level platforms which double the area for storage and machinery, while the foundation piers are built under them and the framework erected over them long before the excavation is completed. Vaults are built far under the street beneath temporary double deck bridges which provide office room and work yards above the sidewalks on their roofs which serve the additional purpose of protecting pedestrians. Ten-ton caissons drawn by a score of horses are quickly swung into place by a central derrick or by a boom mounted on a timber tower which covers, without obstructing, the street, and moves back and forth to command the whole foundation area, while the tower affords more storage room on its decks. Girders weighing thirty tons are lowered many feet to the cellar floor in a few minutes. A thousand tons of columns and beams are erected in a few weeks to form the twenty-story superstructure, by special equipments of hoisting apparatus which may consist of a slender tower reaching from the cellar to the topmost story, or of traveling derricks rising with the structure and moving over all parts of the skeleton floors to handle every column and girder. Steam and compressed air from the cellar are piped all over the building to operate the hoisting engines and pneumatic riveters, chisels and drills. The walls are simultaneously built in half a dozen different horizontal belts before the framework is finished. Mortar is delivered ready mixed from a central station miles away and hoisted to place by swift moving steam elevators. Wagon loads of brick or steel are swung in

one operation from the street to the top of the work and distributed on railroad tracks and the million-dollar building is completed and ready for its thousands of tenants within a year from the time the first work was commenced on its foundations.

In no department of field construction has there been such great advance and radical changes as in bridge erection, which has reached incredibly wide limits and has been almost recreated since 1877 when the 519-foot channel span of the Cincinnati Southern Railroad bridge across the Ohio, for years the longest truss on this continent or in the world, was slowly erected on the elaborate and costly upper falsework system which has since become obsolete. Similar erections are now accomplished with a fraction of the time and danger on falsework built by overhanging pile drivers and supporting movable striding towers from which are suspended dozens of sets of hoisting tackles operated by multiple-spool hoisting engines which handle the 40-ton members so rapidly that a 207-foot span weighing 160 tons has been completely erected in less than 4½ hours. Where the conditions have been exceptionally difficult or dangerous, great courage and ingenuity has been displayed in erecting long and lofty bridge spans by new and brilliant methods. The 900-ton 525-foot span of the Brunot Island Bridge across the Ohio was lifted nearly 100 feet above the water on a long line of barges, towed several hundred feet and deposited on its piers. The longest arch span in the world, the 840-foot Niagara bridge, 240 feet high, was erected in three winter months, by 100 men, by the guyed cantilever method. The famous Victoria and International bridges were rebuilt with traveling spans which enclosed the old superstructures and supported the new ones, built outside of them, while maintaining the railroad traffic and removing the original trusses. Many spans of the Florence Bridge were lowered from overhead movable trusses which supported the new spans clear of the traffic during erection and seated them in place of the old ones within a few minutes after the former were displaced. The 236-foot span double track Girard Avenue Bridge was horizontally displaced and the heavier new span simultaneously moved into its place in 2½ minutes. Viaducts more than 300 feet high are built wholly from above by steel travelers overhanging them 160 feet and lowering the materials down from the trolleys and numerous tackles. The final connections of great cantilever spans are made by a dozen men with toggles, wedges or hydraulic jacks, lifting or lowering the long semi-trusses under many millions of pounds stress.

For great dams rivers are diverted and the foundations are built more than 100 feet below their beds where it would be impossible to accomplish the work without able management and the most improved powerful plant; pumps which lift 10,000,000 gallons a day 130 feet, steam shovels working 50 feet below the surface, inclined planes to remove the spoil, multiple long-span cableways to deliver materials and scores of powerful derricks operated by steam or air pressure from a great central power plant to lay 17,000 cubic yards of masonry per month. To build the great Otay dam shafts and tunnels were cut in the solid rock of the adjacent mountain side, and the many tons of dynamite exploded in them not only shattered the granite for the stone slopes, but the blast was actually so directed as to throw the fragments almost where needed to build the huge embankments.

A definite era of radical change has seldom or never been so sharply and suddenly defined as by the new and improved methods of work on the $30,000,000 Chicago drainage canal where entirely new methods and plant were devised to handle great quantities of materials at previously unprecedented prices. Large tools and great efficiency, with the minimum of hand labor and the maximum of power distribution from central stations, was the rule. Huge steam shovels were operated in new ways and served by long rolling bridges and inclines. Earth was continuously and automatically handled by a moving belt and dumping bridge or by steam plow excavation and an enormous traveling cantilever conveyor. Soft wet material was excavated by powerful suction dredges and discharged thousands of feet away through pipes by water conveyance. The vertical sides of the canal were for the first time smoothly cut in long narrow slots 15 feet deep made without waste, by steam channeling machines, unknown in previous canal work. Blasted rock was removed by long span movable tower cantilevers, by traveling cableway conveyors, and by fixed and movable derricks of unprecedented dimensions and capacities.

In river and harbor improvements drill boats, rock chisels and huge suction dredges, with a maximum capacity of as much as 7,800 cubic yards of sand an hour, have been introduced. In general contract work the establishment of central field power stations and transmission of steam, electricity and compressed air, and the great number of pneumatic tools recently invented has almost revolutionized former methods and results. The construction of large and tall buildings and chimneys wholly of reinforced concrete and the use of massive concrete foundations has occasioned the development of concrete mixing and conveying plants with very efficient mechanical installations and excellent arrangement, which minimize hand labor and secure exceedingly large outputs at a very small cost.

Roof spans much longer than had been before constructed have been built, and the trusses have been assembled in two or four sections at the site and bodily lifted in place by trussed ginpoles of great height and large capacity. These complex and lofty structures and the powerful special engines and efficient tackles with which they are equipped have done much towards the development of the permanent structures served and their initial use in this country has been patently copied abroad. With the increased number and dimensions of brick and steel stacks the former method of constructing them from costly auxiliary falsework towers built up around them has been superseded in many instances by very light platforms and derricks designed to be supported by the finished structure itself and to be carried up with it. A particularly ingenious arrangement for building tall steel tanks has been with derricks and scaffolds floated on water pumped into the tank to fill it as rapidly as it was erected. Slender tall brick stacks have been safely lifted from their original bases and transported to distant new foundations, and when it has been necessary to raze them it has been accomplished by undercutting, burning and dynamiting so as to fell them within a few feet of the desired position.

Irrigation, water supply and hydraulic plants have necessitated the construction of many miles of wooden, steel and concrete conduits of large diameter, which have been handled or built in the field by new methods and appliances. Several methods of laying large submerged pipes are especially interesting. They have been laid through the ice, from rafts and by suspension from pile trestles. They have been launched from barges and lowered between catamarans; have been dragged across the river bottom or sunk in sections and bolted together by divers, and some of the largest, longest and most recent have been built in successive lengths on shore, encased in continuous concrete shells and almost balanced under water, independent of tide and navigation until they were complete rigid conduits lowered into deep dredged trenches.

In deep shaft sinking the earth sides have been retained and permanent and temporary linings have been built by greatly improved methods, the most striking of which is doubtless the Poetsch system of freezing the soft wet soil so as to form a stable wall, enclosing a core which can be safely excavated at depths far below the limits of pneumatic caisson work, such as has been adopted for difficult land and river shafts. Shafts are sunk through deep water, mud or quicksand by open excavation inside steel shells loaded and dredged down to hard strata and afterwards provided with permanent brick linings. The old systems of sinking brick walls on wooden curbs and of poling boards, tubbing or sets and stulls are less used and the brick lining is often built from the top down, suspended by steel rods, or in short successive sections of underpinning as in the shafts of the Chicago and Cleveland waterworks intakes. Even in tunneling, which had attained considerable perfection long before many modern kinds of field construction were introduced, numerous important developments have been made in systems, details and plant. The use of pneumatic pressure, of shields and pilots, the successful application of the freezing process, great improvements in poling boards and methods of supporting and driving them, the use of conveying machinery, electric locomotives, cable traction and double deck railroads for spoil and materials, of steam shovels and locomotive power derricks, of traveling overhead platforms, excavating machinery and power drills, of new high explosives, efficient ventilation, and especially the system of conveying pneumatic and hydraulic power from a central station have been very important, besides which curtains and other means of excluding quicksand, the use of diamond drill holes for alignment from the surface, and the availability of powerful steam pumps and hoisting apparatus has been of great value.

A distinctly new class of tunnel work involving great difficulty and expense and much danger has arisen in the construction of rapid transit subway lines within the last ten years, and remarkable skill and ingenuity has been shown in developing new methods and plant for successfully executing the work under great disadvantages. Tunnels have been driven with the shallowest roofs or with no roofs at all which occupied nearly the whole width of congested metropolitan thoroughfares in which heavy vehicular and car traffic was maintained, and excavations were carried under heavily loaded foundations in treacherous soil without injuring them. The most important features of this work have been the methods of supporting street surface and overhead tracks, the building of the tunnels in covered trenches, their construction in sections and detached portions, the methods of excavating multiple drifts and building walls and roof before removing the dumpling, special systems of transverse and compound drifts, and the use of roof shields, the storage and handling of spoil, the special apparatus for building the concrete lining and the system of simultaneous work at numerous points close together.

Field construction has become so important, and the necessity for scientific skill, exact methods, ingenuity and resourcefulness of execution has been so great that the conduct of the work has passed largely from the merely practical man to the trained engineer.

The Philadelphia Filtration System—I.

Philadelphia, situated at the confluence of the Delaware and Schuylkill Rivers, has had from the first a bountiful supply of potable water very near at hand. For over a century the city has had public water-works, and, naturally enough, the first works drew the supply from the Schuylkill River. On January 27, 1801, water was first furnished by these works, which consisted of two settling basins on the river bank at the foot of Chestnut Street, a 6-foot tunnel to a pumping station at Twenty-second Street, and a 6-foot brick conduit to the pumping station in Centre Square on the site of the present City Hall. From this latter station, which is shown in an accompanying illustration, the water was pumped through log mains to the consumers. These works continued in service until 1815, when superseded by the Fairmount pumping station.

Probably in the earlier days, the Schuylkill water was of a satisfactory quality during a considerable portion of the year; but the river has a high turbidity and after rains becomes very roily. It is the natural drainage channel for a large territory which has rapidly become populous as the seat of large and numerous industries, with the consequent pollution of the stream by the wastes from mines and manufactories and the drainage of highly cultivated land. Nevertheless, this river has continued



CENTRE SQUARE PUMPING STATION, 1801.

until now to be the city's chief source of water supply, although since 1877 a large and increasing quantity of water has been obtained from the Delaware. The Delaware also receives much objectionable drainage, but its flow is so enormous, several times that of the Schuylkill, that the dilution is very great. In natural characteristics also the water of the Delaware is somewhat superior to that of the Schuylkill, being softer and somewhat lower in turbidity.

With wonderful patience or supineness, the people of the Quaker City continued to use for years a water which was almost unendurable to visitors from places having supplies of wholesome water. Finally, after a few years of discussion, agitation and study, a commission of engineers was appointed by Mayor Samuel H. Ashbridge, May 9, 1899. Messrs. Rudolph Hering, of New York; Joseph M. Wilson, of Philadelphia, and Samuel M. Gray, of Providence, constituted this commission and made their report on September 15, 1899, the term allowed for their studies being limited by the resolution of the councils under which they were appointed. The gentlemen named acted in conjunction with the director of the Department of Public Works and the chiefs of the Bureaus of Water and Surveys, and the report which they presented is noteworthy for its completeness and thoroughness, considering the brevity of the time allotted them for the consideration of so vast a question. The report was reviewed in The Engineering Record of September 30 and October 7, 1899, and contained the following final recommendations: First, "The adoption of that project by which the waters of the Schuylkill and Delaware rivers, taken within the city limits, are purified by filtration." Second, "The immediate improvement of the existing plants, in accordance with the detailed recommendations of our report."

At the time of this report, about 95 per cent. of the water used by the city was drawn from the Schuylkill. The experts recommended, however, that this river should not be counted upon for more than 150,000,000 gallons per day in the future, this being regarded as the quantity which could safely be taken in periods of extreme low water. The Delaware, on the other hand, is capable of furnishing a practically unlimited quantity.

It will be readily perceived that the period allowed the commission of experts for the study of such a problem as the reorganizing of the water supply system of a city of a million and a quarter of people was very brief for even the broad treatment of the questions involved, and would not permit the elaboration of the details of the system proposed with such thoroughness as to preclude the need of further study. The principal recommendations of the commission were accepted, however, and in January and March, 1900, extensive appropriations were made by the city government for the inauguration of the great undertaking of building filter plants for a daily supply of 300,000,000 gallons. Recently, as the work, and the force engaged upon it, had become very large, a Bureau of Filtration, separate from the Bureaus of Water and Surveys, was constituted with Mr. John W. Hill as chief engineer.

At the date of the report of the commission of experts, the city's pumping stations had for some time been taxed to their utmost in order to meet the exorbitant demand, so that, in most of them, no opportunity could be had for even the ordinary repairs. Consequently, much of the machinery was in bad condition and the grave danger of a shortage constantly confronted the water-works officials. Furthermore, the reservoir capacity was hardly sufficient and the distribution pipe system was in part inadequate—and all these troubles in addition to the execrable quality of the water furnished. There were eleven pumping stations with a combined capacity of 438,000,000 gallons per day. Of these the stations known as Queen Lane, Fairmount and Spring Garden will be abandoned upon the completion of the new works; but a number of new pumping engines were installed and many important repairs made at the various stations in order to provide for current needs in the interim of construction. Eleven reservoirs and six standpipes, with a combined capacity of nearly 1,500,000,000 gallons, received the water from the pumping stations and supplied it to the distribution system. Of these the Queen Lane, Fairmount, Corinthian and East Park reservoirs will be abandoned and the Roxborough and Belmont reservoirs will be used as sedimentation basins for filter plants.

While the recommendations of the commission of experts were accepted in the main, continued study and more extended examinations brought out the advisability of a number of changes in detail. It is our purpose in this series of articles to describe with such degree of thoroughness as is practicable the new system of filtration works, beginning with those parts which are completed, or nearly so, and adding accounts of the others at such times as their progress shall warrant it. The expectation is that all the works now under construction will be substantially completed by October, 1904.

The system includes, in the western part of the city, the Lower and Upper Roxborough and the Belmont filters, with subsiding reservoirs, filtered water basins, auxiliary pumping stations and the necessary additional main pipes connecting with the distribution system; and on the extreme eastern side of the city, the Torresdale filters with their filtered water basins and a 300,000,000-gallon conduit in tunnel to convey the filtered water from Torresdale to Lardner's Point, where a large pumping station is being built to force the water into the distribution system, through the necessary additional mains. Besides these, a 70,000,000-gallon distributing and compensating reservoir is in progress of construction on elevated land at Oak Lane, at the extreme north of the central part of the city, and a number of large mains are being laid in the heart of the city. It is intended that the four filtration plants, when completed, shall have an effective daily capacity, reckoned on a basis of 6,000,000 gallons per acre per day, of about 300,000,000 gallons, allowing one-fifth of the filter beds to be out of service for cleaning or other reasons at any time. The Roxborough and Belmont filters will treat water drawn from the Schuylkill River and will supply the high areas and a limited low district, in the westerly part of the city, in which dwell about one-quarter of the population; while the great plant at Torresdale will receive its raw water from the Delaware and, through the agency of the Lardner's Point pumping station, will supply the greater part of the city's area, containing about three-quarters of the people, or over 950,000 persons. All the filters and filtered water basins are to be covered. The accompanying diagram indicates the relative locations of the various parts of the system.

Lower Roxborough Filters.—A somewhat detailed illustrated preliminary description of this plant was printed in The Engineering Record of December 8, 1900. Contract No. 10, for the construction of the plant, complete with the exception of the filtering materials, underdrains and sand washers, was made with Daniel J. McNichol, March 20, 1901; and the filtering materials, underdrains and sand washers were furnished and placed by the same party under contract No. 24, awarded in December, 1901. The plant comprises five filters, of a net area of .537

acre each, and a filtered water basin of 3,000,000 gallons capacity, situated just below the pre-existent Lower Roxborough reservoir of 12,800,000 gallons capacity, to which the water is pumped directly from the Schuylkill River by the pumping station at Shawmont. The old reservoir now serves as a sedimentation basin. The filters and the filtered water basin are arranged like a flight of steps on the sloping shoulder of the hill, with a difference of level of 2 feet 9 inches between adjacent filters.

This plant was put under construction first because it was the smallest and so could most quickly be made ready to furnish filtered water, and because the experience, which could be gained in its construction and operation with less risk, could be taken advantage of in constructing the larger plants. It was built substantially in accordance with the preliminary description above referred to and was sufficiently completed in August, 1902, to be put into service. The design and the methods of construction pursued here did not differ materially from those of other filters which will be described subsequently in considerable detail. The nominal capacity of the plant is 6,000,000 gallons in twenty-four hours at the rate of 3,000,000 gallons per acre, allowing at all times one filter to be out of commission. It is expected to practically double this capacity by the installation of preliminary filters of the Maignen type similar to those described in The Engineering Record of November 22, 1902, for the construction of which contract No. 37 was awarded October 3, 1902, to the Maignen Filtration Company. As the work on these preliminary filters has only begun, it will be well to defer a detailed description of them.

At present, and until the preliminary filters shall have been completed, under ordinary conditions of the river, the water is drawn from the Lower Roxborough reservoir, at the side opposite that at which it was admitted, after a subsidence of about 24 hours and applied to the filters; but in case the river is very turbid and the subsiding capacity of this reservoir is not sufficient, settled water can be drawn from the Upper Roxborough reservoir. The arrangement of the pipes and drains and the combinations of them that can be made to accomplish various purposes were so fully described and illustrated in the article of December 8, 1900, that it is unnecessary to mention them in particular again.

These filters have been in operation so short a time that it is not yet advisable to publish details of the results, but we hope that when the proper time comes we shall be able to give our readers some account of them. In general, however, it may be stated that the new filters have "ripened" in about three weeks; that a filter gives an effluent of normal quality in from three to five days after being scraped; that the bacterial content which varies from a good many hundreds to several thousands per cubic centimeter in the raw water, is reduced to a very small number, ranging upwards from 3 to 4 per cubic centimeter but almost never exceeding 100; and that the turbidity is usually completely removed. It has been found both here and at the filtration laboratory at Spring Garden (described in The Engineering Record of March 24, 1900) that slightly better results are obtained when the filtering layer is river sand than when bank sand is used, and that the filters made with river sand settle less when first put into service and ripen more quickly. These facts are believed to be due in part to the presence in bank sand of some very fine clay which is not wholly removed by the preliminary washing, while the river sand is free from such clay; and in part to the presence in the river sand of minute quantities of organic matter which, at the very outset of filtration, furnishes some food for the nitrifying bacteria.

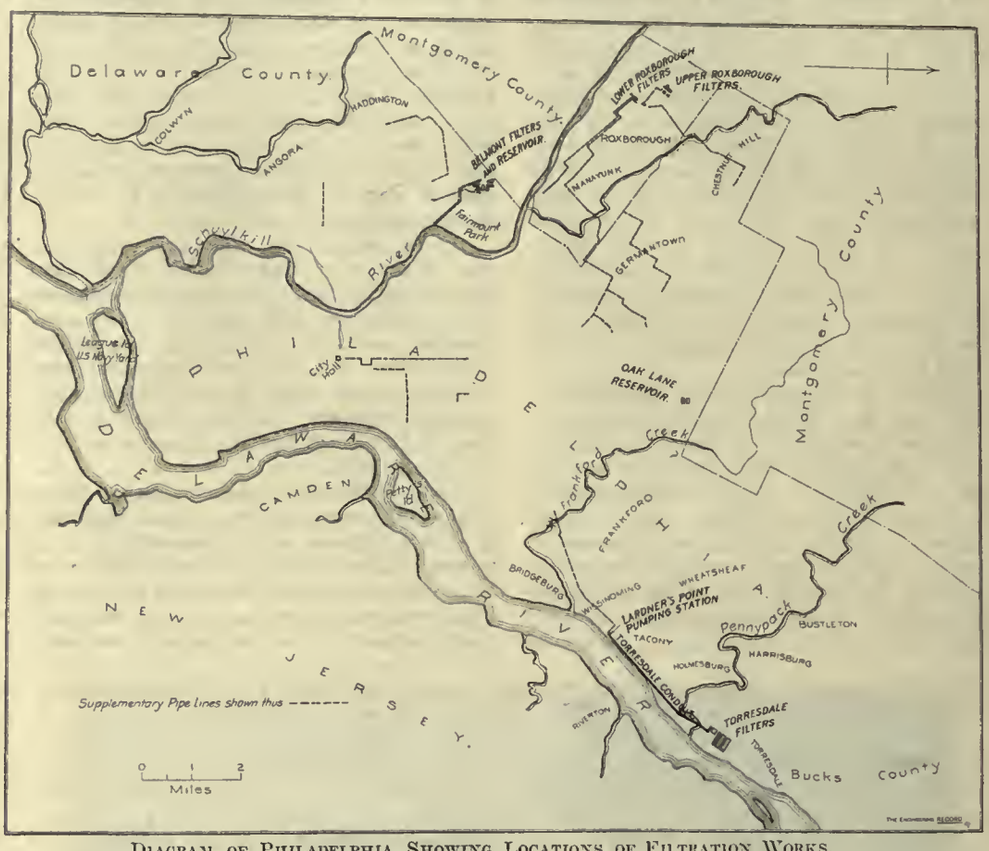


Diagram of Philadelphia Showing Locations of Filtration Works.



General View of Lower Roxborough Filters.

The interval between scrapings varies, of course, with the condition of the river water and the rate of filtration. The dirty top layer of sand and mud is removed to a uniform depth, varying at different times from ½ to ¾ inch according to the conditions, by means of light, square-ended shovels 11 inches wide, with long handles set at such an angle with the blade as to permit the men to maintain a nearly erect posture. The thickness of the layer of dirty sand to be removed at a scraping is clearly defined by the discoloration, and skilled laborers have very little difficulty in making the distinction and removing the sand with remarkable uniformity as to depth. For perfect operation of the filters, as is now well understood, it is essential to maintain the surface of the sand absolutely level. To avoid footprints the men wear 7x15-inch flat wooden sandals strapped to their shoes, whenever working on the surface of a filter. As the dirty sand is scraped off, it is cast into piles around the piers which support the roof and is afterwards removed in wheelbarrows through the sand-run entrance and deposited on the curb. Provision has been made for the installation at an early date, of an hydraulic sand ejector to be used for removing the dirty sand after it has been put into piles and to discharge it directly to the sand washers.

An accompanying view shows the neat Roman brick and stone houses over the effluent chambers, the entrances to the sand inclines and the sand washers. When recently visited, the plant

presented a pleasing appearance. The principal quantities involved in the construction include 61,137 cubic yards of earth excavation, 12,534 cubic yards of Portland cement concrete, 17,808 cubic yards filtering materials, and 73 tons of steel and cast-iron. The average daily force employed by the contractor was 350 men, and the average number of horses 100. The total payments for this plant, made under contracts Numbers 10 and 24, amount to $330,078.06, and cover the work and material above mentioned. In the performance of the work the moving of materials was done with scrapers and carts; three Carlin cubical concrete mixers were used; and two pug mills, one made by the Wallace Manufacturing Company and one by the Chambers Brick Machine Company, were employed for mixing the puddle placed beneath, around and over the filters and filtered water basin.

Mr. William C. Haddock, director of the Department of Public Works, has general executive charge of the works appurtenant to the improvement, extension and filtration of the water supply; Mr. John W. Hill, chief engineer of the Bureau of Filtration, has direct engineering supervision of all the work; Mr. Frank R. Fisher is resident engineer in charge of construction of the Lower and Upper Roxborough plant, and Mr. H. W. Underwood is in charge of the maintenance and operation of the Lower Roxborough filters. The information used in the preparation of this article was kindly supplied by Mr. John W. Hill.

Letters to the Editor.

Economic Power Production.

Sir: Referring to the paper in which Professor Hollis so ably discusses the subject of "Economy in the Use of Coal for the Production of Power," in your issue of November 22, I shall submit a few words on the outlook for improvement in that economy, a subject which is becoming more urgently pressed upon the attention of the engineer each year as the certainty of early increase in the cost of fuel and of ultimate exhaustion of our supplies becomes more and more a living issue.

Anthracite coal is to-day something of a luxury and the coal strike and the undoubtedly certain effect of the agitation for higher labor-costs can do no more than slightly hasten the day when it will be no longer a source of power. The market for anthracite as a manufacturing fuel is practically lost already. Our deposits of bituminous coal are very extensive and it will be a long time before their approaching exhaustion will seriously affect manufactures, probably; yet the end of even that supply will be seen within a short time, as the historian measures it. We have an area estimated at about 200,000 square miles of coal fields, and at the usual estimate, roughly approximate probably, of a million tons per square mile, a total of 200,000,000,000 of tons for consumption. It is unknown how much coal may be yet discovered in China and other unexplored countries; but published estimates give about fifty per cent. more than we have in our own country. We are using some sixty millions of tons of anthracite alone and about two hundred millions of "round tons" of bituminous coal now. The increase is extremely rapid and out of all proportion to population, as is that of the total of national wealth. Our anthracite will probably be exhausted during the present century and very possibly, unless prices become prohibitive of its employment in any industry, long before its end. Our bituminous coal will last much longer, but even if we could hold down the consumption to its present rate, it would be but a very short time, as the lives of nations are measured, before it would become scarce and costly. Should the present rate of growth of population and of our manufacturing industries be maintained, we shall be demanding at least 25 per cent. more each decade and that means, in 1950, about five hundred millions of tons a year, and in A. D. 2000, about 1,750,000,000 tons. Two thousand millions of tons a year will be demanded early in the next century, by a population of presumably nearly five hundred millions of people—provided, always that our people continue peaceful and prosperous, another hundred years, no great social catastrophe occurring.

The one threatened catastrophe, so far as can to-day be seen, is an industrial civil war in which we shall scotch, if not kill, the goose laying our golden eggs, an error which can only come of lack of intelligence on the part of the mass of our people. We have the most effective system of education the world has ever seen, and the progress of intelligence should outrun the advance of demagogism and barbarism and save us from that entirely unnecessary self-destruction. Intelligence and ability and enterprise being upheld by the nation, and the rights of the individual, of property and lawful industry being maintained, we are probably justified in anticipating uninterrupted social and industrial progress.

Whatever the estimates of the statisticians, it is sufficiently evident that the improvement of our methods of power-production constitutes the most imperative duty of our engineers and inventors and manufacturers. The direction in which to seek solution of the problems involved has been distinctly pointed out by science; but the path is itself difficult to find and to hold, and the obstacles to be met are unquestionably serious. Our heat-engines are to be improved and the wide range between the ideal and real machine of maximum efficiency is to be narrowed. New ways of obtaining and of transforming thermal energy for development of power are to be sought. Other natural sources of power are to be utilized and rendered more productive of mechanical energy. Every resource of science, and of art, known and to be known, meantime, is to be availed of.

With our steam engines we now waste from 20 per cent. upward of available energy in the combustion of our coal and a similar waste occurs in its transfer to the engine by the boiler. We should find ways of reducing the waste in the furnace to an insignificant quantity, of making that of the boiler itself less than 10 per cent., and of supplying the engine with 90 per cent. of the power latent in our fuels.

In the engine itself, we waste, in the best of constructions, about 80 per cent. of all the heat supplied it, of which the larger part is the thermodynamic waste inevitable with all heat-engines. The average engine, receiving heat from the fuel, in its steam supply, instead of giving us the horse-power-hour on 2½ pounds of steam, as would be the case could we secure unity efficiency, or on something like 7 or 10 pounds with an ideally perfect heat-engine demands from 25 pounds up to several times that quantity. These wastes should be made a minimum of not above one-half their present amount in the best of engines, by suppression of internal conduction, and of heat exchanges between metal and vapor, and by raising steam pressures, superheating, and, perhaps even more, by reduction of back-pressure, with increase of vapor-pressures at the same time on the exhaust side of the machine by use of secondary fluids. Josse has made a record of less than 8½ pounds of moderately superheated steam, which should, in an equally perfect boiler, correspond to not above ⅔ pound of solid fuel, ½ pound of liquid combustible.

In the mining and transportation of coal, a large opportunity is offered to reduce wastes by more perfect systems of coal cutting, by more complete separation of the slate, by securing freedom from loss in transportation, and by reaching those portions of the deposits now so shamefully neglected and left unmined. It remains, also, for the engineer to render available our water powers. The introduction of electric transmission has enormously simplified this problem and that advance is now rapidly taking place. Solar heat is a source of energy of unmeasured magnitude and of indefinite period of availability. The work of Captain Ericsson is to be carried on in later decades and centuries and that work is actually in progress. A time will come when, the human race being driven into the tropics once more by extinction of the fuel deposits, this must become the main source of power. Tidal action is a similarly enduring source of power, though vastly less available, probably, and its use will in time constitute one of the pressing problems of the engineer.

At the moment, we are watching with interest the development of new forms of motor, as the steam turbine and the "series-vapor" engine, of which the one seems likely to lend itself effectively to our work of electric power production and distribution and the other to general power production in localities in which economy of fuel is peculiarly necessary. The one gives us simplicity of parts and absolutely uniform speed of rotation, and with what is now esteemed good economy, adapting itself especially to the requirements of alternating currents; the other, with some as yet unpromising features, and with maintained complication, far excels the single-fluid engine in thermodynamic efficiency. The gas engine, also, is becoming a feature in the system of power production of the twentieth century. It has already equaled the standard steam engine in its economy of fuel—both having practically the same record to date, about one pound of coal per horse-power-hour—and its range of opportunity for reduction of wastes and improvement in efficiency is apparently far greater—unless, indeed, the use of superheat and of the series-vapor systems shall prove satisfactory sources of gain in the engine employing steam.

The study of the series-vapor systems has peculiar interest at the moment and it is not at all impossible that we may see the temperature range of the heat engines increased in the upward direction by the use of the gas-engine in conjunction with steam and other vapors which permit the extension of that range downward toward the impassable limit, the mean temperature of surrounding objects and of the external atmosphere.*

The urgency of such improvements is obvious, and the difficulties are no less imposing; but it may fairly be hoped that the rapid extension of scientific education and of improvement in the arts, the fruitful employment of vigorous and educated minds of the rising generation and their successors, and the inventions and discoveries in science of the coming years will conspire to insure a satisfactory solution of the problem of the twentieth century, sufficiently early to prolong greatly the period of industrial progress which marks its beginning.

It is probably even not unreasonable to hope that the engineer of the new century may find ways of utilizing those processes of nature, which, for uncounted ages, have been showing the possibility of producing light without heat, power without waste, and mechanical energy without thermodynamic loss. There is but one more important problem pressing for

*Manual of the Steam Engine. Vol. I., Par. 232.

solution and that is the vitally important, the essentially necessary task of finding ways of keeping the population of workers with brain as well as muscle employed without interruption, each individual at his maximum efficiency as to quantity and quality of product, and every man satisfied to take what his services fairly earn, without embarrassing the industrious, the talented, the men of ability, in their greatest of all tasks, the performance of work allotted to high intelligence and beyond the powers of the average mind. If we can keep the three legs of Mr. Carnegie's stool, labor, ability, capital, all sound, strong and symmetrical, the rest will surely come. Yours truly,

R. H. Thurston.

Sibley College, Cornell University.
Ithaca, N. Y., December 13, 1902.

Residential Septic Tanks.

Sir: The writer read with interest in The Engineering Record of October 11, 1902, a letter by Mr. Burton J. Ashley, city engineer of Zion City, Illinois, upon "Residential Septic Tanks," followed by some pertinent comments by Mr. Benjamin H. Flynn, and Mr. Ashley's reply in the issues of October 25 and November 22, and was led to make a rough estimate based upon the suggestions contained in the article, which, with a few brief comments, may be of interest to some of your readers.

Mr. Ashley described the method adopted by Zion City for disposing of its sewage by "requiring the universal construction of residential septic tanks." He states that the system "seems to have been a growth, rather than the result of enactment," brought about in part by financial limitations, in part by the facts that "farm drains were available;" that the system would "render the sewer . . . immune from greasy incrustations, . . . decrease the demand for installation of flush tanks at the upper ends of small laterals, reduce the gradients to a minimum;" and finally, "greatly minimize the cost of providing . . . a plant for further treating the sewage of the city at one place in one volume." It cannot be doubted that for a few isolated houses the method of sewage disposal suggested offers in many localities an economical and satisfactory solution of the problem. On the other hand, there must be a point beyond which, even upon financial grounds, this method of sewage disposal for a small community would certainly not be economical.

If we estimate the cost of the septic tanks in use at Zion City, we will find, perhaps, that the average cost amounts to about $35 or $40, made up of the following items and based upon the following assumptions:

House drains 5 feet below the surface of the ground.

Septic tank 3 feet in internal diameter (with 8-inch brick wall and floor) and 3 feet storage depth below invert of sewer, giving a total depth over all of about 8½ feet.

Twenty-four-inch cast-iron manhole cover on top, and two vitrified sewer pipe quarter-bends for inlet and outlet.

This construction would involve: Excavation, 4.5 cubic yards, $2; brick masonry, 2.5 cubic yards, at $12, $30; cast-iron cover and specials, $6; total, without allowance for inspection, $38. Such a septic tank would serve the ordinary household, which would average perhaps five persons, thus making a per capita outlay of $7.60 for septic tank, or in some few cases, where ten persons might be served, as suggested by Mr. Ashley, one-half of this amount, or $3.80 per capita. The content of these tanks is approximately 158 gallons each, giving, on a basis of five persons and 30 gallons per capita, a 24-hour period of contact for the sewage in the tank. Upon this basis, a community of 1,000 persons would require a tank of 32,000 gallons capacity, or a community of 5,000 persons, 160,000 gallons capacity: for individual septic tanks the total cost would be $7,600 or $38,000 respectively.

On the other hand, the cost of a number of septic tanks of from 60,000 to 150,000 gallons capacity each that have been built in this country within the last few years, has averaged about $5,000 per 100,000 gallons capacity—based upon a 24-hour period of contact, as, for instance, the Lake Forest, Ill., tank, 60,000 gallons capacity, $3,200; the Princeton, Ill., tank, 60,000 gallons capacity, $3,500; the Holland, Mich., tank, built entirely of wood, 60,000 gallons capacity, $1,200, designed by Mr. John W. Alvord, and several tanks built by the writer, averaging about $5,000 per 100,000 gallons capacity, the cost for smaller tanks being somewhat greater proportionately, than for the larger tanks. It appears, therefore, that for a community of 1,000 persons, the cost of one central septic tank should not be more than from one-third to one-quarter of the aggregate cost of residential septic tanks, and for a community of 5,000 persons, not over one-fifth. Moreover, there can be no doubt that the cost of maintenance and the likelihood of obtaining proper supervision, inspection and care would be considerably in favor of the central tank, as against the residential tanks.

Is it not, after all, therefore, largely a question of expediency, for undoubtedly a time is likely to come in the development of any small town when it would be for the common good to have a general sewerage system operated by the town, rather than individual tanks? The convenience of the public system and the resulting freedom of the individual from care is certainly a very important consideration, for the average householder neglects such matters and then worries over his own neglect. Mr. Ashley himself recognizes this and says, "Two years elapsed before we heeded a long existing conscious call to clean out this catch basin (at his own house), and we confess that up to that time for some months we felt guilty of having been grossly neglectful in not having attended to the matter earlier." While it is true that the residential tanks would accomplish in most cases what Mr. Ashley claims for them, the facts should not be lost sight of that the varying conditions as to the number of persons, the use of chemicals, sometimes antiseptics, etc., in any household would in many cases have a material effect in the character of the effluent, as would the neglect to periodically inspect and clean out the deposit; while the removal of the sludge and mat from time to time from the different cesspools would certainly be far more offensive than the periodic removal at one central tank located outside of the town.

As a general proposition, sanitarians would doubtless agree that it is far wiser to remove all sewage at once from the heart of the community and treat it at a distance from human habitations by some approved means, than to adopt the method of residential septic tanks. After all, the suggested system is much the same as the old French system, adopted in Paris by ordinance in 1820, and in use for sixty years, until the ordinance was repealed and the discharge of all sewage direct into the sewer ordered, with the one improvement that the tanks are located out of doors instead of in the house cellar. Those who have studied into the operation of the French system will remember the fierce opposition with which the plan of doing away with the house tanks, the fosse fixes, the tinettes filters, etc., met, yet today the system of public sewers and public disposal works is almost universal, and the wisdom of the change unquestioned.

As an adjunct to present methods of sewage disposal, or a preliminary step in the purification of sewage, septic tank treatment is probably in many cases a valuable process. First, in giving a more uniform effluent or mixture of the sewage and other wastes; second, in reducing the amount of sludge to be handled, thus reducing the cost of operation; third, in giving an effluent which may safely be turned in many cases into a neighboring stream, without any danger of its creating a nuisance; and fourth, in making possible much higher rates of flow through filter beds, thus materially decreasing the first cost of the plant by reducing the area of beds required. On the other hand, septic sewage is generally more offensive than fresh sewage; the sludge is much fouler than the sludge from fresh sewage; and the periodic cleaning required is more difficult, not alone on account of the fouler sludge, but the more tenacious character of the sewage mat which is sometimes found in the tanks. This matter of successfully handling the sludge deposit and the heavy mat forming upon the tanks is in some cases a very serious problem. Mr. Carpenter in his experiments at Pawtucket, found great difficulty in disposing of it. Another striking example of this has recently come to the attention of the writer, in which the mat upon the surface of the tank liquid was so thick and tough that it could not readily be broken up even by a powerful fire stream. The offensive character of the material made it impossible, if not actually dangerous, to send men into the tank to break the mat up with hoes or other tools, while its removal through the manholes would have been attended not only with great expense, but also with the same difficulties and dangers.

Both experience and experiment have shown that the use of the septic tank is not advantageous in all cases. Mr. Harry W. Clark, chemist of the Massachusetts State Board of Health, has put the case very fairly in the last annual report of the Massachusetts State Board of Health* in his statement that "The results (of the experiments at the Lawrence Experiment Station) indicate that when treating ordinarily fresh domestic sewage, an accumulation of sludge within the septic tank must be expected, amounting to a considerable percentage of that primarily present in the sewage entering the tank. In an older sewage, which has undergone considerable mechanical, chemical and bacterial action before entering the tank . . . it is possible . . . that the action of the tank will be as nearly perfect as could be desired; that the accumulation within it will be small; that much matter in suspension will be removed from the sewage and liquefied or changed to gaseous forms; and that its effluent will be easily purified upon sand or contact filters. With a still older sewage, however, like that entering the Andover septic tank, the bacterial process in the tank may be not only unnecessary, but harmful, in that it renders the sewage difficult to purify by subsequent oxidation."

The writer's experience tends to confirm this statement and to indicate that in cases where a very fresh sewage is received in the septic tank, it may be of advantage, contrary to the usual practice of keeping the contents of the tank as quiet as possible, to stir and break up the organic masses and surface mat from time to time, to prevent its accumulation to a depth of several feet, as has sometimes been the case. In any event, intelligent, if not skilled, supervision of septic tanks is certainly needed to

*Report of Massachusetts State Board of Health, 1901, page 280.

produce the best results. The difficulty of controlling the bacterial action under the varying conditions of actual practice is shown by the wide range of results obtained in such careful and extensive experiments as have been conducted at Manchester, London and Leeds, at Hamburg, at Worcester and the Lawrence Experiment Station, and at other places.

In closing, one statement by Mr. Ashley on the authority "of a well-known engineer" might perhaps be dwelt upon. Referring to a certain "tank with two filter bed purifiers," he says: "That 95 per cent. of the solids which had passed into the tank in one year had been converted into an effluent which, after the second filtration, was pure enough to be drunk by the workmen about the premises." Might not the better way have been to state that in many cases sewage may have 95 per cent. of its impurities removed by septic tank treatment, followed by suitable sand filtration, from one-third to one-half of this removal being accomplished by the septic tank, the remainder by the filtration beds? Both English and American experience have shown that the septic tank may accomplish a purification of the raw sewage amounting to from 20 to 50 per cent., as measured by the reduction of total albuminoid ammonia and the oxygen consumed. In a tank designed by the writer for the Draper Company, at Hopedale, Mass., through which from 150,000 to 250,000 gallons of fresh domestic sewage from the town and mills passes daily, being subsequently treated on 2⅓ acres of sand filter beds, the average of thirteen analyses made by the Massachusetts State Board of Health, at different intervals since October, 1900, shows the following results:

Purification effected by the septic tank, as measured by the total albuminoid ammonia, 49.6; as measured by the oxygen consumed, 45.5. Total purification as effected by the joint action of the tank effluent and the filter beds, as measured by the total albuminoid ammonia, 92.5; as measured by the oxygen consumed, 90.7.

Yours truly,

LEONARD METCALF.

Boston, Mass., December 17, 1902.

A New Steel Highway Bridge across the Assanpink Creek, at Trenton, N. J., is reported to have failed recently without warning. The bridge was almost completed, the solid concrete floor was made and part of the road surfacing was in place. The break is said to have occurred at the middle of the lower chord of one of the trusses and to have been due to crystallization. The other truss was badly strained, but the masonry was practically uninjured. The total cost of the bridge is about $20,000.

The Seventh Competition for the John Stewardson memorial scholarship in architecture will be held at the University of Pennsylvania, Philadelphia, in April and May, 1903. The value of the scholarship is $1,000, and the holder is to spend one year in travel and in the study of architecture in Europe. Candidates for the scholarship must be under thirty years of age, and must have studied or practiced architecture in the State of Pennsylvania for the period of at least one year immediately preceding the twenty-third day of May, 1903. Preliminary examinations will be required in free-hand drawing, history of architecture, construction and language, but graduates of schools of architecture by the managing committee will be exempt from these preliminary examinations. The final examination consists of a design for an official building for a county. For circulars of information address Prof. Warren P. Laird, School of Architecture, University of Pennsylvania, Philadelphia.

Ventilation and Heating in the Lying-In Hospital, New York—I.

One of the most extensive and elaborate heating and ventilating plants in this country is that forming part of the mechanical equipment of the Lying-In Hospital, in New York City. The plant is of the class in which heating is provided by direct radiation in the various rooms and in which the air supply is furnished only for ventilation. The chief interest in the work lies in the unusual measures which were taken in both heating and ventilation, as well as in the general equipment of the building, to assist in making it so far as possible proof against the lodgment of dust and the cultivation of bacteria. As regards the heating apparatus it has meant the use of enclosed pipe coils sheathed on the room side by a smoothly finished sheet iron air-tight casing instead of the ordinary direct radiators. As regards the ventilation it has required, among other things, the elimination of registers and the use instead of readily washable room openings into the air passages. A determination of the size of enclosed coils required to do the work of the exposed radiators, which they displace, led to a number of special tests, but in this connection it will only be possible to describe the ventilation, leaving for a succeeding issue a summary of the method of calculating the proper amount of heating surface in a number of typical instances. It has also been necessary to defer giving an account of the interesting mechanical plant which serves the building and of the piping by which the steam for heating is distributed through it.

For circulating the air through the building sixteen fans have been installed, discharging into and exhausting from some three miles, or 140 tons, of galvanized iron ducts. The entire cubical contents of the building, exclusive of the walls, floors, partitions, etc., are 1,862,100 cubic feet, of which 1,561,600 cubic feet are heated. In direct radiation there are all told about 22,500 square feet of surface, including 12,650 square feet of enclosed coil surface. The total amount of air delivered into the building per minute is 120,580 cubic feet, and that exhausted per minute, 157,820 cubic feet; the space in the building connected directly to the exhaust systems is, however, larger than that connected to the supply system, as will be explained. On the basis of the space ventilated, 1,297,150 cubic feet, the ventilating apparatus provides for an average change of air throughout the building 7 to 7½ times an hour; the number of air changes is, of course, varied for each room. For tempering the fresh air supply there are 5,275 square feet of tempering coils, so that the total radiating surface supplied by the steam plant amounts to 27,775 square feet.



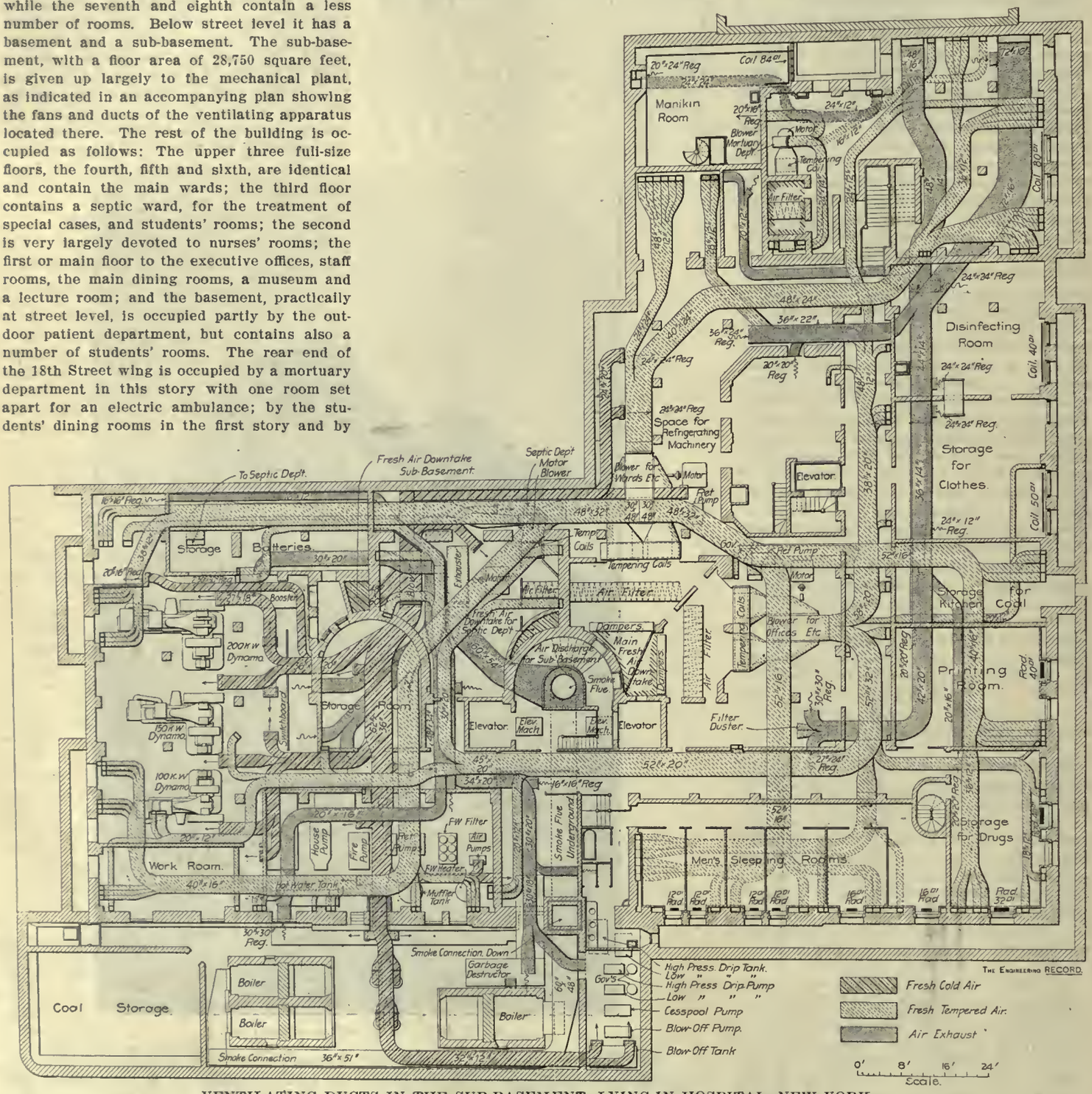
THE LYING-IN HOSPITAL, NEW YORK.

The building is an eight-story fireproof structure, extending along Second Avenue from 17th to 18th Street. It was presented to the Society of the Lying-in Hospital, an association incorporated in 1799 to conduct a mater-

nity hospital, by Mr. J. Pierpont Morgan, one of the board of governors. In ground plan it takes the form of a letter L, its 18th Street end being continued backward along that street 166 feet. In the upper part it maintains its general shape, but is modified by indenting light courts. Six of its stories are full size, while the seventh and eighth contain a less number of rooms. Below street level it has a basement and a sub-basement. The sub-basement, with a floor area of 28,750 square feet, is given up largely to the mechanical plant, as indicated in an accompanying plan showing the fans and ducts of the ventilating apparatus located there. The rest of the building is occupied as follows: The upper three full-size floors, the fourth, fifth and sixth, are identical and contain the main wards; the third floor contains a septic ward, for the treatment of special cases, and students' rooms; the second is very largely devoted to nurses' rooms; the first or main floor to the executive offices, staff rooms, the main dining rooms, a museum and a lecture room; and the basement, practically at street level, is occupied partly by the outdoor patient department, but contains also a number of students' rooms. The rear end of the 18th Street wing is occupied by a mortuary department in this story with one room set apart for an electric ambulance; by the students' dining rooms in the first story and by the servants' rooms in the second and third stories. On the seventh floor in the front part is an operating theater, rising through two stories; at the 17th Street end, which is the southern end of the building, is a solarium (a room of glass walls and roof); and at the 18th Street end is a kitchen. The theater and accessory rooms are the only ones comprising the eighth story. The main stairway is behind the central portion encircling the smoke-stack from the boilers, and there is a service stairway rising through the building in the 18th Street wing. In the former case there are two elevators and in the latter one elevator. The main ward stories are 16 feet in clear height, and have 16,760 square feet of floor area.

The ventilating plant, as already stated, employs 16 fans, six in the sub-basement and 10 at the roof. The sub-basement fans are all of the centrifugal type, of the B. F. Sturtevant make, and the roof fans all of the Blackman type of the Howard & Morse make. Five of the sub-basement fans supply fresh air, as do also two of the roof fans. They are all electrically driven by C. & C. motors.

As regards the way in which the rooms are grouped for the control of the ventilation, the ventilating apparatus is divisible into eight systems. One of these supplies the whole of the main ward floors, on the fourth, fifth and sixth floors, and comprises a fresh air fan in the sub-basement and two Blackman fans at the roof, these being indicated on the accompanying diagram of the location of roof fans. The second system supplies the general offices and the bedrooms of the staff and the main dining rooms on the first floor, and comprises a centrifugal fan in the sub-basement and two Blackman fans on the roof, one for the dining rooms and the other for the rooms which occupy places in the main or front part of the building. The third system is entirely devoted to the septic department in the southern end of the building on the third floor, the supply fan in the sub-basement and the exhaust on the roof. The fourth system serves the mortuary department, and is likewise given both a supply and an exhaust fan. The fifth system provides for an air supply to the mechanical plant, the supply and exhaust fans being mounted side by side, in the sub-basement, and mounted on the same shaft. The sixth system consists of one fan drawing air



VENTILATING DUCTS IN THE SUB-BASEMENT, LYING-IN HOSPITAL, NEW YORK.
R. H. Robertson, Architect; Alfred R. Wolff, Engineer.

from the part of the sub-basement not included in the mechanical plant and from the main laundry which occupies the 18th Street wing on the seventh story. The seventh system is located above the eighth story in the front part of the building, and comprises two Blackman fans for circulating air through the operating theater and adjoining rooms. The eighth system may be considered to comprise the fan and connecting ducts for delivering fresh cold air into the kitchen on the seventh floor. By this division, it is possible to regulate the air supply to the wards independently of that to the septic department, for example; and to run the ventilating apparatus to the engine room, or to the operating theater, or to the mortuary department only when desired, and so on. The

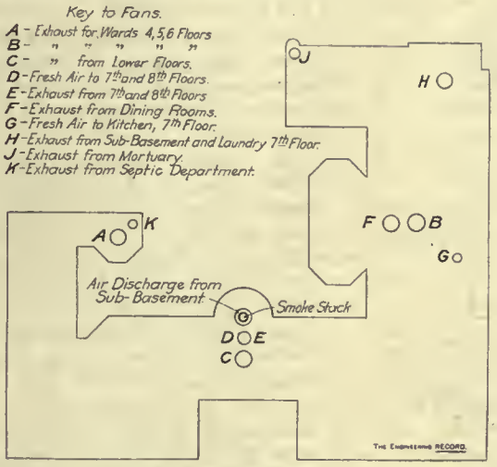


DIAGRAM OF THE ROOF FANS.

PLAN OF THE SIXTH FLOOR.

most important point in this connection, however, is the entire isolation that has been effected in the ventilation of both the septic and mortuary departments from that of the rest of the building.

The system for the wards and that for the offices receive fresh air through a shaft dropping from a court above the first story, the shaft being divided by a partition of No. 16 wrought iron into cross-sectional areas proportional to the capacities of the two fans. At their inlets they are protected with 1-inch mesh brass-wire screens and at the sub-basement are fitted with louver dampers. In each case the air passes through a cheese-cloth filter, consisting of wooden frames with cheese-cloth stretched in them against a large mesh galvanized wire-screen for protection. They are set in the usual zigzag fashion to obtain a large filtering area, the amount of which is indicated in the accompanying table of sub-basement fan-units. These areas are based on a velocity of flow of about 30 feet per minute. The fans are of the double-inlet class, and the tempering coils, which are placed on the suction side of the fans, are arranged in double sections, so that the air passing to each inlet can be equally heated. They are connected in five groups, but for the wards there are 3 two-row and 2 four-row sections and for the offices 4 two-row and 1 four-row sections, so that in the former case the coils are 14 pipes deep in the direction of air flow and in the latter 12 pipes, and, other things being equal, a higher temperature increment can be imparted to the air for the wards than to that for the offices In each case there are roughly 20 cubic feet of air passed per minute per square foot of tempering coil surface, which is designed to warm incoming air in zero weather to 70 degrees Fahrenheit. This figure is equivalent to a transfer of 1,530 British thermal units per hour per square foot of the tempering coil surface. The tempering surface in these cases, and also in the others, is controlled by Johnson thermostats with diaphragm valves on both the steam and return connections, one thermostat in each instance located in the cold air side of the coils and controlling the two sections first encountered by the incoming air and a second thermostat located in the tempered air passages and controlling the three other sections. The run of ducts is indicated in the sub-basement plan; they are suspended by galvanized-iron hangers and throughout the system, including the connections of the vertical flues with the ducts, the bends are made on curves of which the inside radius is not less than the width of the duct. Dampers with outside attached quadrants are fitted into all branch ducts to regulate, so far as may be necessary, the distribution of air through the various paths.

The air is delivered into the rooms through openings in general 10 feet above the floor.

These appear as recesses in the walls, and are finished hard and smooth like the walls of the room with rounded edges, where its surfaces meet those of the rooms and fillets where there would otherwise be crevices for the lodgment of dust. The exhaust outlets from the rooms are similar to those for the fresh air. In the wards the exhaust openings or recesses are located at the floor line, but in toilet rooms, they are at the top of the rooms. In the case of the private rooms on the ward floors, as shown on the sixth-floor plan, openings are left in the partition wall separating the nurses' rooms from the private rooms, and the air is withdrawn through top registers in the rear rooms. Wherever it was necessary to shift the position of flues to desirable locations in their rise through the building, short connecting ducts were used over suspended ceilings; and at the roof, a space of 5½ feet in depth between the seventh-story ceiling and the roof is almost entirely used for these ducts. The use of suspended ceilings for conducting the vitiated air to points of discharge is indicated on the sixth-floor plan. Exhaust fans A and B, of the roof system of fans, handle the air from the wards. Their dimensions are given in an accompanying table.

SUB-BASEMENT FAN UNITS.

Systems.	Fan wheel. Size, ins.	Temp. coils. Sq. ft.	Air filters. Sq. ft.	Motor. H.-P.	Max. speed. R.p.m.
Wards	108x60	2,500	1,500	17	135
Offices	96x54	1,600	1,100	13	150
Septic	42x21	420	300	3	300
Mort'ry	36x18	280	200	1	250
Eng. room..	96x48	...	...	30	165
Eng. room..	96x48	...	...		

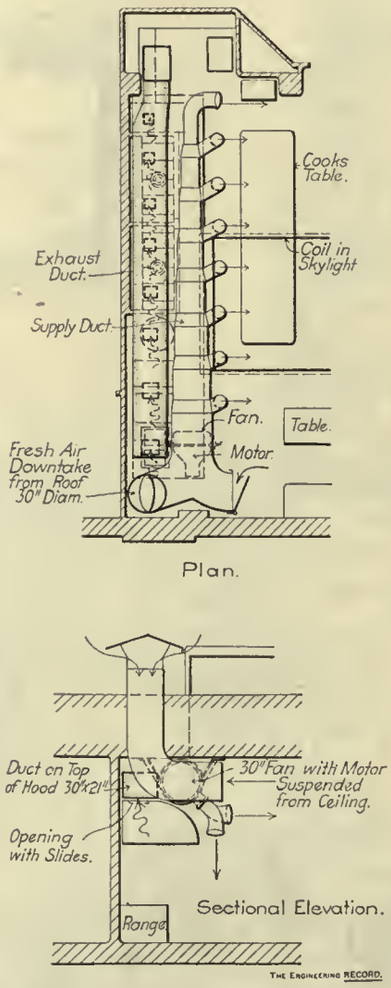
SUMMARY OF ROOF FANS.

A—5 feet diam.	F—5 feet diam.
B—6 feet diam.	G—30 inches diam.
C—6 feet diam.	H—5 feet diam.
D—42 inches diam.	J—42 inches diam.
E—42 inches diam.	K—42 inches diam.

The ventilating system for the ward floors is based on 5 changes per hour, so far as the supply of fresh air is concerned, except in the private rooms, the babies' ward, the labor room, the isolating room and the dining room, where 6 changes are calculated for. As regards the withdrawal of air, the exhaust system is based on one less change per hour in the main rooms with the exception of the babies' ward and the dining room, which are designed to have 7½ changes per hour on the exhaust system and the students' rooms on those floors, which have 10 changes. For the lavatories, which have no direct fresh air supply, a positive exhaust of air is arranged for by designing for 15 changes per hour; and for the serving room, to prevent odors from diffusing into the adjoining rooms, a similar effect is sought by designing for 6 changes. This has resulted in a greater amount of air being exhausted than supplied by the fresh air system, but in such a way that there will be more or less of an outflow from the main rooms into the halls and corridors and not into the rooms from the halls; and there will be a positive flow from the halls into the toilet rooms, the doors of which have louver panels for allowing for this movement of air.

The fresh air passages in the ward and office systems are proportioned on velocities of 24 feet per second in ducts, 12 feet per second in flues and 6 feet at openings. The exhaust passage velocities are about 5 feet per second at room openings, 10 feet in flues and 20 feet in ducts. Fresh air is supplied directly to 159,800 cubic feet of space on each of the ward floors at the rate of 13,910 cubic feet per minute, which gives a change on the average of every 11.5 minutes, but 187,300 cubic feet all told are connected directly to the ventilating apparatus, with an exhaust at the rate of 17,230 cubic feet per minute, or a general average change every 10.87 minutes.

The third, or septic-department system of ventilation, receives its air through an intake dropping from one of the courts near the two intakes already described, but entirely independent of them. In general characteristics it is similar to the wards and office systems, but greater care was taken to make the ducts air tight, all joints being soldered and painted with red lead. In addition to isolating the department from the rest of the building so far as the architectural arrangement is concerned, the separation has been carried to that extent that where a heating pipe, for example, has to run from the main portion of the building into the department, it must pass first through the outside air, the pipe, of course, being covered.



KITCHEN VENTILATION SCHEME.

Like the other systems, the tempering coils are located on the suction side of the fan, and the fan is driven by a direct-connected electric motor. The tempering coils are 14 pipes deep like those for the ward system. The discharge duct from the fan supplies a large flue toward the southern end of the building, and this in the third story connects into a large duct carried over a suspended ceiling in that portion of the building, where the septic department is located. Short branches are carried from this duct to the various comparatively small rooms into which the department is divided, and in a similar way the vent passages from the room feed into a vent duct also supported above the suspended corridor ceiling, the duct emptying into a flue above the fresh air supply flue and discharging finally into the atmosphere through roof fan K. In this system the same velocities were adopted for the proportions of the galvanized iron work as were used for the ward and office systems; but the main rooms, that is, the various patients' rooms are designed to have more air exhausted from, than is delivered to them, in order that no air can be carried from one into another or into the halls, the cases there treated being special ones in which contagion must be prevented. The air supply to these rooms, which range from 1,200 to 2,700 cubic feet in contents, is based on 5 changes per hour and the air exhaust on 6 changes. In other respects the ventilation is figured on the basis of the systems described; 33,300 cubic feet of space receives 2,980 cubic feet of air per minute and 35,300 cubic feet has an outflow of 3,740 cubic feet per minute.

The mortuary system, which for convenience is called the fourth system, is similar to the septic system in arrangement of fans, and the general provisions for entire isolation. It supplies air to the manikin room in the rear of the sub-basement and to a chapel, autopsy and other rooms immediately above in the basement. The amount of fresh air supplied per minute to this system is 1,720 cubic feet and the amount exhausted, 3,380 cubic feet. In all these rooms, the amount of air exhausted is greater than that supplied; the manikin room, with 6,300 cubic feet of contents has 5 changes per hour provided for by the fresh-air system and 7½ changes per hour by the exhaust system. In the case of this room the duct, flue and register velocities are 30, 20 and 10 feet per second, respectively, for the fresh-air passages and 16, 8 and 8 for the exhaust passages.

The fifth, or ventilating system for the mechanical plant, includes two centrifugal blowers, one to discharge fresh, cold air which is distributed to the various outlets from the fresh-air ducts without warming and the other to collect the air which is discharged by that fan into the atmosphere through the annular space that insulates the smoke-stack from the main stair hall. The two fans are mounted on the same shaft and are driven together by a direct-connected motor. The engine and boiler rooms are designed to receive 15 changes per hour and to give up to the exhaust system an equivalent of 20 changes per hour. These figures are reversed in the case of drip pit and pump rooms. In the boiler room the air is delivered through downward pointing spouts. The velocities through the fresh-air opening is in general 10 feet per second and through exhaust openings, 9 feet per second. There are 250,800 cubic feet ventilated in the basement into which nearly 43,000 cubic feet are delivered per minute by the basement fan, but from which 48,110 cubic feet are withdrawn, partly by roof-fan H, which has been designated as a separate system, Number 6, for the reason that its air is drawn almost entirely from rooms without special air inlets. Besides such rooms of the sub-basement, fan H draws air also from the laundry, the kitchen and accessory rooms on the seventh floor.

The kitchen has also a special fresh-air system, shown in one of the accompanying illustrations; this has been designated as the eighth system, and includes fan G. This fan can receive air from the kitchen or from the outside air and discharges through a circular duct over the ranges with delivery spouts having dampers for directing the air either horizontally or vertically downward, as indicated. The exhaust duct for the kitchen is fed by openings in the top of the hood extending over the row of ranges. The air inlet to the fan is 30 inches in diameter and the discharge outlets are 10, 11 and 12 inches in diameter, according to the distance from the fan. The aggregate area of the openings into the room is 781 square inches and that of the opening into the exhaust duct is 764 square inches.

The ventilating system for operating the theater will be discussed in the second article. The

architect for the building was Mr. R. H. Robertson, of New York, and the mechanical plant, steam heating and ventilation was designed by Mr. Alfred R. Wolff, consulting engineer of the same city. Messrs. Baker, Smith & Company, also of New York, were the contractors for the heating and ventilating plants. Mr. J. George Hermes is chief engineer of the hospital.

(To be continued.)

New Books Received.

Under this heading books received from publishers will be punctually announced. Reviews may be published in subsequent issues. Publishers are requested to send retail price with each book.

MALARIAL FEVER, ITS CAUSE, PREVENTION AND TREATMENT. By Ronald Ross, F.R.C.S., D.P.H., F.R.S., Walter Myers, Lecturer, Liverpool School of Tropical Medicine. New York: Longmans, Green & Co. 68 pages, illustrated. Price, 75 cents.

THE EARTH IN RELATION TO THE PRESERVATION AND DESTRUCTION OF CONTAGIA, being the Milroy lectures delivered at the Royal College of Physicians in 1899, together with other papers on sanitation. By George Vivian Poor, M.D., F.R.C.P., professor of the principles and practice of medicine, University College, London, and physician to University College Hospital. New York: Longmans, Green & Co. 257 pages. Price, $1.75.

THE SEA-COAST; DESTRUCTION, LITTORAL DRIFT AND PROTECTION. By W. H. Wheeler, M. Inst. C. E. New York: Longmans, Green & Co. 361 pages, illustrated. Price, $5.

A TEXT-BOOK OF FIELD ASTRONOMY FOR ENGINEERS. By George C. Comstock, Director of the Washburn Observatory, Professor of Astronomy in the University of Wisconsin. New York: John Wiley & Sons. 202 pages, illustrated. Price, $2.50.

THE HOW AND WHY OF ELECTRICITY. By Charles Tripler Child. New York: Electrical Review Publishing Company. 127 pages, illustrated. Price, $1.

ENGINEERING EDUCATION. Containing Volume X of the proceedings of the Society for the Promotion of Engineering Education and an index to Volumes I to X. Edited by Robert Fletcher, Calvin M. Woodward and Clarence A. Waldo. New York: Engineering News Publishing Co. 300 pages. Price, $2.50.

Book Notes.

The first edition of Trautwine's Civil Engineer's Pocket Book was published thirty-one years ago, and the eighteenth edition which has just been issued, with revisions and extensions by John C. Trautwine, Jr. and John C. Trautwine, 3d, brings the issue up to the seventieth thousand. The volume greatly resembles its predecessors, and has over one thousand 4x7-inch pages, making a book 1¼ inches thick, which is bound in flexible morocco covers, without a flap. Nearly four hundred pages of new matter have been added, and twenty of the former articles have been rewritten, among the most important of which are those on the Strength of Beams, Shearing Strength, Torsional Strength, The Effect of Curves and Bends on Flow in Pipes, Steel Shapes, Concrete, Timber Preservation and Statics, the last especially having been completely modernized. The article on Arithmetic has been considerably extended, and the new article on the Location of the Meridian is accompanied by a new table of azimuths of Polaris. In the discussion of trusses modern methods of calculating stresses and dimensions are accompanied by diagrams of various types of structures, details and descriptions of the connections of wooden and steel spans, and some condensed memorandum relative to the transportation and erection of structural work. There are also special sections on cantilevers, movable and skew ridges. A very convenient and valuable addition is the digest of specifications for steel and combination highway and railroad bridges and buildings. This is prepared from twelve sets of specifications issued by prominent specialists, bridge companies and railroads. It is not quotations or excerpts, but is a condensation of the principal features of important requirements from the different authorities, arranged and tabulated for convenient reference and comparison. There are also digests of the specifications for cement, steel and iron. There is a new and enlarged, as well as an abbreviated, table of logarithms. An especially valuable and convenient table is that for the conversion of English and metric units. This table gives the equivalents of the units and logarithms, so that the conversion of simple quantities or of rates and proportions is very easily effected. As heretofore, all rules and formulas are simply expressed in arithmetical terms so as not to involve any complicated operations or the use of higher mathematics. Besides the above additions, the new matter includes: Logarithmic Chart and Slide Rule, Isogonic Chart, Venturi Meter, Ferris-Pitot Meter, Miner's Inch, Water Consumption in Cities, Cost of Water Pipe and Laying, Price List of Manufactured Articles, Business Directory and Bibliography.

LETTERS AND LETTERING. By Frank Chouteau Brown. Boston: Bates & Guild Company. 211 pages, illustrated. Price, $2.

So many books on letters and lettering have appeared within the last few years that it is with considerable interest one examines a new work on this subject to see what new ideas are developed. This is a varied collection of alphabets composed largely, but not entirely, of ornamental forms, and is of great value if one wishes suggestions on decorative letters for drawings, book covers, illustrations, posters, stone cutting, type faces, etc. In Chapter I., which is devoted to ancient and modern Roman capitals, the analysis of the letter forms is interesting. Chapter II. discusses modern Roman letters, especially miniscule letters, and briefly refers to lettering for working drawings. The value of the treatise could be greatly increased by giving more space to working drawings. Chapters III. and IV. are devoted to Gothic letters, Italic and Script. Chapter V. contains hints to the beginner. The book shows great care in its preparation.

LIGHT RAILWAY CONSTRUCTION. By Richard Marion Parkinson, Assoc. M. Inst. C. E. New York: Longmans, Green & Co. 244 pages, illustrated. Price, $4.

Light railways in England were authorized by Act of Parliament in 1896 and were constructed with a view to extending railway communication to districts in which the usual heavy construction could not be profitably used. These light railways are exempt from many of the financial and physicial requirements which the government imposes on trunk line construction. Mr. Parkinson has prepared an office reference manual which describes the preparation of plans, the requirements of the government, and the various parts of construction of these English railways. There are many diagrams showing the construction of roadbed, track, stations, structures, etc.

THE RAILWAY CONTRACTORS' HAND BOOK, containing tables of level cuttings or banks, for single or double track and for second track work, etc. By John M. Hazen, 501 New York Life Building, Minneapolis, Minn. 4½x6 inches, 147 pages. Published by the author at $2.

This is a small book containing a set of tables for calculation of earthwork, together with several other useful tables relating to railway construction.

ANCIENT AND MODERN ENGINEERING AND THE ISTHMIAN CANAL. By William H. Burr, M. Am. Soc. C. E., M. Inst. C. E. New York: John Wiley & Sons. 473 pages, illustrated. Price, $3.50 net.

Early in 1902 Professor Burr delivered a course of six lectures at the Cooper Union, in New York, and these lectures, suitably expanded, form the six parts of the contents of this volume. Practically all the broad fields of civil engineering are reviewed, and so, of course, parts of the book are brief and general in statement. What little is known of pre-historic engineering and architecture and the story of the works of which the early records contain information are briefly summarized in Part I. The other parts treat, in order, of bridges, water works for cities and towns, some features of railroad engineering, the Nicaragua route for a ship canal and the Panama route for a ship canal. While many subjects are necessarily allotted but brief space, the chapters on bridges and other structural work and those dealing with the Isthmian canal are more extended and detailed. Several methods of computation are developed, and a number of useful tables are incorporated in the text. Many diagrams and drawings are reproduced, and a large number of views contribute to the attractiveness of the book. The book is largely historical in nature but narrates to some extent the development of theory and design as well as describing works built. To many readers the work will be useful and engineers of all ranks will find the various chapters interesting, instructive and entertaining.

Directory of National Engineering Societies.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting January 21st and 22nd in New York. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st Street, New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, R. W. Pope, 95 Liberty Street, New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Convention at Albany, N. Y., February 17th, 18th and 19th. Secretary, R. W. Raymond, 99 John Street, New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Elmira, N. Y.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, John C. Trautwine, Jr., 357 South 4th Street, Philadelphia, Pa.

Trade Publications.

The Fort Wayne Electric Works, Fort Wayne, Ind., has issued bulletins Nos. 1027, 1035 and 1036, relating to enclosed, alternating-current, 104-volt arc lamps, electrostatic ground detectors and small direct-current motors, respectively. The lamps are adjustable for 100 to 120 volt circuits and for 60 or 140 cycles. The ground detectors are for use with single, two and three-phase circuits. The motors range in size from 1 to 20 horse-power, have three speeds and are built for 115, 230 and 500 volts. Mast arms

and outriggers for supporting outdoor arc lights are illustrated in bulletin 1,037 and a device for truing generator and motor commutators in 1,038. Flyer 4,040 shows the construction of single and double-pole fuse boxes for the protection of primary circuits, and 4,041 describes two instances in which transformers were struck by lightning.

The new Walker Boiler is the subject of a number of testimonial letters that have been printed in a folder distributed by the Walker & Pratt Mfg. Co., 31 Union Street, Boston.

The Waterbury Brass Co., Waterbury, Conn., has published its standard stock catalogue, which is a valuable book of 52 pages containing tables of weights and measures bearing on brass and copper in tubes, rods, sheet and wire.

"Sparks," for November, published by the Crucible Steel Company of America, Pittsburg, Pa., contains the following articles: The effect of reheating on the coarse structure of over-heated steel; softening self-hardening steel; the Crucible Steel Co.'s annual report; heating for hardening in gas furnaces; a curious experiment in tempering, making up cartridge punches and dies; heavy milling versus planing; the shape as affecting hardening and the importance of technical information. The December issue contains articles on the internal structure of iron and steel; why some pieces are peculiarly liable to crack; heating a cutter; critical points of steel; hardening errors; drawing the temper; case hardening; and die forging.

Air compressors and receivers are described in four bulletins and a booklet lately issued by the Herron & Bury Mfg. Co., of Erie, Pa. Bulletin No. 14 gives a description of its Straight Line steam-driven air compressor built for heavy duty, and Nos. 15 and 16 describe its center crank compressors. Three types of receivers are given in bulletin 17. Each of the four bulletins contains tables of sizes, pressures, etc., and cuts and tables from the four bulletins are reprinted in a reduced form in booklet No. 2 for letter distribution.

Bulletin No. 15 from the H. W. Johns-Manville Co., 100 William St., New York City, introduces a new branch block for electric circuit work using Noark fuses. The construction is a departure from the customary plan of having the fuses on one side of and at right angles to the mains and in the same plane with them. Here the fuses are placed over the mains at right angles to them with a resulting economy of space. The blocks are at present furnished for two and three-wire circuits with a fuse capacity of 1 to 30 amperes at 220 volts.

A catalogue of steam specialties issued by the Direct Separator Co., Syracuse, N. Y., is devoted to the construction and use of the Sweet steam and oil separators, the Sweet exhaust head and the Powers steam trap. Photographic views of shipments notable for size or quantity are given. A second booklet contains the results of tests of the Sweet separator and an extensive list of users.

A revised reissue of "Wire Rope Tramways," published by the Trenton Iron Co., Trenton, N. J., is now being distributed. It describes with the aid of numerous half-tone engravings and detail line drawings the Bleichert system of wire-rope transmission with special reference to the use of the locked-coil track cable, and the Webber compression grip with automatic attacher, by means of which cars are hauled up steep grades without requiring lugs or knots on the traction rope. An interesting illustrated account is also given of a number of typical lines. At the works of the Solvay Process Co., in Syracuse, N. Y., the tramway has a length of 16,500 feet and an hourly capacity of 75 tons. At the Chilkoot Pass there is a line 7 miles long with a capacity of 5 tons per hour.

The Western Electric Co., 259 So. Clinton St., Chicago, is advertising its Sunbeam incandescent lamps and the Edwards specialties through two illustrated letters. It is western agent for the line of switches, alarms, bells, watchmen's clocks, etc., manufactured by Edwards & Co., of New York.

A new thread milling machine for cutting threads, worms, spiral gears and solid-end springs is the subject of a comprehensive catalogue published by the Pratt & Whitney Co., Hartford, Conn. The construction in detail together with samples of work done is shown by many excellent cuts, and a number of tables relating to the cutting of threads to various standards are given. A brief illustrated description is included of an automatic cutter grinder to be used in connection with the thread milling machine.

The Case automatic high-speed engine built by the New Britain Machine Co., New Britain, Conn., is furnished in sizes from 2½ to 13 horse-power in the single type and 16 to 25 horse-power in the double type, according to that company's latest catalogue. The smaller sizes may be had with frames to allow for mounting on the floor, wall or ceiling. The catalogue shows the application of the engine to driving generators, pumps, fans and stokers by direct-connection.

The W. N. Wight system of lock-woven steel and concrete construction as applied to a floor arch is the subject of a folder received from the Wight-Easton Co., 160 Fifth Avenue, New York. The flooring comprises a peculiar form of concrete arch reinforced by a steel fabric made of hard-carbon drawn-steel wires.

During the past year the Ball Engine Co., Erie, Pa., has developed a new inertia governor which has been adopted as its standard. A pamphlet describing it shows it to be a single-weight governor and states that it is practically in gravity balance and will regulate the speed from the lowest speed to 35 per cent. higher without anything being removed from or added to it.

The seventh edition of catalogue No. 8, of the Allis-Chalmers Co., Chicago, contains 60 pages on the subject of crushing rolls. The book deals with the speed of rolls, dry crushing, the arrangement of crushing plants, the erection and operation of rolls, besides giving a detailed account of the construction of the different classes of rolls it makes.

The Whiting Foundry Equipment Co., Harvey, Ill., has issued catalogue No. 36 on cranes and electric travelers. The book is a 124-page description of bracket, pillar, jib and traveling cranes with some 50 or 60 full-page half-tone views of notable installations.

Four bulletins on compressed air apparatus have been received from the Machinery Department of the Havana Bridge Works, Montour Falls, N. Y. No. 49 describes compression riveters which are made in four sizes, of 24, 30, 36 and 42-inch reach. It is provided with a bottom heading attachment by means of which a rivet on the under side of the work may be headed without inverting the machine. Bulletins 50 and 51 describe pneumatic hammers and dollies. The former are of the Shepard type for calking, chipping and riveting, made in six sizes from 12 to 22-inches long and using from 12 to 20 cubic feet of free air per minute. The dolley is to replace the hand dolley bar. Bulletin 52 explains the Shepard pneumatic motor hoist. The motor consists of three single-acting cylinders radially mounted upon the driving shaft, which is direct-connected to a double train of spur gearing. It is built in sizes of ½ to 10 tons capacity, using either chain or wire rope hoists.

The Buffalo fan system of heating, ventilating and drying is briefly explained in a pamphlet issued by the Buffalo Forge Co., Buffalo, N. Y. The different methods of combining heaters and blowers for different work are represented by a number of cuts, which include views of buildings containing typical installations.

Warren Webster & Co., Camden, N. J., have taken advantage of some striking instances of pipe incrustation to describe in brief in a leaflet the features of their feed-water heater and purifier. The photographs show a large pipe nearly closed up with laminations of lime and earthy materials and are particularly interesting, as they were taken from an exhaust steam pipe connected to a feed-water heater.

The Standard Steam Specialty Co., 111 Fifth Avenue, New York City, has issued a number of circulars relating to the Utility exhaust muffler tank and the Utility pump governor valve. The muffler tank is placed in the exhaust line and is designed to separate the oil from the steam, to serve as a return tank for the condensation from the heating system, to act as a feed-water heater and to govern the operation of the feed pump. The governor valve is made to fit all makes of pump governors.

The C. W. Hunt Co., West New Brighton, Staten Island, N. Y., has printed a pamphlet-circular on narrow-gauge electric storage-battery locomotives. It is designed for use with industrial railways and comprises a storage battery, two independent motors and eight driving wheels.

The annual offering of calendars to The Engineering Record this year has been surprisingly small. Most of those received, however, are easily up to the standard of last year and among them may be mentioned the following: The Ashton Valve Co., 271 Franklin St., Boston, a large and beautiful calendar which will be mailed on request to any engineer; the Bullock Electric Mfg. Co., Cincinnati, twelve lithographed cards for the twelve months, each card bearing the portrait of a noted man of science and engineering with a brief sketch of his life and work on the back; Charles Millar & Son Co., Utica, a large calendar with a beautiful reproduction of a painting by J. G. Brown; the New Jersey Foundry & Machine Co., 9 Murray St., New York, a dainty calendar accompanying the portraits of two pretty girls; the Lord & Burnham Co., Irvington-on-Hudson, N. Y., a large calendar showing an attractive occupant of an attractive greenhouse; The Henry Martin Brick Machine Mfg. Co., Inc., Lancaster, Pa., a large calendar intended for utilitarian purposes in an office; Pittsburg Meter Co:, East Pittsburg, Pa., a wall calender with figures 1 inch high; The Berger Mfg. Co., Canton, O., a wall calendar with monthly sheets 12½ inches square, attached to a perspective view in colors of its sheet metal works.

Personal and Obituary Notes.

Mr. A. W. Stevens has been elected superintendent of the water-works department of Logansport, Ind.

Mr. Alfred E. Martin, for 17 years superintendent of the Framingham, Mass., water company, has been elected superintendent of the Springfield, Mass., water-works.

William Perkins Tyler, who was the originator in this country of a method of manufacturing charcoal iron for boiler tubes, died in New York, December 27, aged 53 years.

Mr. J. F. Case, formerly assistant engineer at the Portland, Ore., water-works, is in charge of the construction of bridges across the Pasig River, for the Corps of Engineers, U. S. A., at Manila, P. I.

Prof. I. J. Macomber has resigned his position as professor of electrical engineering at the Armour Institute, in Chicago, to accept a position with Messrs. Westinghouse, Church, Kerr & Co., of New York.

Mr. Gratz B. Strickler has been assigned by Mr. James Knox Taylor, supervising architect of the Treasury Department, to superintend the erection of the government buildings at the Louisiana Purchase Exposition.

The Engineers' Club of Cincinnati has elected the following officers: President, A. O. Elzner; vice-president, H. E. Warrington; directors, Charles H. Meeds, Frank E. Morris and James A. Stewart; secretary and treasurer, J. F. Wilson.

The Rochester, N. Y., Engineering Society has elected the following officers: President, C. E. Turner; first vice-president, Charles O. Harris; second vice-president, J. Foster Warner; secretary, John F. Skinner; treasurer, Robert Cartwright.

Captain Robert McGregor, Corps of Engineers, U. S. A., died in the Manila hospital, December 23 from acute appendicitis. He was a native of Michigan, and was graduated from the U. S. Military Academy at West Point in the class of 1889.

Mr. A. Kennedy Ashworth, formerly of the firm of D. Ashworth & Son, consulting steam engineers, and for a number of years in charge of the engineering department of the Pittsburgh Gage & Supply Co., Pittsburgh, has been appointed assistant manager of the Underfeed Stoker Co., with headquarters in the Marquette Building, Chicago.

Mr. Bernhard A. Behrend has been made chief engineer of the Bullock Electric Manufacturing Co., of Cincinnati. He is yet but a very young man, having been born in 1875, in Pomerania, Germany. He began his practical experience with the Oerlikon Co., at Zurich, Switzerland, which he left in 1899; and in 1900 he was engaged by the Bullock Company as chief engineer of its alternating-current department.

Edward S. Waters, the designer of the famous Holyoke dam and for the past 15 years treasurer of the Holyoke, Mass., water-power company, died at his home in that city on December 26 of pneumonia. He was born at Salem in 1831. In 1857 he entered the employ of the Hartford & Fishkill Railroad, in the construction department, having turned his attention to civil engineering on his failure, owing to ill-health, to prepare for admission to Harvard University. At the outbreak of the Civil War he obtained an assignment on the staff of General Burnside, but soon became a prominent member of the engineer corps. After the war he was engaged in the lumber business in Wisconsin and for 14 years at Wilmington, Ill., on the development of the Kankakee River. In 1887 he became identified with the Holyoke work and has long been regarded as one of the prominent hydraulic engineers of the country.

Three Vacancies in the Civil Engineer list of the navy are said to exist, and it is reported that competitive examinations will be held in New York and Chicago, on February 16, by Rear Admiral Mordecai T. Endicott, chief of the Bureau of Yards and Docks, to fill the places.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

For proposals see pages 47, 48, 50 and 83.

WATER.

Brockton, Mass.—The U. S. Cast Iron Pipe & Foundry Co., of Philadelphia, Pa., is stated to have secured the contract for furnishing the Water Dept. with 12,000 ft. of 24-in. pipe, at $28.40 per net ton.

Boston, Mass.—The Metropolitan Water Bd. is stated to have awarded the contract for the superstructure of siphon and gauging chambers on the Weston Aqueduct to Norcross Bros. & Co., Tremont Bldg., for $27,552.

Crompton, R. I.—The citizens are reported to have voted on Dec. 23 to construct a reservoir on Huckleberry Hill; it will have a capacity of 500,000 gals. of water and cost about $20,000. C. D. Robinson and Jas. Cumisky have been appointed on committee to have charge of its construction.

Providence, R. I.—The Warren Fdy. & Mach. Co., 160 Bway, New York, has been awarded the contract for furnishing 466 tons of pipe at $32.70 per ton, on the basis of bids opened Dec. 20. The Camden Iron Wks. bid $33.50 per ton; the U. S. Cast Iron Pipe & Fdy. Co., $35.90 for pipe 4 to 8 inches in diameter and $34.80 for pipe 12 to 24 inches.

Ashfield, Mass.—John M. Sears, Town Clk., writes that a stock company is being formed here to construct water works. A. D. Daniels, of Ashfield, and L. Farragut, of New York, N. Y., are reported interested.

Yonkers, N. Y.—The Water Bd. on Dec. 18 is reported to have decided to engage a consulting engineer to assist in the preparation of plans and construction of the proposed filter bed syatem, and Comrs. Flannery and Walsh were appointed on committee to secure this engineer.

Alexandria Bay, N. Y.—The Village Trus. are reported to be considering the construction of water works and a sewerage system. Frank A. Hinds, of Watertown, will prepare the plans and estimates.

Plainfield, N. J.—See "Dwellings."

Philadelphia, Pa.—Mayor Ashbridge has approved the ordinance providing for the laying of water mains for the distribution of filtered water in Robbins, Tacony and Worrall Sts., Old Front St. Road and Frankford, Torresdale and Kensington Aves.

Lebanon, Pa.—The Heights Water Co., of Lebanon, is reported incorporated, with a capital of $15,000.

Watertown, N. Y.—Local press reports state that at a meeting of the Water Bd. Dec. 22 the City Engr. presented estimates on the contemplated sources of water supply for the city. A resolution was adopted providing that a committee to be selected from the Water Bd., with Pres. Knowlton and City Engr. McComb, to visit certain cities and examine the filtration systems in use, and report at the meeting in Jan.

Brighton, N. Y.—The Rocheater & Lake Ontario Water Co., of Rochester, has been incorporated with a capital of $2,500,000, to supply water from Lake Ontario to the villages of Brighton and Fairport, and in the towns of Greece, Gales and Brighton, in Monroe County. Geo. M. Bunting, of Philadelphia, Pa.; Sampson Q. Mingle, of New York, and A. H. Harris, of Rochester, are among the incorporaters.

Brooklyn, N. Y.—The following bids were opened Dec. 30 by R. G. Monroe, Comr. of Water Supply, for furnishing and laying water mains in 92 streets, only the main items being given:

Items and Quantities.	Isaac Harris.	John J. Cashman
Straight pipe, 2,675 tons	$30.50	$29.15
Specials, 190 tons	58.00	56.00
20-in. pipe, to lay, 1,800 ft	.48	.50
12-in. pipe, to lay, 12,100 ft	.20	.32
8-in. pipe, to lay, 57,000 ft	.18	.25
6-in. pipe, to lay, 34,000 ft	.16	.18
273 fire hydrants, total	5,651.00	7,507.50
Macadam relay, 2,600 sq. yds	.15	.30
Block pavt. relay, 3,000 aq. yds	.15	.20
Asphalt relay, 1,700 sq. yds	4.00	3.10
20-in. wet connect'ns to 48-in. pipe, 2	575.00	550.00

Brooklyn, N. Y.—The following bids were opened Dec. 30 by R. G. Monroe, Comr. of Water Supply, for furnishing and laying 30-in. cast iron force main in Underhill Ave. and for other mains:

Main Items & Quantities.	Isaac Harris.	Robt. L. Christie.	Fredk. N. Lewis.	John J. Cashman.
30-in. C. I. pipe, 297 tons.	$31.00	$35.00	$29.50	$30.50
30-in. specials, 43 tons.	58.00	60.00	55.00	57.00
20-in. C. I. pipe, 40 tons.	31.00	32.00	29.50	31.00
20-in. specials, 11½ tons.	58.00	58.00	55.00	58.00
12-in. pipe, 202 tons.	31.00	31.00	29.50	31.00
Lay. 30-in. pipe, 1,750 ft.	1.17	1.75	2.20	2.00
Lay. 20-in. pipe, 375 ft.	.49	1.00	1.60	.90
Lay. 12-in. pipe, 3,625 ft.	.20	.75	.75	.47

Jamaica, L. I., N. Y.—The following bids were opened Dec. 30 by R. G. Monroe, Comr. Water Supply, N. Y. City, for laying water mains in N. Washington Pl. and other streets in Queens Boro.:

Main Items and Quantities.	Pence Bro.	Robt. L. Christie.	Lloyd Collis.	Thos. F. Tuohey & Co.	Fredk. N. Lewis.
Straight pipe, 450 tons	$31.00	$31.00	$30.50	$32.00	$30.50
Branches, 30 tons	58.00	58.00	57.50	58.00	57.50
Earth excavation, 10,000 cu. yds	.25	.30	.25	.26	.35
Filling and embankment, 15,200 cu. yds.	.25	.50	.25	.30	.31
Laying 12-in. pipe, 5,145 ft	.29	.30	.30	.30	.25
Laying 8-in. pipe, 4,350 ft	.22	.15	.25	.24	.20
Laying 6-in. pipe, 8,498 ft	.15	.15	.20	.18	.18
82 double-nozzle case hydrants, total	$7,790.00	$2,870.00	$4,205.50	$7,626.00	$2,870.00

Rochester, N. Y.—Water bonds amounting to $3,000,000 have been sold.

Washington, D. C.—Bids will be received at the office of the Washington Aqueduct, Jan. 28, for filters, pure water reservoir and appurtennnces, and cement, as advertised in The Engineering Record.

Baltimore, Md.—Bids are wanted Jan. 7 for furnishing and delivering water meters which may be required, to the Water Dept. of this city, during the year 1903. Alfred M. Quick, Water Engr. Address Thos. G. Hayes, Pres. Bd. of Awards.

Georgetown, S. C.—Bids will be received Jan. 16 by the Bd. of Pub. Wks. for boring an artesian well. Address J. B. Steele, Chmn.

Augusta, Ga.—About 2,000 ft. of 6-in. pipe will be laid on Park Ave. and Pine St., in January.

Parkersburg, W. Va.—The South Parkersburg Light, Power & Water Co., of Parkersburg, has been incorporated to build and maintain an electric light, water and power plant; capital, $10,000. Incorporators: J. Fucey, of Weston. G. L. Fries, of Parkersburg.

Fostoria, O.—Benj. H. Flynn, Engr. State Bd. of Health, Columbus, writes that Fostoria has municipal water works and is not contemplating any extension or change for the present. It is, however, talking of a municipal electric light plant, which will probably be started under the new council to be elected in the spring. Nothing has as yet been done on the project except talk and figure.

Lake Wilson, Minn.—The Village Recorder writes that nothing has been done regarding water works at present, only the advisability of constructing being discussed.

Algoma, Wis.—The citizens are stated to have voted Dec. 23 to construct water works and an electric light plant.

Truman, Minn.—Bids will be received Jan. 20 by O. N. Steenstrup, Village Recorder, for $5,800 water-works bonds.

Westbrook, Minn.—Bids will be received Feb. 3 by the Village Council for $7,000 water bonds. John E. Villa, Village Recorder.

Two Harbors, Minn.—Water and light bonds amounting to $24,000 are reported to have been sold.

Henderson, Ky.—It is reported that the Council will employ a water engineer to prepare plans for water works.

Ft. Morgan, Ala.—L. Cravens, Q. M., writes that it has been recommended to readvertise for bids for sinking an artesian well.

Birmingham, Ala.—The Mayor has appointed Aldermen J. J. Altman and Harry Jones to consider the advisability of city owning water works.

Cuero, Tex.—It is reported that bonds for water works improvements have been authorized by vote.

Chickasha, Ind. Ter.—See "Sewerage and Sewage Disposal."

Memphis, Tenn.—The Water Com. of City Council on Dec. 22 decided that the Artesian Water Co. might proceed with the conatruction of 6 wells and other improvements.

Beaumont, Tex.—It is stated that some extensions are to be made to the plant of the Beaumont Water Works Co. Geo. W. Sykes, Ch. Engr.

Ardmore, Ind. Ter.—Bids are wanted Jan. 14 for constructing water works, as advertised in The Engineering Record.

St. Louis, Mo.—Local press reports state that bids will be received Jan. 13 by the Bd. of Pub. Improv. for installing 6 furnaces in the low-service pumping station.

St. Martinsville, La.—The citizens on Dec. 26 are stated to have voted to issue bonds for water works and an electric light plant.

Denver, Colo.—Incorporation papers of the Middle Park Land & Irrigation Co. were filed on Dec. 24 in the office of the Secy. of State by Wm. F. Knight, Pres. of the Knight Investment Co.; Sami. D. McDaniel, and others; capital, $100,000.

Grand Junction, Colo.—Chas. W. Haskell, of Grand Junction, Engr. in Charge, writes that it is proposed to construct a ditch 18 miles in length from Gunnison for irrigation purposes. Bids for the work will be received at once. The North Delta Canal Co. is the owner. J. H. Colo, Pres., and W. H. Burnett, Secy., both of Delta.

It is stated that a water and sewerage system will be constructed at the Indian Training School, Congress having appropriated $18,000 for this work. Theo. G. Lemmon, Supt.

Denver, Colo.—Geo. Richardson, Secy. Farmers High Line Canal & Reservoir Co., writes that nothing has been definitely decided about proposed irrigation district; expect to build some reservoirs.

Renton, Wash.—The Washington Pipe & Foundry Co., of Tacoma, is stated to have secured the contract for constructing the water works, at $4,750.

North Yakima, Wash.—W. H. Code, the Indian Inspector who has been here looking into the proposition of building an irrigation system on the Yakima Indian reservation, will return to Washington, D. C., and make a report to the department. In all probability the canal will be built, and it will open up a large body of land to cultivation.

Whatcom, Wash.—The City Council is stated to have ordered extension of the water main to Eureka addition; probable cost of improvement, $5,100.

Wilbur, Wash.—The following bids were opened by the City Council Dec. 17 for constructing water works: M. E. & E. T. Hay, $14,998; Jas. C. Broad, Spokane, $14,865 (awarded contract); W. E. Thomas, $15,000, and Bell & Price, $15,938. Geo. N. Matzger, Town Clk.

Adams, Ore.—M. A. Ferguson, City Recorder, writes that it is proposed to construct water works, at a cost of from $5,000 to $7,500. It is first required to have an amendment to the charter, and this has been drafted and will go before Legislature as soon as it convenes.

Redlands, Cal.—A press report states that the Riverside Water Co. has purchased land just west of Redlands and will install a pumping plant and develop water on property for use of the Riverside orange groves.

Merced, Cal.—C. B. Harrell, City Clk., writes that it is proposed to construct water works and an electric light plant, at a probable cost of $95,000. The election for same has not yet been held.

Los Angeles, Cal.—The Paloverde Irrigation & Improvement Co. has been incorporated; capital, $25,000. Directors: A. G. Hinckley, Jas. V. Douthill, Geo. S. Whaley, and others.

It is stated that bids will be received Jan. 5 by the Domestic Water Dept., 322 Wilcox Bldg., for a double acting duplex pump, having 4,500 gal. capacity per minute, lifted at a height of 230 ft.; also for an inverted vertical engine.

Modesto, Cal.—It is stated that bids will be received Jan. 6 by the Bd. of Dirs. of the Modesto Irrigation Dist., for the purchase of $130,000 bonds. C. S. Abbott, Secy.

San Bernardino, Cal.—City Clk. Legare Allen writes that at the election held Dec. 23 on the issue of water bonds, the 1st and 2d propositions for $163,000 and $68,000 water bonds carried, and the 3d proposition for $66,000 water bonds was defeated.

Truckee, Cal.—The McGlashan Water Co., of Truckee, has been incorporated, with a capital of $30,000. Directors: C. F. McGlashan, F. Finnegan, and others.

Layton, Utah.—The Stockholders of the Holmes Creek Irrigating Co. are stated to have authorized the directors to secure estimates of cost of making a cobble flume through which to run the waters of Holmes Creek from the mouth of the canyon to the mountain road, a distance of about 80 rods.

Calgary, Asa., N. W. T.—The Canadian Pacific Ry. Co. is reported to have on hand a project to irrigate the territory between Calgary and Medicine Hat, embracing 2,500,000 acres of semi-arid land.

SEWERAGE AND SEWAGE DISPOSAL.

Boston, Mass.—C. G. Beidon & Co., of Quincy, are stated to have secured the contract for constructing Sec. 48 of the high level sewer at Quincy, for $241,000.

Brooklyn, N. Y.—At a meeting of the local board of the Williamsburgh District Dec. 26 a resolution was passed recommending the construction of a sewer to take the place of the present Bushwick Creek sewer, at a cost of $75,000.

Bids will be received Jan. 14 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and constructing a sewer in portions of Narrow Ave.; also outlet sewers in portions of 3 streets. Engineer's estimate is as follows: 710 lin. ft. 30-in. brick sewer. 5,610 lin. ft. 12 to 24-in. vitrified stoneware pipe sewer, etc.

Buffalo, N. Y.—The city intends to purchase property on Hamburg St. for a dry sewage pumping plant; size, 199x298 ft.

Alexandria Bay, N. Y.—See "Water."

Albany, N. Y.—Local press reports state that the construction of an intercepting sewer is in contemplation: it will be about 11,000 ft. in length and accommodate all sewage of city, and deposit it in the Hudson River; it will probably cost about $500,000.

Philadelphia, Pa.—See "Electric Railways."

Reading, Pa.—See Paving and Roadmaking.

Harrisburg, Pa.—Local press reports state bids will be received Jan. 7 by Highway Comr. McConkey for constructing a 12-in. terra cotta pipe sewer in portions of Herr St.; also for grading the eastern approach of the Herr St. subway.

Augusta, Ga.—About 2,200 lin. ft. brick sewer, egg shape, 36x54, will be constructed at once. Plans on file at City Engr.'s office.

Richmond, Ind.—It is stated that the Legislature will be asked to appropriate $15,000, to be used for the disposal of sewage at the Easthaven Hospital.

Youngstown, O.—The City Council has passed ordinances providing for the construction of sewers in Hughes St. and Delason Ave.

Winchester, Ill.—Chas. H. Condit, F. H. Allen, and other owners of a tract of land comprising 12,000 acres west of the city along Illinois River and between Sandy, Walnut, and Plum Creeks, are reported to have petitioned the Scott Co. Comrs. for the formation of the "Big Swan Drainage and Levee District." Levees will be built for a distance of 15 miles, and steam pumps will be put in and operated to dispose of surface water.

Chicago, Ill.—Local press reports state that improvements of the north branch of Chicago River from Belmont to Lawrence Ave. was ordered by the Engineering Com. of the Drainage Bd. Dec. 22. The present stream will be widened and straightened at a cost of $700,000. The plan contemplates a channel 90 ft. wide and 8 ft. deep to cleanse the lower portion of the north branch, and supply additional water for the dilution of the city's sewage. The work will require the excavation of about 1,000,000 cu. yds. of material and the construction of several miles of dock. In addition to this $50,000 will be expended in constructing new bridges across the channel.

New Albany, Ind.—The Co. Comrs. are reported to have decided to ask City Council to construct a sewer from Vincennes St. to the mouth of Falling Run. It will probably cost $30,000.

Findlay, O.—Plans have been prepared and contracts will be let early in the spring for pipe sewers in Front, Shinkle, 3d, E. Lincoln and W. Lincoln Sts. and Washington Ave. John W. S. Riegle, City Engr.

Decatur, Ill.—Bids will be received Jan. 23 by the Drainage Comrs. of Illinois Special Drainage Dist. for constructing certain ditches calling for the excavation of 90,000 cu. yds. of earth, for constructing 1,285 rods of tile drain; also for furnishing f. o. b. cars at Latham 21,200 10, 15 and 18-in. tile. Jas. Allison, Chmn.

Toledo, O.—Bids will be received Jan. 12 by Chas. H. Nauts, City Clk., for furnishing material and constructing a circular pipe sewer 8, 10 and 12 in. inside diameter in portions of Genesee St.; also for furnishing material and constructing a circular brick sewer 2 ft. inside diameter and 4 in. shell and a circular pipe sewer 15 in. inside diameter in portions of Scottwood Ave.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service Jan. 26 for improving and constructing trunk sewers and drains in portions of 3 streets. Robert Allison, Pres.

Pine Bluff, Ark.—S. Geisreiter, Secy. Drainage Dist., writes in regard to the contemplated drainage district at Pine Bluff, that nothing definite has as yet been done, and the preliminary survey cannot be completed until the water subsides. It is doubtful whether anything further can be done until next summer.

Chickasha, Ind. Ter.—A press report states that F. W. Gale, of Chicago, Ill., Gen. Western Mgr. of Erie City Iron Works Co., of Pennsylvania, who holds a franchise for a water works system for Chickasha, was granted a franchise for a gas and sewerage system by City Council Dec. 18. All three systems will be put in at the same time, and work will begin immediately.

Pendleton, Ore.—Thos. Fitzgerald, City Recorder, writes that the citizens voted Dec. 18 to issue $30,000 bonds for a sewerage system.

Grand Junction, Colo.—See "Water."

Nampa, Idaho.—The City Council is stated to have decided to let contracts for a septic tank, settling basins and filtering beds, for the completion of the sewerage system.

Merced, Cal.—It is stated that bids are wanted Jan. 7 for a drain pipe along the Ashby and British Colony Road to the Landrant Co. Road. W. H. Croop, Clk.

BRIDGES.

Boston, Mass.—Local press reports state that the Metropolitan Park Bd. has completed plans for the draw for the Wellington bridge, and will soon ask bids for constructing same.

Lewisburg, Pa.—It is stated that plans are to be prepared at once and bids asked as soon as possible for the building of a bridge across Susquehanna River at Lewisburg, connecting Union and Northumberland Counties. The bridge is to be 1,200 ft. long.

Allegheny, Pa.—Local press reports state that the Western Bridge Co. has filed plans with Capt. W. L. Sibert for the erection of a bridge to span the Ohio River at Preble Ave., Allegheny.

Sharon, Pa.—The building of a viaduct at Budd Ave. is reported to be under consideration.

Sayre, Pa.—The contracts for constructing a county bridge across Susquehanna River, at Sayre, are reported to have been awarded as follows: To Herman Riebe, of Lansford, Pa., for the substructure at $7,950, and to Wynkoop & Braly Co., N. Y. City, N. Y., for the superstructure, at $31,999.

Seneca Falls, N. Y.—Bridge bonds amounting to $19,800 have been sold.

Pulaski, Pa.—Bids are wanted Jan. 14 for rebuilding the substructure and superstructure of the bridge over Shenango River at Pulaski; probable cost, $20,000. Wm. A. Stone, Chmn. Bd. Comrs. of Pub. Grounds & Bldgs., Harrisburg.

New Castle, Pa.—The building of a viaduct at Cherry St. is said to be under consideration.

Pittsburg, Pa.—Capt. Sibert has, according to local press reports, submitted a report with recommendations to the Secy. of War at Washington, for the raising of Union bridge across Allegheny River, 35 ft.

Philadelphia, Pa.—See "Electric Railways."

York, Pa.—Local press reports state that the York Bridge Co., of York, has secured the contract to construct a bridge at Richland Ave., for $22,490.

Wilmington, Del.—The Park Com. is reported to be preparing plans for park improvements, including the widening of 18th St., and the construction of a boulevard on said street, which will include the building of 2 macadamized roads, also a bridge across the Brandywine.

Philadelphia, Pa.—Mayor Ashbridge has signed the ordinance granting the Rapid Transit Co. permission to construct a bridge across Schuylkill River at Market St.

Utica, N. Y.—Engr. Clifford Lewis, Jr., reports the Schuyler St. bridge to be unsafe, and recommends its immediate repair and the building of a new structure in the near future.

New York, N. Y.—Bids will be received Jan. 30 by the Aqueduct Comrs. for furnishing material and building 14 highway bridge steel superstructures in Westchester Co. Wm. H. Ten Eyck, Pres.

Jacksonville, Fla.—A correspondent writes that bids are asked for building the Bridge St. viaduct, and that plans, etc., can be had from E. B. Pleasants, Engr. Roadway Atlantic Coast Line R. R., Wilmington, N. C., or from P. Aylett, Bridge Engr., Seaboard Air Line, Portsmouth, Va.

Marseilles, Ill.—It is reported that a $12,000 bridge is to be built across the Canal in this city.

Rockford, Ill.—The Northwestern R. R. officials are reported to have made an offer to Mayor Hutchins to open Wyman St. by constructing a bridge and maintaining it, provided the city construct abutments for said bridge, and excavate the opening of the street.

Moline, Ill.—Press reports state that the Com. to whom the Supervisors referred the building of a bridge across Rock River will submit the following estimates of the cost of constructing bridge, without fills or excavations: At Cleveland, $20,000; Barstow, $28,000; Colona, $26,000.

Milwaukee, Wis.—Local press reports state that the officials of the Northwestern R. R. have assured the Bd. Pub. Wks. that they will build the abutments of the proposed viaduct at Bartlett St., 18th Ward, the city to build the remainder of the structure.

Huron, O.—It is stated that plans have been prepared for a $60,000 bridge which the Lake Shore Electric Ry. Co. contemplates building in this city.

Waterloo, Ia.—It is stated that a bridge is to be built across Black Hawk River in connection with the Cedar Falls road; said road is to be opened next spring.

Sioux City, Ia.—Local press reports state that plans will soon be prepared by City Engr. Lewis for 2 steel bridges which will replace structures now across Perry Creek, at junction of West 3d and 4th Sts. and in 3d St.

Marinette, Wis.—The Business Men are said to be interested in the building of a draw bridge across the River near H. Witbeck's Mill.

Chicago, Ill.—See "Sewerage and Sewage Disposal."

Ironton, O.—See "Railroads."

Albion, Ind.—It is stated that bids will be received Jan. 6 by Thos. A. Huston, Co. Aud., for constructing 6 steel leg girder Co. bridges. Address Jas. T. Johnston, Bridge Engr.

Niles, O.—Local press reports state that bids will soon be asked by the Co. Comrs. for the stone work on the 2 bridges to be built in this city.

Adair, Mich.—It is reported that a steel bridge is to be built across Belle River next spring.

Youngstown, O.—See "Business Buildings."

Ironton, O.—Press reports state that the Cincinnati, Hamilton & Dayton Ry. Co. will build jointly with the Chesapeake & Ohio R. R. Co. a bridge across Ohio River between Ironton and Ashland, Ky.

Youngstown, O.—Local press reports state that the cost of Mill Creek bridge is to be increased from $150,000 to $200,000. It is reported to be the intention of the Co. Comrs. to build the bridge 300 ft. longer than was at first intended.

Kansas City, Mo.—Press reports state that a company has been organized in Kansas City under the name of the Kansas City and Clay County Toll Bridge Co., which has for its purpose the building of a bridge from Holmes St. in Kansas City to the fair grounds boulevard in Clay County. Jas. Lynn, of Wabash, Ind., is said to be one of the directors of the company.

Castroville, Tex.—H. E. Haass, Co. Judge of Hondo, writes that bids will be received Feb. 10 for constructing a bridge over Medina River at Castroville, consisting of 1 252-ft. steel span and 2 100-ft. spans with 2 stone piers and 2 stone abutments. Probable cost, $13,000 to $15,000.

Westmoreland, Kan.—It is stated that bids will be received Jan. 10 by the Bd. of Comrs. for constructing 2 40-ft. steel span bridges and 1 50-ft. span. A. P. Scritchfield, Co. Clk.

Omaha, Neb.—It is stated that a viaduct, from Ninth and Capitol Ave., over the tracks at the foot of Davenport St. is to be constructed as a part of the plant of the Union Pacific shops.

Tacoma, Wash.—It is stated that bids are wanted Jan. 15 for constructing a 240 ft. span draw bridge over Puyallup River. Norton L. Taylor, City Engr.

PAVING AND ROADMAKING.

Boston, Mass.—Local press reports state that the committee appointed by the Mayor to devise some plan for improving the teaming facilities across the city between the two terminal stations has voted to recommend to the Mayor and the City Government the immediate adoption of what is known as the Atlantic Ave. improvement, involving the widening of the avenue from Rowe's wharf to Eastern Ave. by the narrowing of the sidewalks between these points, at an estimated cost of between $50,000 and $100,000; also to recommend the widening of Causeway St. 20 ft. from Beverly St. to New Washington St. at an estimated cost of $50,000. It was also voted to recommend and request Mayor Collins to have plans prepared and estimates of the cost of the proposed improvement made looking to the widening of Exchange St. about 25 ft., and the improvement of Dock Sq.

Springfield, Mass.—Mayor Ellis has signed the order providing for the $125,000 Court Sq. extension bond issue.

Westfield, Mass.—The improving of the public square by paving with brick or asphalt is reported to be contemplated.

Manticello, N. Y.—Engr. C. H. McCulloch, State Engr's office, Albany, is reported to be surveying for a State road which is to be built from Monticello to Liberty.

Ballston Spa, N. Y.—The Saratoga Bd. of Supervisors has authorized good roads appropriations as follows: Ballston Spa and Saratoga Springs, by way of Geyser, $20,185; Waterford, north side, $5,150; Wilton Highway, north from Saratoga Springs, $4,960; Mechanicville and Stillwater, $10,650, and Saratoga and Schuylerville, $29,775. The work is to be done on plans and specifications furnished by the State Engineer and under his supervision.

Philadelphia, Pa.—Mayor Ashbridge has signed the ordinance providing for a driveway, 300 ft. wide, and about 8 miles long, from Torresdale to Broad and Cayuga Sts. Estimated cost, $2,500,000.

Pittsburg, Pa.—The Councils have adopted ordinances to grade, pave and curb the following streets: Republic St. from Greenleaf St. to Grandview Ave., estimated to cost $11,800; Elmer St. from Bellefonte to Filbert Sts., estimated to cost $3,900; Preble St., from Thirtieth to Thirty-third Sts.; estimated to cost $12,800.

Councilman Jas. J. Booth is reported to be advocating the building, by the city, of an asphalt plant for repairing and repaving streets. Probable cost, $10,000.

Reading, Pa.—A bill has been passed by both the Common and Select Councils providing for an election to be held to increase the indebtedness of the city, to the extent of $100,000, $85,000 thereof to be devoted to the erection of a bridge across the P. & R. R. R. at Spring St., $40,000 to construct a storm sewer on Franklin St., $35,000 to complete the intercepting sewer from 11th and Douglass Sts. to [illegible] and Walnut Sts., and $200,000 for general paving purposes, and making an appropriation to defray the expenses of such election.

Buffalo, N. Y.—The following are the lowest bids received by Francis G. Ward, Comr. of Pub. Wks., Dec. 27, for repaving portions of Lafayette Ave. and Fillmore Ave.: Lafayette Ave., Barber Asphalt Paving Co., Ellicott Sq. Bldg., asphalt, $4,931; brick, $7,271, and stone, $11,701. Fillmore Ave., Eastern Construction Co., D. S. Morgan Bldg., asphalt, $4,600; Barber Asphalt Paving Co., brick, $6,355, and stone, $9,313.

Harrisburg, Pa.—An ordinance has been adopted by the Select and Common Councils whereby the Highway Comr. will soon ask bids for paving on portions of several streets, with sheet asphalt, asphalt block, and vitrified brick on a concrete base, Warren's bituminous macadam waterproof pavement or any other known pavement which has been in constant use upon a roadway for 1 year, and for curbing with granite, marble, bluestone, medina stone, or steel.

Atlantic City, N. J.—State Road Comr. H. L. Budd, in his annual report, recommends that the road appropriation be increased from $250,000 to $300,000.

Binghamton, N. Y.—The City Engr. has been directed to prepare plans and specifications for a macadam pavement, 16 ft. wide, on Front St., from Gaines to the city limits.

Keeseville, N. Y.—The Bd. of Superv. has authorized the construction of about 2½ miles of macadam road from the outskirts of Keeseville in the direction of Lewis. Probable cost, $20,000.

Wilmington, Del.—See "Bridges."

Toledo, O.—Jas. F. Lehaney & Co. are reported to have secured the contract to pave, with Logan block on concrete foundation, Wayne St., from Western to Detroit Aves., from $12,820.

The Council Com. on Streets has approved a petition to repave 18th St. from Adams to Monroe Sts.

Cleveland, O.—The Co. Comrs. have passed a resolution to pave W. Madison St. from Highland Ave. to the River Road, and have instructed the City Engr. to prepare plans and specifications, and an estimate of the cost, of said improvement.

Moline, Ill.—Petitions are being circulated for paving, with asphalt, on portions of 12th Ave.

Bloomington, Ill.—The City Council is reported to have under consideration the paving, with asphalt, of a portion of Wood St.

Duluth, Minn.—The Bd. of Pub. Wks. has begun preliminaries for the paving of East Superior St. next year. Among the materials which will be considered are asphalt, tar macadam and asphalt macadam.

Findlay, O.—Petitions have been allowed for the paving of W. Sandusky, E. Lima and Front Sts. John W. S. Riegle, City Engr.

Cleveland, O.—Bids are wanted Jan. 29 for grading, draining, curbing and paving with brick on portions of numerous streets. Chas. P. Salen, Dir. of Pub. Wks.

Zanesville, O.—Bids are wanted Jan. 17 for furnishing material and improving by paving with vitrified brick on a portion of Hall Ave. Chas. W. McShane, City Clk.

Cincinnati, O.—G. S. Gleason & Co., 618 Crown St., have secured the contract to pave with brick a portion of Rochelle St., for $9,555.

The Bd. of Pub. Service will receive bids Jan. 9 (readvertisement) for paving with granite on Gilbert Ave. and with macadam on Bassett Road. F. Holmes, Clk. Bd. Pub. Service.

Iowa City, Ia.—Street paving bonds, amounting to $6,300 are reported to have been voted recently.

Lakewood, O.—It is stated that the Co. Engr. will prepare plans and specifications with an estimate of the cost for paving a portion of W. Madison Ave.

Columbus, O.—Ordinances have been adopted by the City Council for improving portions of several streets, as follows: Trevitt St. from Atcheson St. to Leonard Ave., by grading and paving the gutters, setting 5-in. curb and constructing a macadam roadway; Noble St. from High to Front Sts., and Oregon Ave. from 3d to 4th Aves., by grading and paving the same with asphalt, hard-burned bricks or blocks, macadam or other substantial materials, setting 5-in. curb, and constructing the necessary sub-drains and catch basins; also providing for the issue of bonds in the following amounts for street improvements: $4,000 for improving Reinhard Ave., $20,000 for improving portions of Jefferson Ave. and 4th St.

South Bend, Ind.—The City Engr. has been directed to prepare plans and specifications for brick pavements on Madison and Marion Sts., and macadam pavement on Clinton St.

St. Paul, Minn.—Bids will be received Jan. 5 by Bd. of Pub. Wks. for paving with asphalt portions of Nina Ave.; also paving with sandstone portions of Eagle St. R. L. Gorman, Clk.

Fond du Lac, Wis.—Bids will be received Feb. 23 for paving 19,442 sq. yds. vitrified block on concrete foundation, as advertised in The Engineering Record.

Bessemer, Ala.—Press reports state that contract for paving 2d Ave. and 19th St. (about 6 blocks) with vitrified brick, will be let in the spring. W. J. Parkes, City Engr.

St. Joseph, Mo.—Petitions have been filed for macadam pavement on 25th St. from Clay to Messanic Sts., and for brick on 18th St. from Messanic to Olive Sts.

Atchison, Kan.—The City Council has adopted a resolution declaring it necessary to culvert, grade, curb and pave with vitrified brick, Parallel St. from 7th to 12th Sts. It will require 9,260 yds. paving and 5,570 lin. ft. cement curbing.

Denver, Colo.—Thos. J. Dermody & John H. Edwards are reported to have submitted the lowest bid for sidewalk construction in Dist. No. 9, at 81¼ cts. per lin. ft.; total, $17,661.

Bids are wanted Jan. 7 for constructing and reconstructing sidewalks in South Broadway Sidewalk Dist. No. 1. R. W. Speer, Pres. Bd. of Pub. Wks.

Montreal, Que.—The Finance Com. has voted an appropriation of $765,000 for the Road Com. with which to put the streets in order next spring. The principal amounts voted are as follows: Repairs to pavements, on which guarantees have expired, $150,000; repair to macadamized roads, $100,000; wooden sidewalks, $50,000; repairs to permanent sidewalks, $25,000; macadamizing new roads, $25,000.

Lindsay, Ont.—It is reported that a by-law to raise $40,000, to macadamize the principal streets of the town, is to be submitted to the ratepayers at the municipal election.

POWER PLANTS, GAS AND ELECTRICITY.

Rochester, N. Y.—J. Geo. Kaelber, of Rochester, Mgr. Central Power Co., writes that about $500,000 will be expended on improvements.

Oneida, N. Y.—The Madison County Gas & Electric Co. is stated to have secured the contract for lighting the city by electricity for 2 years at $6,500 per yr.

Plainfield, N. J.—See "Dwellings."

Phillipsburg, N. J.—The Town Council is stated to have granted a franchise to the People's Electric Light & Power Co., of Easton, Pa.

Sellersville, Pa.—It is stated that Morris A. Clymer will probably secure a franchise for an electric light plant.

New York, N. Y.—Bids will be received Jan. 12 by Robert Grier Monroe, Comr. of Water Supply, Gas & Electricity, for furnishing gas or other illuminating material, for lighting, extinguishing, cleaning, repairing, maintaining, etc., the public lamps in the various Boroughs for 1 year commencing Jan. 1, 1903.

Fostoria, O.—See "Water."

Perrysburg, O.—The Witzler Electric Light Co. is reported incorporated, with a capital of $10,000, by Chas. F. Chapman, Jr., Geo. D. Wells, and others.

Bethany, W. Va.—It is stated that plans are being prepared for an electric light plant.

Parkersburg, W. Va.—See "Water."

Hawley, Minn.—N. K. Lee is reported interested in the construction of an electric light plant.

St. Cloud, Minn.—The Council is reported to be considering the question of a municipal electric light plant.

Graettinger, Ia.—Mr. Derby is stated to have secured a franchise for an electric light plant.

Correctionville, Ia.—The Home Electric Co. is reported to have been formed, to install an electric light plant.

Algoma, Wis.—See "Water."

Chicago, Ill.—Edw. B. Ellicott, city electrician, reports that the following bids were opened Dec. 18 for lighting during 1903: American Development Co., Chicago, $2.12½ per 60 c. p. gasoline lamp per month if awarded entire contract or $2.20 if awarded separate sections, and $3.75 per 200 c. p. gasoline lamp per mo.; Cleveland Vapor Light Co., Cleveland, $2.09 and $2.15 per 60 c.p. gasoline for certain sections; Chicago Suburban Water & Light Co., Cicero, Ill., $8.65 per 2,000 c. p. electric lamp per mo.; Peerless Gas Light Co., Chicago, 23½ cts. gas mantle lamps per mo.; Chas. D. Nickolai, Washington, 19½ cts.; Robin Mfg. Co., Chicago, 27¼ cts.; Engel & Co., Chicago, 28½ cts.

South Bend, Ind.—Geo. W. Loughman and F. H. Wurger have petitioned the City Council for a heating and power franchise.

Two Harbors, Minn.—See "Water."

Detroit, Minn.—Bids will be received Jan. 12 by E. J. Bestick, Village Recorder, for $14,000 bonds to be used for purchasing, constructing and operating an electric light plant.

Chanute, Kan.—The City Council is stated to have decided to construct an electric light plant. The plant decided upon provides for 100 street lamps and 5,000 incandescents, and will cost about $35,000.

Clarence, Mo.—The citizens are reported to have voted to issue $10,000 bonds for an electric light plant.

Danville, Ky.—J. C. Bogle, Chmn. Com. on Lighting, writes that it is proposed to construct an electric light plant, and A. T. Maltby, of Chicago, Ill., will prepare the plans.

Jellico, Tenn.—The Jellico Electric Light, Heat & Power Co. has been incorporated, with a capital of $12,000, by R. B. Baird, W. S. Harkness and others, of Jellico. The plan is to furnish this city with a system of electric lights, and motive power for manufacturing purposes.

Chattanooga, Tenn.—At a meeting of the Bd. of Pub. Wks. Dec. 23 it was decided to send a recommendation to the committee on permanent improvements, of which Councilman Paul R. Albert is Chmn., that $115,000 be set aside for the purpose of constructing an electric light plant to be owned, controlled and operated by the city.

Chickasha, Ind. Ter.—See "Sewerage and Sewage Disposal."

St. Martinsville, La.—See "Water."

San Antonio, Tex.—It is stated that the Western Union Telegraph Co. will place its wires underground.

Tacoma, Wash.—Ch. Engr. Chas. H. Baker, of the White River Power Co., is stated to have approved the plans of Architect Bullard and Engineer Hawks for the location of the power house and the buildings to be erected near Sumner, about 9 miles from Tacoma. The plans show the main building to be of red brick, slate roof and concrete foundations, 250x70 ft. The arrangement of the floor space is for ten 5,000-H.-P. generators; only 5 will be put in for the present.

Merced, Cal.—See "Water."

ELECTRIC RAILWAYS.

Otis, Mass.—The Selectmen are stated to have granted a franchise to the New York & Berkshire St. Ry. Co.

Springfield, Mass.—The Worcester & Southbridge St. Ry. Co. is stated to be surveying for an extension of its line to Springfield. H. W. Culver, Ch. Engr., Worcester.

Millbury, Mass.—The Millbury, Lake Singletary & West Millbury St. Ry. Co. is stated to have petitioned the Selectmen for a franchise to build its road from Millbury Center to West Millbury, and also the right to relocate the tracks of the Worcester Consolidated St. Ry. through W. Main St.

Waterbury, Conn.—Local press reports state that the Connecticut Ry. & Lighting Co. contemplates making some important changes in the trolley system of this city next year. J. E. Sewell, Gen. Mgr., Waterbury.

Westfield, Mass.—The Western Massachusetts St. Ry. Co., is about to commence surveying for its line to connect Winsted and Lee. R. D. Gillett, Pres.

Hempstead, L. I., N. Y.—The Bd. of Highway Comrs. of the Town of Hempstead is stated to have granted the New York & Long Island Traction Co. permission to lay its tracks on the town highways from Freeport to Rockville Center.

Oswego, N. Y.—The Syracuse Rapid Transit Co. (J. E. Duffy, Supt., Syracuse,), the Lakeside Co. (E. R. Canfield, Gen. Mgr., Syracuse,) and the Syracuse & Ontario Ry. Co. have petitioned the Council for franchises.

Fredonia, N. Y.—The Village Trus. are stated to have granted a franchise to the Lake Shore Traction Co. This company proposes constructing a line to Buffalo. Danl. F. Toomey, of Dunkirk, is reported interested.

Holley, N. Y.—The Albion Electric Ry. Co. is stated to have petitioned the Village Trus. for a franchise.

Salamanca, N. Y.—The Salamanca & Little Valley Traction Co. is stated to have petitioned the State R. R. Comrs. for a franchise to construct a trolley line from Salamanca to Little Valley, and from Salamanca to S. and B. Junction, a distance of about 11 miles.

Baldwinsville, N. Y.—The Syracuse & Ontario R. R. Co. is stated to have petitioned the Council for a franchise in Salina and Phillips Sts.

Trenton, N. J.—The City Council has passed an ordinance granting the Johnson Trolley Co. permission to construct a line on Calhoun and W. Hanover Sts.

Siegfried, Pa.—The Siegfried & Danielsville St. Ry. Co. is reported incorporated, to construct a line from Alliance to Kreidersville, Pennsville, Cherryville, Harpers and Danielsville, to connect with the Slate Belt road.

Bridgeport, Pa.—The Town Council has granted a franchise to the Phoenixville & Bridgeport Electric Ry. Co.

Hazleton, Pa.—The City Council is stated to have granted a franchise to the Hazleton, Weatherly & Mauch Chunk Ry. Co.

Johnstown, Pa.—The Conemaugh Valley St. Ry. Co. is reported organized to build an electric railway between Johnstown and Ebensburg.

Philadelphia, Pa.—The Council is reported to have passed the ordinance granting permission to the Philadelphia Rapid Transit Co. to construct a subway in Chestnut St., from Broad St. to 5th. The bridge of the company will be constructed north of the present structure. In connection with the subway project it is reported that an ordinance has been introduced in Councils providing that the city build two main sewers in Market St.; probable cost of these sewers is $175,000.

The Broad St. and Boulevard Ry. Co has been incorporated, with a capital of $60,000, to construct an electric railway from Broad and Cayuga Sts. to Grant St., Torresdale. Incorporators: C. P. Weaver, John B. Peddle, and others.

Seaford, Del.—The Sussex Ry. & Steamship Co. is reported to have secured a right of way from Seaford to Rehoboth and Lewes. B. F. Sweeten, Glassboro, N. J., and Jas. D. Carpenter, of Woodbury, N. J., are reported interested.

Elkton, Md.—The Elkton, Newark & Eastern Shore R. R. Co., which proposes to construct an electric railway from Elkton to Delaware City, by way of Newark, is stated to have petitioned the Council for a franchise.

Phoenix, N. Y.—The Village Trus. are stated to have granted a franchise to G. Adolph Manz.

Mt. Holly, N. J.—The Bd. of Freeholders is stated to have granted the People's Traction Co. a franchise to construct a trolley line between Mt. Holly and Burlington, a distance of 7 miles.

Parkersburg, W. Va.—The South Parkersburg Electric Ry. Co., of Parkersburg, W. Va., has been incorporated to own and operate an electric railway in Wood County, W. Va.; capital, $100,000. Incorporators: Joe Fuccy, Weston, W. Va., and G. L. Fries and John Mossman, of Parkersburg.

Madisonville, O.—The Cincinnati & Columbus Traction Co. is stated to have petitioned the Co. Comrs. for a franchise to lay tracks on the Madisonville Pike, between Madisonville and Oakley.

Piqua, O.—The Springfield, Piqua & Greenville Ry. Co. is stated to have secured a right of way between Piqua and Greenville.

Mansfield, O.—It is stated that work will soon commence on the construction of the Mansfield, Mifflin & Ashland Electric Ry. Jas. J. Maguire and Wm. Galbraith are reported interested.

Dayton, O.—G. M. Gest, 277 Bway., N. Y. City, has secured a contract from the Oakwood St. Ry. Co. and the People's St. Ry. Co. for the reconstruction of their tracks in Dayton; contract amounts to approximately $15,000.

Marion, Ind.—The Bunday-Clark Co. is reported to have filed a petition with the Co. Comrs. for permission to construct an electric railroad through Grant County, from Marion to Kokomo, and also from Marion to Bluffton.

Aurora, Ind.—The Indiana Southern Electric Ry. Co. has been incorporated to build and operate a street railway in Aurora and Rising Sun; capital, $10,000. Incorporators: Ernest W. Swarthout, Cassius W. McMullen, and others.

De Pere, Wis.—The City Council is reported to have been petitioned for 2 franchises, one from the Knox Construction Co., which proposes building a line from Green Bay to Kaukauna; the other from the East Wisconsin Traction Co., which proposes constructing a line in Green Bay; another from Manitowoc to De Pere, and another from Kaukauna to De Pere. Wm. F. Paul, of Oshkosh, and M. Maxey, of Washburn, are interested in the latter company.

La Crosse, Wis.—The La Crosse & Southwestern R. R. Co. has been incorporated, with a capital of $800,000, to construct and operate a road by electric, steam or other power in and about La Crosse. Incorporators: Jos. Borchert and David H. Palmer, of La Crosse, and others

Grand Rapids, Mich.—The Grand Rapids & Chicago Ry. Co. is reported organized to construct an electric railway from Grand Rapids to Kalamazoo, a distance of about 57 miles. W. H. Patterson, of Grand Rapids, is reported interested.

Mt. Zion, Ia.—A press report states that a meeting was held here Dec. 18 to discuss plans for an electric railway to be constructed from Morne to Manning, a distance of about 40 miles. M. N. Esbeck acted as Chmn. and A. H. Jacobson, Secy.

Decatur, Ill.—It is stated that the Decatur Traction & Electric Co. will expend $40,000 the coming year in making extensions to its railway. Wm. Moore, Ch. Engr., Decatur.

Olathe, Kan.—The Kansas City & Olathe Southwestern Electric Ry. & Power Co. is stated to have petitioned the Council for a franchise.

Portland, Ore.—It is stated that the Portland Ry. Co. will expend about $400,000 in extensions and improvements. F. I. Fuller, Gen. Mgr., Portland.

San Bernardino, Cal.—Kohl Bros., owners of the San Bernardino & Arrowhead Motor Road, are reported to have decided to convert their steam road into an electric line and increase the width of the track to standard gauge.

Los Gatos, Cal.—The Town Trus. are stated to have granted a franchise to F. S. Granger, Mgr. San Jose, Saratoga & Los Gatos Ry. Co.

RAILROADS.

Wrightsville, Pa.—The Susquehanna & Tidewater R. R. Co. and the Baltimore & Harford R. R. Co., two Maryland concerns, are reported to have merged as the Tidewater & Susquehanna River R. R. Co., with a capital of $1,300,000. The road is to run from Havre de Grace, Md., to Wrightsville.

Baltimore, Md.—Press reports state that the Baltimore & Ohio R. R. Co. will build a new railroad, about 200 miles in length, to shorten the distance between Baltimore and Pittsburg by at least 50 miles, and Pittsburg, Chicago and Baltimore 80 miles. J. M. Graham, Ch. Engr., Baltimore.

Valdosta, Ga.—The Valdosta Construction Co. is reported organized, to build a railroad from this city to Douglas. W. S. West, Pres.

Savannah, Ga.—The stockholders of the Savannah & Statesboro R. R. Co. are stated to have authorized a bond issue of $500,000 for the purpose of securing funds for the extension of the line north of Statesboro, a distance of about 20 miles, in the direction of Swainsboro. Cecil Gabbett, Pres., Savannah.

Beckley, W. Va.—Bids are wanted Jan. 17 for the graduation (including tunnels), trestle work and masonry on 20 miles of the Deepwater Ry. in Raleigh and Wyoming Counties. Address C. P. Howard, Engr. in Charge.

Bluefield, W. Va.—Jones & Luck are stated to have secured the contract for constructing 6 side tracks for the Norfolk & Western R. R., for about $175,000.

Cincinnati, O.—The Cincinnati Interterminal R. R. Co. is reported formed, to build warehouses and freight terminal stations and connecting lines of track between the various railroads in this city. Incorporators: Jos. Trevor, J. H. Woodward, Chas. B. Wing, and others, all of Cincinnati.

Ironton, O.—It is stated that the Cincinnati, Hamilton & Dayton Ry. Co. (C. A. Wilson, Ch. Engr., Cincinnati,) will extend its line from Gallia through the Waterloo coal fields to Ironton. The company will build jointly with the Chesapeake & Ohio R. R. Co. (J. W. Haynes, Supt. of Terminals, Cincinnati,) a bridge across Ohio River, between Ironton and Ashland.

Momence, Ill.—Wm. Kenefick, of Kansas City, Mo., is stated to have secured the contract for constructing a railroad from Momence to East Dubuque, a distance of 287 miles, for the Illinois, Iowa & Minnesota R. R. Co.

Wichita Falls, Tex.—It is stated that the Wichita Valley R. R. is to be extended from Seymour, Tex., to Sweetwater, a distance of 100 miles; also from Wichita Falls to a point on the Red River. M. C. Jones, Supt., Wichita Falls.

Kansas City, Mo.—A charter has been granted to the Kansas City & Rock Island Ry. south of Kansas City; capital, $1,000,000. The road is to extend from Kansas City to Strassburg, 40 miles, and is to be the Kansas City entrance of the St. Louis-Kansas City line now building westward from St. Louis. W. B. Leeds, of New York, N. Y.; Robt. Mather, of Chicago, Ill., and W. F. Evans, of St. Louis, are among the incorporators.

Houston, Tex.—The Council has passed on second reading the ordinance granting to the Chicago, Rock Island & Gulf R. R. Co. a right of way in the 5th and 2d Wards for an entry into Houston.

Anchor, Tex.—An amendment to the charter of the Velasco, Brazos & Northern Ry. Co. has been filed. It provides for the extension from Anchor, north through Brazoria, Ft. Benwaller and Grimes Counties, to a point on the Gulf, Colorado & Santa Fe, and also from Velasco to a point on the east bank of Brazos River opposite Quintana; total length of extensions is about 50 miles. E. L. Burke, Gen. Mgr., Velasco, Tex.

Donaldsonville, La.—The Donaldsonville & Napoleonville R. R. Co. is reported organized, with Dr. Wm. M. McGaillard, Pres., and H. E. Hanson, Secy. The company will construct a standard gauge steam railway from Donaldsonville to Napoleonville.

McComb, Miss.—A charter is stated to have been granted to the Liberty-White R. R. Co. to construct a railroad from McComb to Liberty. J. J. White is one of the incorporators.

Blountsville, Miss.—It is stated that the Pearl & Leaf River R. R. will be extended from its present terminus at Blountsville, Miss., to Natchez. F. R. Davidson, Gen. Mgr., Hattiesburg.

Portland, Ore.—Incorporation articles of the Columbia River & Nehalem Ry. Co. were filed in the office of County Clerk Dec. 19 by David L. Kelly, Franklin G. Kelly, J. M. Long, and others, with a capital of $100,000, to build and operate a railroad and telegraph line from a point on the Columbia River near Blind Slough Station, in Clatsop County, to Grand Rapids; also from Grand Rapids to Portland.

Spokane, Wash.—It is reported that Senator Turner and D. C. Corbin, builders of the Spokane Falls & Northern R. R., will build a railway from Spokane to a junction with the Canadian Pacific.

Oroville, Cal.—The Indian Valley R. R. Co., of Oroville, is reported incorporated by H. H. Yard, S. L. Gillen and C. Gray; capital, $1,000,000.

Trinidad, Colo.—A press report states that the branch of the Texas & Pacific R. R., from Weatherford, Tex., to Mineral Wells, Tex., is to be extended to Trinidad, Colo. E. S. Wathen, Ch. Engr., Dallas, Tex.

Naco, Ariz.—The Arizona & Colorado R. R. Co. is reported organized, with a capital of $200,000, to construct a railroad about 200 miles in length from Naco to Bisbee, Douglas, Turquoise and other places. Wm. C. Green, of Bisbee, and E. S. Ives, of Yuma, are reported interested.

PUBLIC BUILDINGS.

Marlborough, Mass.—The City Hall is reported destroyed by fire Dec. 25.

New Britain, Conn.—The members of the Swedish Lutheran Church are reported to be considering the erection of an edifice on Franklin St., to cost about $50,000.

New York, N. Y.—The lowest bidder Dec. 16 for erection of a fire engine house on 150th St. near Courtlandt Ave. was Fanning & Reilly, 150 5th Ave., for $32,800. Recommended for award.

A. Stevens, 157 E. 67th St., is stated to have prepared plans for a 3-story brick engine house at 88 Park Row, to cost $85,000.

Buffalo, N. Y.—Niederpruem, Gibbs & Schaaf Co., 804 D. S. Morgan Bldg., is stated to have received the contract for the construction and equipment of the cold-storage building at the Almshouse, for $27,876.

Randall's Island, N. Y.—Bids will be received on Jan. 16 by A. E. Orr, Pres. Bd. Mgrs., House of Refuge for Juvenile Delinquents, Randall's Island, for renewing the telephone system and plumbing improvements, Girls' Dept. and Shop, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids will be received Jan. 8 by Homer Folks, Comr. of Pub. Charities, for furnishing material for alterations to Cumberland St. Hospital, and stable connected with same.

Larchmont, N. Y.—The Citizens are stated to have voted to issue $20,000 bonds for erecting a village hall and engine house.

Utica, N. Y.—A committee, consisting of Willis C. Hine, Paul L. Livermore and Wm. H. Baker have been appointed by the Bd. of Superv. to act in conjunction with committees from Common Council and from the Business Men's Asso. to investigate the feasibility of erecting a municipal and county building in this city. If erected it will probably cost about $150,000.

Pittsburg, Pa.—It is stated that the Congregation of Friendship Ave. Presbyterian Church will erect a chapel at Roup St. and Friendship Ave., to cost about $25,000.

Sonyea, N. Y.—Bids are wanted Jan. 13 for erecting, including heating, plumbing, electric wiring and fixtures of Men's and Women's Bldgs., at the Craig Colony for Epileptics. Geo. L. Williams, Pres. Bd. of Mgrs.

Canton, O.—The following bids were opened Dec. 26 for erecting an auditorium and market house. Bidders of Canton, unless otherwise mentioned: Geo. Whike, $136,596; Danl. Holwick, $138,940; F. Wentz & Co., Canal Dover, $141,892; Melbourne Bros., $134,747. The sub-bids for plumbing and heating were: W. D. Theobold & Co., $19,962; Fife Bros. & Co., $17,197; The A. C. Egnon Co., $16,847; Jonas A. Mills, $17,113. P. H. Weber, City Engr.

Middletown, O.—It is stated that the First Baptist Society has appointed a committee to secure plans for an edifice, to cost $60,000.

Cambridge, O.—Local press reports state that bids will be received Jan. 15 by Frank Packard, Archt., Columbus, for remodeling the Guernsey Co. Court House.

The same architect will soon be ready to receive bids for the erection of a Carnegie Library for Cambridge.

Cincinnati, O.—It is stated that a $50,000 building will be erected at the Zoological Garden. It will be 140 ft. long, 72 ft. wide and 55 high.

Springfield, O.—It is stated that bids are wanted Feb. 1 for erecting a 4-story brick and stone city hospital, including steam-heating apparatus, laundry machinery, and an elevator; probable cost about $60,000. R. C. Gotwald, Archt., 56 and 57 Gotwald Bldg.

Boonville, Ind.—The Grand Jury of Warwick Co. is stated to have recommended the erection of a $40,000 court house.

New Castle, Ind.—The Co. Comrs. are stated to have decided to install a hot water heating system in the jail.

Birmingham, Ala.—The Congregation of the 11th Ave. Methodist Church is stated to have decided to erect an edifice, to cost $30,000.

Joe Trimby is reported to have secured the contract for erecting the First Baptist Church, for about $50,000.

Danville, Ky.—Bids will be received Jan. 20 by Bldg. Com. of Bd. of Comrs. of Kentucky Institution for the Deaf, for erecting 2 dormitories, power building and steam plant, including plumbing, gas-piping, sewers, etc., for said institution. Dittoe & Wisenall, Archts., 75-76 Blymyer Bldg., Cincinnati, O. B. O. Rodes, Chmn.

Billings, Mont.—The plans of C. E. Bell, of Helena, are stated to have been accepted for the court house and jail building, to cost about $75,000.

Fresno, Cal.—It is stated that bids are wanted Jan. 14 for erecting a 1 and 2-story brick county hospital. G. W. Cartwright, Clk. Bd. of Superv.

BUSINESS BUILDINGS.

Laconia, N. H.—The Masonic Building Assoc. has voted to rebuild the masonic temple, recently destroyed by fire, and has appointed a committee to procure plans and estimates; probable cost, $80,000. Henry B. Quinby, Lakeport, N. H., is Pres. of the Assoc.

Tuxedo Park, N. Y.—A press report states that the Erie R. R. Co. (C. W. Buchholz, Ch. Engr., N. Y. City) will erect a depot here, to cost $65,000.

Schenectady, N. Y.—The Maxon Block is reported destroyed by fire Dec. 26.

Paterson, N. J.—A police station, to cost about $30,000, will be erected to replace the one destroyed by fire last Feb. Wm. Vermenlen is now preparing plans. H. J. Harder, City Engr.

Trenton, N. J.—Ogden Wilkinson is reported as having plans prepared for a 6-story business building to be erected on E. State and Montgomery Sts.

Erie, Pa.—Local press reports state that a new hotel and theater will be erected on 12th and State Sts., to cost about $150,000. E. O. Rickets, of Columbus, O., is reported interested. M. M. Gleichman, 89 Euclid Ave., Cleveland, O., is the Architect.

Philadelphia, Pa.—M. W. Newton, Proprietor of Green's Hotel, is stated to have decided to erect a 7-story addition, at a cost of about $60,000.

Horace Trumbauer, 310 Chestnut St., is stated to have prepared plans for a home for orphan daughters of the Free Masons of Pennsylvania, to be erected at Broad St. and Bristol Ave., to cost about $500,000.

New Kensington, Pa.—Local press reports state that bids will be received Jan. 10 by Machin & Brown, Contractors, 147 N. 7th St., Philadelphia, for erecting a 3-story building for the Westmoreland Boiler Co.

Baltimore, Md.—Edw. H. Glidden, Atlantic Trust Bldg., is stated to have been commissioned to prepare plans for a hotel to take the place of the present Hotel Baltimore, on Courtland St., near Lexington. It will be 4 stories high, of brick, and probably Colonial style.

The Hammond Ice Co. is stated to have awarded to John A. Sheridan, 321 N. Holliday St., the contract for erecting its building, on Block St. and the water front. It will be a 190x450 ft. 1-story frame building, sheathed with corrugated iron, and cost about $90,000.

Bradford, Pa.—The I. O. O. F. Bldg., which was burned Dec. 23, valued at $70,000, will be rebuilt.

Richmond, Va.—It is stated that the Whitlock Estate will erect a store and office building on 8th and Main Sts., at a cost of $25,000.

Cincinnati, O.—A permit is stated to have been issued for a 15-story brick building to be erected at 4th and Vine Sts. by the Ingalls Realty Co., to cost about $400,000.

Youngstown, O.—The Erie R. R. Co. is reported to have decided to expend here about $250,000 in improvements, including the erection of a depot, at Phelps and Hazel Sts.; also 2 viaducts, one from Belmont Ave. over its tracks to W. Federal St., the other at Hazel St. J. M. Barrett, Div. Supt., Youngstown.

Alton, Ill.—Plans are stated to have been completed for a brick freight depot for the Chicago Great Western R. R. Co., to be erected on 7th St. and 9th Ave. Plans are also being prepared for a brick roundhouse to be erected on 16th Ave. and 3d St. Saml. C. Stickney, Gen. Mgr., Chicago, Ill.

Crookston, Minn.—E. Strassberger, of Crookston, is reported to be preparing plans for a 3-story, 50x140 ft. business building for Fontaine & Anglim.

Marinette, Wis.—Ferry & Clas, of Milwaukee, are stated to have prepared plans for a 3-story brick and stone department store building, to be erected by Isaac Stephenson, to cost $70,000.

Carpenter Cook Co., of Menominee, Mich., is stated to have prepared plans for a hotel to be erected on the site of the White Hotel on Dunlap Sq.; probable cost, $20,000.

Chicago, Ill.—Huehl & Schmid, 163 Randolph St., are stated to be preparing plans for a masonic temple to be erected at 6732 Wentworth Ave., to cost about $60,000.

Vicksburg, Miss.—Rawson & Paunack are stated to have prepared plans for a Home for the Elks. The building will be of brick, 2 stories, and measure 50x80 ft.

Waco, Tex.—It is stated that the St. Louis Southwestern Ry. Co. (M. L. Lynch, Ch. Engr. Tyler) will erect a depot at Franklin and 3d Sts., to cost $50,000.

Oklahoma City, Okla.—The Shriners of this city are reported interested in the erection of a temple to cost $75,000.

Colorado Springs, Colo.—The Santa Fe R. R. Co. (Jas. Dun, Ch. Engr., Chicago, Ill.) is reported interested in the erection of a hotel here, to cost about $100,000.

York, Neb.—The Y. M. C. A. is reported interested in the erection of a $15,000 building.

Lincoln, Neb.—The Cudahy Packing Co. is stated to have purchased a site on M and 8th Sts., and will erect in the spring a $60,000 building.

Portland, Ore.—It is stated that W. D. Fenton will soon commence the erection of a 3-story building on 6th and Oak Sts., to cost about $35,000.

Denver, Colo.—Philip F. A. Ryan will erect a $25,000 business building on Colfax Ave.

Pueblo, Colo.—F. W. Cooper, 108 Pope Blk., is stated to have completed plans for a theater to be erected at Lake Minnequa, to cost about $22,000.

San Francisco, Cal.—The Trus. of Chas. T. and Jennie A. Crocker are stated to have decided to erect a 4-story business building on Powell and Geary Sts., at a cost of about $200,000. Architects, Bliss & Faville.

Montreal, Que.—It is stated that bids are wanted Jan. 5 for erecting a fireproof office building for the Bank of Montreal. Taylor & Gordon, Archts., 43 St. Francois Xavier St.

NEW YORK.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Broome and Allen Sts, 6-story br tenemt and stores, c, $45,000; o, Harris Floe; a, Horenburger & Straub.

Grand and Attorney Sts, 6-story br tenemt and stores, c, $42,000; o & b, Abraham Silverson and Germania Bank Bldg; a, G F Pelham.

University Pl and 13th St, 11-story br and stone loft building, c, $200,000; o, 13th St Co; a, Frank Goodwillie; b, Isaac A Hopper & Son.

8th St and Ave B, 6-story br tenemt and stores, c, $40,000; o, Max Horn; a, Sass & Smallheiser.

59th St and 3d Ave, 6-story and 2-gallery extension to 6-story br store, c, $125,000; a, Lyman G Bloomingdale et al; a, Buchman & Fox.

BROOKLYN.

Gilson Pl and Jamaica Ave 1-story frame club house, c, $25,000; o, Brooklyn City R R Co; a, Brooklyn Heights R R Co.

DWELLINGS.

Brookline, Mass.—B. M. Dixon, of Lewiston, Me., and E. S. Libbey, of Boston, are stated interested in the erection of a brick apartment house, to cost $100,000.

Plainfield, N. J.—A press report states that about $1,000,000 will be expended by a New York syndicate, headed by Herbert M. Taylor, in establishing a model settlement in the western section of this city. Four blocks will be devoted to the purpose, and the company will install its own water and electric power and light supplies, as well as a central steam heating apparatus, which will furnish all houses to be erected.

Atlanta, Ga.—Collier, Brown & Walker are stated to have submitted plans for a 6-story apartment house for Geo. P. Howard, Coal Dealer. The building will be erected on Peachtree and Pine Sts., and cost about $200,000.

Chicago, Ill.—Henry L. Newhouse, 4630 Prairie Ave., is reported to have prepared plans for a residence for S. L. Marks at 4726 Greenwood Ave., to cost $45,000.

Spokane, Wash.—A. Held, 516 "The Rookery," is preparing plans for an apartment house to be erected for F. Beck, to cost $60,000.

NEW YORK.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

244 and 246 E 21st St, 6-story br tenemt, c, $42,000; o, Jacob Silberman; a, G F Pelham.

50th St and 2d Ave, 6-story br tenemt, c, $40,000; o, Barnett Levy; a, Horenburger & Straub.

6 to 10 E 117th St, br and stone restaurant & store bldg, c, $70,000; o, Jacob Fliegman; a, Thos Graham.

302 & 304 E 5th St, br tenemt, c, $35,000; o, Hyman Levine; a, Bernstein & Bernstein.

17 to 21 W 115th St, 2 br tenemts, c, $68,000 all; o, Deborale Herrman; a, Franklin Bayles.

53d St and 3d Ave, 6-story br and stone flat, c, $40,000; o, Jos Wittner; a, Sass & Smallheiser.

38th St and Lexington Ave, 2 4-story br and stone dwells, c, total $28,000; o, Wm R Martin; a, Ralph S Townsend.

St Nicholas Ave and 133d St, 6-story br flat, c, $100,000; o, The Realty Co of N Y; a, Moore & Landsiedel.

Crotona Ave and 170th St, 4-story br tenemt, c, $30,000; o, Chas Hohl; a, Wm F Schwanewede.

313 5th Ave, extension to 4-story and basemt br dwell, c, $30,000; o, Fishel, Adler & Schwartz; a, Edward Necarsulmer.

BROOKLYN.

Park Pl and Franklin Ave, 3-story br flat, c, $20,000; o, Mohawk Realty Co; a, Neville & Bagge.

SCHOOLS.

Quincy, Mass.—Geo. Howard, of Brockton, has secured the contract for erecting a brick school, for about $42,000.

Bridgeport, Conn.—Bids are wanted Jan. 15 for erecting a school on Huntington Road. Henry A. Lambert, Archt., 1 and 2 Warner Bldg.

Waterbury, Conn.—Bids are wanted Jan. 5 for erecting the Mulcahy School. Address John J. Fitzgerald, Clk. Bd. of Educ.

New York, N. Y.—The following bids were opened Dec. 22 by C. B. J. Snyder, Supt. School Bldgs., Dept. of Educ., for the general construction of School 24, Boro. of Manhattan: *a*, to complete Oct. 1, 1903; *b*, to complete Feb. 1, 1904; Patk. Sullivan, *a*, $174,000; *b*, $172,000. Geo. Hildebrand, *b*, $166,480. Francis Sullivan, *a*, $151,795 (awarded); *b*, $148,445. Chas. H. Peckworth, *a*, $168,000; *b*, $164,775. Thos. Cockerill & Son, *a*, $163,376; *b*, $163,376. Thos. B. Leahy. *b*, $160,943. John H. Goetschius, *b*, $160,000. Luke A. Burke, *a*, $154,000; *b*, $153,000.

Bids opened same time for ventilating and heating apparatus of School 188, Boro. of Manhattan: Jas. Curran Mfg. Co., $66,600; John Hankin & Bro., $79,000; Frank Dobson, $58,939; Walker & Chambers, $63,250; Wm. N. Tobin (Irregular); Blake & Williams, $57,784; John Neal's Sons, 218 Centre St., $57,693 (awarded); United Htg. Co., $59,638.

Bids will be received Jan. 12 by C. B. J. Snyder, Supt. of School Bldgs., for installing ventilating and heating apparatus in school No. 31, Boro. Manhattan; also for sanitary work in school No. 176, Boro. Bronx.

Bids will be received Jan. 14 by the Com. on Bldgs., Bd. Trus. of the College of City of New York, for excavation, rock blasting and foundation walls; also for terra cotta work for the college buildings on Nicholas Terrace. Edw. Lauterbach, Chmn.

Contracts for school work, bids opened Dec. 29 and Dec. 30 by C. B. J. Snyder, have been awarded as follows: General construction, School No. 106, Boro. of Manhattan, Patk. Sullivan, 389 Broome St., N. Y. City, $338,000; general construction, School 145, Boro. of Brooklyn, Wm. P. McGarry, 236 Huron St., Brooklyn, $223,876; sanitary work in School 138, Boro. of Brooklyn, Wm. C. Ormond, $11,999; general construction, Schools Nos. 91 and 119, Boro. of Brooklyn, Chas. H. Peckworth, Prospect Pl. near Nostrand Ave., $119,730 and $148,445 respectively; installing ventilating and heating apparatus of addition to and alterations in School 51, Boro. of Queens, E. Rutzler, 178 Centre St., N. Y. City, $6,288, and for general construction of School 34, Boro. of Richmond, Thos. Cockerill & Son, 137 Columbus Ave., N. Y. City, $58,900.

Brooklyn, N. Y.—The following bids were opened Dec. 22 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for ventilating and heating apparatus School 130, Boro. of Brooklyn: John Neal's Sons, $15,821; Jas. Curran Mfg. Co., $16,700; United Htg. Co., $15,298; Blake & Williams, 362 W. B'way, N. Y. City, $15,068 (awarded); Frank Dobson, $15,575.

Bids were opened on Dec. 24 for general construction of School 144, Boro. of Brooklyn, as follows: *a*, to complete Sept. 1, 1903; *b*, to complete Jan. 1, 1904: John H. Goetschius, *b*, $242,000. Geo. Hildebrand, *a*, $234,980; *b*, $228,918. W. & T. Lamb, *b*, $229,666. Thos. Cockerill & Son, *a*, $230,353; *b*, $230,353. Peter Cleary, *b*, $222,500. Myron C. Rush, *b*, $227,777. Wm. P. McGarry, *a*, $238,539; *b*, $231,387. Edwin H. Thatcher, *a*, $238,700; *b*, $236,700. Chas. H. Peckworth, *a*, $228,775; *b*, $224,775. Rutan & Heningham, *a*, $240,000; *b*, $229,900.

Bryn Mawr, Pa.—John Sweatt, of Boston, Mass., is stated to have secured the contract for erecting Rockefeller Hall at Bryn Mawr College; probable cost, $250,000. Architects, Cope & Stewardson, 320 Walnut St.

Sharon, Pa.—The Bd. of Educ. is stated to have decided to erect 2 schools, each to cost $35,000.

Baltimore, Md.—Jackson C. Gott, 218 N. Charles St., is stated to have been commissioned by A. A. Brager to prepare plans for a residence he is to erect on Eutaw Pl. and Laurens St. It will be 3 stories high, and cost about $50,000.

Long Island City, N. Y.—Bids will be received Jan 12 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing a ventilating and heating apparatus in the Long Island City High School, Boro. of Queens.

Fairfield, Ia.—H. K. Holsman, 153 La Salle St., Chicago, Ill., is stated to be preparing plans for buildings for Pearson's College, to cost $110,000. Dr. D. K. Pearsons, of Chicago, Ill., is interested.

Bloomington, Ill.—The American Warming & Ventilating Co., of Chicago, is stated to have secured the contract for ventilating and heating Edwards School, for $6,266.

Clarksville, Ia.—Local press reports state that bids will be received Feb. 1 for erecting a $15,000 school. Murphy & Ralston, Archts., Waterloo.

Columbus, O.—The Trus. of the Ohio State Univ. at a meeting Dec. 26 are stated to have decided to proceed at once with the erection of the Physics Bldg. and the Engineering Bldg., each to cost $80,000.

San Antonio, Tex.—A R. C. Theological Seminary is to be erected on Laurel Heights, to cost $30,000. Architects, McSweeney & McSweeney, Hicks Bldg.

Louisville, Ky.—Dodd & Cobb, 600 Equitable Bldg., are stated to have completed plans for buildings for the Louisville Theological Seminary, to cost complete $165,000. At present only the dormitory wing will be erected at a cost of $45,000.

Baton Rouge, La.—The lowest bid received for erecting for the University the building for physics, electricity and civil engineering, is stated to have been submitted by the Union Development & Construction Co., of New Orleans, for $24,233.

Webster Groves, Mo.—A press report states that bids will be received Jan. 8 by the Bd. of Educ. of Webster Groves for erecting a school.

Salem, Ore.—It is stated that bids are wanted Jan. 15 for erecting a brick dormitory at the Salem School, Chemawa. W. A. Jones, Indian Comr., Supt. of Interior, Washington, D. C.

STREET CLEANING AND GARBAGE DISPOSAL.

Buffalo, N. Y.—The Bd. of Councilmen have approved the Aldermanic resolution to have the Bd. of Pub. Wks. prepare plans and specifications and advertise for bids for removal of snow and ice from streets and public grounds.

Philadelphia, Pa.—Contracts for cleaning the streets and collecting garbage during 1903 are stated to have been awarded on Dec. 24 by Dir. of Pub. Wks. Haddock as follows, according to districts: 1 and 2, Edwin H. Vare, $125,000 and $180,000, respectively; 3, Danl. Dooley, $59,000; 4, Jas. Curran, $172,000; 5, David McMahon, $134,450, and 6, Richard P. Bennis, $23,400; total, $693,850. The contract for collecting and disposing of garbage was awarded to the American Product Co. for $516,700.

Rochester, N. Y.—Mayor Rodenbeck has signed the order granting to Chas. W. Hartung the contract to collect the garbage of the city next year, beginning Jan. 1; his bid amounted to $25,360.

Mt. Carmel, Ind.—A press report states that Aug. Kellerson, of the Star Tankage & Fertilizer Wks. of Vincennes, is interested in the construction of a garbage crematory at Mt. Carmel.

Topeka, Kan.—The Topeka Desiccating Co. is reported to have filed notice with Council that it has made arrangements with the International Waste Utilization Co. for the erection of a $40,000 garbage plant in Topeka.

Louisville, Ky.—It is stated that the International Waste Utilization Co. is about to petition this city for a 20-year franchise for the disposal of garbage.

St. Louis, Mo.—Local press reports state that bids will be received Jan. 13 by the Bd. of Pub. Improv. for the annual street sprinkling contract.

GOVERNMENT WORK.

Newport, R. I.—Bids will be received at the U. S. Engr. Office, Newport, Jan. 30, for breakwater construction at Point Judith, R. I., as advertised in The Engineering Record.

Philadelphia, Pa.—Bids will be received at the U. S. Engr. Office, Philadelphia, Jan. 29, for constructing bulkhead in Delaware River between Edgemoor and mouth of Christiana River, as advertised in The Engineering Record.

Maj. Frank Heath, Ord. Dept., U. S. A., writes that the following bids were opened Dec. 20 for the installation of a power plant at the Frankford Arsenal—*a*, for a 250-Kw. plant complete; *b*, for a 200-Kw. plant; c, for a 200-Kw. turbine plant; *d*, for 600-H.-P. boiler plant; *e*, piping: Sanson & Rowland, *a*, $60,000. Providence Eng. Wks., *a*, $42,500. McCay Eng. Co., *a*, $35,320. D'Olier Eng. Co., *a*, $37,413; *b*, $35,757; *c*, $31,715. Stephens & Tyler, *a*, $39,943; *b*, $38,693; *c*, $38,860. David R. Burns, *a*, $37,600; *b*, $36,835. M. R. Muckle, *c*, $36,118. Moore W. T. Boiler Co., *d*, $13,926. Natl. W. T. Boiler Co., *d*, $8,000. Babcock & Wilcox Co., *d*, $9,412. Aultman-Taylor Machy. Co., *d*, $9,935. Standard Heat & Eng. Co., *e*, $6,897. Harris & Alger, $5,829.

Ft. Fremont, S. C.—Bids are wanted Jan. 24 for installing plumbing fixtures, etc., in public buildings at this post. Address Chas. L. Fisher, Q. M.

St. Augustine, Fla.—Bids will be received at the U. S. Engr. Office, St. Augustine, Jan. 26, for dredging in St. Johns River, Fla., or for hire of dredging plant, as advertised in The Engineering Record.

Savannah, Ga.—Two bids, both of which are recommended to be rejected, were opened Dec. 22 by Capt. Cassius E. Gillette, Corps of Engrs., U. S. A., for building training dikes in Savannah River, for which $58,000 was available—Jas. Evins, Dardanelle, Ark., $56,075; Albert J. Twiggs, Augusta, Ga., $59,020. The former bid 56 cts. per cu. yd. for 39,000 cu. yds. brush bundles, and $2.15 for 9,500 cu. yds. riprap; the latter, 60 cts. and $2.25. They both bid 4½ cts. per ft. for 110,000 lin. ft. piling, 8 cts. per ft. for 57,000 lin. ft. pile driving and 75 cts. per cu. yd. for 4,300 cu. yds. mattress weaving.

Chicago, Ill.—Bids are wanted Jan. 26 for the ventilating system of the Post Office, Court House, etc.; bids will also be received at the same time for an elevator system in said building. Address Henry Ives Cobb, Archt., Chicago Bldg., Treas. Dept., Washington, D. C.

Creston, Ia.—Bids are wanted Jan. 27 for furnishing and installing the low pressure steam heating apparatus, etc., for the U. S. Post Office at Creston. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Ft. Riley, Kan.—Capt. G. O. Cress, Q. M., writes that the contract for changing the heating plants of buildings (bids opened Oct. 20) has been awarded as follows: General contract, to Moses & Holmgren, Junction City, for $13,950, and heating to J. J. Hanighan, Omaha, Neb., $14,774.

Galveston, Tex.—The following bids are reported opened by Capt. C. S. Riche, Corps of Engrs., U. S. A.—*a*, dredging Division 2, about 4,300,000 cu. yds.; *b*, dredging Galveston channel proper, 2,850,000 cu. yds.; *c*, dredging Div. 1, 5,700,000 cu. yds.; *d*, south jetty work furnishing for 40,000 tons granite blocks of 5 to 10 tons each; *e*, for north jetty work, 125,000 tons granite blocks of 10 to 12 tons; *f*, for Aransas Pass jetties (1) 31,000 tons small riprap, (2) 24,000 tons large riprap, (3) 7,200 tons granite blocks: Lake Superior Contg. & Dredg. Co., Duluth, Minn., *a*, 15 cts. per cu. yd.; *c*, 10.07 cts. Geo. W. Catt, 13 Park Row, N. Y. City, *a*, 18 cts.; *c*, 10 cts., for whole work, *a*, 14.5 cts.; *b*, 8.8 cts.; *c*, 9.3 cts. Bowers Southern Dredging Co., Galveston, *a*, 16.3 cts.; *c*, 9.08 cts.; for whole work, *a*, 14 cts.; *b*, 8.3 cts.; *c*, 8.8 cts. Raymond A. Perry, San Francisco, *c*, 10.86 cts. Coastwise Dredging Co., Wilmington, Del., 10.125 cts. Isaac Heffron & Co., Galveston, *d*, $3.05 per ton; *e*, $4.58; *f* (1) $4.40, (2) $5.35, (3) $5.70. Parker, Wasington & Co., Kansas City, Mo., *d*, $2.79; *e*, $4.32; *f* (1) $4.25, (2) $5.10, (3) $5.40. Chas. Clarke & Co., Galveston, *d*, $2.99; *e*, $4.38; *f* (1) $3.98, (2) $4.97, (3) $5.40.

Seattle, Wash.—The following bids are reported opened by Major John Mills, Dec. 18, for *a*, dredging of harbor at Olympia, 55,000 cu. yds., and *b*, extension of dredging for Lake Washington Canal through Salmon Bay to city dock at Ballard, 235,000 cu. yds.: Raymond A. Perry, San Francisco, Cal., *a*, $19,800, or 36 cts. per cu. yd.; *b*, 53 cts. per cu. yd. Puget Sound Bridge & Dredging Co., *a*, $16,445, or 29.9 cts. per cu. yd.; *b*, 4.82 cts. per cu. yd. The Northwestern Bridge Co., Tacoma, *a*, $18,645, or 33.90 cts. per cu. yd., and the Pacific Coast Dredge Co., *b*, 48.8 cts. per cu. yd.

Bids are wanted Jan. 20 for dredging Tacoma Harbor. Maj. John Mills, Corps Engr., U. S. A.

Ft. D. A. Russell, Wyo.—The following are the awards for constructing, heating, plumbing, etc., officers' quarters, barracks, etc., at Ft. D. A. Russell. Bids were received by the Lieut. Col., J. W. Pope, Ch. Q. M., Denver, Colo., Oct. 15: M. P. Keefe, Cheyenne, Wyo., construction of all buildings, $96,900; Johnson & Davis, 427 15th St., Denver, Colo., plumbing and gas piping, 3 buildings, $3,533; Dwyer Plumbing & Htg. Co., 30 E. 6th St., St. Paul, Minn., plumbing, heating and gas-piping building No. 150, $7,821; W. O. Morrison, 331 Cooper Bldg., Denver, Colo., heating building No. 124A, $1,360; Jos. A. Hurley, 392 Selby Ave., St. Paul, Minn., heating building No. 145, $907, and Gilbert Wilkes & Co., 251 Coronado Bldg., Denver, Colo., electric wiring all buildings, $1,300.

San Francisco, Cal.—Bids are wanted Feb. 3 for furnishing material and erecting medical officers' quarters, a contagious disease hospital; also for changes in the main hospital building at the Navy Yard, Mare Island. A. S. Kenny, Paymaster Gen., U. S. N., Washington, D. C.

Los Angeles, Cal.—Bids are wanted Jan. 21 for constructing breakwater at San Luis Obispo Harbor. Address Capt. Edgar Jadwin, Corps Engr., U. S. A.

Vancouver, Wash.—Press reports state that Col. F. L. Hathaway, Q. M., on Dec. 22 opened the following bids for the construction of one double set of infantry barracks, one double set of artillery barracks, and one officers' quarters: Garder & McLennan, $149,518; Maxen & Co. (for all complete), $183,042; C. L. Spoare, $150,578; Brigham & Hoska, $125,557; H. O. Robinson, $134,602; Baimberg & Fastabend, $139,251; W. R. Nichols (for all complete), $167,600; J. T. Goss, $138,349; Hasty & Dugan, $129,079; Irb & Van Patten, $151,121. Larney & Kiggins were the lowest bidders on the plumbing and gas fittings, at $15,012, and J. R. Harvey was the lowest separate bidder on electric wiring at $3,997.

MISCELLANEOUS.

Brookline, Mass.—The Com. appointed to investigate the purchase of the Boston reservoir grounds in Brookline are stated to have reported recommending the purchase of this 1,500,000 sq. ft. of land, at an expenditure not to exceed $100,000. It is probable that this site will be devoted to a park.

Boston, Mass.—Bids will be received Jan. 14 by John B. Martin, Penal Institutions Comr., for repairing steamboat wharf at Deer Island, Boston Harbor.

New York, N. Y.—The American Fire Engine Co., 85 Liberty St., was the only bidder Dec. 30 for furnishing fire pumps for a new fireboat, at $11,000.

Brooklyn, N. Y.—The lowest bidder Dec. 29 at Dept. of Parks, N. Y. City, for furnishing road materials on parkways as required was Isaac Harris, 485 Flatbush Ave., whose bids were as follows: 6,600 cu. yds. Hudson Riv. road gravel, $1.58; 6,000 cu. yds. crushed trap rock and 3,000 cu. yds. trap rock screenings, $1.62½; 7,550 cu. yds. blue limestone, $1.75, and 6,700 cu. yds. blue limestone screenings, $1.85.

Rochester, N. Y.—The question of constructing a retaining wall on the west bank of Genesee River from a point south of Clarissa St. to the beginning of the present wall near Court St. is under consideration. Probable cost, $25,000. E. A. Fisher, City Engr.

Harrisburg, Pa.—The Park Comn. on Dec. 23 is reported to have decided to confer with Warren H. Manning, a landscape architect of Boston, Mass., with a view of securing his assistance in creating a system of parks.

Richmond, S. I., N. Y.—The lowest bid opened Dec. 31 for installing a telegraph fire alarm system in Richmond Boro., was that of Fredk. Pearce, 18 Rose St., N. Y. City, for a total of $18,321.

Richmond, Va.—The James River Improv. Com. is stated to have instructed the City Engr. to take steps looking to the immediate letting of the contract for the construction of a dredging plant, to be used in the harbor; the equipment not to cost over $38,000.

Cleveland, O.—C. H. Fath & Son Construction Co. is stated to have secured the contract for straightening the Cuyahoga River at Jefferson St., for $19,276.

St. Louis, Mo.—An ordinance has been introduced in Council granting the Batcheller Pneumatic Tube Co. a franchise to install an underground pneumatic tube service in this city. A power house is to be established at some point on the line, with perhaps one or more relay power houses. 54 stations are to be established in various sections of the city, at which goods will be received and delivered. The cost of the plant is estimated at $3,000,000.

Sturgeon Falls, Ont.—It is stated that bids are wanted Jan. 10 for constructing a wharf. H. E. Gray, Engr., Confederation Life Bldg., Toronto. Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa.

Halifax, N. S.—It is stated that bids will be received about Jan. 24 for constructing a breakwater at Tiverton. C. E. M. Dodwell, Res. Engr., Halifax. Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

NEW INDUSTRIAL PLANTS.

The Kalamazoo, Mich., Railway Supply Co. is erecting new factory buildings, consisting of foundry and forge, machine shop, woodworking and carpenter shop, and paint and finishing shop, which will have about 40,000 sq. ft. floor space; also office building, lumber sheds, etc. A 250-H.-P. steam engine, dynamo and electric motors will be bought.

The New Orleans, La., Cold Storage & Warehouse Co., Ltd., will erect an additional 2-story building, to be about 310x85 ft. in size. Details of new power plant are not decided.

The Hiett Wagon Co., Jonesboro, Ark., has been organized with a capital of $20,000, and has let contract for a 2-story, 50x100-ft. building. A 40-H.-P. engine and a 50-H.-P. boiler will be installed.

The Union Cotton Mills, Lafayette, Ga., are preparing to build a 3-story, 200x76-ft. addition. A 600-H.-P. cross compound condensing engine and 300-H.-P. in boilers will be installed.

J. P. Moser, Okahumpka, Fla., expects to begin about Feb. 1 to erect a small machine shop, and will be in the market for a complete outfit of machinery.

The Washington Iron Works Co., Seattle, Wash., is adding a 2-story, 70x240 ft. machine shop, equipped with a 20-ton traveling crane of 40-ft. span running the entire length of the building, and an addition 60 ft. square to the foundry, also a 60-in. cupola. These additions will more than double the company's output.

W. S. Fillmore, Gaylord, Mich., is interested in the erection of a plant to produce graded sand and gravel, crushed stone, cement brick and cement sewer pipe. The plant will have a daily output of 20,000 brick and 20 cars of sand, gravel and crushed stone.

BUSINESS NOTES.

The Contractors Plant Co., which has recently moved to its new office and factory at 37 Pittsburgh St., Boston, has installed a very complete machine shop to make its concrete machinery, especially the portable gravity concrete mixer. The company reports that its business has grown to large proportions within the last year, and that the prospects for future business are very good.

The Bellefontaine, O., Bridge & Iron Co. has just completed a new brick power plant and installed a new engine and boiler of treble the capacity of its old plant and an additional Ingersoll-Sergeant air compressor. The company reports the following among contracts on hand: Structural steel for a large business block in Cambridge, O.; rebuilding and strengthening draw span for the C., C., C. & St. L. Ry. Co.; steel buildings for the Bellefontaine Foundry & Machine Co., and a large number of highway bridges throughout the Middle and Western States.

The Mohawk Portland Cement Co., Warner, N. Y., has been incorporated with a capital of $1,000,000. The directors are: D. B. Dean, Amawalk, N. Y.; A. G. Sherwood and Pasquale Francolin, New York.

The Ball Engine Co., Erie, Pa., reports the following among recent sales: Strouse Bros., Baltimore, Md., 125 and 60-H.-P. engines; Douglas & Co., Cedar Rapids, Ia., an engine for electric service.

The American Blower Company's heating apparatus is to be installed in the Lake Shore & Rock Island depot, Chicago, and the fans and heaters for the Colonial Theatre at Cleveland, O., are to be furnished by the same company.

The York Mfg. Co., York, Pa., builder of refrigerating apparatus, is equipping its works for electric power distribution, and has recently purchased from the Westinghouse Electric & Mfg. Co. a number of direct-current, 220-volt motors; the Union Abattoir Co., of Baltimore, is making large additions to the electrical equipment used for power distribution in its plant, and a 200-Kw., 7,200-alternations, two-phase, engine-type generator, with exciter, and two 40-H.-P., type C motors have recently been purchased through Dr. W. A. Drysdale, constructing engineer, of Philadelphia, from the Westinghouse Electric & Mfg. Co. This machine is to be installed as an addition to the present plant, which consists of a 150-Kw., engine-type generator and about twenty induction motors, ranging in size from 3 to 40 H.-P. inclusive.

The Stanley Electric Mfg. Co., Pittsfield, Mass., has secured, through its New York office, a contract to supply the New York Edison Co. with four 2,000-Kw. S. K. C. rotary converters, twelve 800-Kw. S. K. C. static transformers of the air-blast type and four auto-regulators, and ten 1,000-Kw. S. K. C. rotary converters with thirty 400-Kw. S. K. C. static transformers of the air-blast type and ten auto-regulators for the various sub-stations. The Stanley Co. is also to furnish three new generating units for the Waterside Station; there are to be 3,500-Kw., 25-cycle three-phase, alternating-current generators, direct-connected to engines working at 75 revs. per min.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Jan. 5.	Los Angeles, Cal.	Jan. 3
Jan. 6.	Centralia, Ill.	Dec. 27
Jan. 7.	Baltimore, Md.	Jan. 3
Jan. 7.	Centerville, Miss.	Dec. 20
Jan. 9.	Lakewood, O.	Dec. 20
Jan. 12.	South Brooklyn, O.	Dec. 27
Jan. 12.	South McAlester, Ind. Ter.	Dec. 27
Jan. 13.	St. Louis, Mo.	Jan. 3
Jan. 14.	Ardmore, Ind. Ter. Adv., Eng. Record, Jan. 3.	Jan. 3
Jan. 15.	St. Paul, Minn.	Dec. 20
Jan. 16.	Georgetown, S. C.	Jan. 3
Jan. 20.	Evans, Colo.	Dec. 27
Jan. 28.	Filters, reserv'r, etc., Washington, D.C. Adv., Eng. Record, Jan. 3.	Jan. 3
Jan. 30.	Havre, Mont.	Dec. 27
———	Metera, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Jan. 7.	Merced, Cal.	Jan. 3
Jan. 7.	Harrisburg, Pa.	Jan. 3
Jan. 7.	Fernandina, Fla.	Dec. 13
Jan. 6.	New Britain, Conn. Adv., Eng. Record, Dec. 20, 27.	Dec. 20
Jan. 6.	Columbus, O. Adv., Eng. Record, Dec. 13 to Jan. 3.	Dec. 13
Jan. 8.	Cleveland, O.	Dec. 20
Jan. 9.	Lakewood, O.	Dec. 20
Jan. 12.	Toledo, O.	Jan. 3
Jan. 14.	Brooklyn, N. Y.	Jan. 3.
Jan. 16.	Clay Center, Kan.	Dec. 20
Jan. 23.	Decatur, Ill.	Jan. 3
Jan. 26.	Cincinnati, O.	Jan. 3
Jan. —	Walnut, Ill.	Dec. 13
Feb. 2.	New Orleans, La. Adv., Eng. Record, Nov. 29 to Jan. 3.	Nov. 29
Feb. —	Dixon, Ill.	Dec. 13
	BRIDGES.	
Jan. 6.	Albion, Ind.	Jan. 3.
Jan. 6.	Stockton, Cal.	Dec. 27
Jan. 6.	Grand Junction, Colo.	Dec. 13
Jan. 7.	Olivet, S. D.	Dec. 13
Jan. 7.	Webster, S. D.	Nov. 29
Jan. 10.	Westmoreland, Kan.	Jan. 3
Jan. 10.	White Eagle, Okla. Ter.	Dec. 27
Jan. 12.	Scranton, Pa.	Dec. 20
Jan. 12.	Tacoma, Wash.	Dec. 20
Jan. 14.	Pulaski, Pa.	Jan. 3
Jan. 15.	Tacoma, Wash.	Jan. 3
Jan. 20.	New York, N. Y.	Jan. 3
Jan. —	Peoria, Ill.	Dec. 13
Feb. 10.	Castroville, Tex.	Jan. 3
	PAVING AND ROADMAKING.	
Jan. 5.	St. Paul, Minn.	Jan. 3
Jan. 6.	Cleveland, O.	Dec. 20
Jan. 6.	Cincinnati, O.	Dec. 13
Jan. 7.	Denver, Colo.	Jan. 3
Jan. 9.	Cincinnati, O.	Jan. 3
Jan. 10.	Ft. Myer, Va. Adv., Eng. Record, Dec. 13 to Jan. 3.	Dec. 13
Jan. 15.	Washington, Ia.	Dec. 27
Jan. 15.	Ft. Collins, Colo.	Dec. 27
Jan. 17.	Zanesville, O.	Jan. 3
Jan. 19.	Toledo, O.	Dec. 27
Jan. 19.	Cincinnati, O.	Dec. 27
Jan. 23.	Cincinnati, O.	Jan. 3
Jan. 29.	Cleveland, O.	Jan. 3
Feb. 1.	Burlington, Ia.	Jan. 3
Feb. 14.	Lafayette, Ind.	Dec. 27
Feb. 23.	Fond du Lac, Wis. Adv., Eng. Record, Jan. 3.	Jan. 3
	POWER, GAS AND ELECTRICITY.	
Jan. 5.	Winona, Minn. Adv. Eng. Record, Dec. 20.	Dec. 20
Jan. 10.	Crystal Falls, Mich. Adv., Eng. Record, Dec. 27, Jan. 3.	Dec. 27
Jan. 12.	New York, N. Y.	Jan. 3
Jan. 12.	Hot Springs, Ark.	Dec. 13
Jan. 15.	Rome, Ga.	Oct. 11
Jan. 30.	Havre, Mont.	Dec. 27
Jan. —	South Norwalk, Conn.	Dec. 13
Feb. 12.	Guayaquil, Ecuador	Dec. 20
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
	GOVERNMENT WORK.	
Jan. 6.	Ft. Townsend, Wash.	Dec. 20
Jan. 6.	St. Louis, Mo.	Dec. 6
Jan. 7.	Newport, R. I.	Dec. 20
Jan. 7.	Hospital (Ft. Greble), Newport R. I. Adv., Eng. Record, Dec. 13 to Jan. 3.	Dec. 13
Jan. 8.	Mobile, Ala.	Dec. 6
Jan. 9.	Plattsburg Barracks, N. Y.	Dec. 20
Jan. 9.	Portland, Ore.	Dec. 20
Jan. 10.	White Eagle, Okla. Ter.	Dec. 27
Jan. 10.	New Orleans, La.	Dec. 20
Jan. 10.	New York, N. Y.	Dec. 20
Jan. 12.	Mobile, Ala.	Dec. 20
Jan. 12.	Washington, D. C. Adv., Eng. Record, Dec. 13, 20.	Dec. 13
Jan. 13.	Superior, Wis.	Dec. 20
Jan. 14.	Steel towboat, Memphis, Tenn. Adv., Eng. Record, Dec. 20, 27.	Dec. 20
Jan. 14.	Helena, Mont. Adv., Eng. Record, Dec. 6, 13.	Dec. 6
Jan. 15.	Duluth, Minn. Adv., Eng. Record, Dec. 20 to Jan. 3.	Dec. 20
Jan. 15.	Los Angeles, Cal.	Dec. 20
Jan. 15.	Chemawa, Ore.	Dec. 20
Jan. 15.	Newport, R. I. Adv., Eng. Record, Dec. 13 to Jan. 3.	Dec. 13
Jan. 15.	Norfolk, Neb.	Dec. 6
Jan. 15.	Machinery for dredge, Wash'ngton, D.C. Adv., Eng. Record, Nov. 29 to Dec. 13.	Nov. 29
Jan. 17.	Charleston, S. C.	Dec. 20
Jan. 17.	Bldg., Philadelphia, Pa.	Dec. 20
Jan. 20.	Seattle, Wash.	Jan. 3
Jan. 21.	Los Angeles, Cal.	Jan. 3
Jan. 22.	Chattanooga, Tenn.	Dec. 27
Jan. 22.	Buffalo, N. Y. Adv., Eng. Record, Dec. 27, Jan. 3.	Dec. 27
Jan. 22.	Dredging, Boston, Mass. Adv., Eng. Record, Dec. 20, 27.	Dec. 20
Jan. 24.	Ft. Fremont, S. C.	Jan. 3
Jan. 26.	Chicago, Ill.	Jan. 3
Jan. 26.	St. Augustine, Fla. Adv., Eng. Record, Jan. 3.	Jan. 3
Jan. 27.	Creston, Ia.	Jan. 3
Jan. 29.	Philadelphia, Pa. Adv., Eng. Record, Jan. 3.	Jan. 3
Jan. 30.	Newport, R. I. Adv., Eng. Record, Jan. 3.	Jan. 3
Feb. 3.	San Francisco, Cal.	Jan. 3
Feb. 7.	Dry dock, Philadelphia, Pa.	Dec. 20
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
	BUILDINGS.	
Jan. 5.	Office Bldg., Montreal, Que.	Jan. 3
Jan. 5.	School, Waterbury, Conn.	Jan. 3
Jan. 6.	Pub. Bldgs., Lake Charles, La.	Dec. 27
Jan. 7.	Jail, Morristown, Tenn.	Dec. 6
Jan. 8.	Pub. Bldgs., Brooklyn, N. Y.	Jan. 3
Jan. 8.	School, St. Louis, Mo.	Jan. 3
Jan. 8.	Pavilion, New York, N. Y.	Dec. 27
Jan. 10.	Bus. Bldg., New Kensington, Pa.	Jan. 3
Jan. 12.	School, New York, N. Y.	Jan. 3
Jan. 12.	School, Long Island City, N. Y.	Jan. 3
Jan. 12.	School, Columbus, O.	Dec. 20
Jan. 12.	Church, Chepstow, Ont.	Dec. 13
Jan. 13.	Hospital, Sonyea, N. Y.	Jan. 3
Jan. 14.	Hospital, Fresno, Cal.	Jan. 3
Jan. 14.	College, New York, N. Y.	Jan. 3
Jan. 14.	Court House, Richmond, Ky.	Dec. 20
Jan. 15.	School, Salem, Ore.	Jan. 3
Jan. 15.	Court House, Cambridge, O.	Jan. 3
Jan. 15.	School, Bridgeport, Conn.	Jan. 3
Jan. 15.	Hospital, Toledo, O.	Dec. 27
Jan. 15.	School plans, Beaumont, Tex.	Dec. 20
Jan. 15.	Library, Winnipeg, Man.	Dec. 13
Jan. 15.	Library plans, Binghamton, N. Y.	Nov. 15
Jan. 16.	Plumbing, etc., Randall's Island, N. Y. Adv., Eng. Record, Jan. 3.	Jan. 3
Jan. 17.	Roundhouse, Dennison, Tex.	Dec. 27
Jan. 20.	Pub. Bldg., Danville, Ky.	Jan. 3
Jan. 20.	Bus. bldg, Flint, Mich.	Dec. 20
Jan. 23.	Jail, Grand Junction, Colo.	Dec. 13
Jan. 24.	School, Milwaukee, Wis.	Dec. 27
Jan. 30.	School, Geneseo, N. Y.	Dec. 13
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Jan. —	Church, Marine City, Mich.	Dec. 27
Feb. 1.	School, Clarksville, Ia.	Jan. 3
Feb. 1.	Hospital, Springfield, O.	Jan. 3
Feb. 1.	Office Bldg., Flint, Mich.	Dec. 27
Feb. 1.	Pub. Bldg. Plans, Louisville, Ky.	Dec. 27
Feb. 1.	School, Dickinson, N. Y.	Dec. 6
Feb. 2.	City Hall, Houston, Tex.	Dec. 13
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
	MISCELLANEOUS.	
Jan. 8.	Park, New York, N. Y.	Dec. 27
Jan. 8.	El. Ry. franchise, Oroville, Cal.	Dec. 20
Jan. 10.	Wharf, Sturgeon Falls, Ont.	Jan. 3
Jan. 13.	Street sprinkling, St. Louis, Mo.	Jan. 3
Jan. 14.	Wharf, Boston, Mass.	Jan. 3
Jan. 14.	Dredging, Chicago, Ill.	Nov. 22
Jan. 17.	Railroads, Beckley, W. Va.	Jan. 3
Jan. 24.	Breakwater, Halifax, N. S.	Jan. 3
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
———	R. R. work, Cincinnati, O.	Dec. 20

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The New York Water Supply Question.

The Commissioner of Water Supply, Gas and Electricity, has appointed, with the approval of the Mayor, a Commission of three civil engineers to consider the broad questions of water waste and additional supply for the City of New York, and these two main portions of the Commission's work involve the consideration of a number of more or less related matters of less magnitude. The problems before the Commission require the exercise of the best engineering judgment and efforts based upon experience and training in this special field of professional work. The whole subject is one which vitally interests the entire city, and it is not a matter of surprise that such organizations as the City Club, the Merchants' Association, and other groups of public spirited citizens should agitate for the most efficient solution of the problems before the Commission.

Mainly at the request of the City Club, the Commission gave a public hearing at the City Hall on the 23rd of December, at which various facts bearing upon the problems to be solved were set forth in a forcible and conclusive manner by the president of the City Club and the chairman of its special committee. On the whole, the attitude assumed by these two speakers may be considered helpful to the Commission. They particularly disclaimed any desire to argue against or to hinder in any way the acquisition of any needed additional sources of supply, but they laid special stress upon the undoubtedly large waste of water at present existing in the city, and insisted that immediate measures should be taken to reduce it as far as possible. All that is reasonable. As usual, however, at such public hearings where unrestricted opportunity is given to everybody to say anything, a number of amateurs, including, we are sorry to say, the secretary of the Citizens' Union, indulged in a large amount of gratuitous assertions and advice without any substantial basis. The discovery of leaky services and a few other isolated instances of culpable waste do not constitute complete technical knowledge of the subjects of water waste and supply. Again, it is more or less pleasing to the amateur to cite unexplained data in support of pet views, particularly when those data relate to foreign usage, but every professional man knows well that data apprently identical in character frequently have varying significance, and that when their conditions are widely different they need careful interpretation in order to avoid completely erroneous application.

There seems to be a widespread impression in the City of New York that the daily consumption of its water is phenomenally large, and consequently that preventable waste is therefore extraordinarily large in amount. As a matter of fact, the daily consumption of water in the Boroughs of Manhattan and the Bronx is about 115 gallons per inhabitant. There is, however, one essential element in that statement nearly always overlooked in the daily press and usually ignored in all amateur expressions of opinion, and that is the unusually large transient population in the Borough of Manhattan. The entire country surrounding New York City, including portions of New Jersey, Long Island, the Hudson Valley and Connecticut, pour into Manhattan a sufficient daily population to constitute a large city in itself, all of whom require some water every day, although they go out of the city for the night. Again, the floating population in the great hotels of the city is measured by thousands, each one of whom is nearly always a large consumer of water. These two classes of transient population add materially to the consumption of water on Manhattan Island, and yet they are usually ignored by amateurs and the public press in dealing with the consumption of water per head of population in New York City. How much the daily use would be reduced below 115 gallons per capita per day by allowing for the consumption of this large transient element cannot be determined, as the necessary statistics are not available, but there can be no doubt that the reduction would be substantial.

If, however, the daily consumption of 115 gallons or even 120 gallons be allowed to stand for the sake of argument, it may be interesting to observe actual facts in connection with the daily consumption of some of the other large cities of this country. The records for 1900 show that the city of Chicago used 190 gallons per head of population per day; the city of Philadelphia, 229 gallons; the metropolitan water district comprising Boston and suburbs, 115.5 gallons; Cleveland, 175 gallons; Buffalo, 262 gallons; Washington, 174 gallons; Albany, 192 gallons, with a considerable number of others not far behind the figures of this list. In citing these figures it is not the purpose of this journal to justify the extravagant use of water, but simply to aid in securing a more complete view of the entire water consumption situation than seems to have been enjoyed by many parties in New York City who have been expressing very positive judgments on this subject.

It has often been stated that the daily consumption of foreign cities is far less than in our own, and that point was particularly insisted upon at the public hearing before the newly appointed Water Supply Commission. Nothing is more familiar to American engineers than this marked difference in daily use observable when the results for foreign and American cities are compared, but it is a hasty and unwarranted conclusion that that difference is wholly due to extravagant use or preventable waste in American cities. In the first place, there are foreign cities in which the daily consumption rises even to 200 gallons per day, or more, although those instances are probably far more rare than in this country. It is imperative in comparing daily consumption in the two countries that the habits, processes, and other usages under the two different sets of conditions, should be carefully recognized, and that is precisely where amateurs and some members of the public press are likely to be seriously misled. The habits and normal requirements of the people of the United States, in reference to the use of water, are radically different from those existing either in Great Britain or on the continent of Europe. Fixed bath tubs and plumbing fixtures through which water is most readily used, are employed far more, both in hotels and residences on this side of the ocean than on the other, although European conditions are now approaching our own with a corresponding increase in the use of water. As a rule the householders of this country have become accustomed to a far more abundant use of water for a multitude of purposes than have people of foreign cities, and those differences must enter any fair comparison of daily consumption. There is not the slightest reason to believe that the daily consumption of water in the cities of this country can by any possible means whatever be brought down to the figures corresponding to the daily consumption in many cities abroad at the present time; but on the other hand, it is practically certain that foreign consumption per head of population will rise considerably above its present values, indeed it is so rising at the present time, although it may never equal our own even when the preventable waste of the latter has been saved.

The difficulties attending the work of the Water Supply Commission are sufficiently great without gratuitously adding to them. In one of the great morning dailies of New York City, the discussion in the public hearing before the Commission was referred to in the following language: "Facts were cited in the discussion pointing to the conclusion that our present per capita supply is at least twice and perhaps three times as much as we need for all purposes, industrial, commercial, domestic or public." Also: "New York cannot use 40 gallons without preventable waste; probably 30 would be sufficient to permit a good deal of waste; no doubt 25 would answer if necessity demanded, without entailing any inconvenience to consumers." Nothing can be more unreasonable, nor could any greater violence be done to the actual conditions of the case than to expect any such results from a treatment of the water waste question in New York City. Such statements are simply grotesque and create expectations which it is absolutely impossible even approximately to realize. If amateur effort is to result in that kind of wild and irresponsible statement the quicker it is ignored the better it will be for the treatment of the water supply question in New York City. What is imperatively needed is a careful and intelligent handling of the matter with an adequate and rational recognition of the results involved in the problem. It is not surprising that such statements as those quoted should provoke the following judgment printed in the editorial columns of a daily evening paper on the day after the hearing: "While the amateur suggestions made at yesterday's hearing were inter-

esting as the outgivings of more or less simple ignorance, they cannot be said to have had any other quality which entitles them to consideration. What is wanted for the solution of this really very pressing problem is not feeling but expert thinking, and this the special commission can be depended upon to furnish."

The waste of water in New York City imperatively needs checking, but its reduction cannot be accomplished in a day or a month. The measures which must be adopted to produce that result, and which the Commission, cooperating with the present administration of the Department of Water Supply, Gas and Electricity, will doubtless ascertain and recommend, cannot be expected to accomplish much under a year. Indeed, judging from the inauguration of similar measures in other cities, it would be most satisfactory if the daily consumption of water in New York City can be reduced to 85 or 90 gallons per head of population per day within the next three years. This is a phase of the water supply situation which needs efficient handling in a reasonable and proper manner, but with no wild guessing as to what ought to be accomplished within a day or a season. It must be remembered that even where water meters are put upon practically every tap of a supply, the legitimate uses of water increase, and that while the prevention of waste will largely overbalance that legitimate increase in demand, the latter will not disappear.

The Commission would pursue a most dangerous policy if it should neglect immediately to seek and plan for such additional sources of supply for the city as may afford all the increase required for an indefinite period in the future. Every competent engineer who has made a careful and unbiased study of the situation realizes that the city of New York is dangerously near the limit of its present water resources, and that it would be ignoring plain warnings to depend upon the reduction of waste to give the city that assurance against water shortage which is imperatively needed for the near future. The irresponsible guesses, or worse, of even well meaning amateurs, furnish no safe rule of procedure. The problems before the Commission involve water waste, and it is the duty of the Commission to give that prompt attention and recommend efficient remedial measures at the earliest possible moment; but, on the other hand, it owes the larger and more important duty to the city to use every effort and means at its command to elaborate and set forth in final and definite shape for prompt construction plans for the development of such additional sources of supply, wholesome in quality and abundant in quantity, as will be sufficient for the great city of New York for an indefinite future period.

The University of California, it is reported, is adding to its mechanical equipment a 10-horse-power, two cylinder Westinghouse gas engine to be used for tests and experiments. It is particularly intended to investigate and compare the efficiency of crude oil, gas and gasoline. A crude oil generator is being constructed for making gas from crude oil.

Construction of the Assuan Dam across the Nile involved the following principal quantities: Excavation, 1,015,000 cubic yards; stone masonry, 650,000 cubic yards; brickwork, 9,150 cubic yards; ashlar masonry, 53,200 cubic yards. The sluice gates through the dam have a combined area of openings amounting to 2,670 square yards. There are 180 sluices, and the velocity of flow through them for the maximum discharge of unusually large floods is estimated to be 23 feet per second.

Structural Steel Work in the Ansonia Apartment Hotel, New York—Roof Trusses, Tower and General Construction.

The "Ansonia," which has recently been completed, at Broadway and 73d Street, ranks among the largest, most elaborate and costly of the numerous handsome apartment hotels in New York, and is provided with mechanical and sanitary equipments, to correspond with the very complete arrangements for the comfort, safety and convenience of its tenants, which have been described at length in The Engineering Record of Nov. 1st and Nov. 15th, which respectively illustrate the water supply system and the mechanical plant. These articles give some details of the arrangement of the building which is therefore unnecessary to repeat here; and as our issue of Nov. 15th also presents an excellent picture of the building and a typical plan of its arrangement, they should be read in connection with this article.

As the building extends from 73d Street to 74th Street and from Broadway to a parallel alley, it has four unobstructed fronts from about 240 to nearly 280 feet in length, and covers an area of 37,000 square feet which, multiplied by its total height of about 225 feet from cellar to roof, gives contents of over 8,000,000 cubic feet. The basement and cellar excavation is made in solid rock and extends about 25 feet below curb level, the cellar floor being at about the level of the adjacent street sewers and far above the ground-water level, so that no difficulty is experienced in its drainage and no anxiety occasioned by the exposure of the metal work to moisture.

Above the street there are seventeen stories and no attic. The lower story is 16½ feet; and the others are from 10 to 12 feet in height; but the two upper stories are special on account of the curved mansard roof, which begins at the fifteenth floor and extends around all sides of the building. It is relieved by domes and pinnacles which terminate the rounded corners of the Broadway front and by a metal tower 28 feet square.

There are bay windows extending the full height of the building, stone balconies, heavy cornices and projecting courses at various points, and at the bottoms of the light courts the lower stories are roofed with steel and glass domes. In the first story restaurant, a cantilever balcony extends around the sides. Over the dining and ball rooms, the ceilings and upper stories are carried by special trusses. The main stairway from basement to roof is enclosed in a separate steel tower occupying the inner end of the rear light court. These principal features and various other special ones, in connection with their regularity of the plan, have developed complicated structural work which it would be difficult to describe as a whole. Some of the essential and peculiar features and special or characteristic details have been selected, and will be illustrated in this and succeeding articles.

A single light court about 35 feet wide and 85 feet long extends nearly to the center of the building on the Broadway face and the one opposite to it, making the plan approximately H shaped in cross section; while there are two light courts about 25x35 feet on the north side and 35x40 feet on the south side. These latter are also roofed over at the second floor level and, with the ornamental features of roof and corner construction, diversify the building and relieve the wide extent of face masonry.

The arrangement of the columns, the character of the girders and beams and the use of trusses has been governed by the effort to design an attractive, safe and economical structure and provide for the large number of different uses which are made of the various portions of the interior. The house contains over 350 suites or private apartments besides the dining rooms, reception rooms, restaurant, kitchen, laundry and other public rooms for hotel service, as well as stores, offices and a bank at the street level, and studios in the upper story and tower; an estimated regular tenancy of about 1,300 being thus provided for.

The building is of fire-proof construction with cast-iron columns and steel I-beams. The street fronts are faced with Indiana limestone up to the fourth floor, where there is a projecting stone balcony 4 feet wide. Above it to the foot of the mansard roof at the fourteenth story, the outer walls are faced with cream colored brick trimmed with light terra-cotta matching the limestone. The window sills and window heads, as well as a number of balconies, each taking in one or two windows at the sixth, eighth and eleventh floors, are also of terra-cotta. At the thirteenth floor a steel framework projects about 4 feet to carry the terra-cotta main cornice. All of the outer walls are thin curtains made of red brick laid in cement mortar and faced with stone, terra-cotta or cream brick as already described. Up to the third floor they are self-supporting on concrete footings leveled up from the solid rock. At the third, fifth and seventh floors they are carried on double and triple I-beam girders and in the upper tiers on single I-beams at every story, being in all cases entirely independent of the floor girders. The partitions are of White's fire-proof blocks 2 to 3 inches thick, which are also used for fire-proof jackets around the columns and to enclose vertical pipe lines.

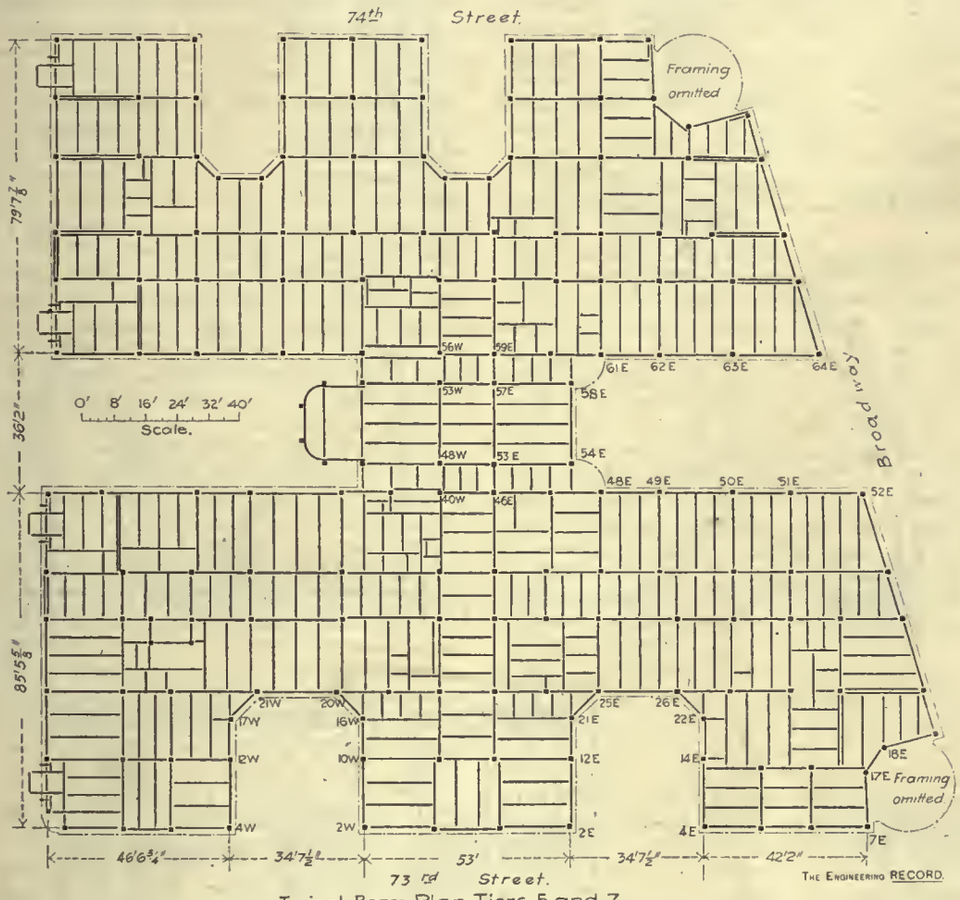
The floors, which are proportioned for 125 pounds per square foot for dead and live load, are of Roebling cinder-concrete arch construction with pine wearing surface nailed to strips dovetailed in the concrete, excepting in such public rooms as have paved floors. The ceilings are plastered on wire netting attached to suspended steel jurying of the Roebling system. The upper ends of the mansard rafters terminate in a flat roof with its beam framework in the 19th tier, which corresponds to the general structural features of the floor tiers, except for the presence of the mansard and ceiling trusses and for about seventy-five hip skylights from 3 to 20 feet square which very much complicate the construction of the roof covering, and are, of course, a costly feature. Between these skylights, the roof surface is made with segmental cinder-concrete arches of Roebling construction covered with glazed tiles 1 inch thick set in Portland cement mortar and pitched to drain.

As the building has three rectangular faces and one oblique face, and as the light courts are not quite alike on opposite sides, it cannot be symmetrical about any axis. The sides opposite the center lines parallel to 74th Street and the rear alley correspond in general features and arrangement; and for convenience of designation the building is considered under two separate portions divided by the north and south center line, the materials for which are respectively marked *W* and *E* to distinguish the west or rear and the east or front sides. There are in all nearly 200 vertical lines of main columns arranged from about 12 to 21 feet apart in fourteen principal east and west rows from about 7 to 21 feet apart.

In general, the floor girders are I-beams up to 18 inches in depth in the planes of the column rows and the floor beams are I-beams up to 15 inches in depth and 5 to 6 feet apart which are web-connected to them with their top flanges about 2 inches below finished floor level. The columns are arranged as shown in the

beam plan of the 5th and 7th tiers which correspond to the 4th and 6th stories and are typical of the floors between the ground level and the foot of the mansard roof. All columns have cast-iron pedestals with granite bases and concrete footings on the solid rock, and are made in single story lengths milled at both ends and having ¼-inch horizontal steel diaphragm plates inserted between their flanges at every splice to prevent the possibility of water penetrating the interior. Up to the 7th floor they have square cross-sections and above that level they are cylindrical. All beams and girders are supported on shelves and have side bracket connections bolted to their webs.

The private dining-room occupies the full height of the 16th and 17th stories and covers a space about 80 feet wide and 130 feet long on the 73rd Street side of the center line of the building. Its mansard roof is supported by curved lattice girders made in symmetrical halves like the one shown on the detail of roof



Typical Beam Plan. Tiers 5 and 7.

truss No. 11 which spans the distance between columns 20*W* and 35*W*, being supported directly at the former and indirectly on a 24-inch 80-pound I-beam girder at the latter. Pairs of similar semi-trusses which together resemble hingeless arches flattened on the top, span the wings between the light courts on the 73rd Street front where large two-story rooms are left unobstructed for public purposes. In each wing the end truss is about 13 feet from the face wall and this distance is spanned by short semi-trusses at right angles to the main truss against which they abut at the crown. These semi-trusses and the corresponding hip trusses are made to resemble the curved portions of truss No. 11; between them there are intermediate rafters like the one which is marked No. 9 in the accompanying illustration.

As all parts of the roof are curved from the flat upper deck to the tops of the outer walls, there is formed a cylindrical surface with its axis on a broken line parallel to and about 12 feet inside of the horizontal center line of the walls. This makes an irregular and intricate system of curved rafters, some of which, in places where the 17th floor is carried through, are made in the manner indicated by the elevation of the intermediate mansard rafters. Those consist of double 9-inch channels riveted together back to back and connected to web gusset plates so as to form chords of a segmental roof curve. The ordinates from these chords to the curve are made by flat bars riveted between the webs of the channels and extending beyond their outer flanges to receive the connection angles for horizontal T-bar purlins 21 inches apart which support hollow tile roof and wall blocks covered with slate. Corresponding T-bars 24 inches apart are riveted across the outer flanges to the mansard trusses. These trusses are also braced by transverse I-beams flange-connected to their webs. The upper part of the truss, in some instances, rests on a main beam of the flat deck roof where it is seated with a drop end bearing on the top flange and is bolted to a cast-iron filler piece below.

Rafter No. 9 is one of those which abuts at the crown against one of the main roof trusses, as shown in the detail. At the foot it has a vertical reaction only, and is seated with ordinary flange angles on the top flange of the 15th story girders. Intermediate mansard rafters are seated with ordinary flange angles on the tops of the 15th story girders and abut at the crowns against the outer girders in the flat part of the roof. They all correspond to the detail given, except that on some of them no ordinates project beyond the outer flanges. The intermediate rafters may be considered to extend to the 15th floor or to terminate at the 16th, according as to whether the lower section, which is composed of a pair of vertical 9-inch channels riveted together back to back, is considered a part of the rafter or of the top section of the column. The outer flanges are punched for horizontal T-bars and the top connection is made with ½-inch splice plates shop-riveted between the channel backs and cut to conform approximately to the curve of the roof at the springing point. The lower ends of these columns have angle flanges riveted to each of the four sides with reinforcements on their bottom flanges to serve as purlins when seated on the tops of the regular column posts. A tall copper cresting is carried on the edge of the roof at the top of the curved portion of the mansard roof trusses. On account of its height and exposure to the wind, this cresting is very strongly braced in the manner indicated by the diagram of cresting and bracing, which is a plan of the end of the roof between the light courts on the 74th Street front. The outer lines indicate the faces of the vertical walls and the parallel inner lines show the edges of the flat portion of the roof, the space between them being the projection of the curved mansard roof. Channels with vertical webs nearly 13 feet apart enclose the opposite sides of the narrow portion of the flat roof and are connected by 7-inch I-beams or pairs of 7-inch channels which serve as roof beams and support the framework for the cresting. This consists of pairs of vertical 4-inch channels 7 feet high which are riveted together back to back and connected at the bottom to the 6-inch horizontal channels, forming a continuous sill around the edge of the roof. The tops are similarly connected to a 5-inch continuous horizontal channel and both channels are set with their flanges down as indicated in the cross sectional elevation. Vertical channels are from 4 to 6 feet apart and have inclined angle braces from their upper ends to the roof beams. In the wide part of the roof the feet of these braces are secured to short sections of horizontal 6-inch channels riveted across the top flanges of the roof beams. In the narrow parts of the roof the lower ends of the braces intersect and overlap, and are connected to each other and to the roof, as shown in the sectional elevation.

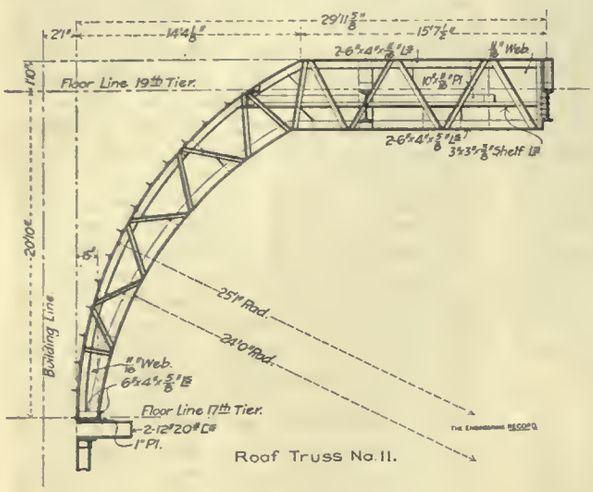
The 13th floor balcony on the 73rd Street side of the building extends continuously around the front and court walls as indicated by the plan of the balcony brackets of the 14th tier which is, however, somewhat misleading, in that it omits the floor between the east and west courts and makes the lines of columns and the court walls appear close together when they are in reality 53 feet apart. The figure shows the arrangement and position of the braced I-beam brackets about 3 feet and 4½ feet in length, and from 18 inches to 2 feet apart which are cantilevered out from the webs of the 15-inch I-beam wall girders.

In the center of the building there rises from the roof a steel frame tower 28 feet square which is intended to have a height of 125 feet above the roof; but has only been carried up two stories, or 25 feet, at present. It is supported directly on double I-beam girders across the tops of cast-iron columns 40 W, 48 W, 53 W and 56 W, 46 E, 53 E, 57 E and 59 E, as shown in the plan of the diagram; and indirectly by girders at right angles to these which are carried by adjacent columns. This system of girders forms a skeleton platform of double I-beams 18 and 24 inches deep, upon which are seated the twelve tower columns arranged symmetrically with regard to the longitudinal and transverse axes of the tower; but eccentrically with the main columns of the building.

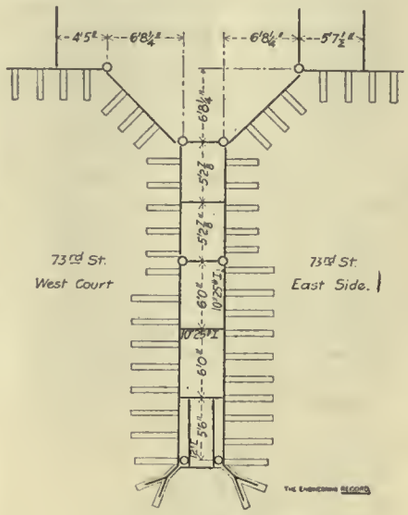
The tower columns have rectangular cross sections made with pairs of channels latticed together back to back. The columns extend through both stories of the tower in single lengths and, with their bracing, are proportioned for the maximum stress calculated for the full height of the tower which it is proposed to complete hereafter. The tower con-

struction is very rigid, with riveted connections at all intersections. The girders in the 21st or roof tier have their flanges seated on the column caps and are web-connected to the beams. In the 20th tier the two main girders are 24-inch I-beams with their ends projecting between the webs of the channels of their supporting columns and are seated on horizontal bearing plates with vertical diaphragms and stiffener angles connected to both webs of the column channels.

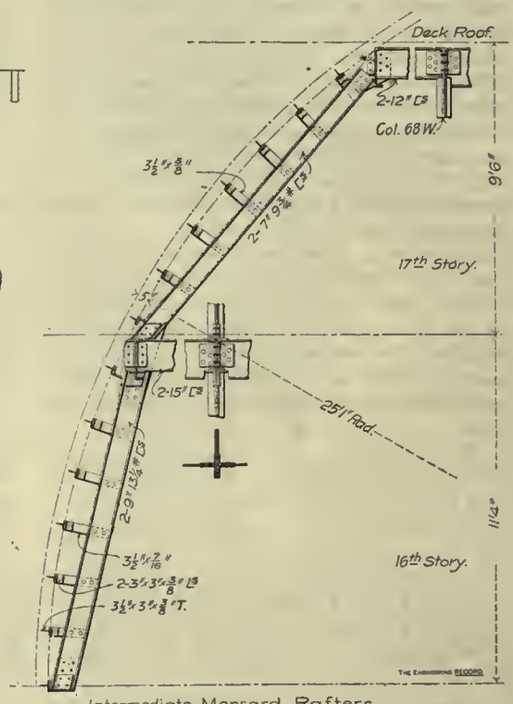
The Broadway corners of the building which are bounded in the general beam plan by four columns on a concave line are in reality rounded out with convex segments of cylindrical walls which reach nearly to the top of the mansard roof and finished with a steel tower



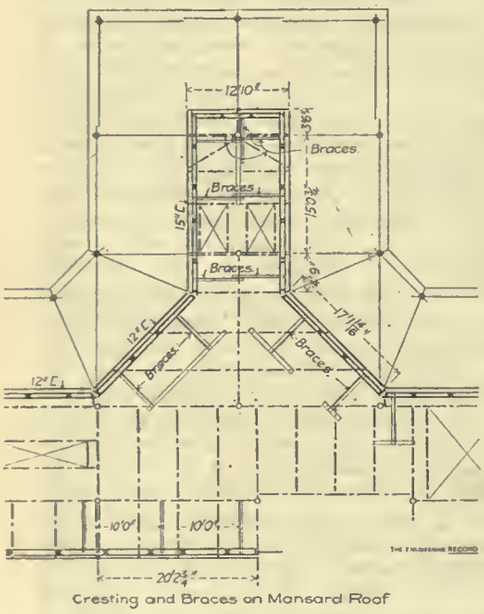
Roof Truss No. 11.



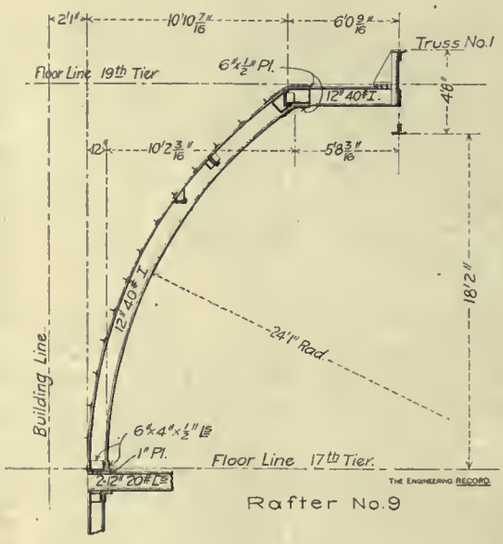
Balcony Brackets 14th Tier.



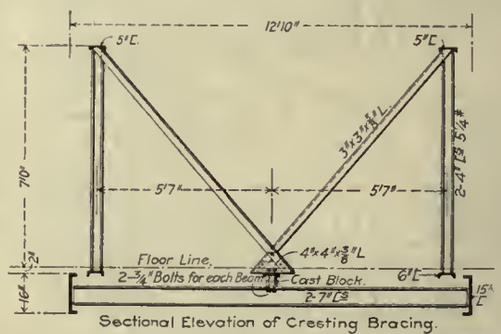
Intermediate Mansard Rafters.



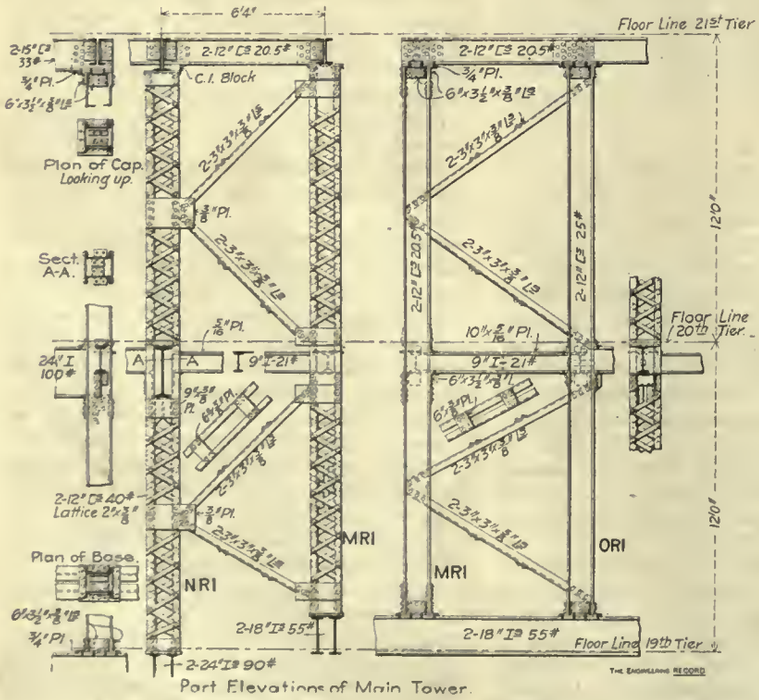
Cresting and Braces on Mansard Roof



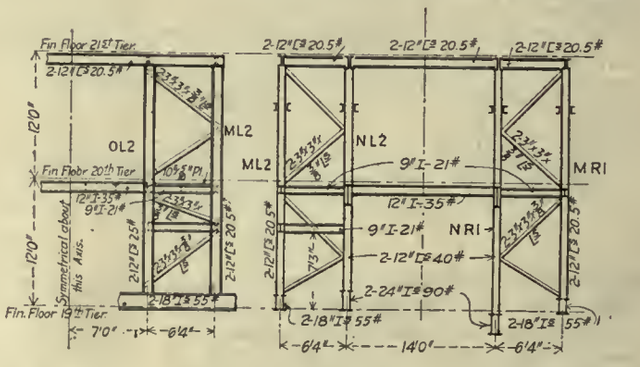
Rafter No. 9



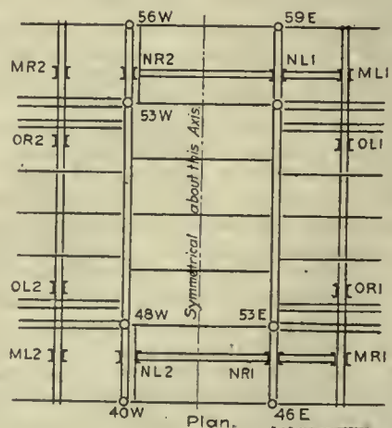
Sectional Elevation of Cresting Bracing.



Part Elevations of Main Tower.



Diagrams of Main Tower.



Plan.

DETAILS OF STRUCTURAL STEELWORK IN THE ANSONIA APARTMENT HOTEL, NEW YORK.

22 feet in diameter terminating in a dome and pinnacle at a height of 35 feet above the roof. The framework of each tower is supported by six cylindrical cast-iron columns including those in the curved outer wall which was not shown in the general column plan. These columns are not spaced exactly equi-distantly and only four of them are on the center line of the circular wall, the others being an inch or two outside of it. At the 18th tier these columns are connected by a circular girder formed with several sections of a 12-inch 31-pound I-beam bent to a radius of 11 feet. These curved girders are web-bolted to the flattened sides of the eccentric columns and are seated across the caps of the other columns. The ends of the beams are thoroughly web spliced together. Three sides of a hexagon incribed within the circle of the I-beams are formed by 12-inch I-beams web-connected to the curved beams at column points. Web-connected to two of these straight beams and to the curved beams are three 12-inch floor beams parallel to the third side of the hexagon. The ends of the floor beams support a circular curb girder made from a 6x4x⅜-inch angle bent to a radius of 10 feet 5 inches and receiving the feet of the twelve dome rafters which are single 6-inch 12-pound I-beams braced by circular horizontal 2x2-inch purlin angles 21 inches apart. All the connections of the curb girder, dome rafters and floor beams are made with bent web plates.

The excavations for this building were commenced in November, 1898, the erection of the steel and iron was commenced in October, 1899, and was substantially finished in March, 1901, the building being open to tenants in 1902. Its total cost, including equipment, is estimated at about three and one-half million dollars. The construction of the building was directed by the owner, Mr. W. E. D. Stokes. Mr. Paul Duboy was architect, Philip E. Raqué was the consulting engineer of steel construction, and Mr. Edward Raqué was the engineer in charge of steel construction. Mr. Thos. J. Reilly was the contractor for brick work and fire proofing, Mr. Chas. L. Peacock for the stone work, Messrs. J. H. Shipway & Bro. for the marble, the Vinton Company, of Detroit, for the interior trimming, the A. J. Ellis Company for the copper work and skylights, Messrs. J. B. and J. M. Cornell for the 6,500 tons of structural steel and iron, and the New York Architectural Terra Cotta Company for the terra cotta work.

(To be continued.)

The Gloucester, Mass., Water Case, which was explained in detail in The Engineering Record of August 19, 1899, and briefly mentioned in the issue of August 18, 1900, has been reopened. The Gloucester Water Supply Company, whose plant was taken by the city of Gloucester under an act of the legislature of 1895, has appealed the case to the United States Supreme Court on the question of the constitutionality of the act relating to the franchise rights of said company. The statute provided that the value of the company's property was to be estimated "without enhancement on account of future earning capacity, future good will, or on account of the franchise of said company." In December, 1901, the city made a settlement with the company by the payment of $793,293.78, which was the amount of the reduced award made by the commissioners in the case plus interest to that date. At the time of this settlement an agreement was entered into by the representatives of the city and the company that the rights of the parties involved to carry constitutional questions to the court of last resort should not be prejudiced by this action.

Compressive Resistance of Concrete-Steel and Hooped Concrete.—III.

Preceding sections of this translation from M. Considére's original paper appeared in the issues of December 20 and 27, 1902.

IX. *Elasticity.—Trial Analysis.*—The facts, as previously given, have only a limited value for practical purposes. It would suffice merely to state them if they were so numerous that from among them identical cases to those encountered could always be selected; but such a result is impossible, since the hooped prisms may vary almost indefinitely in the proportions of their solid elements, the proportion of the water used, the tamping, and the nature and dimensions of their longitudinal reinforcing. Aside, therefore, from the natural desire to solve the new problems, the practical needs compel us to investigate the laws governing the elasticity and resistance of hooped concrete. To find experimentally the effects of hooping to an absolute certainty it is evidently necessary to make identical prisms with and without hoops; but this is manifestly impossible. Two methods were adopted to avoid this difficulty. The first consists in preparing specimens as nearly identical as possible and correcting for their differences. The second seems to be exact, but can be used only for concrete tested by one load only. It consists of testing a prism with its spirals and then testing the same prism after removal of the spirals.

For the application of the first method two prisms were made with the same care, of the same proportions and dimensions. They were first tested to establish their difference in elastic behavior. Then the exterior surface of both specimens was removed to the cylinder enclosed by the hooping wires and one of the prisms so prepared was again tested. The other prism was identically tested after removing the spirals. The results obtained for both were compared and the corrections required, as shown by the preliminary tests, were made. It was thus determined that the increase of the coefficient of elasticity due to the hooping was practically equal to .90 per cent. of the coefficient of elasticity of the longitudinal wires of the same weight of metal.

The second method was applied to three prisms; of which two contained 500 pounds of cement and the third 1,000 pounds per cubic yard of gravel and sand. Each of them was subjected to a maximum pressure repeated seven times, which was sufficient to reduce the increase of deformation between the two last loadings to a negligible quantity, so that the concrete could be considered in a stable condition. The results obtained afterwards were then comparable to each other. The deformations which were produced under the last load were measured and the coefficient of elasticity resulting from them for hooped concrete was computed. The external layer of the concrete, together with the spirals, was removed and the prisms were again loaded. The new deformations were also measured and the corresponding coefficient of elasticity computed. If the removed outer layer of concrete could be neglected, the difference in the coefficients of elasticity could be wholly attributed to the hooping; but the error will be very small if the resistance of the removed shell of concrete be computed from the data obtained while testing the reduced prism.

Let n denote the ratio of the increase of the coefficient of elasticity due to hooping to the coefficient of elasticity of longitudinal rods of equal weight. The greatest shortening caused by the seven times repeated load was, in the three prisms, respectively, 0.029, 0.039 and 0.055 inch, and n had the values 2.10, 1.60, 0.67. In explanation of the above results it should be added that the shortening of 0.055 inch exceeded by 0.012 inch the shortening corresponding to the elastic limit, which was 0.043, that the shortening of 0.039 inch was not far from it, and that 0.029 inch was appreciably below. The effectiveness of the elasticity of the hooped specimens was 210 per cent. of that of longitudinal rods, while the previously applied load was considerably below the elastic limit. It was reduced to 160 per cent. when the previous load approached the elastic limit, and it fell to 67 per cent. only of the elastic effect of longitudinal rods of same weight when the elastic limit had been previously exceeded. In practice the testing load will always be well below the elastic limit, except in unexpected cases, and the experiments, therefore, lead us to believe that in the loadings and unloadings after the test loads the hoops will produce elastic effect at least twice the value of those of longitudinal rods of the same weight.

At first sight these facts seem to disagree with those previously stated, which give a value of 90 per cent. for n under the first load, that is, in the case where the elastic limit of the concrete has not been reached previously and has not even been approached. The explanation of this anomaly is furnished by the results obtained on the swelling of the compressed prisms in section V. As long as the pressure exerted remained below 1,345 pounds per square inch, the measuring instruments did not indicate any appreciable swelling, but under higher pressures a rapid swelling was observed, which reached 0.2 per cent. of the length of the specimen under a pressure of 3,130 pounds per square inch. The shortening of .07 per cent. which these prisms underwent under a pressure of 1,345 pounds certainly caused an appreciable swelling of the concrete, and it must be admitted that the spirals, whose diameters were measured, did not follow the surrounding concrete during the first movement. This is not surprising in view of the phenomena which take place during the setting and hardening of concrete in air. It seems to be certain that the contracted concrete does not press effectively against the inner surface of the spirals before the load is applied, and that the first swelling only causes a stronger contact between the concrete and the spirals. The hooping does not, therefore, produce its normal effect on the elastic behavior before the application of a certain load, which is in the neighborhood of 220 pounds per square inch. Such were the effects of hooping on the concrete during the first loading and it is easy to understand what they were afterward. Of the total deformation caused by the first load a permanent swelling remained, after unloading, sufficient to maintain an effective contact between the metal and the concrete, and the hoops showed their normal effect during the subsequent applications of pressure.

These considerations indicate an important difference between the action of hoops and longitudinal rods. In section I, it was seen that the rods are compressed by the shrinking of the concrete, that their effect is immediate and that they reach rapidly the elastic limit of the metal. For steel this limit is reached when the load has caused an average shortening of .06 per cent. of the length. The hoops compressed by the shrinking must, on the contrary, first return to the state of molecular equilibrium before they take any tension, and this tension only becomes important when the longitudinal shortening has reached values above 0.06 per cent. of length. *The hoops only begin to be seriously stressed under the*

first application of load in prisms hardened in the air when the longitudinal rods having already reached their elastic limit are almost at their ultimate strength and cannot offer any further resistance.

It is easy to understand why the action of the hoops extends through a wider range than that of the longitudinal rods. The elongation of the spirals is a result of the swelling of the concrete which is comparatively small and varies between 0.3 and 0.4 of the longitudinal shortening. The stress of the metal being proportional, within the elastic limit, to its deformation, it is evident that having begun later it grows much more slowly in the hoops than in the longitudinal rods. It has been shown, however, by numerous experiments that, while stressing the metal but little, the hoops produce a considerable useful effect. These considerations explain the very great deformations which hooped concrete can undergo without sustaining injury either to the metal or to the concrete.

Quite a different aspect would be presented by concrete hardened in water. Instead of contracting, the concrete will expand putting in tension the hoops and the longitudinal rods. The first will be stressed still higher by the application of load, while the second will first overcome their initial tension before taking compression.

It was seen that a first test load causes the hoops in concrete set in air to act effectively when loaded afterwards, giving thus to hooped concrete a higher coefficient of elasticity. It is probable that similar results will be obtained without previous loading by keeping the hooped pieces in water or moist air during a sufficient length of time before finally exposing them to the air. Numerous experiences show, indeed, that the shrinkage of concrete exposed too soon to the dry air and the sun causes inconveniences. Cracks are sometimes noticed, which, while of small importance are not ornamental, and the minute analysis of experiments on deformations has led the author to believe that the resistance and especially the coefficient of elasticity have somewhat decreased. It is certain that these inconveniences will be much reduced and possibly completely avoided by keeping the reinforced concrete in water or in moist places during several weeks before exposing it to the air and the sun. No doubt the change of humidity will also cause some shrinking, but it will be less and, what is very important, it will act on a body which has acquired much more strength and which will not crack. Instead of acting on a raw concrete, it will cause internal stresses whose effects can be computed and which will not decrease the elasticity, because within the elastic limit. A decrease in tension causes exactly the same effect as an increase in compression.

X. *Elasticity and Resistance of the Concrete in Hooped Members.*—To determine the effect of hooping, the elasticity and resistance of the same prism were measured first when hooped and then without the hoops. The latter tests have thus shown the properties which concrete retains after having been stressed in hooped members without having exceeded the limit set by the test load. Figure 1 is reprinted here and will well serve to illustrate these properties. The ordinates of the deformation curve A represent the resistances which the hooped concrete specimen has offered when the shortenings represented by the abscissas took place. Curve B indicates the resistances of the core left after the removal of the hooping. Curve C has for ordinates the differences of A and B and, hence, represents the increases in resistance which the hooping has given to the concrete. It is this curve whose practically uniform inclination has given the value $n=2.1$, which has been mentioned previously.

The phenomena illustrated by this diagram are quite different from those shown during the first application of load. It proves the predominating influence of the hooping on the concrete after the test load, while the influence of the concrete predominates before it. The direction of curvature which the curve shows up to a shortening of 0.074 per cent., which it has reached previously, corresponds well with the results found for prisms G, H, I, J discussed in section VIII. It is especially important to observe the form taken by curve B under heavy loads. Its inclination to the horizontal, which furnishes a measure of the coefficient of elasticity of the concrete proper, first increases until the coefficient reaches the value of 3,700,000 pounds for a pressure of 1,280 pounds per square inch; and then decreases very rapidly until it becomes zero for a pressure of 1,565 pounds per square inch. After having reached the latter value with a shortening of 0.095 per cent., the resistance offered by the concrete remained constant until crushing. It was not feasible to measure the shortening at the moment of rupture, but the last observations made on two opposite sides, long before the deformation had reached its limit, showed shortenings of 0.12 and 0.265 per cent., which were much exceeded before failure. This experiment proves directly that *the compressive resistance of concrete which has been hooped after having reached a certain greatest value, remains constant, at least within wide limits, notwithstanding the increase in deformation.*

Exactly the same phenomena is shown by concrete-steel in tension subjected to elongations exceeding its elastic limit. This has been proved many times and it is mentioned here in order to state the hitherto unknown similarity of the properties which concrete shows under different deformations. It should, however, be noted that a possible source of error may be contained in the above results. The core of the specimen after the removal of the spirals still contained the longitudinal reinforcing rods. To compute the resistance of the concrete the compressive resistance of the longitudinal rods for each shortening had to be subtracted from

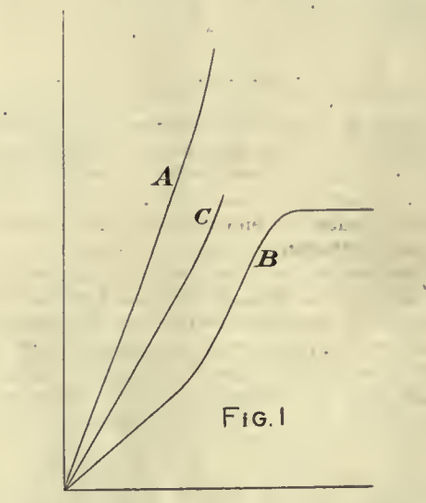


Fig. 1

the total pressure. As long as the metal was within the elastic limit no appreciable error could arise from assuming the resistance of the longitudinals to be equal to the product of their area by their coefficient of elasticity and by the amount of their shortening; but after exceeding the elastic limit the assumption was not exact. It was assumed that this pressure had a value of 100 pounds per square inch, the same as in similar specimens for which it has been measured. Whatever slight error may have been involved in the analysis of the above results, a very important fact was established. The total pressure on the prism was increased only from 70,100 to 73,850 pounds, while the average shortening increased from 0.109 per cent. to 0.194 per cent. of the length of the prism. It is thus seen that the sum of the resistances of the two materials was almost unchanged by the increase of the deformations and, since metal always shows some increase in resistance even when outside of the elastic limit, it is quite certain that the concrete did not gain in resistance during the considerable shortening of 0.194—0.109 = 0.085 per cent. The resistance of 1,565 pounds which the core inside of the hooped steel showed after the removal of the hooping following a first test load should be compared with the resistance of prisms of the same concrete without hooping, which had values of 832 to 1,170 pounds per square inch.

In the prism just discussed the preliminary compression, with the aid of the hooping, increased the resistance of the concrete by 50 per cent. This prism was the only one which gave such good results. The others failed, after removal of the hooping, without much shortening. This was due either to damaging the concrete when tearing off the spirals or to unequal bearing at the bases. But in such investigations a single positive fact is sufficient to illustrate the property of the material. It seems certain that this property of concrete must always produce its effects in hooped members, because numerous prisms experimented upon, without exception, stood great shortening without injury, which is essential to the development of this property.

XI. *Practical Rules for the Computation of Hooped Concrete Members.*—The considerations discussed in the preceding chapters covered the various points which had to be known to determine the values of the coefficient of elasticity and the compressive resistance of members reinforced by hoops and longitudinals. Only a small place was given to the elastic limit, as it may be raised at will to any amount desired, even to the compressive resistance, which is considerable. The value of the elastic limit is, therefore, not important for structures made of members subjected to test loads exceeding the working load. This method will be described in a following section; but for other structures the value of the elastic limit should receive attention.

The elastic limit of hooped members, as shown, under a first load evidently depends on that of the concrete, which is reached before that of the metal. It may be admitted that the shortening of the concrete is much increased under higher pressures and that, hence, the practical elastic limit is reached when the shortening attains 0.08 per cent. to 0.13 per cent., according to the character of the concrete. This will be assumed in the following. On the other hand, it will be prudent to neglect the fact, which appears from experiments, that the resistance shown by the concrete in hooped members exceeds by about 50 per cent. that of the same concrete not reinforced. For the same reason it will be well to neglect the other fact that the longitudinal rods undergo, before the crushing of the hooped members, considerable shortenings which are much greater than the elastic shortening of the metal and which, therefore, produce resistances much above the elastic limit. In members without reinforcement, on the contrary, the elastic limit can not be exceeded. We thus arrive at the following rules:

Coefficient of Elasticity. 1. For the first load, the coefficient of elasticity of a hooped member is equal to the sum of the coefficients

of the concrete, of the longitudinal rods, and of the imaginary longitudinals whose volume shall be assumed as 90 per cent. of the hoops, or spirals.

2. For pressures less than a previous test load, the coefficient of elasticity of a hooped member is equal to the sum of the coefficients of the concrete, as increased by the test load, of the existing longitudinal rods and of imaginary longitudinals whose volume shall be assumed as double that of the hooping, or spirals.

Elastic Limit. The elastic limit of a hooped member, for a first load, is equal to the natural elastic limit of the concrete increased by the resistance of the reinforcing as found for a shortening of 0.08 to 0.13 per cent. and computed on the basis indicated above for the coefficient of elasticity under a first load. Every load has the effect of making the final elastic limit practically equal to the pressure due to this load.

Compressive Resistance. The compressive resistance of a hooped member exceeds the sum of the following three elements:

1. Compressive resistance of the concrete without reinforcing.

2. Compressive resistance of the longitudinal rods stressed to their elastic limit.

3. Compressive resistance which would have been produced by the imaginary longitudinals at the elastic limit of the hooping metal, the volume of the imaginary longitudinals being taken as 2.4 times that of the hooping.

XII. *Column Resistance.*—It is not sufficient for a structural member in compression to have adequate crushing resistance, it must also offer resistance to lateral flexure. The well known formula of Euler gives the resistance N of a member whose coefficient of elasticity is E, length between "hinges" l and least radius of gyration r.

$$N = E\,\pi^2\,\frac{r^2}{l^2}$$

It is known that this formula is exact only for a very long member of little resistance and does not agree with results obtained on columns of dimensions met in practice. Experiments made on iron columns and reported by the author to the Congress on Methods of Construction, of 1889, and to the French Commission on Methods of Testing, of 1892, showed that Euler's formula is exact for iron columns of any dimensions if for the coefficient of elasticity that value is introduced which it has when the column is under flexure and not, as is usually done, the coefficient of elasticity corresponding to a light load. Such an interpretation of the Euler formula does not allow of a solution for N, because it contains a value of E which is itself a function of the unknown N. But the formula can be written in the form

$$\frac{r}{l} = \frac{1}{\pi}\sqrt{\frac{N}{E}}$$

and it can be used to determine the value which shall be given in the ratio $\frac{l}{r}$ in order that the column resistance shall have the value N. For this purpose it suffices to introduce any value N with its corresponding coefficient of elasticity. Tables giving the resistances for different ratios $\frac{l}{r}$ can thus be made.

The application of the Euler formula to concrete requires additional careful considerations. The formula is based on the assumption that a loaded column has an indefinitely small curvature and that it is in equilibrium under the action of the pressures which pass through the centers of gravity of its bases. This means that there is equilibrium between the moment of resistance due to the bending and the bending moment caused by the load, which is equal to the product of this load by the deflection. The moment of resistance consists of two components. One is represented by the sum of the increases in pressure caused in the fibers nearest to the center of curvature by the increase of their shortening. The other is given by the sum of the decreases in pressure of the fibers on the opposite side whose shortenings are relieved by the bending. The coefficient of elasticity of the column is for one component the coefficient of the material under a first load, if the column has never been loaded before, and for the other component the coefficient for a decreasing load. We have thus two coefficients of elasticity while Euler's formula contains only one. It was shown in section VIII that these two coefficients are almost equal under light loads, and that their values continue to diverge as the loads increase until the difference becomes very great when the elastic limit is exceeded.

If the ratio of the smaller to the greater of these two coefficients be denoted by m and the distance from the neutral axis to the extreme fiber having the less coefficient of elasticity by x, and the total depth of the section be taken as unity, the following equation is obtained by making the two components of the couple equal $m\,x^2 = (1 - x)^2$. Whence $x = \frac{1}{1 + \sqrt{m}}$. The distance between the two forces of the couple being always ⅔, independent of the value of x, their moment is proportional to either of them. It results from this formula, using the same highest value for the coefficient of elasticity, for m = 1.0, 0.50, 0.25 and 0.09, that the moments are proportional to 1.0, 0.68, 0.44 and 0.21, respectively. When m is near to unity the average value of the coefficients E can be introduced in Euler's formula.

By plotting the results of the experiments on prisms G, H and I, given in section VIII, it is seen that for the pressure of 3,270 pounds per square inch the coefficient of elasticity varied between 2,850,000 and 3,570,000 pounds, under the first loading, and between 5,690,000 and 7,110,000 pounds during the unloading. If in the above formula the lowest values of these coefficients be introduced, which have a ratio of 0.50, the value of E found by this method to be put in Euler's formula for a resistance N = 3,270 pounds per square inch is E = 3,900,000 pounds. The value 0.0091 is thus determined for $\frac{r}{l}$. For cylindrical members this value of $\frac{r}{l}$ corresponds to l = 27 diameters. In other words, in order that a concrete column should have under a first load a column resistance of 3,270 pounds per square inch the length of the column, center to center of "hinges," must not exceed 27 diameters. Higher values than 3,270 pounds can be obtained under the first load only by appreciably reducing the length of the column since above this value the coefficient of elasticity rapidly decreases. It should, however, be remembered that the resistance also increases rapidly with a decrease in length, it being proportional to the square of $\frac{r}{l}$

Much higher resistances can be found for members which have been preliminarily subjected to a sufficient test load. Thus for a load of 6,400 pounds per square inch an average coefficient of elasticity exceeding 4,830,000 pounds can be expected, and the Euler formula shows that to obtain the above high value the greatest length of column must not exceed 22 diameters. Hinged columns are really seldom met in practice and the lengths of the columns could therefore somewhat exceed the limits named. Concluding, it may be said that it is not the fear of flexure which makes it inadvisable to use for hooped concrete 3,270 pounds for the first load and 6,400 pounds per square inch after preliminary test loads. It is self-evident that as these pressures represent the upper limit of values, a margin of safety should be left for the working loads.

(To be continued.)

Growth of Massachusetts Institute of Technology.

Registration of students at the Massachusetts Institute of Technology has increased from 1,187 to 1,606 within three years. Although a portion of this increase has been due to the fact that during and after 1903 the requirements for admission will be extended, nevertheless it is practically certain that the number of students at the Institute will continue to increase at a rapid rate.

Early in 1902 it was decided to erect two new buildings at the present site, one for the Department of Electrical Engineering and the other as a memorial to General Francis A. Walker. This latter building was to be arranged and equipped solely with a view to improving the physical and social life of the student body. Plans for these buildings were being drawn when it became evident that the incoming freshman class was so much larger than usual that the existing buildings would not meet the requirements until the building proposed for the Department of Electrical Engineering could be erected. This, together with the fact that the Institute had recently been the recipient of several acres of valuable land a short distance from the crowded portion of the city, raised the question of removal.

The present location in the heart of Boston affords comparatively no room for extension. As a result of the rapid growth of the school the question arose whether the Institute must shape its future so that the growth will be limited to its present quarters, or whether a new site, still in close touch with the industrial life of the city, shall be chosen where room will be obtained for expansion along present lines. Until this question could be settled it appeared advisable to abandon for the time being the two proposed buildings just mentioned, and to erect at once a temporary structure that would afford relief for a few years. Accordingly work was begun July 1, 1902, and within sixty days the building was ready for the furniture, etc. The structure is called the Augustus Lowell Electrical Engineering Building, is one story high and has a floor area of 43,000 square feet. Among the forty-seven rooms in the building the power house is the largest, being 42 by 324 feet. This power house will be used largely for tests on various electrical machines. It is provided with a traveling crane which can move throughout its length and is connected to the adjoining lecture hall with tracks so that heavy apparatus may be taken from the power house for the use of lectures. On either side of the power house are offices, recitation rooms, lecture halls and laboratories. The building is unique in that it has practically no windows, but is lighted almost entirely by skylights of the saw-tooth variety.

Large Shipbuilding Yards, it is reported, are to be built at Detroit by the Great Lakes Engineering Works. The plant will include four shipbuilding berths, 600 feet long, and two slips for the side launching of vessels, each 600 feet long, one of which will be 125 feet wide and 14 feet deep, and the other 150 feet wide and 30 feet deep. There will also be a floating dry dock large enough to accommodate any vessel on the lakes.

The Electrolysis Ordinance of Atlantic City.

The City Council of Atlantic City, N. J., recently passed an ordinance stating that "any company or individual operating a street railway within the limits of the city, shall, on or before February 1st, 1903, take adequate measures to completely prevent injury to water mains, service pipes and other metallic structures on account of electrolysis, and shall file with the water department of said city, details of the plans adopted to accomplish this result. In the case of new lines of track, such plans shall be filed before construction is commenced. In no case will bonding to the water mains or other conductors, not provided for the express purpose, be allowed in order to equalize the potential between such conductor and the rail, but means must be taken by furnishing and insulating a complete metallic circuit both inside and outside of city limits, to effectually prevent leakage of current from the wires or rails of the railway. The company or individual operating the street railway may select the particular method of securing this protection and will be held responsible only for the result."

Section 2 of the ordinance states "that any company or individual operating a street railway within the limits of the city shall so confine its current to the metallic return circuit which it shall provide, as to comply with the following conditions: (a) The maximum difference in potential between any part of the metallic return circuit and any water or service pipe, or other metal conductor not intended as a part of such return circuit, shall not at any time exceed ¼ volt. (b) The difference in potential between any two points upon said metallic return circuit within a distance of 200 feet from each other, shall not at any time exceed ¼ volt. (c) The current passing along any water or service pipes or other metallic conductor not intended as a part of said return circuit shall not, at any given time and point, exceed one ampere."

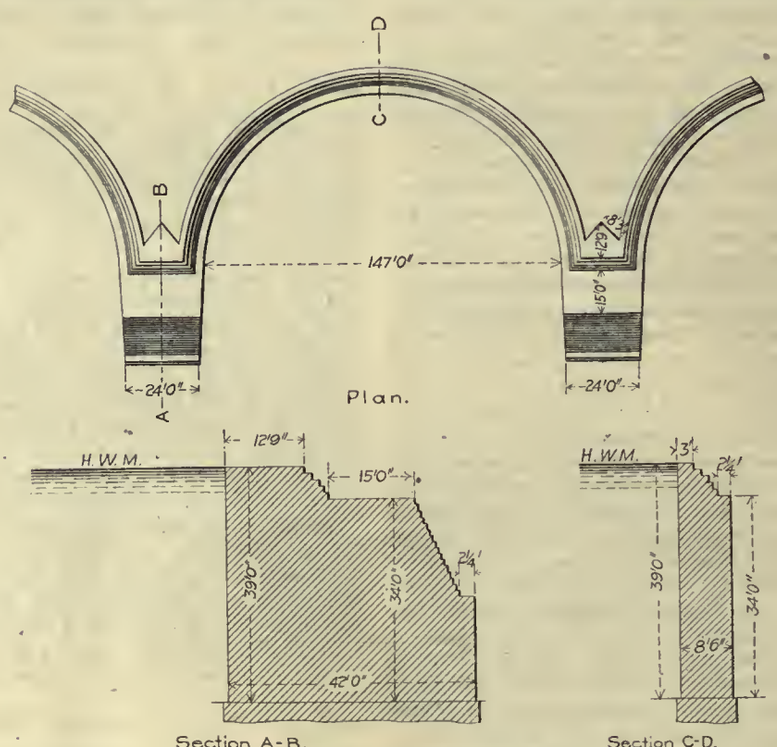
Section 3 provides for inspections in February and August of each year to determine whether the ordinance is being complied with, these inspections to be conducted by an expert to be agreed upon by the railway and the engineer and superintendent of the water department. On failure to agree on an expert, the test is to be made by the city electrician. Section 4 states that failure to effectually remedy without delay the cause of any electrolytic damage constitutes a violation of the ordinance, and the company is to be held subject to damages amounting to the cost to the water department of discovering and repairing the injury.

In Section 5 it is further ordained "that any company or individual who violates the terms of this ordinance, or refuses to comply therewith, shall, upon conviction of said violation, failure, neglect or refusal to comply, be subject to a fine of not less than $50 and not more than $200 and the costs of prosecution; and such company or individual shall be deemed guilty of a separate and distinct offense for every day during which such company or individual violates, falls, neglects or refuses to comply with any or all of the requirements of this ordinance. And the payment of such penalty shall in no way release the said corporation or individual from obligation to make compensation in full for damage done, heretofore or hereafter, to water or service pipes or other metallic conductors by reason of the escape of electric currents from the wires or other appurtenances of the railway."

Mr. Kenneth Allen, the engineer and superintendent of the water department, states that it was not deemed best to prescribe the means to be adopted in order to prevent electrolysis, but to frame the ordinance so as to place the responsibility for the result entirely with the railway company; and the requirements are sufficiently severe to enable the city to demand the adoption of the double trolley system should dangerous electrolytic action not be otherwise eliminated. The ordinance was prepared in anticipation of the construction of a new trolley road, the franchise for which has just been granted, but it applies as well to the lines now in operation.

An Unusual Arched Dam.

A masonry dam of very unusual design was described some time ago in "Indian Engineering." The body of water impounded by the dam is known as the Meer Allum Lake, from which the water supply of the city of Hyderabad, India, is drawn. The structure is built in the form of a large arch, and this large arch itself consists of twenty-one smaller arches or scallops, transmitting the water pressure to solid masonry buttresses. It is stated that the dam was constructed about 1800, and it appears to have been built as a sort of religious offering, being paid for out of prize money obtained in war.



Details of One Arch, Meer Allum Dam.

The area of the lake is stated to be 1.4 square miles, with a contour of about 8 miles and a capacity of about 2,222,000,000 gallons. The greatest depth of water found by soundings is nearly 50 feet. The catchment area of the basin is hilly and undulating and fairly well covered with jungle. The main feeder of the lake takes its rise from the River Esee, and is about eight miles in length.

The dam is roughly half a mile in length, and the twenty-one arches composing it range all the way from 70 to 147 feet in length of span. The largest of these arches, which is at about the center of the dam, is shown in the accompanying cut. It is seen that the dam is built with walls vertical on both faces, the down-stream face being rapidly stepped out near the top so as to attain the maximum thickness of 8 feet 6 inches within a few feet. A waste weir is provided at one end of the dam, but it is stated that during heavy rains, when the lake is full, the water for a depth of one or two inches flows over the crest of the whole dam, thus adding greatly to the natural beauty of the scene.

Difficult Tunnel Repairs.

An interesting method of executing repair work was recently adopted in the Cornallaz Tunnel between Grandvaux and Chexbres on the railroad from Lousanne to Berne. The tunnel has a circular masonry lining about 26 feet in diameter. On the second of May last a portion of the roof arch, about 35 feet long, fell and a considerable amount of the rock above caved into the tunnel, obstructing it with large stones and gravel for a distance of about 45 feet. About 33 feet beyond each end of the obstruction a hole was cut in the crown of the uninjured arch and from these points drifts were run in a vertical plane through the axis of the tunnel at an inclination of 20 or 30 degrees from the horizontal. These drifts were timbered and when they met the cavity from which the material had fallen into the tunnel they were driven with great care under poling boards with very heavy supports until they finally met at a summit over the center of the cavity and about 44 feet above track level.

Timbering and excavating was then very carefully continued down on both sides of the drifts until the pocket from which the material had fallen into the tunnel was thoroughly enclosed and the timbering well braced across and to the solid rock. The spoil was then removed from the tunnel, centers was set in it and the arch rebuilt; traffic being resumed in the tunnel after an interruption of 53 days. The new arch masonry was covered with Portland cement plaster, tarred plates and rubble masonry and the remaining cavities above the roof were grouted. All work was directed by Mr. M. Fougerolle and was described in the "Schweizerische Bauzeitung."

Lehigh University has a new four-story building in course of construction for the departments of Mechanical Engineering, Mining Engineering, and Geology. The area will be 186x70 feet.

Some Features of Irrigation.

By Wm. O. Webber.

The writer recently was called upon to investigate an important irrigation scheme in southwestern Colorado and found so much misinformation prevalent as to the possibilities and the practical side of the subject that it has seemed to him worth while to call attention in a general way to some of these features, especially as there is a strong movement at present to induce congress to vote government aid to these projects. It is true that the office of hydrography of the United States Geological Survey, Department of the Interior, has for some time been making very careful investigations into the flow of streams all over the country, and has prepared very elaborate tables for converting the flow of streams into acre feet per day, available for irrigation purposes. This work has been thoroughly done, and is invaluable. It is also true that the United States Department of Agriculture, through the office of experiment stations, has published a great deal of data of the greatest importance regarding the use of water in irrigation and the duty to be obtained from water in different localities, all of which is of the greatest importance; but it still remains a fact that most of the irrigation schemes which are presented to Eastern capitalists demand and require special investigation in connection with the particular problem under consideration.

The most important of all of the items to be considered in this connection is that of available water supply. It would seem imperative that this question of available water supply should be thoroughly understood before works are designed or contracts entered into for the sale or rental of water. Many prominent engineers have reckoned without this definite knowledge, and have built or designed works that have been much too large, and have had to reduce the section of their conduits after construction was started. It is absolutely necessary that a compilation of records of the rainfall and run-off should be carried out through a sufficient length of time to establish the relation between the maximum, mean and minimum years of precipitation and run-off. Owing to the great lengths of time needed to form accurate estimates on this subject, it is often neglected entirely, and there is much yet to be learned as to the topographical influence on the amounts of precipitation, evaporation and run-off. Considering first the subject of rainfall; most of the government stations for the observation and measurement of rainfall are situated in locations of comparatively moderate elevation, and at such stations the precipitation is generally less than at greater elevations, which would seem to be on the safe side, and that more rain might be expected at the higher elevation where head ditches and reservoirs would be established, but at the same time this conservative data would often preclude construction which might be practically possible if more data in regard to the rainfall, or higher elevations was available. It is a well known fact in general that the amount of rain increases with the elevations above the sea level up to a maximum plane above which a decrease takes place, and empirical formulæ have been deduced for determining such propositions. These formulæ however, must be modified very largely by the topography of the country in question, and the exposure towards prevailing winds. The elevation at which the maximum rainfall is precipitated, is, according to the observed law of decrease in temperature, at that point at which the prevailing winds are cooled to just below their dew point. Very few stations have been established at these very high elevations. Most of those stations are in charge of private observers, who do not keep continuous records, and unless absolutely continuous records are kept for a series of years, the data obtained is of comparatively small value.

To show how much difference there may be due to elevation, it might perhaps be stated that the average rainfall, together with the elevation, is as stated below for the following points in Colorado:

	Elevation.	Average rainfall.
Fort Garland	7,937 feet	12.74 inches per annum
Fort Lewis	8,500 "	17.10 " "
Ruby 10,000	"	27.26 " "
Pikes Peak 14,134	"	28.65 " "
Summit 11,300	"	29.00 " "

It does not show, however, that this average precipitation will occur each year, because at Ruby, in 1898, the rainfall was 17 inches, and in 1900, 17.86 inches, while in 1899 it was 44.97 inches. Again at Rico, elevation 8,758 feet, average rainfall is 29.58 inches, and at Telluride, elevation 8,756 feet, average rainfall is 28.17 inches, and again at Telluride in 1901 the rainfall was only 19.06 inches. At Breckinredge, normal precipitation is 29.86, while in 1898 it was only 16.29 inches. Hence, it follows conclusively that elevation alone does not mean large precipitation continuously.

We now come to the next important question, which is that of run-off, or the proportion of rainfall which finally finds its way into the streams. In those sections of country where the streams are largely fed from the melting snow, precipitated high up on the mountain slopes from 10,000 to 14,000 feet above the level of the sea, the months of greatest run-off are May, June and July, especially if the water sheds have a southern or southwestern exposure, and as these months cover the period when irrigation is most demanded for growing crops, the run-off then taking place is thus immediately available for that purpose, but all storage water or water to be held in reservoirs for additional irrigation in those months must come from the average run-off of the preceding months. To illustrate, for instance, take the mean discharge of the San Miguel River; the average of the May, June and July run-off for the years 1896, '97, '98 and '99 was at the rate of 1.458 cubic feet per second per square mile. On June 16, 1897, however, there was found a flow of 3.05 cubic feet per second per square mile, and this may be safely taken as the maximum discharge per square mile of any stream in that vicinity. The average of the remaining months in the year would, however, only give us about one-third of a cubic foot per second per square mile available for storage purposes, and from this must be deducted all losses for leakage, seepage and evaporation. Again in a dry year it is possible that even this amount would not be available, and as low as 0.2 cubic foot per second per square mile might be all that could be depended upon for storage purposes.

The next most important question is that of duty, that is, the number of acres of irrigable land, for which one acre of drainage area will supply irrigation water. Here again there are great discrepancies, varying with the class of crop, nature of soil, method of irrigation and in fact so many different conditions that no rule can be laid down. It varies all the way from fifty acres per cubic foot of water per second for peaches in Arizona to 250 and even 300 acres for sugar beets in California, and even for the same crop there are great variations. Take sugar beets, for instance, at 75 acres in Arizona, 96 acres in New Mexico, and 190 in Utah; oats, 74½ acres in Idaho and 150 acres in Montana.

We now come to the subject of storage reservoirs. The few storage reservoirs the writer has examined personally have impressed him with the fact that the engineering work in the construction of the dams, waste gates and overflows represented an extraordinarily low type of engineering and slip-shod methods. These dams are many of them much higher at one end than the other, with little or no riprapping on the water side. The waste gates are almost always too small, and the overflows, or waste weirs, most shabbily constructed, or practically not constructed at all. Here at least one would expect to find first-class engineering work, and one can hardly contemplate with equanimity what would happen if the water ever reached the crest of the dam.

Another subject of grave criticism, from an engineering point of view, is that of ditches. Most of the head ditches are constructed upon gradients which an Eastern engineer would never deem possible. Gradients all the way from 8 to 12 feet to the mile are quite common. The side slopes of the ditches are often one on one, or one and one-half on one. This makes cheap original construction, but the result, of course, is inevitable. The lower laterals are frequently badly silted up and often worthless. Breaks in the upper ditches are of common occurrence, and where one or two washouts have occurred, at or near the head of a ravine, conditions are soon produced which make it next to impossible to ever repair that section of the ditch, so that it will ultimately be safe. Heavy drops are often made in the head ditches with practically no protection at all from erosion and wear, and the writer himself has seen sections of ditches just above a drop of this kind where, with a ditch 10 feet wide, the sides were perpendicular for 20 feet, and cave-ins were of frequent occurrence.

The construction of head gates and flumes along partly precarious sections was of equally poor workmanship, and it is at least startling to an Eastern hydraulic engineer that such construction could in any way be considered permanent work. There is no question in the writer's mind but that vast sums of money have been spent in this manner from which no adequate return can ever be expected, for the reason that after a few years such construction destroys itself and becomes worthless, and almost precludes the adoption of proper engineering methods to rectify the mistakes originally made.

Eastern capitalists should be warned to be pretty careful about investing in Western irrigation schemes which are partially developed and constructed. It would be oftentimes better to put the money into entirely new propositions, rather than to attempt to reconstruct a poorly-planned and worthlessly-constructed scheme already partially developed. In any event the most careful and painstaking investigation should be made by thoroughly competent hydraulic engineers who know what good hydraulic engineering means, and who cannot be led astray by the fact that haste excuses many things, but rarely poor engineering.

An Expenditure of $20,000,000 by the Federal Government for good roads throughout the country is proposed in a bill recently introduced in the House of Representatives by Mr. W. P. Brownlow, of Tennessee. As the government appropriates money for improving the navigable waterways of the country there is no reason why roads should not be improved by Federal appropriations, provided provision is made for equitably dividing the money between the different States and for spending the money to good advantage. The bill provides for the creation of a Bureau of Public Roads of the Department of Agriculture.

The Adelaide-Port Darwin (Australia) Transcontinental Railway.

The North Australian League has issued from its headquarters at 452 Collins Street, Melbourne, a circular calling attention to an act passed by the South Australian Parliament and approved November 13, 1902. This act provides for the construction of about 1,063 miles of 3-foot 6-inch gauge, single-track railway between Oodnadatta in the State of South Australia and Pine Creek in the Northern Territory. The line constructed between these two termini will complete the Adelaide and Port Darwin Transcontinental Railway. The act also provides for the maintenance and operation of the railroad until the government exercises its right of purchase as stipulated. Some of the provisions of the most important clauses of the act, as abstracted below, will give an idea of the nature and requirements of the work.

The act requires that within three months of its passage the Commissioner of Railways shall call for tenders by advertisement in the "Government Gazette" and in the public papers of Australia, Great Britain, America, France and Germany. All proposals to be sent to the Commissioner of Railways, at Adelaide, not later than eighteen months from the date of the passage of the bill. Each proposal shall stipulate:

(1) The quantity of land required by the tenderer for the construction of each mile of railway.

(2) The number of miles undertaken to be constructed in each year from each of the termini—Oodnadatta and Pine Creek.

(3) The time within which the tenderer undertakes to complete the construction of the line.

(4) Such other particulars as the Commissioner shall set out in the specifications.

Each bidder shall deposit with his proposal the sum of £10,000 to be absolutely forfeited if, in the event of his tender being accepted, he should fail to carry out the work. On the acceptance of the proposal the amount of the deposit shall be increased to £50,000 and will be held by the Commissioner for security for the performance of the contract. No proposal shall be accepted which requires more than 75,000 acres for each mile of railway. The general idea of the bill is that the railroad line will be constructed by one contractor, but one of the clauses is so framed as to enable the government to accept more than one proposal, in order that parties may tender for such portion of the line as they choose. Working drawings are to be deposited with the engineer-in-chief and to be approved by the Commissioner in writing before construction can be proceeded with. The line is to be completed in 8 years. Not less than 200 miles is to be constructed within the first two years after the signing of the contract, and not less than 100 miles in any year thereafter.

The contractor will be required to run a train once a week the whole length of the line and to carry passengers and freight at a speed of not less than 20 miles an hour. There are clauses providing for the regulation of rates of charges for transportation, for the forfeiture of the deposit and of the railroad, but not of the lands, in case the contractor fails to fulfil his obligations, and for regulating the amount and disposition of the land to be granted to the contractor. Upon the opening of the railway the deposit of £50,000 shall be refunded, and during the interim it shall bear interest at 3 per cent. per annum. It is stipulated that the government shall have the right to purchase the railway at any time after its completion at a price to be fixed by arbitration. The rails to be used are to weigh not less than 60 pounds per yard.

Various reports, some of them containing preliminary plans of possible locations for portions of the road, are available for those proposing to make tenders for the construction of the railway, and the North Australian League stands ready to assist bona fide tenderers in securing information and statistics and in the investigation of local conditions. To this end the following persons have been authorized to act for the League: Mr. G. R. M'Minn, C.E., chairman of League, (formerly senior government surveyor and acting-government resident in the Northern Territory, surveyor in command of the Central Australian section of survey of the overland telegraph construction); the Hon. V. L. Solomon, M.H.R., for South Australia in the Commonwealth Parliament, vice-chairman of League; Mr. Dugald Little, Hon. Treasurer, and Mr. J. J. Rendle, M.A.I.M.E., secretary, (joint author, with Mr. G. R. M'Minn, of report on "The Northern Territory, with Some Account of the Position Port Darwin will eventually hold when the Trans-Australian Railway is completed.")

Specifications may be seen and forms of tender obtained at the office of the Agent-General for South Australia in London, copies of which have been forwarded by the foreign consuls in Australia to their respective governments for public information in the countries they represent. The tender is open to the whole world.

Losses From Irrigation Ditches in California.

In the report of Irrigation Investigations of the United States Department of Agriculture, just published as bulletin No. 119 of the Office of Experiment Stations, there are some interesting papers.

Professor Hilgard, of the University of California, gives the results of 14 years' study of the water problems of the Santa Ana valley in southern California. In this valley water is scarce and exceedingly valuable. The right to a single inch sells for $1,250, and irrigated orange lands have sold for $1,800 an acre. He shows that the gravel deposits of the river where it leaves the mountains act as a regulator, the water sinking into the débris, where it is stored up without expense for dams or losses from evaporation. This water feeds the artesian wells below, and as the number of wells is increased the pressure and flow is diminished, the final result, however, being a considerable gain in the water obtained. The recent decision of the State Supreme Court in the case of Katz vs. Walkinshaw, limiting the right of a land owner to take percolating water from his own land, has given the subject of interdependence of underground supplies new interest.

The report of Prof. Hilgard is supplemented by one made by Mr. Wm. Irvine, engineer of the Gage Canal, giving the duty of water in the Santa Ana valley and some conditions which influence it. An interesting feature of this report is the illustrations of the canal, measuring boxes, and methods of distributing water. Nowhere in this country if in the world is water used with greater economy and skill than in this section. The main canal and many of the distributing laterals are cemented and in some cases pipes are used. Water is delivered to the different tracts from hydrants and carefully measured over weirs. The canal was operated at first without cementing, but the losses from seepage and growth of vegetation in the banks and bottoms reduced its capacity so much that only one-fourth of the calculated volume could be carried through it. Since cementing the loss is only about 1 per cent. The plans and specifications for this work are given so that engineers may understand clearly its character. The expense of cementing a channel 7 feet wide on the bottom, 15 feet on top, and 4 feet deep was 75 cents per linear foot.

Irrigation in central California is covered by a report by Mr. A. E. Chandler. Mr. Chandler made measurements in canals which were not cemented, and in some cases the losses from seepage were as great as those in the canal in southern California before its improvement. On the Vandalia Ditch 92 per cent. of a discharge of 16 cubic feet per second was lost in a distance of two miles. He estimates that some canals on which the losses are large could be cemented for a cost of between $4,000 and $5,000 per mile, and that the value of the water lost in a single season in some sections has been 28 per cent. more than the cost of this work. The products of irrigation in this section have a high value. Under the Pioneer Canal the orange crop was worth $137 per acre; on one orchard under the Pleasant Valley Ditch, $107 an acre. On this orchard water was sparingly used, so that the value of the crop grown with an acre-foot of water was $63.79. This report may be obtained by applying to the Director of the Office of Experiment Stations, U. S. Department of Agriculture, Washington, D. C.

A $300,000 Private Train was the Christmas gift made to King Edward VII. by the London & Northwestern Railway. This train is luxurious in the furnishings of its cars, and includes a locomotive built from special designs. It will be used only for members of the royal family.

The Wages of Street Railway Employes in Malaga, Spain, during 1901, are described by Consul Benjamin H. Ridgely in "Commercial Relations of the United States" substantially as follows: Drivers were paid about 32½ cents and conductors 38 cents per day and no extra pay for long hours. During the summer the men were compelled to work from 16 to 18 hours on a stretch. They struck in August for an increase of 6 cents per day and a decrease of the working time to 12 hours. These figures seem the more pitiful when it is considered that meat in Malaga costs about twice as much as it does in the average American city, and that coal, coffee, tea, sugar and the other necessities of life are also much dearer.

A Slow Sand Filtration Plant is to be built for Washington, D. C. As advertised in another column of The Engineering Record, sealed proposals for the construction of the filters, pure water reservoir and appurtenances, and for furnishing the filtering materials and Portland cement will be received until January 28. The contract will not include the sand-washing apparatus, regulator houses and fixtures above the substructures, the track system and the pumping station and appurtenances. The projected plant will consist of 29 filters having a net area of about one acre each. Twenty-four complete filters and the foundation embankments for five additional filters are to be built first, but the completion of filters 25 to 29 may be ordered before the termination of the contract. The excavating plant must be capable of handling at least 6,000 cubic yards per day and on no account is the average rate of excavation for any month to fall below 3,000 cubic yards. The cast-iron pipes and special castings shall conform to the standards adopted by the New England Water-Works Association. About 135,000 barrels of Portland cement will be required.

Rotary Pumps.

Condensed from a paper presented by John T. Wilkin before the American Society of Mechanical Engineers.

The development and commercial use of rotary pumps kept pace with the other types until about thirty or forty years ago, when they became quite unpopular, largely due to the fact that they were misapplied, and because the manufacturers undertook to produce them too cheaply in order to compete with centrifugal pumps, making the contact surfaces of the impellers unfinished castings. The misapplication was in using small capacity machines for high pressures, resulting in a large per cent. of leakage and developing weakness of construction.

The author, after a careful study and analysis of different forms including those which were on the market at the time, decided, about ten years ago, that a rotary pump having two similar impellers, the contours of which were formed by complete epi and hypo-cycloids, would make a machine which would give excellent results if properly constructed and applied.

He has proceeded with a belief that a rotary pump is a good device for moving large volumes of fluids at low or moderate pressures, and has avoided using steam on high pressure work. This form was selected for the following reasons: The outlines of the impellers are mathematically correct, hence the clearance can be made uniform. The shape admits of a strong casting in a single piece, thus avoiding internal fastenings or joints. The impellers revolve freely in their cylinders, hence there is no internal friction, packing, nor necessity for lubrication. The minor axis of the impeller is large enough to permit the use of a shaft of ample diameter, leaving sufficient metal for a good hub, and at the same time giving a relatively high capacity to a machine having a given distance between the shaft centers. There is no sudden change of work on these impellers nor in the pump as a whole. There is no tendency to form enclosed pockets between the impellers in which the fluid would be compressed, causing unnecessary work.

It is a remarkable fact that all of the principal rotary pumps on the market at that time were so arranged that there were two or more points of contact between the impellers in certain portions of the revolution, thus forming compression spaces, the same as in the case of a pair of gears used as a pump. This reduction of volumes when the pump is used for liquids is very destructive in its effect, and was recognized by certain designers, who provided grooves in the end plates connecting these spaces with the suction side of the pump, thus relieving to some extent the shock.

The displacement per revolution of a two-lobe cycloidal pump is exactly the volume of the cylinder in which the impeller revolves, or, in other words, the area of a two-lobe cycloidal impeller is one-half the area of the circumscribed circle. This fact makes it possible for this form to be used as a meter, the displacement of which can be very accurately determined.

The discharge from the pump is continuous but not uniform. One of the errors which has been committed in connection with rotary pumps is that their manufacturers have claimed the discharge to be uniform. The minimum work of the pump occurs when the impellers are at right angles to each other, as in this position one impeller is balanced and the opposite one is at its point of maximum work. The position of maximum combined work of the two impellers is when their major axes are parallel to each other and at angles of 45 degrees to the line of centers.

The area which each impeller presents to the working pressure is variable, as is also the direction of the resultant pressure, the maximum area of the impeller being exposed to the full difference of pressure, under which the machine is working, when the major axis of the impeller is parallel to the line of shaft centers. The points of contact with the cylinder and with the other impeller are on the center line at this point, and the impeller is in a balanced position doing no effective work, so that in this position the total load due to the pressure, plus the weight of the moving parts, is downward or at right angles to the line of centers. As the impeller leaves this position the direction of pressure and the exposed area vary until the impeller reaches a position at right angles to the line of centers, where it has its maximum unbalanced area exposed, and also where it undergoes a change in direction of pressure, due to the passing from suction to the discharge, of the inclosed volume of fluid between it and the cylinder.

In designing rotary pumps one of the principal problems to be solved is the proper provision for supporting the impellers. They are supported by their shafts resting in journal bearings separated from the cylinders by stuffing boxes; hence, the problem is a modification of the beam supported at the ends and carrying a load varying in intensity and direction, the load being distributed over a portion of its length. This problem can hardly be solved by any other method than experience, but when properly solved the rotary pump has proven itself to be an excellent device for moving large volumes of fluids against moderate pressures. The designer of rotary pumps is not compelled to consider a multiplicity of valves, ports, etc., such as is met with in the design of reciprocating machinery, nor does he have the problem of velocities, centrifugal force, fluid friction, accurate balancing, etc., as encountered in designing centrifugal machines.

The author has up to this time used the word pump in its broader sense, but in considering the uses of rotary pumps the machines used for elastic fluids should be discussed apart from those used for liquids. The action of a rotary pump or blower as an air compressor is practically the same as the action of a duplex, crank-and-fly-wheel, double-acting, piston compressor which has mechanically operated valves opening and closing at the beginning and end of the stroke, assuming the piston machine to have no clearance spaces. There is, therefore, no gradual compressing of air in a rotary machine, and the unbalanced areas of the impellers are working against the full difference of pressure at all times. The possible efficiency of such a machine under ordinary temperature and conditions of atmosphere, assuming no mechanical friction, leakage, nor radiation of heat or compression, would be as follows:

Compression to	1	pound gauge	pressure	97½ per cent.
"	" 2	"	"	95½ "
"	" 3	"	"	93 3/10 "
"	" 4	"	"	91 7/10 "
"	" 5	"	"	90 "
"	" 10	"	"	82 7/10 "
"	" 15	"	"	76 7/10 "

He considers a rotary machine of this type out of place when working in elastic fluids at more than 5 pounds difference of pressure. The proper application of rotary positive machines when operating in air or gas under differences of pressures from 8 ounces to 5 pounds is where constant quantities of fluid are required to be delivered against a variable resistance, or where a constant pressure is required and the volume is variable. These are the requirements of gas works, pneumatic-tube transmission (both the vacuum and pressure systems), foundry cupolas, smelting furnaces, knobbling fires, sand blast, burning of fuel oil, conveying granular substances, the operation of many kinds of metallurgical furnaces, etc.

The efficiency of a rotary pump depends on the size, the speed at which it is operated, the pressure under which it is working, and its construction, while the capacity varies as the square of the diameter of the cylinders, or distance between gear centers, and directly with the length of the impellers and cylinders. The principal leakage lines are the contact lines between the impellers and between the impellers and cylinders, as the impellers can be fitted quite closely at their ends. It is obvious, therefore, that in a large machine the per cent. of slip due to the working pressure and the clearance is less than in a small one. For example, one blower has a capacity of 12½ cubic feet per revolution, its shaft centers are 16 inches apart and its impellers, 48 inches long; another has dimensions just twice these and its capacity is 100 cubic feet per revolution, or eight times as great. If we assume the machines to have the same clearances and running under the same speed and pressures, then the per cent. of slip in the larger machines would be only one-fourth that of the smaller, because the leakage lines are twice as long in the larger machine and its capacity is eight times the smaller one.

Since the leakage lines are exposed to the working pressure at all portions of the revolution, the slip is practically constant for a given pressure whether the machine be running fast or standing still. This argues for as high a speed for a blower as is consistent with successful mechanical operation, because the loss due to air friction is inconsiderable if the inlet and discharge are made large. For water, however, questions of velocities are very important, and the speed should be reduced. The theoretical weight of a cubic foot of air at one pound above atmosphere and at a temperature of 62 degrees Fahr. at sea level is 0.076 pound. The height of a column of air of equal density necessary to produce a pressure of one pound per square inch would be 1,895 feet. If $V = \sqrt{2gH} = 8.02\sqrt{H}$, then the theoretical flow at the base of the column would be 8.02 times the square root of 1,895, or 349 feet per second, and for small differences we assume that the velocity varies as the square root of the pressure. Therefore, doubling the pressure doubles the load, and increases the slippage to 1.41 times what it was at the original pressure. He has found the above assumptions concerning the slippage in rotary blowers to be practically correct, after having tested hundreds of them by closing the discharge and counting the number of revolutions of slippage at different pressures.

An interesting experience was had with two pumps, each to have a capacity of 25,000 gallons per minute, lifted 31 feet, coupled direct to a Corliss engine, running at about 67 revolutions per minute, designed with two air chambers on the discharge and two on the suction side of the pumps, as near as possible to the impellers, the air chambers having connections to the pumps 7 inches in diameter. They would run smoothly up to 50 revolutions per minute, at which speed a powerful water hammer occurred. An indicator to the discharge side of the pump, 18 feet below the upper water level, showed that the pressure there varied from 5 to 6 pounds vacuum to 30 or 40 pounds pressure. The action of the suction side was similar except that the vacuum was about 12 pounds and the pressure rose slightly above atmospheric pressure. By the addition of more chambers the pumps were operated at a speed of 85 to 90 revolutions per minute.

Since then the author has made pumps having capacities of 35,000, 40,000, and 50,000 gallons per minute, which are operating under heads of from 8 to 25 feet, and have had no trouble from water hammer. He has taken many indicator cards from engines operating rotary pumps, and finds the combined efficiency of the pump and engine to be from 80 to 84 per cent.

Motor Driving of Machine Tools.

At a recent meeting of the New York Electrical Society, a paper was read by Mr. Charles Day on the requirements of machine tool operation with special reference to the motor drive. Aside from an extended, though general, reference in a graphical way to the various common systems of electric machine driving, the paper is an argument against the hasty advocacy of electric transmission of power for this purpose without a study of all other conditions that exist in that connection. His point is that it is so easy to become interested in a given detail—the motor drive, for example—that its true position in the general scheme of factory management and operation is entirely lost sight of. He lays much emphasis upon the importance of a knowledge of the cutting speeds which different brands of tool steel will permit, of the size of cuts that various machines will pull, of the feeds that are or should be used and so on. In his opinion the most inefficient part of most shops is the machine equipment, and until the user of this apparatus realizes this point and demands machines designed along correct lines, the desired results will not be reached. He has found the feeds on the average drill press ridiculously low and the power supplied and rigidity of the frame on machines using multiple cutters out of all proportions to the work they should be able to absorb at the cut.

The motor, he says, is an equally poor investment if, after its introduction, the shop is run along the same old lines, and for this reason an understanding of its possibilities is most essential. He refers to the motor on individual tools, where such use is advised. The accompanying chart was made to show at a glance the different methods on the market for motor-driving machines, and his opinions in that connection are substantially as follows:

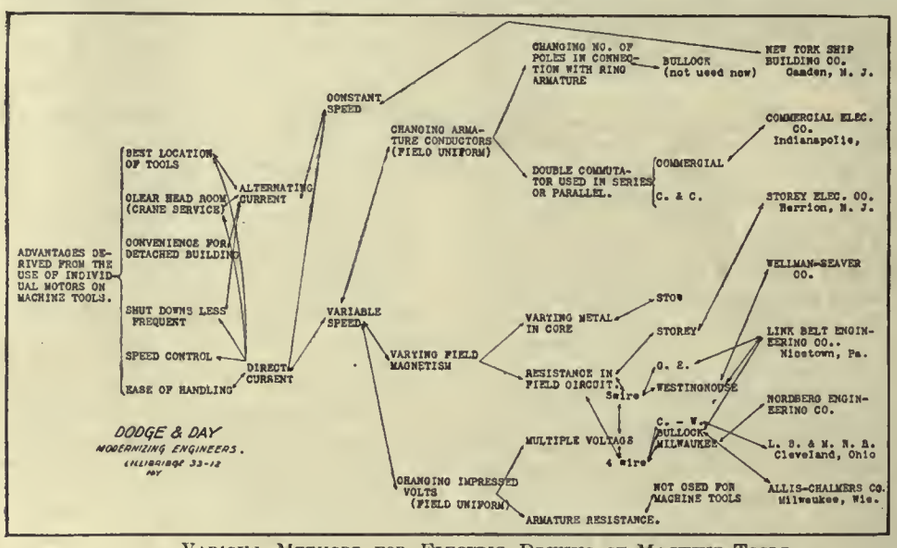
The constant speed motor, particularly of the alternating type, though simple in character, lacks two great essentials, ease of handling and speed regulation, and all attempts to supply these shortcomings by mechanical means have so far proved unsatisfactory. The induction motor is a source of power, just as the line shaft, and the principal advantages resulting from its use are clear overhead room, independent location and possibly a saving in power.

With regard to the variable speed type of motors, he showed the accompanying diagram of the schemes of voltages adopted by manufacturers of multiple-voltage apparatus, one sketch showing a three-wire system and the other two four-wire systems, the voltages being arranged in geometrical and arithmetical progression respectively. In the first instance but two voltages are used, while in the latter cases six are possible. He continued on this subject as follows:

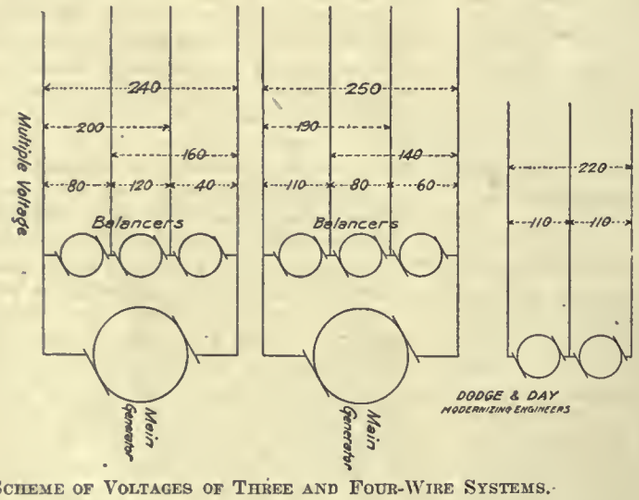
Intermediate speeds are obtained by inserting resistance in the field, 100 per cent. variation being necessary in the three-wire systems, as compared with 30 per cent. in the four-wire. In either case the horse power that the motor can develop satisfactorily is directly proportional to the voltage.

A comparison of the underlying principles of these systems is shown by the accompanying chart of horse power curves for the different systems. It is interesting to note the relative sizes of motors required to obtain a given range, but in this connection we must not form a hasty conclusion, as the cost for a given horse power depends upon the system adopted. That is, with the three-wire scheme there may be a variation in speed of 150 per cent. by field weakening alone, a special field winding being necessary. The satisfactory operation of these systems can only be ascertained after experience with the apparatus in the shop, so we can readily see how many considerations must be looked into before a final decision as to their relative merits can be reached.

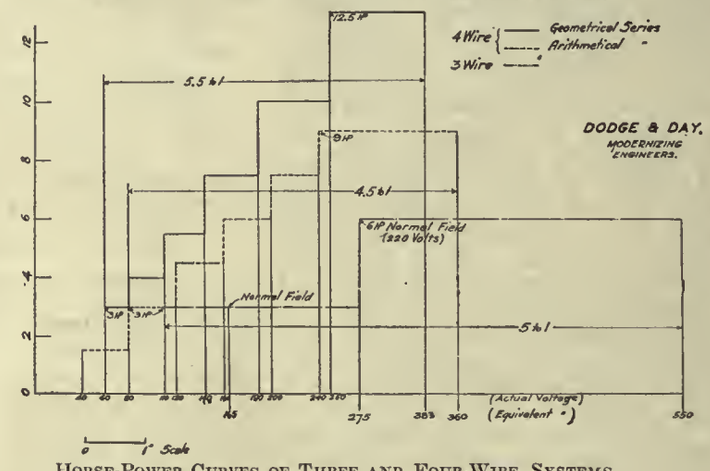
In a desirable system, standard motors should be utilized, the controller operated by a single handle, and the entire range of speeds passed over while the work continues. The range of motor speeds is a most important factor, as the first cost of the motor, the cost of the installation and the efficiency of the outfit are all dependent upon it. It is impossible to lay down any fixed rules to base our discussion on, as each machine is a different problem, and must be treated as such. For general machine shop work the author has found that a range of 4 to 1 to 6 to 1 adapts itself to all conditions fairly well, but in every case where old tools are being equipped we must be satisfied with a compromise.



Various Methods for Electric Driving of Machine Tools.



Scheme of Voltages of Three and Four-Wire Systems.



Horse-Power Curves of Three and Four-Wire Systems.

Two German Electrical Companies, the Allgemeine Elektricitäts Gesellschaft and the Union Elektricitäts Gesellschaft, are reported to have combined. The capital of the former is given as $22,125,000 and of the latter as $85,000,000.

The Fiftieth Annual Meeting of the American Society of Civil Engineers will be held at the Society House, 220 West Fifty-seventh Street, New York, on January 21 and 22. There will be the usual annual reports of the Board of Direction and of special committees, and the ballots for officers for the ensuing year will be canvassed. In connection with this meeting there will be excursions to visit portions of the Rapid Transit subway under construction in New York City, the Blackwell's Island Bridge, the masonry piers of which are now being built, the new piers and bulkhead structures of the North German Lloyd Steamship Company at Hoboken, and the filtration and pumping plant of the East Jersey Water Company, at Little Falls, N. J.

Letters to the Editor.

The editor is pleased to receive letters discussing current engineering matters, whether suggested by articles appearing in these columns or otherwise, or narrating interesting experiences and observations. Such of these communications as are deemed suitable and of sufficient value for our readers will be published from time to time. It is our purpose to have the pages of The Engineering Record always open to intelligent and purposeful discussions of live engineering questions. We do not and cannot, however, assume responsibility for the opinions and statements of our correspondents.

AMERICAN AND EUROPEAN WATER WHEELS.

Sir: As pertinent to the subject of the relative merits of the American and European wheels, I beg to offer the following brief observations:

The term "American" has been applied to that particular type of wheel which has been developed in this country, designed originally to take the place of the over-shot and breast wheels operating under heads of 20 feet or less, in which a prominent feature of the design is the obtaining of a larger amount of power for a given diameter than has been obtained by any other design, and consequently a higher speed for a given amount of power under a given head.

Some 25 years ago the Holyoke Water Company built a flume and appliances for testing water wheels and offered to test wheels for manufacturers or purchasers at a very nominal cost. Taking advantage of these facilities, several different water wheel manufacturers in the United States tested the different sizes of wheels and by the "cut and try" method perfected a line of wheels from 1 to 6 feet in diameter and developing power under 20 feet head of various amounts up to 1,000 horse power or thereabouts, of a very high degree of efficiency.

Each manufacturer, following the American custom in machine manufacture, standardized the parts of these wheels, and making each size always the same was able to turn out wheels in large numbers at a much lower price than could have been done by any other method. These wheels are well adapted for furnishing the motive power for the ordinary factory, or for any other purposes where the speed and power of a standard size wheel, or the union of two or more wheels on one shaft can be adapted to the use required. This type of wheel taking water at right angles to the shaft and discharging in a line with the shaft and to a greater or less extent both outward and inward, that is, at right angles to the shaft in both directions is distinctively American in its design and manufacture. Having been built up by experiment, it does not lend itself readily to any considerable change of diameter in proportion to the power developed, and for that reason, when a head of any considerable height is to be developed, and particularly if it is desired to couple electric generators to the same shaft carrying the water wheel, the speed being therefore fixed, it is usually necessary to use a simpler type of wheel. These simpler types are often called European. By that term, we are giving to the European engineer and manufacturer credit that does not entirely belong to them. Of these simpler types, the inward discharge turbine, which is used perhaps more than any other type, particularly when the water wheel is mounted on a horizontal shaft, is commonly called the "Francis" turbine. It takes this name from the late Mr. James B. Francis of Lowell, who developed that type of wheel from the wooden wheel of similar form, which had formerly been used in Europe.

In connection with the Jonval or downward discharge type, great credit is due to the late Mr. Emil Geyelin, of Philadelphia, for his work in its development. Wheels designed by him more than forty years ago are now in operation at Cohoes and elsewhere. Of the Fourneyron or outward discharge type, there are no better examples than some now in use in New England. Good work has been done in America in the development of water wheels of all types. Unfortunately, however, after the American manufacturers were started in the manufacture of a stock wheel, they, for the most part, determined that an engineer was a useless expense, and had better be replaced by a traveling salesman.

Endeavoring to get into communication with any person or corporation contemplating the development of water power, before anything had been done, the first duty of the agent has been to persuade the prospective purchaser that his own particular brand of water wheel was the only one, and next, that the employment of an engineer would be folly, explaining that he, the manufacturer, knew more about such matters than any engineer, his real idea being that, forsooth, the engineer may desire something that is inconvenient for him to manufacture. In the effort to push the sale of their wares, American manufacturers of water wheels, who had no engineer in their employ have often undertaken the design of entire water power developments when they had not sufficient talent on their staff to properly design the water wheels,—with the result which should have been expected.

The European manufacturer, on the other hand, has been accustomed to design each water wheel for the service for which it was intended, and now that we are undertaking in America the use of heads and pressures higher than those formerly used, and find it necessary for the purposes of operating electric machinery to have the water wheels built to develop a certain power and run at a certain speed, and in other ways, to adapt themselves to a general plan instead of having every other part of the plant adapted to the water wheel, we find in Europe, engineers and manufacturers prepared to intelligently undertake the design of such wheels, whereas, in America, there are very few engineers who have had sufficient experience.

When the American manufacturer learns that the building of a water wheel for special purposes is an engineering problem, and not a question of the best salesman, there is no reason why as good water wheels for special purposes should not be produced in America as in Europe, but very few American manufacturers have reached that stage as yet.

Truly yours,
WALLACE C. JOHNSON.

Niagara Falls, N. Y., Dec. 24, 1902.

THE TWO-HINGED ARCH.

Sir: In Mr. Edward Godfrey's article on the two-hinged arch, printed in your issue of December 27, 1902, he criticises the assumptions made in order to obtain approximate horizontal thrusts in an earlier article by the undersigned, because the deflections of the sections incidentally obtained "failed to balance." He did not consider that the sections obtained from these assumptions were not used again and had nothing to do with the final sections; whereas the approximate horizontal thrusts obtained by these assumptions were very close to the real thrusts. Long application has shown the assumptions give very close results, even on the first approximation, and so justifies their use in practice.

Most truly,
ALEX. RICE MCKIM.

New York, Jan. 3, 1903.

Laying Out Streets.

The Street Commissioner of Worcester, Mass., has recently been empowered to compel the observance of the ordinances relating to the laying out of streets. These ordinances are as follows:

"Section 1. Whenever any street or way shall be opened over any private land by the owners, lessees or occupants thereof, and dedicated to or permitted to be used by the public before the width, location and grade of the same shall have been first approved by the mayor and board of aldermen, as required by law, the street commissioner shall forthwith permanently and effectually bar all entrances from such streets or ways to and upon all public ways, streets and highways.

"Section 2. Whoever, whether owner, lessee or occupant, shall open any street or way over any private land before the width, location and grade of the same shall have been approved by the mayor and board of aldermen, shall be liable to a penalty of not less than one nor more than twenty dollars."

The penalty imposed hardly seems adequate when one considers the perpetual expense and inconvenience which are brought upon a city in its corporate capacity and upon the citizens individually by poorly laid-out streets. Especially is this true in a city having many steep hills, as is the case in Worcester. In many instances in this city, streets have been laid out to ascend the hills directly, with consequent excessive grades, which become impassable in icy weather and are continually eroded by the flow of storm water. In addition to these very utilitarian considerations, the ugliness of such a treatment of hilly topography is very noticeable. Much more pleasing effects, greater ease and pleasure in travel and superior economy in maintenance can be secured by developing the streets on the steeper acclivities so as to secure more reasonable grades and give to the building sites greater advantages for the enjoyment of broad and pleasing outlooks. In commendable contrast with the straight line treatment of some of Worcester's hill districts may be placed the very attractive results attained in Newton, Brookline and other suburbs of Boston as well as in other municipalities. The first cost of the more artistic and intelligent method of laying out streets may be greater, for it requires the services of engineers skilful in this line of work, but the ultimate economy, it seems to us, must be greater, while the esthetic merits of this method so evidently excel those of the other that it is difficult to understand why intelligent persons should fail to take advantage of them.

The Annual Meeting of the New England Water Works Association will be held in Boston on Wednesday, Jan. 14, at Hotel Brunswick. President Frank E. Merrill will present an address, and reports will be made by officers and committees. Tellers appointed to canvass ballots will report on the election of officers. Mr. E. H. Gowing will read a paper entitled "How I Reduce Pressure on a Gravity System," and Mr. Leonard Metcalf will describe the Echo Lake dam at Milford, Mass. The special committees on "Apportionment of Charges for Private Fire Protection, and the Means of Controlling the Supply Thereto," and on "Uniform Statistics" will present reports.

Heating in the Lion House, Bronx Park, New York.

Some 260 acres of the southeastern part of Bronx Park, in New York City, are in charge of the Zoological Society of that city, and comprise about 60 different series of buildings, cages and ranges. It was the original intention to heat all of the menagerie buildings by steam from a central heating station, but it was decided that a more uniform and satisfactory service could be secured for the particular cases presented in each building through the use of independent hot-water heating apparatus in each, and the first plan was discarded. Accordingly a low-pressure heating system of this character has been installed in the Lion house, as in the Reptile and Monkey houses already in use.

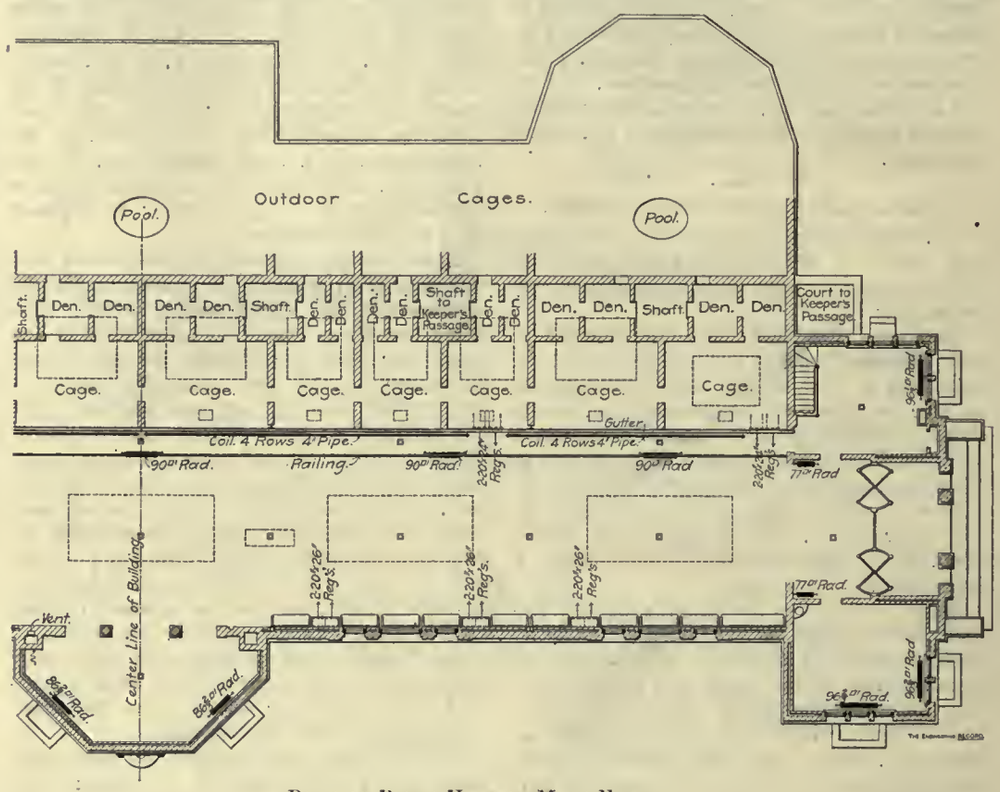
The material of the building is pressed brick with terra cotta and stone trimmings all of colors to match its predecessors. Following the general scheme adopted, the design of the trimmings is an index of the use of the house. Lions' heads are the prevailing feature of the terra cotta cornices; the stone pediments over the main entrances at either end will be carved with full figure reliefs of lions and lionesses; and at either side of the approaches there will be sentinel lions seated on their haunches. The planning of the building is the outcome of protracted research during which time noted structures of its class both in this country and abroad were visited to learn their desirable features. As a result it is claimed that this will be the best equipped building for such a purpose in existence.

The building includes one story and a basement, the general plan being rectangular. Through the center of the main floor extends the visitors' hall, flanked on one side by the animals' cages, which are elevated about three feet above the main floor level, and at the center of the opposite side by an alcove where photographs of the lions will be on sale. Along the alcove side of the hall a platform has been built on which settees are placed, where persons desiring to watch the animals for an extended time may sit with their view unobstructed by people passing between them and the cages. At each of the four corners of the building there is a smaller room. On the cage side there is one for the preparation of food, and at the other end of the same side a room in which artists will be enabled to make studies from the animals without the distracting presence of sight-seers. A special cage on one side of the artists' room will have walls of plate glass protected by iron bars to admit the greatest amount of light. The end rooms of the other side will constitute an office and a curator's room.

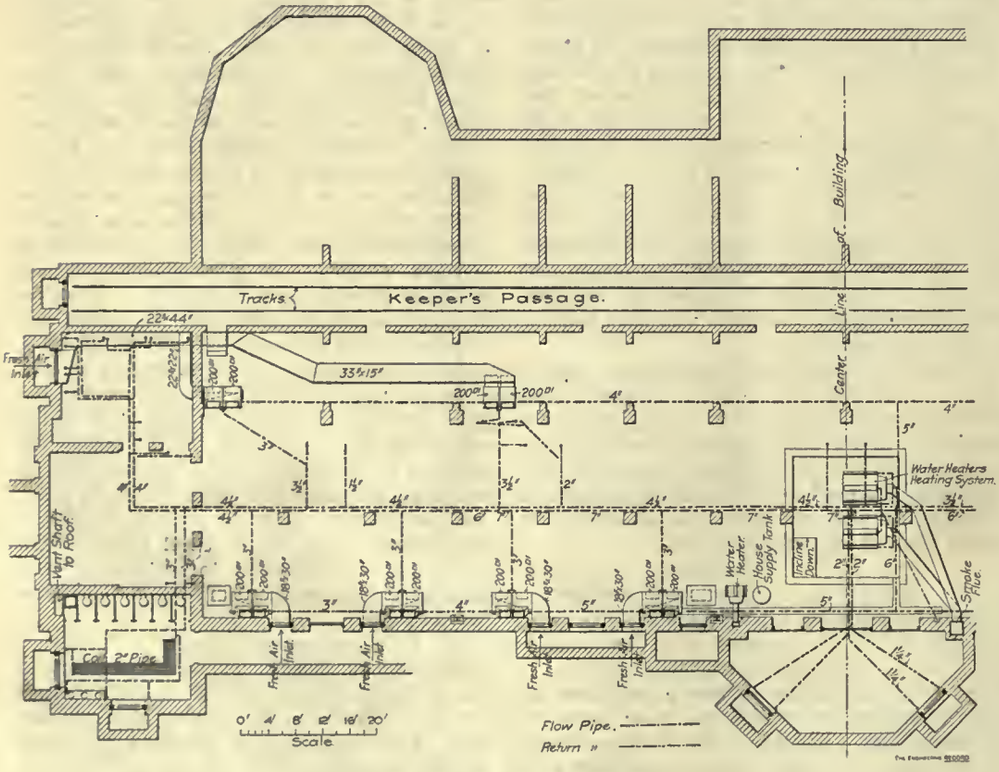
The indoor cages are twelve in number, six being of double size for two animals. The walls are of brick with the exception of the front, which are steel wire gratings of 3-inch mesh supported on a frame of angle and T-iron. At the rear of each cage are two small sleeping dens, one of which communicates with the corresponding outdoor cage. All of the doors are operated by chains in the keeper's passage in the basement except the front cage doors, which are only opened to admit an attendant when the cage is empty.

Food for the animals is conveyed to the cages from the preparation room by a car running on a track along the front of the cages. The cage floors are of 1x3-inch maple set on edge and inclined so as to drain into a gutter along the front. Taps with hot and cold water are placed between alternate pairs of cages and may be used for flushing out the drainage gutter. The outdoor cages occupy a space resembling a large piazza. They are divided by walls into nine separate cages, one large double one at each end and one in the middle, with three smaller individual cages in each intermediate section. Screens like that on the front of the indoor cages surround the outside, and iron doors in the brick partitions furnish intercommunication. The floors are of cement, and each of the large cages, which accommodate the occupants of two double inside cages, contains a recessed cement bathing basin.

The scheme for moving the animals from one cage to another or bringing new ones in from the outside is ingenious. Running the entire length of the basement beneath the sleeping dens is a keepers' passage with an outdoor court at one end and an open space or shaft leading from it between the dens of each successive pair of cages. Along the passage way are tracks on which a car carrying a moving-cage travels. This cage is equipped with an elevating contrivance so that it may be raised in the court to the ground level to receive the new arrival. After the lion is transferred from its traveling box to the car cage the latter is lowered and rolled to the shaft adjoining the permanent cage in which it is to be placed. Again the car is elevated, and when close up against the den wall both doors are opened by chains for the animal to pass into the den.

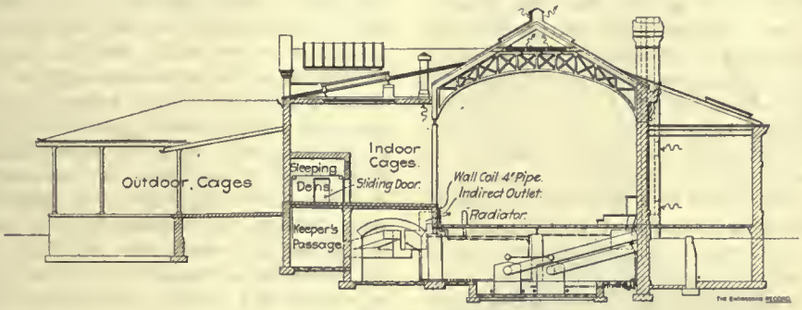


Plan of Right Half of Main Floor.



Plan of Left Half of Basement.

The heating of the building is accomplished by both direct and indirect radiation with the open expansion tank method of circulation. The principal use of the indirects is to secure a natural circulation of air for ventilation. Two hot-water heaters of the Royal sectional type, manufactured by the Hart & Crouse Company, of Utica, N. Y., are located in a pit near the center of the basement. The grate surface of each amounts to 12 square feet, and the heating surface to 350 square feet. Together they supply a total of 7,312 square feet of radiation, of which 1,942 square feet is in the form of direct radiators, 782 square feet in coils of 4-inch wrought iron pipe on the main floor, 188 square feet in 2-inch pipe-coils in the basement, and 4,400 square feet in indirect stacks.



TRANSVERSE SECTIONAL ELEVATION.

Independent smoke connections 15 inches in diameter and of No. 14 galvanized iron lead from each heater to the chimney which rises at one side of the alcove bay. The corresponding flue at the other side serves as a ventilating shaft for the photograph room. Each heater has an automatic damper regulator with connections operating the draft door and cold air check.

The heaters are cross-connected and feed into two large mains leading in opposite directions lengthwise of the basement at about its middle line. The whole is so arranged with valves that either heater, or either of the main circuits can be cut off without interfering with the proper operation of the system. The flow pipes are erected on a grade away from the heaters of about 1 inch rise in 10 feet run; the size of pipes being indicated on the plans. Branches from the mains supply the stacks at the bases of the indirect flues and the pipe coils on the ceilings of the two toilets at the ends of the basement. Other branches lead to risers supplying the pipe coils and radiators on the main floor. The expansion tank is situated over a girder near the center of the building and under the peak of the roof, and has a capacity of 200 gallons. It is provided with a 3-inch overflow pipe discharging on the roof and a ⅜-inch tell-tale overflow venting over the drain in the boiler pit to indicate to the fireman when the tank is full. The return piping from radiators and coils follows the same general lines as the supply, but that for the indirects is run in two separate lines along the walls. All three return mains unite at their middle points in the return to the heater.

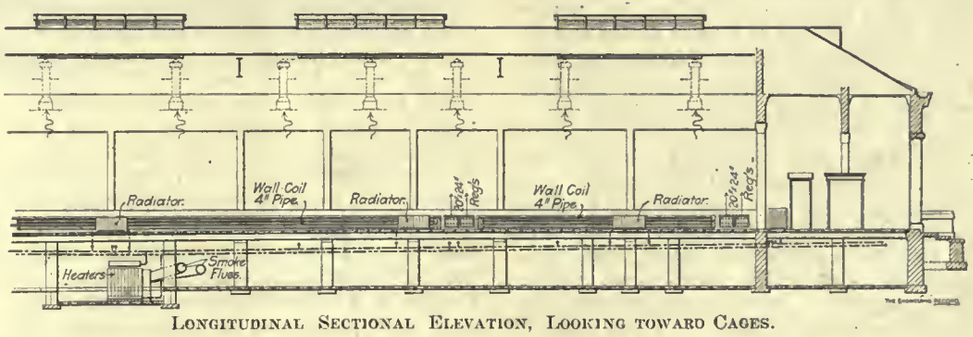
The pipe and duct runs are confined to the basement so that no unsightly piping is exposed in the public portion. The basement and main floor plans here given show but one half of the building in each case, the two halves being practically symmetrical. The elevation sections, transverse and longitudinal, are given mainly to show the ventilation. The indirect flues for the supply of the cage side of the main floor are in two systems, each receiving its fresh air through a screened inlet at the nearer end of the building. The stacks have 200 square feet of surface each and are placed in pairs discharging into the large room through two adjoining vertical registers beneath the cage. The registers are of bronze metal, each having an opening 20x24 inches in area, and are set in boxes of No. 26 galvanized iron.

The air for the cages is received through the open fronts and escapes through ventilating registers in the ceilings, thence out through short flues with ventilator caps above the roof. The opposite side of the first floor is supplied by seven pairs of registers, each having an opening of 20x26 inches. These are placed in the front faces of boxes made of bronze plates ½ inch in thickness. The plates are fastened together at the corners with 1½-inch angle iron and the tops are covered with slabs of Tennessee marble. The boxes are double, each receiving heated air from two stacks, which also have a surface of 200 square feet each. The air for each pair is taken through an adjacent window in the basement. All air inlets are protected with galvanized hoods and screens of ½-inch mesh. The amount of air admitted is limited by a hand-operated damper. The ducts throughout are of galvanized iron No. 22 gauge, and the stack casings of No. 20. The foul air from the main room passes out through slatted openings beneath the skylight in the ridge of the roof. The regulation is obtained by swinging glass doors hung underneath the skylight and controlled by hand.

The additional heating of the main story beyond that supplied in connection with the ventilation is furnished by radiators distributed as indicated on the plan and by wall coils consisting of four rows of 4-inch pipe. These coils are hung beneath the cage fronts and occupy all of the space between the registers in the face of the cage platform. At a distance of 4 feet out from the cages a line of five flue radiators is placed under the guard railing and two more are set at the sides of each entrance vestibule. The heating apparatus has been proportioned with a view to heating the several locations to the following temperatures in zero weather: the public space to 60 degrees, the feed and store rooms to 50 degrees, and all other rooms to 70 degrees Fahrenheit. It was further required that the water is to circulate at a temperature never to exceed 200 degrees in the flow pipes of the heater. To automatically maintain this uniformity of water temperature and thereby a uniform atmosphere temperature throughout, the Johnson system of thermostatic regulation has been installed.

The house supply of hot water is furnished from a separate heater also located in the basement, having 2¼ square feet of grate surface and 45 square feet of heating surface. The smoke flue is 8 inches in diameter, and connects to a chimney rising beside the ventilation flue from the photograph room. A closed tank of 200 gallons capacity is situated beside the heater, and is connected by a pipe with two house tanks in the roof space. The tanks are 2 feet deep, 5 feet long and 2 feet wide, are framed with wood and lined with 10-ounce copper. The whole system has a guaranteed capacity of 80 gallons of water per hour heated to a temperature of 180 degrees Fahrenheit.

The building is the design of Messrs. Heins & La Farge, of New York. Mr. H. de B. Parsons, also of New York, was the consulting engineer, from whose plans the heating apparatus was erected by Messrs. Baker, Smith & Company. Mr. William T. Hornaday, director of the New York Zoological Gardens, and Mr. Martin Schenck, chief engineer of parks, represented the commissioner of parks in supervising the work during the course of its erection.



LONGITUDINAL SECTIONAL ELEVATION, LOOKING TOWARD CAGES.

An Old 36-inch Sewer in Conover Street, Brooklyn, N. Y., which was built before the first sewerage system for the city was designed is now to be replaced by an 18-inch pipe. The need for this is shown by the fact that fourteen patches have been made on it in a single block within the past two years.

The Immensity of Street Car Traffic in New York City is pretty well brought out by a statement made recently by Mr. Oren Root, assistant manager of the Interurban Street Railway Company. It is well known that the greatest number of cars that can travel on main lines is limited by the number which can be gotten across the busiest cross street lines. For the Broadway lines the most congested intersection is at Broadway, Sixth Avenue and Thirty-fourth street, where two north and south and one crosstown line intersect in a triangle. Records show that during the busy hours 1,150 cars pass this corner hourly, making an average of 19 cars per minute. The busiest double track intersection is at the corner of Fourth Avenue and Twenty-third Street, where 900 cars per hour, or 15 cars per minute pass.

The Granite Sea Wall built by the Santa Fe Railway Company to aid in the reclamation of China Basin, a portion of the harbor of San Francisco, recently settled into the bay, out of sight. According to the San Francisco papers a similar accident happened some time ago, and the reports state that the wall was founded upon mud, which was forced up on either side, destroying the timber approach of an adjacent ferry slip, and causing the subsidence of about an acre of reclaimed land.

New Books Received.

A New System of Heavy Goods Transport on Common Roads. By Bramah Joseph Diplock. New York: Longmans, Green & Co. 116 pages, illustrated. Price, $2 net.

The Art of Illumination. By Louis Bell, Ph.D. New York: McGraw Publishing Company. 339 pages, illustrated. Price, $2.50.

Book Notes.

The Earth in Relation to the Preservation and Destruction of Contagia. By George Vivian Poore, M.D., F.R.C.P., New York: Longmans, Green & Co. 257 pages. Price, $1.75.

Dr. Poore is a professor of the principles and practice of medicine, University College. London, and the present work is a collection of his Milroy lectures delivered at the Royal College of Physicians in 1899, to which have been added several papers on such topics as the sanitation of camps, the collection of rain water, the pollution of water supplies, milk, and dietetics. The author treats of soil in its relation to various diseases, such as tetanus, anthrax. diarrhœa, dysentery, plague, malaria and typhoid fever, but it is chiefly in connection with the subject of sewage disposal and water pollution that the book will have an interest for the engineer and on this subject it will interest rather than instruct. Dr. Poore is an enthusiastic believer in the purifying power of the soil and his motto seems to be that "agriculture is the corner-stone of preventive medicine." The safest and most rapid method of rendering sewage innocuous, he maintains, is by admixture with earth. He is emphatic in his denunciation of the practice of mixing excreta with water, and is apparently out of sympathy with the modern trend towards the water-carriage system even when accompanied by some method of purification. He favors ground water in preference to surface supplies and gives many facts to prove their safety if properly protected and their danger if exposed to contamination. His remarks upon the pollution of ground water near the surface through channels made by earth-worms are most interesting, especially when he seeks to connect this fact with the seasonal distribution of typhoid fever. He argues that during dry weather earth-worms burrow to greater depths and that in the autumn vegetation demands less water, and hence the opportunities for downward percolation of polluted water into wells are increased. He claims absolute safety for ground water taken from below the zone of earth-worms and roots, and suitably protected for a distance of 5 to 8 feet down from the surface. Judged critically, the book may be considered aa one which stimulates, rather than feeds; which asks questions rather than answers them; and which contains the earnest pleadings of an advocate rather than the impartial judgment of an authority.

Malarial Fever, Its Cause, Prevention and Treatment. By Ronald Ross, F.R.C.S., D.P.H., F.R.S. Ninth Edition. New York: Longmans, Green & Co. 68 pages, illustrated. Price, 75 cents.

This book was published originally by the Liverpool School of Tropical Medicine, under the title "Instructions for the Prevention of Malarial Fever." The author is a well recognized authority on the subject and needs no introduction to the public. The book, though small,—it has only 68 pages, 5½ by 8½ inches —contains the essence of the modern theory of malaria transmission. It is written entirely for the individual and gives "full details for the use of travelers, sportsmen, soldiers and residents in malarious places." Its four chapters treat of Malaria, Mosquitoes, Prevention and Treatment. The book is concise and practical, and is a valuable addition to the library of any engineer whose work carries him into malarial districts.

The Sea-Coast; Destruction, Littoral Drift and Protection. By W. H. Wheeler, M. Inst. C. E. New York: Longmans, Green & Co. 361 pages. Illustrated. Price, $5.

This book is largely made up from papers which the author has published or read before the Institution of Civil Engineers and other bodies on the different subjects covered by the book. These have been brought together and extended, much material being added which was not available at the time the original papers were prepared. The works described are practically all located on the shores of England and the countries on the opposite side of the English Channel. The book would have had a greater value if the author could have included descriptions of works constructed in other portions of the world, but even in its present form it will be a great help to any engineer studying the subject of sea-coast protection. In Chapter I. the author describes the general geological and tidal conditions which bear upon the subject of the destruction of the sea shore and the principles which are to be followed in designing works of coast defense, giving many illustrations. In the second chapter he takes up the form of various kinds of waves, stating the difference between the wind waves and tidal waves and the methods by which they act upon the shore, giving many illustrations of the tremendous power exerted by these waves when striking the shore, the depth at which the waves act and experiments which have been made to determine their force. In the third chapter is described the littoral drift, or the movement of gravel and other material drifted along the shore by the waves and currents, the sources from which such material is derived and the extent of the deposits made by it in various places, including in detail many of the more important shingle banks and their formations; also the reasons why the drift prevails in one direction at one point and in a different direction at another. In the fourth chapter, the styles of sea-walls which have been built at various places to protect the shore and prevent its wearing away, and the action of the sea upon the different forms are treated. From these are deduced what the author considers to be the best form of wall for this purpose, and after describing the effect which walls have on the beach by directing the force of the waves, he gives the rules which should be followed in designing walls so far as strength is concerned, and also the various materials used for building. In Chapter V. he gives the forms of walls which have been constructed at various places, describing the method of construction and the effect which their construction has had upon the beach. The larger number of the walls described are on the English coast, but some are on the French and Dutch coasts. Chapter VI. is devoted to groynes, or short spurs, built out across the shore, generally at right angles to the trend of the beach, and at the end of the chapter are conclusions as to their efficiency based upon examination of the principal works of this character along the coasts of England, Belgium and Holland. Chapter VII. is devoted to a description of the south, east and west coasts of England and the changes which have taken place there due to the action of the sea, the works which have been built to protect the shore and the effect on the shore which the erection of these structures has had. The last chapter gives descriptions of the same subjects on the coasts of France, Belgium and Holland. The book has a very full index. In general it appears to be a complete description of the works which have been built along the English, French and Dutch coasts and an analysis of the natural forces which are there working.

The How and Why of Electricity. By Charles Tripler Child. New York: Electrical Review Publishing Company. 127 pages, illustrated. Price, $1.

The little book clearly fulfils the purpose as stated by its author in the preface to be as follows: "It is not the purpose of this book to tell what electricity is, for the writer does not know, but to tell something of its properties, of how it is generated, handled, controlled, measured, and set to work, and to explain how familiar electrical apparatus operates. If this object is attained, or if it makes plain to anybody who wishes to know about these things, the points concerning which he seeks information, it will have accomplished its purpose." "The How and Why of Electricity" is designed primarily for the non-technical reader and the happy faculty possessed by Mr. Child for stating technical and scientific matters so as to be clearly and readily comprehended by the layman is in evidence throughout the book and makes the presentation interesting to the professional reader. The twenty-three chapters, each bearing upon a different phase of the subject, are short, clear and directly to the point. The book is well printed and provided with a number of illustrative line cuts. The proceeds from the sale of the book will go, in large measure, to the family of the deceased.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual meeting January 21st and 22nd in New York. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Convention at Albany, N. Y., February 17th, 18th and 19th. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 357 South 4th Street, Philadelphia, Pa.

Lignolite, Invented by a German chemist, is made by mixing a chemical with sawdust and can be used for floor surfaces and similar purposes. It can be spread in a moist condition similarly to mortar, and is said to harden in forty-eight hours. It is claimed for this material that it is noiseless, non-combustible and impervious.

The Successful Development of wireless telegraphy by Mr. Marconi seems assured by the receipt by a news bureau in New York City of a dispatch from that gentleman, on December 21, announcing that he had established wireless communication between Cape Breton, Canada, and Cornwall, England, with complete success. Messages from the Governor General of Canada to the Kings of England and Italy and one to a London newspaper were sent. Mr. Marconi is unable to state when his stations will be ready for commercial messages.

An Automatic Weighing and Dumping Machine.

An automatic weighing-hopper, or scale, which has been sold in European countries during the past ten years, has recently been placed on the American market by the Richardson Scale Company, having offices at 16 Park Row, New York City. The accompanying cut was made from a photograph taken in a large power station at Bristol, England, where the scale is used to check the weight of coal as it is received. The scales may also be used for weighing the coal as it is delivered on the floor in front of the furnaces or to the automatic stokers. When desired the scales are equipped with a register which records the number of times the weighing-hopper is filled. Each filling being of the same quantity, the amount of coal used in a given time is readily obtained.

The machines are made in a variety of sizes for weighing many other materials such as cement, sand, sugar, grain, etc., with hopper capacities ranging from a few ounces to six tons, and furnished with suitable mountings for the different uses, these being either stationary or movable on trucks or overhead carriages. The weighing-hopper and weights are hung at opposite ends of a long equal-armed beam and swing freely and entirely independent of the working parts of the machine, all pivotal members being nicely suspended on knife edges.

The material to be weighed is received from a bin or hopper above the scale and is admitted into the weighing-hopper through a gate of peculiar construction. This consists of a swinging cut-off plate, which, when closed, comes in contact with a brush of stiff bristles, thus insuring a complete stoppage of the flow of the material and obviating the danger of a piece of the substance lodging between the gate members and preventing their entire closure; as might be the case where both members are of unyielding material. When the charge is nearly completed the gradual descending of the weighing-hopper partially closes the cut-off and reduces the stream to a mere dribble. When an exact balance is reached the gate closes entirely and throws up a lever which opens the bottom of the hopper. The bottom is counterbalanced so that it closes by gravity when the load is discharged and in doing so throws the lever down again, opens the cut-off and allows a new charge to flow into the hopper.

Both the bottom of the hopper and the swinging cut-off are actuated by toggle-joints which hold them securely in their closed position, but require only a touch to open them. The movement is a simple one, the only power required being the momentum of the falling material. The drip or column of the material, which is in the air at the moment that the feed is automatically cut off, is compensated for by a small weight, capable of being calibrated and so arranged that it increases the weight on the hopper side until the balance is reached. At this instant it is caught by an external support, its influence is withdrawn and equilibrium is maintained by the descent of the drip.

Among the advantages claimed for the machine are: An absolute balance of every weighing, a discharge from the hopper without any rocking or vibrating to injure the delicate knife edges, and a smaller amount of head room required than by any other machine of the same capacity. More detailed information is given in the company's catalogue.

Personal and Obituary Notes.

Mr. John Savage has been appointed superintendent of streets in Kansas City, Mo.

Mr. T. A. Pendergast has been appointed member of the board of water commissioners of St. Paul, Minn.

Mr. Winslow L. Webber has been re-elected city engineer of Gloucester, Mass., for the fifteenth consecutive year.

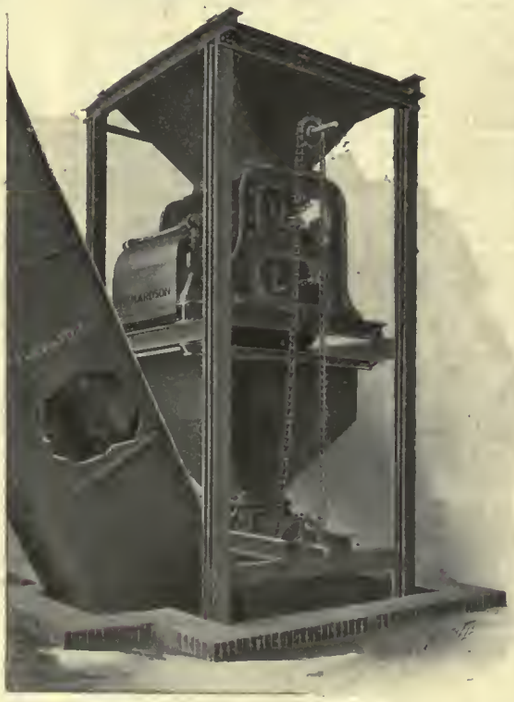
Mr. Frederick R. Harris, of New York, has been nominated by the President to be a civil engineer in the U. S. Navy.

Mr. Emmett Smith has been appointed city surveyor in Jersey City, N. J., and Mr. Thomas B. Mettam street commissioner.

Mr. James P. Morrissey has been reappointed city engineer of Dunkirk, N. Y., and Mr. Cornelius Daly, street commissioner.

Mr. Hakiva Ito, of Tokyo, Japan, is making a study of American bridges and bridge building on behalf of the Japanese government.

B. C. Epperson, superintendent of the Second Division of the Central Railroad of Georgia, died at his home in Macon, Ga., January 6.



RICHARDSON AUTOMATIC SCALE.

Mr. James O. Bogardus has been appointed water commissioner of Lockport, N. Y.; and Mr. Julius F. Frehsee has been reappointed city engineer.

Mr. Herman L. Arbenz, for the past four years assistant city engineer of Wheeling, W. Va., has been elected civil engineer of Ohio County, W. Va.

Messrs. John C. Payne, James C. Lindsay, Thomas Connolly, John Doscher, and Stephen Cornell have been appointed members of the Street and Water Board of Jersey City, N. J.

Mr. J. B. C. Lockwood, of Seattle, Wash., has been appointed by the Port of Portland Commission to be supervising engineer in charge of the construction of the sectional dry dock at Vancouver.

Praxedes Mateo Sagasta, the distinguished Spanish statesman, died of heart failure at Madrid on January 5. He was born in 1827 in the province of Logrono, received an engineering education, and was at one time a professor in the School of Engineers at Madrid.

Former City Auditor Thomas B. Rutan, of Brooklyn, died of heart failure January 5. He was a well-known builder, having constructed the Mount Prospect water tower and many large public and private buildings in Brooklyn. In 1892 he became commissioner of buildings for that city.

Mr. Louis Ruprecht has resigned his position as chief engineer of the Russell & Erwin Manufacturing Co., of New Britain, Conn., to establish a consulting practice in fuel economy, power distribution, etc., for mills and factories, steam and hot water heating, etc., at 19 Whitehall St., New York.

H. R. Stanford, civil engineer, U. S. Navy, has been ordered from the Mare Island, Cal., navy yard to the Bureau of Yards and Docks, Navy Department; and Civil Engineer H. A. Rousseau from the Bureau of Yards and Docks, Navy Department, to the Mare Island Navy Yard.

Mr. Frederick A. McClure has been re-elected city engineer of Worcester, Mass.; Mr. Wright S. Prior, street commissioner; Mr. Charles H. Peck, superintendent of public buildings; Mr. John G. Brady, water commissioner; and Mr. Harrison P. Eddy, superintendent of sewers. Mr. H. S. Clark has been elected assistant street commissioner, and Mr. Charles Adams assistant superintendent of public buildings.

The following candidates for membership in the American Society of Civil Engineers were announced elected January 7:—Members: Thomas H. Loomis, Steubenville, O.; William Martin, Bellevue, Pa.; John C. Neale, Pittsburg, Pa. Associate members: Lewis E. Ashbaugh, Ames, Ia.; William D. Connor, New London, Conn.; William H. Ferguson, Denver, Col.; George S. Frost, New York City; Charles R. Hall, Portland, Me.; Austin C. Harper, Norfolk, Va.; Frederick W. Schwiers, New York City; John E. Shepardson, New York City; Samuel P. Waldron, East Berlin, Conn.; and Ralph N. Wheeler, New York City. Juniors: Richard E. Dougherty, New York City; William D. Faucette, Savannah, Ga.; Max Feldman, New York City; Langdon Pearse, Roxbury, Mass.; and William E. Wilson, Detroit, Mich.

The following railroad appointments have been reported: Messrs. W. C. Cushing and Robert Trimble, chief engineers of the Southwestern and Western divisions, respectively, of the Pennsylvania Railroad; Mr. W. J. Brunning assistant engineer on the Pittsburg Division, and Mr. F. N. Crowell assistant engineer on the Logansport Division. Mr. J. R. Hawkins, superintendent of the Memphis Division of the St. Louis, Memphis & Southeastern Railroad with headquarters at Caruthersville, Mo., and Mr. W. W. Fagan, superintendent of the St. Louis division of that road. Mr. C. S. Hayden, superintendent of construction for the Tennessee Central Railroad. Mr. J. F. Deems, general superintendent of motive power, rolling stock and machinery of the New York Central & Hudson River, the Lake Shore & Michigan Southern, the Lake Erie & Western, and the Indiana, Illinois & Iowa railroads. Mr. Bernard Gilleas, superintendent of the Council Bluffs Division of the Illinois Central Railroad, and Mr. C. B. Fletcher, superintendent of the Cherokee Division. Mr. N. D. Maher, general superintendent of the Norfolk & Western Railway, with headquarters at Roanoke, Va.; Mr. S. T. Crapo, general superintendent of the Pere Marquette Railroad. Mr. John V. Neubert, assistant division engineer of the New York Central & Hudson River Railroad, headquarters at Albany; J. P. Bradfield, assistant general superintendent of entire New York Central system, with headquarters at New York, and F. W. Everett, acting superintendent of the Western Division, with headquarters at Buffalo. On the Western Maryland Railroad,

Mr. V. G. Bogue, New York City, consulting and supervising engineer; Mr. J. Q. Barlow, chief engineer in charge of construction, Central Station, Cumberland, Md.; Mr. C. O. Vandevanter, resident engineer, Hillen Station, Cumberland, and H. R. Pratt, engineer maintenance of way, Hillen Station. Mr. A. L. Goetzmann, superintendent of the Minnesota and Dakota Division of the North-Western Line, with headquarters at Winona, Minn. Messrs. I. W. Geer and H. E. Culbertson, engineers maintenance of way on the Pittsburg Division of the Panhandle and the Erie and Ashtabula Division of the Pennsylvania Railroad, respectively, and Messrs. B. V. Somerville and E. C. Ericson, chief assistant engineers of the Southwest and Northwest systems of the same road. Mr. John F. Kinsman, assistant chief engineer of the Baltimore & Ohio Railroad. Mr. F. K. Huger, general superintendent of the Seaboard Air Line. Mr. W. A. Slocum, general superintendent of the Brunswick & Birmingham Railroad. Mr. John Krey, division engineer of the Marine Division of the New York Central & Hudson River Railroad, with headquarters at Weehawken, N. J. Mr. J. C. Christy, resident engineer of the Gulf, Colorado & Santa Fe Railroad, headquarters at Temple, Tex.; and Messrs. F. Merritt and M. F. Temple, resident engineers on the Northern and Beaumont divisions, respectively, of the same road. Mr. J. M. Howe, resident engineer of the Texas & New Orleans Railroad and the Galveston, Houston & Northern Railway. Mr. A. Clark, superintendent of Northern Division of the National Railroad of Mexico.

The Canadian Society of Civil Engineers will hold its annual meeting in Montreal on January 27, 28 and 29. The following papers will for reading at the meeting: "Dam Construction and Failures During the Last Thirty Years," by C. P. Baillairge; "The Industries of the Consolidated Lake Superior Company," by E. C. M. Cape; "Hydraulic Dredge King Edward VII.," by A. W. Robinson; "The Relation of the Precipitation and Drainage Area to the Discharge of Streams," by R. S. Lea; "Some Problems in Connection with the Erection of the Miramichi Bridge," by H. D. Bush.

A Successful Septic Tank Installation is that of Vancouver, British Columbia, the construction of which was described in The Engineering Record of October 12, 1901. There are three tanks, designed to treat the sewage from districts having populations of 5,000, 3,000 and 2,000, respectively. They are built of concrete and are entirely covered over. In regard to the results accomplished, Mr. Thomas H. Tracy, the city engineer, states that the tanks have now been in operation for nearly two years and they have given most decided satisfaction, the effluent having been at all times (after the first three months) clear and inoffensive. There is a deposit of sediment about two inches thick at the inlet end of the tanks, none at the outlet end. The scum is about ten inches thick at the inlet end and very slight at the outlet end. This would seem to indicate that a much greater quantity of sewage conid be treated in the tanks than is at present passing through. Where sewers are constructed on the separate system, Mr. Tracy does not consider the grit chambera necessary, and, in fact, a very decided septic action has been noticed in the grit chambers of the smaller tanks. A small manhole for convenient inspection would, it is thought, be better. The tanks have not cost a cent either for operation or repair in the two years. They have been inspected fairly often, as the installation has attracted much attention on account of its marked successfulness.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 24 and 35.

WATER.

Portland, Me.—A press report states that plans for water works for Ft. McKinley have been prepared and sent to Washington for approval, and contracts for the work will probably be let in the near future. Capt. A. W. Gates, Q. M., 185 Middle St., Portland.

Great Barrington, Mass.—Engineer J. W. Curtiss is stated to have completed his survey of the proposed water supplies, and has sent his figures to the hydraulic expert, T. H. McKenzie, of Hartford, who will soon make an official report. The committee expect to be able to recommend some supply at the next special meeting.

Cambridge, Mass.—The Water Bd. in its annual report states that to fully provide all domestic supplies with meters, would require about 8,000 additional meters, at an estimated cost of $96,000; the Bd. also reports that the cost of a new pipe line from Stony Brook to Fresh Pond, would be about $500,000.

Brookline, Mass.—At the annual town meeting Dec. 30 it was stated the following orders were authorized: The Water Bd. was authorized to make contracts for the construction of a covered reservoir, at a cost of about $15,000, and $16,000 was ordered borrowed for a new pumping engine, and for changes in the low service pumping station; $12,000 was ordered borrowed for a stone crushing plant, and the School Com. was authorized to erect a grammar and primary school at a cost of $100,000. Edw. W. Baher, Town Clk.

Providence, R. I.—Fred. E. Shaw has been awarded the contract for furnishing pipes, bends, etc., for which bids were opened Dec. 26, for a discount from list prices 66.1 per cent. in the case of 3-ft. lengths and a discount of 68⅓ per cent. in the case of 2-ft. lengths and under.

Pascoag, R. I.—The stockholders of the Pascoag Water Co. at a meeting Dec. 31 are stated to have authorized the president, Moses Joy, to execute a deed with the Union Trust Co., of New Haven, to secure the funds necessary for the construction of water works.

Providence, R. I.—Mayor Miller in his annual message states that the 36-in. main from the pumping station to the reservoir should be laid next year. He also states that the city will require another pump of not less than 20,000,000 gals. capacity as soon as the filtration plant now in process of construction is completed.

Far Rockaway, L. I., N. Y.—The Queens County Water Co., which furnishes Rockaway Beach, Far Rockaway, Cedarhurst and Lawrence with water from its pumping station at Valley Stream, has increased its capital from $500,000 to $550,000, and will apply the proceeds for the extension of mains.

Oneida, N. Y.—Supt. of Pub. Wks. Danl. J. Conroy in his annual report is stated to have recommended the construction of a reservoir.

Northport, L. I., N. Y.—The Northport Water Works Co. is reported to have issued bonds to the amount of $13,000, the money to be used in the installation of the Acme water storage system as an auxiliary to the present system.

Pennsgrove, N. J.—Bids will be received by the Boro. Council Jan. 13 for the construction of water works. John P. Leap, Chmn. Water Com.

East Orange, N. J.—The Orange Water Co. is reported to have accepted the offer of the Council for its plant. The Council offered $350,000 if the use of the wells and pumps was included. The supply of water in the company's wells is reported to be inadequate, and it will be supplemented by water from Newark.

Little Falls, N. J.—The Little Falls Water Co. is reported to have applied for franchise to establish a water supply.

Gloucester City, N. J.—The City Council on Jan. 1 passed the ordinance providing for the issue of $16,000 bonds for water works improvements. John H. Boylen, Mayor.

Bayonne, N. J.—Mayor Seymour in his annual message is reported to have recommended a new water main on the west side, the improvement of the park located between the Boule. and Newark Bay, and the erection of new schools.

Delmar, Del.—Howell & Co., Drexel Bldg., Philadelphia, Pa., write that it is proposed to construct water works at Delmar, at a cost of $30,000. Engineer, Wm. H. Boardman.

Lancaster, Pa.—The Council has passed an ordinance providing for the appointment of the following five citizens as a commission to formulate plans and specifications for the improvements to be made to the water supply, award contracts, etc., $145,000 having been voted by the citizens for this improvement: Chester W. Cummings, Mayor; Edw. F. Frailey, Supt. of Water Wks., and B. Yecker, Geo. A. Wallace and Prof. J. E. Kershner.

Atlantic City, N. J.—Thos. B. Harper, Jenkintown, Pa., has been awarded a contract for boring 10 or more artesian wells. Kenneth Allen, Engr. Water Dept., writes that he bid $4 for first 50 ft. bored and cased, $3.50 for each additional ft. bored and cased to total depth of 150 ft., $7 for each ft. in length 8-in. Cook strainer in place, $12 for each ft. 10-in. strainer, $10 for each test after first not over 8 hrs. duration, $1.25 for boring 3-in. test well to depth of 100 to 400 ft., $25 for use of outfit and men per day.

Summit, N. J.—A press report states that this city will probably investigate the feasibility and cost of new water works, as the Essex-Union Water & Light Co. is not prepared to sell its plant to the city.

Middletown, N. Y.—Bids are wanted Jan. 24 for completing the construction of cast-iron pipe conduit, roadway and aerator, for the enlargement and improvement of the water works. Geo. R. Wengenroth, Clk. Water Comrs.

Watertown, N. Y.—The Bd. of Water Comrs. are stated to have decided to install a filtration plant near the pumping station; it will cost between $100,000 and $150,000.

Atlanta, Ga.—Judge Geo. Hillyer, Pres. Bd. Water Comrs., in his annual report recommends the construction of a reservoir and the purchase of a new dynamo and engine at Station No. 2.

Richmond, Va.—The Water Com. is stated to have adopted the recommendation of Supt. Botting for pipe extensions in several streets.

Marion, S. C.—A charter has been issued to the Marion Water, Light & Power Co., of Marion, with a capital of $100,000. J. W. Johnson, Pres.; H. Witcover, Secy.

Elizabeth City, N. C.—The Gen. Mgr. of the Elizabeth City Electric Light & Water Co. writes that about $350,000 will be expended on water works, a sewerage system, an electric light and gas plant, and an electric railway. D. B. Banks, of Baltimore, Md., is also interested.

Kirkersville, O.—A press report from Columbus states that Special Canal Comr. L. D. Hamlin has gone to Kirkersville with an engineer, to make some trial surveys with a view of locating a small reservoir there to supply water on the Licking Summit.

Columbus, O.—The Bd. of Pub. Wks. on Dec. 23 recommended to City Council for passage an ordinance providing for the issue in 1903 of $500,000 bonds for the construction of the storage dam in Scioto River.

St. Croix Falls, Wis.—The citizens are reported to have voted to construct water works.

Sioux City, Ia.—It is reported that a pressure tower and reservoir are to be built in the stockyards district to furnish fire pressure for that section, to be supplied by a 16-in. water main.

Jacksonville, Ill.—C. W. Brown, City Engr., writes that W. F. Mayhorn & Co. have secured a franchise for water works and have leased the present plant of the city, and contemplates laying pipe line for force main to Illinois River, a distance of 19 miles.

Shinnston, W. Va.—Press reports state that bids are wanted Jan. 15 for $11,000 water and street bonds.

Lanesboro, Minn.—Bids are wanted Jan. 12 for $6,000 water and light bonds. O. N. Viste, Village Clk.

Gillett, Wis.—Bids are wanted Feb. 2 for constructing water works. L. B. Stuelke, Village Clk.

Logansport, Ind.—The Fire & Water Com. has under consideration the construction of a reservoir or standpipe to protect the higher levels of the city Michael Sullivan, Chmn.; W. A. Osmet, City Engr.

Springfield, Ill.—The City Council is stated to have authorized the Mayor to purchase a high duty pump for the water works.

Menominee, Mich.—The City Council is reported to be considering the question of purchasing the water works.

Wilmont, Minn.—Bids will be received Jan. 23 by the Village Council for $8,000 water works bonds. S. L. Long, Village Recorder.

Milwaukee, Wis.—Contracts for building brick conduits are stated to have been awarded as follows: On Farwell and North Aves. to R. J. Nickey, for $4,833, and on Prospect Ave. to E. Bowler, $4,708.

Wellsville, O.—Bids will be received by the Bd. of Wks. Trus. until Feb. 6 for furnishing engines, pumps, tubular boilers, etc., as advertised in The Engineering Record.

Jamaica, L. I., N. Y.—The following bids were opened Jan. 2 by R. G. Monroe, Comr. of Water Supply, for laying water mains in Grand Ave. and other streets in Queens Boro.:

Items and Quantities.	Robt. L. Christie.	Norton & Dalton.	Fredk. N. Lewis.	Lloyd Collis.	Peace Bro.	F. Tuohy & Co.
Straight pipe, 650 tons	$31.00	$30.00	$30.50	$30.00	$31.00	$31.75
Specials, 25 tons	58.00	57.00	56.50	57.50	57.00	58.00
Rock excav., without blasting, 10 cu. yds.	5.00	6.00	5.00	2.75	5.00	5.00
Rock excav., 10 cu. yds.	3.00	4.00	3.50	2.75	7.50	7.00
Earth excav., 8,200 cu. yds.	.25	.22	.35	.23	.27	.29
Filling, 10,650 cu. yds.	.15	.22	.25	.20	.23	.25
Laying 14-in. pipe, 2,380 ft.	.30	.35	.30	.35	.30	.31
Laying 12-in. pipe, 9,830 ft.	.30	.25	.25	.28	.27	.29
Laying 8-in. pipe, 50 ft.	.18	.20	.20	.25	.25	.26
Laying 6-in. pipe, 700 ft.	.14	.20	.20	.20	.20	.21
Stop cocks, 25, total	1,390.00	1,315.00	1,355.00	2,581.00	1,763.40	1,920.00
Double-nozzle case hydrant, 32	35.00	37.00	35.00	45.00	60.00	92.00
Brick masonry, 10 cu. yds.	3.00	10.00	15.00	12.50	15.00	16.00
Concrete masonry, 10 cu. yds.	3.00	5.00	5.00	5.00	8.00	7.50
Asph. pavt. to relay, 184 sq. yds.	4.00	3.00	4.00	4.00	3.00	3.00
Granite block pavt. relay, 10 sq. yds.	1.00	1.60	2.00	1.00	2.00	2.00
Macadam relay, 10 sq. yds.	.20	.50	1.00	.50	.25	.25
Pavt. and flagging to relay, 2,091 sq. yds.	.30	.40	.40	.75	.50	.50
Curb and gutter to reset, 265 ft.	.10	.10	.20	.20	.25	.25

Obion, Tenn.—It is reported that enough money has been subscribed to put in a water and light plant.

Kansas City, Mo.—The Kansas City Stock Yards Co. is reported to have perfected plans for the construction of a water storage reservoir of 2,500,000 gallons capacity, to be located at 19th and Wyoming Sts.

The Lower branch of Council is stated to have appropriated $6,000 for changes in piping at Turkey Creek and $10,000 for pipe for the Water Dept.

Hennessey, Okla. Ter.—The citizens are reported to have voted to issue $10,000 water works bonds.

Biloxi, Miss.—It is stated that bids are wanted Jan. 15 for $18,000 water bonds.

Ft. Ringgold, Tex.—See "Government Work."

Birmingham, Ala.—It is stated that the Birmingham Water Works Co. will construct a reservoir on the crest of Red Mountain, which will supply the section south of 15th Ave. S. A. M. Lynn, Gen. Mgr.

Brinkley, Ark.—The Mayor writes that bids will be received about Feb. 1 for constructing water works and an electric light plant, at a probable cost of $20,000.

Joplin, Mo.—The City Council is reported to have voted to purchase the plant of the Joplin water works.

Louisville, Ky.—Local press reports state that bids will be received Jan. 15 by the Louisville Water Co., Chas. Hermany, Ch. Engr., for furnishing water pumping machinery to be used at Crescent Hill.

Weiser, Idaho.—B. C. White, of Baker City, is reported to have secured and signed the contract for constructing water works and an electric light plant, for about $40,000, to be completed May 15, 1903.

Phillipsburg, Mont.—It is stated that the city has issued $20,000 for the purchase of the water works, and that about $10,000 will be spent on improvements.

Great Falls, Mont.—Contracts will soon be let by the Water Wks. Comrs. for furnishing and laying about 4½ miles of mains. There is now available for this work about $41,000.

Dillon, Mont.—It is stated that bids will be received about Mar. 14 for constructing water works; probable cost about $60,000. Engineer, F. C. Kelsey, Salt Lake City, Utah.

Bosin, Wyo.—The citizens are stated to have voted to issue $12,000 water bonds.

Salt Lake City, Utah.—The Utah Lake Reservoir & Irrigation Co. is to be the name of the new company to be formed, by the merging of the four canal companies now drawing water from Utah Lake. Col. E. F. Holmes and State Engr. A. F. Doremas are reported interested.

Salt Lake City, Utah.—City Engr. F. C. Kelsey writes that P. J. Moran, of this city, was awarded the contract for constructing water mains for 1903 on the basis of the following bids, opened Dec. 26:

Items and quantities.	Bid of 1902.	P. J. Moran.	Greene & Reeve Co.
Excav. 6,000 cu. yds.	$0.49	$0.54	$0.49½
Pipe—			
6-in., 15,000 lin ft.	.81	.93	1.04
8-in., 5,000 lin. ft.	1.23	1.30	1.52
10-in., 1,600 lin. ft.	1.70	1.70	1.96
Special castings, 25,000 lbs.	.04	.04½	.04½
Valves—			
6-in., 80	17.50	17.50	12.00
8-in., 12	24.00	24.00	19.75
10-in., 4	37.00	34.00	31.00
Hydrants, 40	47.00	47.00	43.00
Valve boxes, 50	39.00	36.00	40.00
Hydrant boxes, 30	47.00	49.00	43.00
Totals	$32,036	$34,509	$36,762

Ogden, Utah.—The Utah-Wyoming Canal & Reservoir Co. has filed articles of incorporation in the County Clerk's office. H. C. Bigelow, Pres.; O. H. Parmley, Secy.

Winnipeg, Man.—Bids will be received Feb. 2 by C. J. Brown, City Clk., for furnishing a quantity of water pipe and specials.

Toronto, Ont.—C. H. Rust, City Engr., writes that $175,000 has been voted for the erection of a new pumping engine for the water works.

SEWERAGE AND SEWAGE DISPOSAL.

Portland, Me.—The following bids are reported to have been opened at the office of Capt. A. W. Yates, Q. M., Portland, Dec. 27, for the construction of a sewerage system at Ft. McKinley: H. A. Hanscomb Co., Boston, $14,000; Andrew Carberry & Son, East Walpole, Mass., $12,887; T. Howard Barnes, Boston, $15,700; R. D. Shanahan, Portland, $17,000; Chas. N. Taylor, Wellesley, Mass., $18,800; Worster & Wilson, Portland, $14,900; C. E. Trumbull Co., Boston, $14,700; Jas. H. Furgeson, Dorchester, Mass., $13,984; Angelo Lorello, Portland, $23,000; Chas. King & Co., Boston, $14,885, and Everett M. Stacey, Waterville, Me., $19,850.

Dedham, Mass.—At a special town meeting Dec. 30, it was voted to use the unexpended balance of the appropriation made for the extension of the sewerage system in the Oakdale district for the general sewer construction. The sum of $5,500 was also appropriated for the general construction of sewers. Articles providing for the creation of an additional indebtedness of $50,000 for the sewerage system was postponed.

New Britain, Conn.—Engineer Wm. D. Cadwell, of New Britain, writes that all bids opened Jan. 6 for constructing Section 2 of the New Britain sewerage system have been rejected.

Hartford, Conn.—The St. Comrs. on Dec. 31 are stated to have approved the plans for the proposed Franklin Ave. sewer extension, which will cost $80,000.

Lancaster, Pa.—The Council has passed an ordinance providing for the appointment of a commission of 5 to have charge of the proposed $250,000 sewerage improvements recently voted by the citizens. Chester W. Cummings, Mayor Wm. K. Beard, St. Comr., and A. H. Eshler. Geo. A. Tripple and Allan A. Herr have been appointed.

Washington, D. C.—The following bids were opened Jan. 3 by Capt. John Biddle, Corps of Engineers U. S. A., Engr. Comr., for constructing a sewerage pumping station:

Items and Quantities.	Ambrose B. Stannard.	The Brennan Constr. Co.	George A. Fuller Co.	Penn Bridge Co.	Herman Probst.	Richardson & Burgess.	Andrew Gleeson.
Earth excav., 42,000 cu. yds.	$1.10	$0.73	$1.09	$1.09	$0.95	$1.11	$1.09
Piling, 225,000 ft.	.18	.16	17¾	.17½	.23	.18	.195
Broken stone, 2,500 cu. yds.	2.50	2.50	2.20	2.40	2.15	2.25	1.95
Under drains, 2,100 ft.	.10	.15	.25	.25	.40	.255	.25
Concrete, A, 2,500 cu. yds.	8.50	8.70	8.28	8.26	9.90	8.50	7.49
Concrete, B, 10,000 cu. yds.	7.00	7.08	7.65	7.60	8.70	7.75	6.90
Concrete, C, 10,000 cu. yds.	6.00	6.00	5.95	5.90	6.55	6.00	6.50
Red brick masry., 250 cu. yds.	9.00	12.58	14.00	14.00	12.50	14.25	12.00
Vitrified masry., 350 cu. yds.	12.00	20.00	19.00	19.00	18.00	19.40	20.00
Steel work, 120,000 lbs.	.04	.03	.034	.0321	.04	.0333	.039
C. Iron bed plates, 16,500 lbs.	.04	.025	.025	.022	.0357	.0225	.039
Screens, 120 ft.	15.00	5.83	5.50	5.30	15.87	5.50	11.25
Floor grating, 30 sections	30.00	23.76	22.00	21.60	31.90	22.50	30.00
C. Iron floor plates, 30 sections	40.00	22.28	21.00	20.25	50.60	21.06	35.00
Substructure	$269,220	$240,763	$265,035	$263,086	$294,308	$268,717	$266,403
Superstructure	279,000	308,000	323,934	334,737	358,600	330,350	...
Totals	$548,220	$548,763	$588,969	$597,823	$652,908	$599,067	...

Corinth, N. Y.—The citizens are reported to have voted Dec. 30 to construct a system of sewers, at a cost of $25,000.

Harrisburg, Pa.—Plans have been completed for the construction of 4 relief sewers on Walnut, State, Juniper and Muench Sts.

Pittsburg, Pa.—At a meeting of the Council Dec. 29, Dir. McCandless asked $91,500 for extending the Beechwood sewer and $40,000 for repaving a portion of Diamond St.

Millville, N. J.—At a meeting of the Council Jan. 2, sewer and street paving ordinances were considered and committees were appointed to get plans and specifications. L. H. Hogate, City Recorder.

New York, N. Y.—Bids will be received Jan. 13 by Jacob A. Cantor, Boro. Pres. for furnishing material for an extension to outlet sewer at ft. of W. 72d St.; also for constructing sewers in Bway, between 28th and 29th Sts. Engineer's estimate: 371 lin. ft. of 4-ft. wooden barrel sewer, 79 lin. ft. of 4-ft. brick sewer, 421 lin. ft. of 3 ft. 6 in. by 2 ft. 4 in. brick sewer; etc.

Bids will be received Jan. 12 by Louis F. Haffen, Pres. Boro. Bronx, for constructing sewers and appurtenances in portions of several streets. Engineer's estimate: 760 lin. ft. 15-in. pipe sewer, 3,045 lin. ft. 12-in. pipe sewer; also for constructing receiving basins in numerous streets.

Plainfield, N. J.—The Com. on Sts. & Sewers has been directed to investigate and report to Council the most efficient means and approximate cost of sewering the territory which lies outside of the area which may be drained by gravity. Italph I. Tolles, Chmn., 47 Westervelt Ave.

Holly Beach, N. J.—Councilmen Forcum, Norton and Barnett are reported to be on the committee to formulate plans for the construction of a sewerage system.

Washington, D. C.—The Comrs. have received a report from D. E. McComb, Supt. of Sewers, on the application of the Brookland Citizens' Assoc., as to the cost of a sewage pumping plant at the intersection of Queen's Chapel Road and Providence St., and another at the intersection of 12th St. and the Bunker Hill Road; he estimates the former at $14,600, and the latter at $10,000.

Jersey City, N. J.—Bids will be received Jan. 13 by the Bd. of Street and Water Comrs. for constructing sewers in portions of Belmont and Gardner Aves.; also a relief sewer in portions of Fairview and Fairmont Aves. Estimate of quantities: 2,391 lin. ft. of 18-to 66-in. brick sewer. Geo. T. Bouton, Clk.

Weehawken, N. J.—The Weehawken Township Com. is stated to have adopted the plans of Engr. Bond for the construction of a pumping station and an outlet sewer, the latter extending to about 1,700 ft.; probable cost, $36,000.

Hoboken, N. J.—Press reports state that the following bids were opened by the Town Council of West New York Jan. 5 for the construction of a sewerage system: Palisade Construction Co., Jersey City, $119,652 (awarded contract); Henry M. Schneider, $123,730, and Callery & Murphy, $126,584.

Hazleton, Pa.—Mayor Reinhart, in his annual message, recommends that the Diamond addition sewerage system be extended this year, and calls attention to the need of a garbage crematory, and the erection of a new municipal building.

Buffalo, N. Y.—A correspondent writes that bids are wanted for constructing 10 to 20-in. sewers in portions of Genesee and Cable Sts.

Philadelphia, Pa.—See "Government Work."

Columbia, S. C.—The Sewerage Comrs. are reported to have directed J. L. Ludlow to prepare plans for a sewerage system.

Elizabeth City, N. C.—See "Water."

Jacksonville, Ill.—The City Council has reported favorably on an appropriation of $20,000 for an intercepting sewer. C. W. Brown, City Engr.

Rock Island, Ill.—Wallace Treichler, City Engr., writes that surveys for the Drainage District in Zuma and Hampton Townships, Rock Island County, have been completed, and contracts will soon be let.

Milwaukee, Wis.—At a Council meeting Dec. 29 ordinances were introduced providing for the issue of $100,000 bonds to build a crib and pumping station, which is reported to be necessary to make the Kinnickinnic River flushing tunnel of practical use, and an ordinance for $50,000, to be used for sewerage purposes on the south side.

Belleville, Ill.—A press report states that plans for a system of sewers are nearing completion. Prof. Arthur M. Talbott, of the Illinois State Univ., will visit Belleville to go over the ground of the proposed system, the plans of which he has already approved.

St. Paul, Minn.—The City Engr. is stated to have sent to the Bd. of Pub. Wks. an estimate of $36,678 for new sewer work.

Milwaukee, Wis.—Local press reports state that contracts will soon be let for lowering the sewers in all the streets which will be intersected in the track depression work.

Plans have been completed for a 66-in. sewer in North Ave., about 1,330 ft. in length.

Dixon, Ill.—Bids will be received about Jan. 24 by E. W. Smith, Secy. Bd. of Local Improv. for constructing sewers in certain streets.

Virginia, Minn.—A press report states that City Clk. Bickford is corresponding with contractors relative to the construction of a sewerage system.

Newark, O.—It is stated that bids are wanted Jan. 27 for constructing a tile sanitary sewer on N. 4th St. F. T. Maurath, City Clk.

Cincinnati, O.—Bids will be received until Jan. 21 by the Bd. of Pub. Service for furnishing material and constructing sewers and drains with necessary appurtenances thereto, in a portion of Sinck St. Geo. F. Holmes, Clk.

Wichita, Kan.—The Sewer and Drainage Com. is reported to have recommended that Wynkoop Kiersted, of Kansas City, Mo., be employed to prepare specifications for storm sewers.

Newport, Ark.—J. R. Mayhan, City Recorder, writes that it is proposed to construct a sewerage system here at a cost of about $50,000. F. S. Ness is reported interested.

Salt Lake City, Utah.—City Engr. F. C. Kelsey writes that P. J. Moran, of this city, was awarded the contract for constructing sewer laterals for 1903 on the basis of the following bids, opened Dec. 26; the prices are given for Ogden pipe, with Dickey pipe; the total of the Colorado bid was $45,949, and that of the Moran bid, $42,495:

Items and quantities.	Bid of 1902.	The Colorado Co.	P. J. Moran.
Excavating—			
Dry work, 20,000 cu. yds.	$0.64	$0.70	$0.66
Wet work, 3,000 cu. yds.	1.03	1.10	1.15
Laying pipe—			
8-in., 30,000 lin ft.	.40	.40	.29½
10-in., 1,600 lin. ft.	.55	.47	.40
12-in., 1,600 lin. ft.	.70	.56	.52
Manholes, 120	52.00	57.20	66.00
Flush tanks, 5	100.00	100.00	75.00
Flush tanks & manholes, 25	150.00	165.00	170.00
Totals	$40,380	$42,437	$39,517

Seattle, Wash.—An ordinance has been introduced in Council providing for the creation of a new district, where 4 miles of sewer pipe will be laid. The district runs from Brooklyn Ave. to the east line of Latona first addition.

Ft. Duchesne, Utah.—See "Government Work."

Ft. Apache, Ariz.—See "Government Work."

Portland, Ore.—Sweeney, Frainey & Keating are stated to have secured the contract for constructing the Cook Ave. sewer, for $78,000.

BRIDGES.

Boston, Mass.—See "Power Plants, Gas and Electricity."

Williamstown, Mass.—The building of a bridge across Green River at Main St. is reported to be under consideration.

Holden, Mass.—The Co. Comrs. are reported to have granted the Worcester & Holden St. Ry. permission to alter bridge across the Boston & Maine R. R. at Main St. in the town of Holden.

Brockton, Mass.—Press reports state that the Ames St. Bridge improvement has been settled, whereby the New York, New Haven & Hartford R. R. Co. is to construct a steel bridge, 45 ft. wide and 14 ft. above the street, and the city is to maintain the highway and grade the same. Probable cost to the city $20,000.

Boston, Mass.—The Park Comrs. of Cambridge, in their annual report, urge the building of a new bridge at Boylston St.

Pittsburg, Pa.—Press reports state that the stockholders of the Ohio River Connecting Ry., owned by the Pennsylvania R. R. Co., have agreed to increase its capital stock from $1,000,000 to $2,000,000, to allow improvements to be made to the approaches of the Connecting bridge across Ohio River. The improvements, it is stated, will cost about $1,000,000, and will include a new approach both to the Allegheny and West End sides.

Lewisburg, Pa.—Oscar Thompson is reported to have been appointed by the State Bd. of Property, Harrisburg, to prepare plans for a bridge to be constructed across Susquehanna River in Lewisburg. A steel bridge, 1,200 ft. long, on stone abutments, is contemplated.

Camden, N. J.—Bids will be received Jan. 14 by James D. Wilkinson, Chmn. Bridge Com., for constructing a steel draw bridge over Cooper's Creek at Baird Ave. Appropriation, $20,000. John J. Albertson, Co. Engr.

New York, N. Y.—Bids will be received Jan. 12 by Louis F. Haffen, Pres. Boro. Bronx, for constructing a bridge over Bronx River at E. 177th St.

Jacksonville, Fla.—Designs, specifications and bids will be received until Feb. 1 for constructing Bridge St. viaduct, to be preferably of concrete-steel construction and approximately 840 ft. long and 60 ft. wide. It is to consist of 5 concrete spans, 2 112 ft. long and 1 each 128 ft., 96 ft. and 36 ft. long; 5 steel spans, 1 to be 45 ft. long and 4 each 43 ft. long. Address E. B. Pleasants, Ch. Engr., Atlantic Coast Line R. R., Wilmington, N. C.

Sandusky, O.—The Toledo Lakeside R. R. Co. is reported to be contemplating the building of a bridge across Sandusky Bay.

French Landing, Mich.—Press reports state that the Wabash R. R. Co. will construct a steel bridge across Huron Bay, this city.

Steubenville, O.—An ordinance has been passed by the City Council granting the Steubenville Bridge Co. the right to construct a bridge in this city, at Market St.

La Crosse, Wis.—The La Crosse St. Ry. Co. and the Chicago, Milwaukee & St. Paul Ry. Co. are reported to be contemplating the building of a steel viaduct at Rose St.

Kansas City, Mo.—Local press reports state that an agreement has been reached between the Kansas City Belt Ry. Co. and the Metropolitan St. Ry. Co., whereby the said Companies will construct a viaduct at Summit St.

St. Louis, Mo.—Press reports state that the Union Depot Terminal Co. proposes to construct a bridge at Mullanphy St. and to spend about $15,000,000 for terminals and an elevated road. M. M. Stephens is reported to be interested.

Damascus, Ill.—The citizens of Harlem township are reported to have voted Dec. 27 in favor of constructing a bridge across Pecatonica River, at a probable cost of from $10,000 to $15,000.

Milwaukee, Wis.—Chas. J. Poetsch, City Engr., writes that it is proposed to erect a bascule bridge at W. Water St., but plans have not as yet been approved by the Government.

According to local press reports the building of a bridge at Bartlett St. is contemplated, and that bonds for said purpose have been sold.

Local press reports state that the $150,000 Jones Island Bridge bonds have been sold.

Willowsprings, Ill.—Bids will be received about Jan. 17 by the Bd. of Trus. of the Village of Spring Forest for furnishing material and constructing a concrete steel culvert across Archer Ave., Spring Forest Village. Thos. Hopcroft, Village Clk. pro tem., P. O., Willowsprings.

Springfield, O.—Bids will be received Jan. 28 by the Bd. of Co. Comrs. for furnishing material and constructing the substructure and superstructure for a bridge over Mad River, on Enon Road, length of bridge to be 200 ft. with an 18 ft. clear roadway, and a single track. A. K. Hahn, Co. Aud.

St. Paul, Minn.—Bids are wanted Jan. 15 for constructing the substructure of the Arcade St. bridge and the approaches thereto over the tracks of the Northern Pacific (St. Paul & Duluth Ry. Co.) and the C., St. P., M. & O. Rys. Matt Jensen, City Clk.

East Peoria, Ill.—Bids are wanted Jan. 27 for constructing a 65 ft. span combined concrete and steel bridge over Farm Creek. Engineer's estimate of cost, $5,700. R. M. Orr, City Clk.

Siloam Springs, Ark.—The Levying Court is reported to have appropriated $5,000 for a bridge to be built at Fisher Ford. E. L. Taylor, Co. Judge, Bentonville.

Arkadelphia, Ark.—It is stated that bids are wanted Feb. 10 for constructing a steel bridge over Onachita River. The bridge is to be 514 ft. long with a 16-ft. roadway, and is to consist of 2 steel spans of 175 ft. each and 2 steel spans of 80 ft. each; it is to rest on tubular steel piers filled with concrete. Joe Hardage, Co. Judge.

Colorado Springs, Colo.—The residents of the East Side are reported to have decided to request the Santa Fe R. R. to construct an 80 ft. bridge at Costilla St. instead of the 60 ft. structure, for which plans were submitted.

Dickinson, N. D.—The Northern Pacific R. R. Co. is reported to be surveying for a bridge, 250 ft. high and 1 mile long, to be built near Dickinson.

Weiser, Idaho.—It is stated that the citizens are contemplating the building of a $35,000 bridge across Snake River.

Santa Barbara, Cal.—The City Engr. estimates the cost of replacing 12 bridges in this city, with stone structures, at about $40,000.

PAVING AND ROADMAKING.

Brookline, Mass.—See "Water."

Brockton, Mass.—See "Bridges."

Fonda, N. Y.—Engineers are reported to be surveying for a macadam road, which is to be built by the State Engineer early in the spring, from Fonda to Berryville and Tribes Hill.

Royalton, N. Y.—The Co. Bd. of Superv. is reported to have passed a resolution appropriating $9,200 for a road to be built from Royalton to Middleport, a distance of about 3 miles. The road is to be constructed under the Higbie-Armstrong law, and the State will also contribute $9,200.

Binghamton, N. Y.—Local press reports state that about $25,000 will be spent next year by 11 towns in this county for road improvements.

Colesville, N. Y.—Resolutions have been adopted by the Bd. of Superv. for constructing about 10½ miles of roads in this town.

Johnstown, N. Y.—The Bd. of Superv. has, according to local press reports, appropriated $69,700 for constructing about 12 miles of road in this town.

Riverhead, L. I., N. Y.—It is stated that $126,951 is to be expended by 10 towns in the Co. of Suffolk next year; the State is to contribute half this amount.

Dansville, N. Y.—The Co. Bd. of Superv. is reported to have under consideration the constructing of a road from Dansville to Mt. Morris, at a cost of about $29,000.

New York, N. Y.—Bids will be received Jan. 12 by Louis F. Haffen, Pres. Boro. Bronx, for repaving with asphalt on a concrete foundation the roadway of E. 149th St.; also for regulating, grading, setting curbstone, flagging sidewalks, laying crosswalks, building approaches, placing fences, laying macadam pavement on portions of several streets. Engineer's estimate is as follows: 15,700 sq. yds. of asphalt and 6,030 sq. yds. macadam pavement, 2,420 cu. yds. concrete, 12,010 cu. yds. rock and 14,260 cu. yds. earth excavation, 15,685 lin. ft. new curbstone, 73,080 sq. ft. flagging, etc.

Bids will be received Jan. 16 by McDougall Hawkes, Comr. of Docks, Dept. of Docks & Ferries, for furnishing material and paving with asphalt the new made land between 18th and 21st Sts., and with granite between piers old 20 and new 16, East River.

Bids will be received Jan. 13 by Jacob A. Cantor, Boro. Pres., for regulating, grading and paving on a concrete foundation the roadway of St. Nicholas Ave. Engineer's estimate is as follows: 51,400 sq. yds. asphalt block paving, 4,170 cu. yds. of concrete, including mortar bed; 8,000 lin. ft. new curbstone on a concrete foundation, 6,700 lin. ft. old curbstone, redressed, rejointed and reset, etc.

Oak Tree, N. J.—The Co. Bd. of Chosen Freeholders, at New Brunswick, are considering the macadamizing of a road, about 4 miles long, between Oak Tree and Woodbridge.

Weehawken, N. J.—Local press reports state that the following are the bids received by the Weehawken Township Com. for asphalting a portion of Highpoint Ave.: Uvalde Asphalt Paving Co., $10,898, and Barber Asphalt Paving Co., $11,422.

Newark, N. J.—A resolution has been adopted by the Bd. of Pub. Wks. authorizing the Supt. of Wks. to macadamize a portion of Military Park.

Stewartsville, N. J.—Co. Surv. Salmon is reported to be making a survey for a road from this town to Phillipsburg, and will submit an estimate of the probable cost of macadamizing said road.

Pittsburg, Pa.—See "Sewerage and Sewage Disposal."

Lowville, N. Y.—The Co. Bd. of Superv. has been petitioned to construct a road from Pickney to Lowville, a distance of about 12 1-3 miles.

Fleming, N. Y.—The Co. Bd. of Superv. has voted to construct 3 miles of State road along the west side of the lake in this town.

Belair, Md.—The Co. Comrs. are said to have under consideration the extension of the Woolsey macadamized road from Churchville to Havre de Grace.

Union, N. J.—Bids will be received by the Bd. of Council until Jan. 26 for improving a portion of New York Ave., by paving with asphalt on a concrete foundation and with specification block on a sand foundation. Emil Bautz, Jr., Town Clk.

Augusta, Ga.—The City Council has ordered Ford St. paved with Belgian block; about 1,000 yds. will be required.

The St. & Drains Com. has under consideration the relaying of asphalt on BroadSt., about 52,000 sq. yds. It is probable that both brick and asphalt will be laid on old concrete base.

Pooler, Ga.—There is talk of petitioning the Co. Comrs. at Savannah to complete the Louisville Road from Pooler to Effingham Co. line.

Shinnston, W. Va.—See "Water."

Toledo, O.—The Co. Comrs. have decided to ask the City Council to use Lake Erie asphalt block in paving Erie St.

Columbus, O.—Ordinances have been adopted by the City Council authorizing the grading and paving portions of Noble St. and Oregon Ave. with asphalt, hard-burned brick or block or other substantial material, setting 5-in. curb, and constructing the necessary subdrains and catch basins.

Three Rivers, Mich.—Bids are wanted Feb. 17 for paving Flint Ave. with brick, as advertised in The Engineering Record.

Cincinnati, O.—Bids will be received Jan. 23 (readvertisement) for paving with granite block a portion of Gilbert Ave. Robt. Allison, Pres. Bd. Pub. Service.

Owosso, Mich.—Bids are wanted Jan. 30 for 14,283 sq. yds. brick or block pavement, on concrete foundation, as advertised in The Engineering Record.

Alton, Ill.—The Co. Bd. is talking of paving with brick the square around the court house.

The Federal Lead Co., of Alton, expects to pave all its streets with brick in the spring. E. E. Rutledge, City Engr.

Belleville, Ill.—The city will pave Race St. for 6 blocks. At next Council meeting it will be decided whether asphalt or brick will be used. Louis Graner, City Engr.

Terre Haute, Ind.—Ralph H. Sparks, City Engr., writes that Roberts & Co. have secured the contract for improving 6th and 7th Aves., for $12,915.

Sioux City, Ia.—The property owners of W. 3d St. are about to petition the City Council to pave that thoroughfare with brick on a sand foundation.

Cleveland, O.—Bids are wanted Jan. 27 for grading, draining, curbing, paving with brick and improving portions of numerous streets. Chas. P. Salen, Dir. Pub. Wks.

Chicago Heights, Ill.—A petition is being signed to pave Illinois St. with vitrified brick and to curb with stone, the paving to be 40 ft. wide and to cost about $5 per running ft.

Grand Rapids, Mich.—The City Engr. has submitted to the Bd. of Pub. Wks. the following estimates for improving a portion of Grandville Ave. Bituminous macadam with brick between the car tracks and 8 in. on either side, $67,542; asphalt block on gravel, $83,597; asphalt block on concrete, $92,480; brick on concrete, $63,002.

Greenville, O.—Bids will be received Jan. 24 by E. E. Calderwood, City Clk., for furnishing material and improving with asphalt block portions of E. 3d St.

Cleveland, O.—Contracts for draining, curbing and brick paving on portions of 12 streets (bids opened Dec. 23) have been awarded as follows: Herring & Burgess, 6 streets, $21,463; Baldwin Bros. & Graham, 4 streets, $7,747, and Roehl Bros., 2 streets, $6,390.

Bids will be received until Jan. 20 for grading, curbing and paving with brick on portions of several streets; also until Feb. 3 for paving with asphalt, on portions of several other streets. Chas. P. Salen, Dir. Pub. Wks.

Winton Place, O.—Bids will be received Jan. 26 by the Village Council for $5,190 bonds, the proceeds to be used for improving portions of Belle Ave. Louis G. Dittoe, Village Clk.

Sandusky, O.—Bids are wanted Feb. 4 for paving a portion of Hayes Ave. with brick, block asphalt, sheet asphalt or Warren's bituminous macadam waterproof pavement. Alex. M. Wagner, City Clk.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service until Feb. 4 for furnishing material and improving portions of Oregon and Delaney Sts. by paving the roadway with brick, setting old curbs and furnishing and setting new granite curbs. Geo. F. Holmes, Clk.

St. Louis, Mo.—The following are the lowest bids for paving opened Dec. 30: Cherokee St., Commonwealth Construction Co., $14,843; Manchester Ave., Parker-Washington Co., of W. Va., $79,921; West Pine Boule., Granite Bituminous Paving Co., $12,501; Jefferson Ave., P. W. Schneider, Jr., $14,249; Compton Ave., J. C. Finck, Jr., $8,645.

Louisville, Ky.—See "Electric Railways."

Bessemer, Colo.—Local press reports state that the citizens are about to petition the City Council to pave with brick, on a concrete base, Northern and Evans Aves.

Durango, Colo.—The replacing in the spring of the cedar blocks on State St. with macadam is reported to be under consideration.

Denver, Colo.—Local press reports state that the Bd. of Pub. Wks. contemplates making the following improvements during the coming year: Grading, curbing and paving with basalt macadam, and brick or cement gutter in the Eighteenth Ave. Improvement Dist. No. 1, estimated to cost $79,217; in Ogden St. Improv. Dist. No. 1, paving similarly, estimated to cost $17,743; for paving with macadam in Boulevard Improv. Dist. No. 1 and with sheet asphalt on 20th Ave.; for laying sidewalks in several districts, including the following: So. Bway. Sidewalk Dist. No. 2, estimated to cost $50,128; Sidewalk Dist. No. 12, estimated to cost $54,600.

Oakland, Cal.—The City Engr. estimates the cost of constructing bituminous crosswalks on the macadamized streets of the city, $127,000.

Salt Lake City, Utah.—City Engr. L. C. Kelsey writes that F. G. Palmer, of this city, was awarded the contract for constructing cement sidewalks for 1903 at 50 cts. per cu. yd. for 1,500 cu. yds. excavation, and at 15⅞ cts. per sq. ft. for 50,000 sq. ft. cement pavt.; total, $8,687.50. The City Street Improvement Co. bid $10,275 and last year's bid was $9,150.

POWER PLANTS, GAS AND ELECTRICITY.

Clinton, Mo.—The Clinton Electric Light & Power Co., of Clinton, has been incorporated; capital, $10,000. Incorporators: Manly Morrison, F. L. Besse, and J. B. Davis, all of Clinton.

Boston, Mass.—Mayor Collins has approved the loan ordinance which provides $10,000 for an electric plant for the Parental School, $175,000 for lands and buildings for schools, and $5,000 for a foot bridge over the N. Y., N. H. & H. R. R. tracks on Gainsboro St.

Bangor, Me.—Engineer Fred. T. Dow writes in regard to the development of the water power of Penobscot River and Pushaw Pond, that the matter is being agitated and there is a possibility of developing a total of 100,000 H.-P. The matter is now under public discussion, and its development depends on the action of the people in this section, and the sale of power to warrant the work.

East Harrisville, N. H.—The East Harrisville Water Power Co. has been incorporated, with a capital of $20,000.

Niagara Falls, N. Y.—The Council is stated to have granted the Lower River Power & Water Supply Co. a franchise to construct and maintain a transmission line.

Cooperstown, N. Y.—The Clinton Mills Power Co. is stated to have secured the contract for lighting the city for 5 yrs., at $70 per light per yr.

Dunkirk, N. Y.—The Dunkirk Power & Htg. Co. has been incorporated, with a capital of $50,000, by Albert W. Cummings, H. Durrell and H. T. Litchfield, all of Dunkirk.

Binghamton, N. Y.—The Bd. of Superv. is stated to have accepted the report of the committee consisting of Supervisors Williams and Van Patten, providing for the erection and maintenance of an isolated heating and lighting plant; it will cost about $4,565.

Jersey City, N. J.—The Street and Water Bd. is stated to have decided to award the contract for lighting the city with electricity for 5 years to the United Electric Co. About 1,373 electric lights will be furnished at $97.50 each per yr.

Johnstown, Pa.—The Consumers' Light, Heat & Power Co. is stated to have purchased a site on Bedford and Baumer Sts. for its power plant. Saml. Lenhart and C. B. Schry have been appointed on the building committee.

York, Pa.—The North York Council is stated to have passed the ordinance granting permission to the Merchants' Electric Light, Heat & Power Co., of York, to extend its line through the borough.

Stroudsburg, Pa.—C. J. Young, 3718 N. Carlisle St., Philadelphia, Secy. Delaware Water Gap Water Power Co., writes that it is proposed to construct a plant, at a cost of about $500,000, and contracts will probably be let in May. Engineer, Jos. H. Young, 19 N. Paxson St., Philadelphia.

Burlingame, Kan.—It is reported that the City Council want bids for furnishing material and supplies for a complete electric system. J. P. Slaughter, Chmn.

New York, N. Y.—Bids will be received Jan. 19 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity for furnishing, operating and maintaining electric lamps for lighting streets, public buildings and parks in the various Boroughs for 1 year, commencing Jan. 1 to Dec. 31, 1903.

Marion, S. C.—See "Water."

Elizabeth City, N. C.—See "Water."

Columbus, O.—Contracts for the municipal electric light plant are stated to have been awarded as follows: For boilers to the Babcock & Wilcox Co. of New York, N. Y., for $14,611, and for the turbine section of the new plant to Westinghouse, Church, Kerr & Co., of New York, N. Y., for $56,735.

Director of Pub. Wks. Immel is stated to have authorized Jos. Dauben, Eberly Bldg., to furnish plans and specifications and superintend the construction of the building for the new municipal light plant; the building will cost between $30,000 and $50,000.

Cleveland, O.—The only bid received by the Bd. of Control Dec. 29 for lighting 1,100 arc lights is stated to have been submitted by the Cleveland Illuminating Co. at $77.88 each per yr. for lamps fed by overhead wiring, and on the others $92.76 each per yr.

Youngstown, O.—See "Electric Railways."

Kokomo, Ind.—Geo. J. Morratt, Pres. Kokomo Ry. & Light Co., is stated to have secured a franchise to construct a steam and hot water system in Kokomo.

Milaca, Minn.—It is reported that the village electric light plant is to be rebuilt at once.

Lakepark, Minn.—The proposition to construct an electric light plant will soon be voted upon, according to reports.

Bluffton, Ind.—The C. L. Olds Construction Co. is stated to have secured the contract for constructing an electric light plant at Bluffton, for about $25,000.

Detroit, Mich.—A press report states that Alex. Dow, of Detroit, Mgr. Edison Electric Co., has purchased the Crawford Fort tract, located at Delray, to be used as a site for a power plant.

Cameron, W. Va.—G. S. Emshelmer, of Wheeling, W. Va., is reported to have applied for a franchise for an electric light plant.

Ironwood, Mich.—Ed. D. Nelson, Pres. of the First Natl. Bank, is reported to have applied for a franchise to supply the city lighting and fuel gas. He already operates the street railway and electric lighting plant.

Lanesboro, Minn.—See "Water."

Cheboygan, Mich.—The Supervisors are reported to have granted permission to the W. & A. McArthur Co. to build a dam and locks at the rapids in Black River for establishing a large water power plant, to furnish electricity for lighting the city of Cheboygan and furnishing power for various enterprises. The work will be done next summer.

Verndale, Minn.—Bids will be received Jan. 24 by the Village Council for $7,000 bonds, to be used for constructing an electric light plant. H. Lyons, Village Recorder.

Marinette, Wis.—The stockholders of the Marinette & Menominee Paper Co. are reported to have appointed a committee consisting of S. M. Stephenson, A. C. Merryman, and J. A. Van Cleve, to investigate the feasibility of constructing a dam and power plant at Chapple Rapids.

Clarence, Mo.—G. T. Gilman, Mayor, writes that it is proposed to construct an electric light plant, at a cost of $10,000. J. L. Ridings, J. M. Wine and G. T. Gilman, are on the committee.

Dallas, Tex.—P. de C. Ball and Chas. L. Wakefield are reported to have filed a petition for a charter for the Dallas Ice, Light & Power Co.; capital, $200,000. The company will furnish electric lights, ice and cold storage and the plant will be located down town.

Pawnee, Okla.—The Pawnee Electric Light & Power Co., of Pawnee, has been incorporated, with a capital of $50,000. Incorporators: W. L. Warr and J. S. Moffitt, of Pawnee, and A. Ward, of Sagnache, Colo.

Chattanooga, Tenn.—The Consumers' Gas Co. is reported to have filed, in the office of the Register, application for a charter to operate a plant for furnishing illuminating gas to the city and suburbs. Incorporators: Ed. Watkins, J. E. Annis, and others.

Obion, Tenn.—See "Water."

Brinkley, Ark.—See "Water."

Kingman, Kan.—The Kingman Water Power & Mfg. Co., of Kingman, has been incorporated, with a capital of $40,000.

Fayetteville, Tenn.—The Bd. of Aldermen is stated to have contracted with the Fayetteville Electric Light Co. to furnish lights for the town for the next 5 years for $1,700 a year. The company contemplates extensive improvements. A rock dam will be constructed across Elk River, and in addition to furnishing lights electricity will be generated to furnish power for manufacturing purposes.

Havre, Mont.—E. V. Hauser is reported to have secured a franchise to construct and operate an electric light plant.

Weiser, Idaho.—See "Water."

Ellendale, N. D.—It is stated that J. A. Johnson, of Fargo, will establish an electric light plant here in the spring.

Yreka, Cal.—Edwin T. Osborn, of San Francisco, and Edgar T. Wallace, of Yreka, are reported to have purchased the plant of the Quinne Electric Light & Power Co., at Yreka. They intend expending about $25,000 in improvements.

Oroville, Cal.—The Golden State Power Co. is stated to have secured all the water rights and filings on the north fork of Feather River from the big bend in Butte County above Oroville to the big meadows in Plumas County. The company proposes to bring power direct to San Francisco. A corps of engineers has been at work for the past year, and practically all of the preliminary work and surveys have been completed. A. S. Macdonald, of Oakland, is Pres. of the company.

Colorado Springs, Colo.—The Pike's Peak Hydro-Electric Co. has been incorporated, with a capital of $700,000. to generate, distribute and sell electricity for light, heat and power purposes in El Paso County. Directors: Geo. A. Taff, H. C. Hall, and others.

Nelson, B. C.—The ratepayers are reported to have voted to issue $150,000 bonds for a power plant and extending the city's electric light system.

ELECTRIC RAILWAYS.

Norton, Mass.—Surveyors are reported to be at work on the extension of the Norton & Taunton St. Ry. from Norton Center through East Norton to Easton. C. E. Short, Ch. Engr., Norton.

Chelmsford, Mass.—The Lowell, Chelmsford & Nabnasset R. R. Co. is stated to have petitioned the Selectmen for a franchise to construct a line from West Chelmsford Centre through North Chelmsford, Chelmsford Centre to Billerica.

Sheridan, N. Y.—The Lake Shore Traction Co. is stated to have secured a franchise in Sheridan.

Clifton Springs, N. Y.—The Rochester & Eastern Rapid Ry. Co. is stated to have secured right of way through this village. A. L. Parker, Mgr., Rochester.

Brooklyn, N. Y.—G. M. Gest, 277 Bway, N. Y. City, has secured additional contracts for placing underground the remainder of the overhead system of the Brooklyn Heights R. R. Co., which is being done on account of the recent order of Com. Robt. G. Monroe. This will practically complete the removal of the overhead system of that company within the prescribed area, and work will be finished early in the spring; contract amounts to about $40,000.

Washington, N. J.—Engineers of the Easton & Washington Traction Co. are reported to have begun a survey of the proposed location of the power house on the R. M. Petty farm in the township. They will also make a complete map of the proposed route of 40 miles, connecting Easton, Hackettstown, Belvidere and Clinton, with Washington as a center.

Perth Amboy, N. J.—The Council is stated to have granted a franchise to the Raritan Traction Co. W. G. Rock, Supt., Perth Amboy.

Bordentown, N. J.—It is stated that the Camden & Trenton Ry. Co. will erect a 1-story brick power house in Bordentown, to cost $60,000. Dr. J. S. Gilbert, Supt., Bordentown.

Belle Vernon, Pa.—The Webster, Monessen, Fayette & Belle Vernon St. Ry. Co. is reported to be considering plans for the construction of a line from Belle Vernon to Uniontown, a distance of 30 miles.

Scranton, Pa.—The Scranton Lake Speedway Co. has been incorporated, with a capital of $100,000. It will construct an electric railway to a park on the mountains east of the city. C. G. Boland and Dr. G. E. Hill, of Scranton, are among the incorporators.

Rockville Center, L. I., N. Y.—The New York & Long Island Traction Co. is stated to have petitioned the Village Trus. for a franchise.

Rochester, N. Y.—The Buffalo & Depew Electric Ry. Co. is reported to be securing right of way to lay its tracks in the southwestern part of city. E. Melvin, Ch. Engr., Depew.

Richmond, Va.—Frank Jay Gould, of New York, N. Y., is reported to have purchased all the street railways in and around Richmond, including the Richmond and Petersburg line. It is reported that many improvements are contemplated.

Elizabeth City, N. C.—See "Power Plants, Gas and Electricity."

Elizabeth City, N. C.—See "Water."

Ft. Wayne, Ind.—Engineers are reported to be surveying the route on the right of way which has been secured by the Ft. Wayne & Springfield Ry. Co. The Ch. Engr. of the party is A. W. Fishbaugh, of Celina. The company purposes to build a line from Springfield, through Urbana, Sidney, New Knoxville and St. Mary's to Ft. Wayne, Ind.

Jeffersonville, Ind.—Engineers of the Jeffersonville & Madison Electric Ry. Co. are stated to have completed the preliminary survey of the road between the terminal stations, and the company will proceed at once to secure the necessary right-of-way. The road will run through Charlestown, New Washington and Hanover. Louis Schenck, of Seymour, is reported interested.

Ottawa, Ill.—The Ottawa, Marseilles & Morris Ry. Co., of Ottawa, is reported incorporated with a capital of $50,000, to construct a line from Ottawa through Marseilles and Seneca to Morris. Incorporators: J. F. Moloney, J. J. Graham, and others, all of Ottawa.

Bloomington, Ill.—The Bloomington, Pontiac & Joliet Electric Ry. Co. is reported incorporated, to construct an electric railway between Bloomington and Joliet, to connect there with an electric line now in operation to Chicago.

Belleville, Ill.—The Belleville & Mascoutah Ry. Co. and the Belleville & Freeburg Electric Ry. Co. have been incorporated; capital of both roads is placed at $600,000. Incorporators: Chas. Thomas, Fred and George Geissler, of Belleville, on the Mascoutah line, and Chas. Becker, of Freeburg, on the Freeburg line.

Green Bay, Wis.—The Knox Construction Co. is stated to have petitioned the City Council for a franchise. Mr. Heskett, Res. Mgr., Gray Blk.

Adrian, Mich.—Dr. Ducket, of Bowling Green, O., is reported interested in the construction of an electric railway to connect Adrian and Hudson.

Zanesville, O.—A. E. Appleyard, 50 State St., Boston, Mass., writes that it is proposed to standard gauge and equip electrically the B., Z. & C. R. R., recently purchased. J. K. Geddes, of Zanesville, is the Engr. in Charge. Other parties interested are Hamilton & Co., of Baltimore, Md., and S. L. Mooney, of Woodsfield, O.

Youngstown, O.—The Youngstown & Sharon Ry. Co. is reported to have increased its capital stock from $600,000 to $725,000, the increase to be used for improvements on the electric lines owned by the company, and also on the plant of the Youngstown Consolidated Gas & Electric Co. R. Montgomery, Gen. Mgr.

Piqua, O.—The City Council is stated to have granted the Dayton, Covington & Piqua Traction Co. a franchise to extend its line. W. Milton, Supt., Dayton.

Urbana, O.—The Champion Construction Co. is reported to have secured a franchise from the Comrs. of Champaign County for an electric line to be built through the southwestern part of the county, being a part of the proposed road from Piqua to Springfield.

Cincinnati, O.—The Co. Comrs. are stated to have granted the Cincinnati & Columbus Traction Co. a franchise for an electric railway on Madison Pike, between Oakley and Madisonville.

The Manufacturers' Belt Line Co. has been incorporated, with a capital of $25,000, to construct a trunk line, to be operated by electricity, about 1¼ miles in length, from the Norfolk & Western R. R. across the B. & O. S. W. tracks to the Pennsylvania R. R. Chas. H. Kilgour and Henry Burkhold are among the incorporators.

Toledo, O.—An agreement has been reached by representatives of the Toledo & Western, the Garrett, Auburn & Northern Indiana and the Chicago & Indiana Air Line Ry. Companies for a through electric line between Toledo and Chicago. The Toledo & Western Ry. has already been constructed as far as Fayette, near the Indiana State line. The project is being pushed by a syndicate headed by Judge C. M. Stone, Luther M. Allen and J. E. Seagraves, of Cleveland, who are building the Toledo & Western. The road will pass through Goshen and South Bend.

Huntington, Ind.—The Co. Comrs. are stated to have granted a 50-yr. franchise to the Ft. Wayne & Southern Traction Co. for a line between this city and Marion, by way of Warren.

Muncie, Ind.—The Indiana & Illinois Traction Co., of Muncie, has been incorporated, with a capital of $10,500, to control and operate a line or system of interurban electric car lines in a number of Indiana and Illinois counties and cities, including Crawfordsville, Veedersburg and Covington, Ind., and Champaign, Urbana and Bloomington, Ill. Incorporators: L. G. Holmes, J. G. Leffler, and others, all of Muncie.

Mansfield, O.—The Mansfield & Eastern Traction Co., of East Orange, is reported incorporated, with a capital of $500,000, to run a railroad, electric or otherwise, through Mansfield, Hayesville, Reedsburg, Jefferson and Wooster, Ohio. Incorporators: Chas. Melly, Jas. J. Maguire, and others.

Casstown, O.—The Council is stated to have granted the Springfield, Troy & Piqua Electric Ry. Co. a right of way through Casstown.

Aurora, Ill.—L. Hollingsworth, Jr., Girard Bldg., Philadelphia, Pa., is reported to have been commissioned to prepare plans for a trolley road and power houses for the Aurora, DeKalb & Roxford Electric Traction Co. It is stated that about $1,250,000 will be expended for the improvements. Several power houses will be provided for, one to be located at Aurora, Ill., the other at DeKalb.

Mitchell, Ind.—Marion Township is reported to have voted a subsidy of $16,000 to the Mitchell, West Baden & Jasper Electric R. R. It is said work will begin at once on the road.

Kokomo, Ind.—A company is reported to have been organized here, to construct an electric line to connect Kokomo, Marion and Wabash. Applications for franchises were presented to the commissioners of the three counties. The promoters are G. W. Duke, O. V. Darby, and T. C. McReynolds, of Kokomo, and others.

Louisville, Ky.—The Louisville Ry. Co. has secured a franchise to construct an electric railway on Castlewood Ave., a distance of about ¾ of a mile. The street is to be paved with brick. F. M. Miller, Ch. Engr., Louisville.

Everett, Wash.—The Snohomish Rapid Transit Co. is reported incorporated, with $300,000 capital, to build trolley lines in Snohomish County.

Nebraska City, Neb.—The Stockholders of the Nebraska City St. Ry. Co. are reported to have increased the capital stock from $100,000 to $150,000. In addition to the changing of the horse car lines to electric lines they will build a line to one of the nearby towns in the spring.

Oakland, Cal.—Mayor Anson Barstow is stated to have signed the ordinance granting the San Francisco, Oakland & San Jose Ry. Co. a franchise on Yerba Buena Ave., to connect the new Emeryville slips with the land terminus of the Oakland Transit Consolidated and the Santa Fe.

RAILROADS.

Buffalo, N. Y.—Bids will be received Jan. 17 by F. W. M. Heerwagen, City Compt., for $17,669 grade crossing bonds.

Williamstown, W. Va.—The Slaughters Creek & Coal River R. R. Co. has been incorporated to build a railroad from Winifrede Junction to White Oak Creek. W. E. Roe and Geo. Hunter, of Parkersburg, W. Va., are among the incorporators.

Sutton, W. Va.—The Holly & Hackers Valley R. R. Co., of Sutton, has been incorporated to build a railroad in Braxton County from the forks of Holly River to Sutton. Incorporators: J. H. Brewster, Weston, W. Va., and Amos Bright, and others, of Sutton.

Cherryrun, W. Va.—It is stated that the engineers of the Western Maryland R. R. Co. (F. S. Landstreet, Gen. Mgr., Baltimore, Md.) are about to commence surveying for the construction of a 65-mile link to connect the Western Maryland R. R. at Cherryrun with the West Virginia Central R. R. at Cumberland.

East St. Louis, Ill.—The St. Louis & East Shore R. R. Co. has been incorporated, to construct a line from East St. Louis, through St. Clair, Monroe and Randolph Counties to Ft. Gage, and passing through Jackson, Williamson, Saline and Gallatin Counties. Incorporators: L. Robinson and U. O. Montgomery, of East St. Louis; Z. W. Finker, of St. Louis, Mo., and others.

Huntington, W. Va.—Surveyors are reported to be selecting a route for a branch of the Guyandotte Valley Ry. along Big Creek into Boone County to a point near Madison. The Chesapeake & Ohio R. R. Co. (J. D. Carlisle, Div. Supt., Hinton, W. Va.,) is reported interested.

Burnsville, Miss.—The North Mississippi & Bay Springs R. R. Co. has been incorporated, to construct a line from Burnsville through Tishomingo and Itawamba Counties, a distance of 35 miles. Incorporators: E. B. Causey, C. W. Wailes and F. J. Ozanne, of Memphis, Tenn.

Little Rock, Ark.—The Felsenthal Southern Ry. Co. has been incorporated, to construct a line from a point at or near where the Bastrop and Eldorado R. R. crosses Lake Landing in Union County, and extend to the State line, and through Union Parish, La., to some point to be hereafter selected, for a distance of 25 miles. Directors: Adolph Felsenthal, H. M. Marshall, C. G. Vaughan, and others.

Guthrie, Okla. Ter.—The Santa Fe R. R. Co. is reported to have decided to construct a line southwest from Guthrie through El Reno and Cement, Okla. Ter., into Texas. Jas. Dun, Ch. Engr., Chicago, Ill.

It is reported that the Missouri Pacific R. R. Co. has offered to construct a line to this city from Claremoore, Ind. Ter., a distance of 80 miles. Russell Harding, Gen. Mgr., St. Louis, Mo.

Enid, Okla. Ter.—It is stated that the Rock Island will construct a line from North Enid, Okla., to Ingersoll, where connection will be made with the Choctaw & Northern, recently purchased by the Rock Island. W. E. Dauchy, Ch. Engr., Chicago, Ill.

Chandler, Okla. Ter.—A charter is reported to have been granted to the St. Louis, El Reno & Western Ry. Co., with a capital of $100,000, to build a railroad 200 miles long, from the eastern border of Okla., in Lincoln County, touching Chandler, Guthrie, El Reno, Anadarko, Hobart and Mangum, and end in the southwestern part of Greer County. The Missouri Pacific is reported interested. Russell Harding, Ch. Engr., St. Louis, Mo.

New Orleans, La.—The New Orleans & San Francisco R. R. Co. is reported incorporated, with a capital of $5,000,000, to build a railroad from New Orleans by way of Arkansas to Chicago. The organization is in connection with the entrance into New Orleans of the 'Frisco system. C. D. Purdon, Ch. Engr., St. Louis, Mo.

Memphis, Tenn.—The Illinois Central R. R. Co. is reported to have authorized the double tracking of its line from Fulton to Memphis, a distance of 122 miles. H. U. Wallace, Ch. Engr., Chicago, Ill.

Egan, Tex.—It is stated that the Dallas, Cleburne & Southwestern Ry. Co. will extend its line from Egan to Dallas, a distance of about 40 miles. W. D. Myers, Pres., Cleburne, Tex.

Enid, Okla. Ter.—The Enid, San Diego & Pacific Co. is reported to be considering the construction of a coast extension for the St. Louis & San Francisco system, between Enid and San Diego.

Denver, Colo.—Orman & Crook and Good & Co., of El Paso, Tex., are reported to have secured the contract for building the Moffat road, 36 miles out of Denver. A tunnel 2½ miles in length is included in the contract. The contract is reported to amount to about $3,000,000.

Omaha, Neb.—A press report states that the Rock Island R. R. Co. will expend about $2,000,000 in improvements during 1903. The Iowa line into Omaha and the Colorado line out of Omaha will be improved. It is also proposed to build a new line to run from Fairbury, Neb., to Harrington, Kan., a distance of 90 miles. W. E. Dauchy, Ch. Engr., Chicago, Ill.

Seattle, Wash.—The Seattle & Canadian R. R. Co. has been incorporated, with a capital of $2,700,000. It will run from Tacoma to Sumas, on the British Columbia border. Incorporators: John H. McGraw, Seattle; Geo. Turner, of Spokane, and others. Surveys will begin at once. Principal office to be at Seattle.

Spokane, Wash.—The Spokane & Kootenai Ry. Co. has been incorporated, with a capital of $3,000,000, by D. C. Corbin, of Spokane; Jacob Furth, of Seattle; Chas. S. Bihler, of Tacoma, and others, to construct a railroad from a point in or near Spokane in a general northeast and northerly direction via Pend Oreille River and Lake, the Kootenai River and tributaries, to a point in Kootenai County, Idaho, a distance of 200 miles.

San Francisco, Cal.—Frank J. Baker, Ch. Engr. Richmond Belt Ry. Co., writes that E. B. and A. L. Stone, of Oakland, have secured the contract for excavating 200,000 cu. yds. of material, and constructing the roadbed for the first section of 4 miles.

Mountain View, Cal.—The Southern Pacific R. R. Co. is reported interested in the construction of a railroad from Mountain View to Los Gatos. Wm. Hood, Ch. Engr., San Francisco.

Creede, Colo.—The Colorado, Arizona & Gulf R. R. Co. is reported to have decided to construct a line from Creede to Clifton, Ariz., a distance of 524 miles, and from Clifton to San Pedro, Cal., a distance of 1,600 miles. Contracts for the construction work will probably be let about Mar. 1st. C. H. Gage, Pres., Denver.

Deming, N. M.—The new California Short Line R. R. Co., of New Mexico, has been incorporated by W. G. Crenshaw, Jr., of New York, N. Y.; S. D. Crenshaw, of Richmond, Va., and R. L. Young, of Las Cruces, N. M., with a capital of $1,250,000. This railroad will start at Deming, N. M., and will proceed easterly, crossing the Rio Grande and also the Santa Fe R. R. again at Las Cruces, which will probably be the headquarters of the company.

PUBLIC BUILDINGS.

Worcester, Mass.—Mayor Edward F. Fletcher has signed the order authorizing the loan of $300,000 for the erection of the City Hospital. The Trus. of the Hospital will have the plans for the changes and additions completed at once, and work will begin on the new buildings in the early spring.

Boston, Mass.—Lamont G. Burnham is reported to have bequeathed to the Boston City Hospital $150,000 for the erection of a building.

Everett, Mass.—An ordinance is stated to have been passed by the Bd. of Aldermen for the erection of a police station, to cost $25,000.

Bridgeport, Conn.—The Sisters of Charity of Baltimore, Md., are reported as having plans prepared for the St. Vincent's Hospital, to be erected at N. Main and French Sts., to cost about $100,000.

Brooklyn, N. Y.—Plans are stated to have been filed for a 4-story extension to Hall of Records at Fulton St. and Court Sq., to cost $400,000. Archt., R. L. Daus, 130 Fulton St.

New York, N. Y.—Plans are stated to have been filed for a 3-story brick repair shop for the Fire Dept., to cost $150,000. Archt., Alex. Stebina.

Easton, Pa.—It is reported that Chas. W. Bolton & Co., Witherspoon Bldg., Philadelphia, will soon let contracts for the erection of an edifice for the Olivet Presbyterian Congregation.

Philadelphia, Pa.—The Mayor has signed the ordinance for the purchase of the Macalester Farm as the site for the erection of the Municipal Hospital. The sum of $300,000 is now available for this improvement.

It is stated that a Synagogue, to be known as the Adath Israel Synagogue, will be erected at 8th and Christian Sts., and cost $175,000. Jacob Berger and Saml. Romanow are reported interested.

Kings Park, N. Y.—The Burleson Hardware Co., of Suspension Bridge, has secured the contract for plumbing improvements on Bldg. B, Long Island State Hospital, Kings Park, for $2,439.

North Tonawanda, N. Y.—Andrew Carnegie is stated to have offered this city $20,000 for a public library.

Gowanda, N. Y.—Bids will be received Jan. 14 by the State Comn. in Lunacy, Albany, for 1 high-pressure boiler with stoker, stoker engine, feed water purifier and connections, to be installed at the Gowanda State Homeopathic Hospital. G. L. Heins, State Archt. Address T. E. Geer.

Philadelphia, Pa.—Andrew Carnegie has offered this city $1,500,000 to be used in the erection of 30 branch libraries, on sites to be purchased by the city.

Washington, D. C.—Andrew Carnegie has decided to give another $350,000 to this city for the erection of branch libraries.

Hazleton, Pa.—See "Sewerage and Sewage Disposal."

Norfolk, Va.—Press reports state that the plans of Herbert D. Hall, of Boston, Mass., and Henry Morse, Jr., of Philadelphia, Pa. (Assoc. Archts.) have been accepted for the Carnegie Library; probable cost, $45,000. Bids for erecting this building will be received, according to reports, about Feb. 15.

Delaware, O.—Andrew Carnegie is stated to have offered this city $200,000 for the erection of a public library.

Springfield, O.—Press reports state that the M. E. Society will let contracts Feb. 1 for the erection of a church.

Marion, Ind.—It is stated that bids are wanted Jan. 19 for erecting a jail and sheriff's residence. Richards, McCarty & Bulford, Archts., Columbus, O. Geo. A. Modlin, Co. Aud.

Marshall, Ill.—The Clarke County Court House is reported destroyed by fire Dec. 31.

Madison, Wis.—It is stated competitive plans will be received for the erection of a $30,000 Carnegie Library.

Clinton, Ia.—Andrew Carnegie is stated to have offered an additional $15,000 for the erection of a public library, making the total cost of the building $45,000.

Centerville, Ia.—Bids will be received Jan. 28 by J. E. Parks, Co. Aud., for erecting a court house.

Marion, O.—Andrew Carnegie is stated to have offered this city $25,000 for a Carnegie Library.

Cincinnati, O.—Saml. Hannaford & Sons, Hulbert Blk., are stated to have submitted plans for the conversion of the Bremen St. Police Station into a bathhouse; the alterations will cost about $20,000.

Kansas City, Mo.—It is stated that the Prospect Ave. Christian Church Society will sell its present site and erect a $100,000 edifice on a new location.

Abilene, Tex.—R. M. Love, Comp. Pub. Accounts, Austin, writes that the Gainesville Plumbing Co., of Gainesville, Tex., has secured the contract for ventilating, heating, etc., at the Epileptic Hospital at Abilene (bids opened Jan. 3) for $48,500.

Corsicana, Tex.—The Comrs. Court of Navarro Co. will receive competitive plans and specifications until Jan. 22 for erecting a court house; probable cost, $125,000. A. B. Graham, Co. Judge, Coraicana.

Johnson City, Tenn.—Andrew Carnegie is stated to have given the National Soldiers' Home, of Johnson City, $25,000 for a library. Contracts for the erection will soon be let.

Chattanooga, Tenn.—W. T. Downing, 702 Equitable Bldg., Atlanta, Ga., is stated to have been selected to prepare plans for the Carnegie Library, to cost $50,000.

St. Francisville, La.—M. T. Lewman & Co., of Louisville, are reported to have received the contract at $38,000 for erecting the court house. Architects, Andrew J. Bryan & Co., of Jackson, Miss.

Warren, Ark.—It is stated that bids are wanted Jan. 19 for erecting the Bradley Co. Court House. W. L. Turner, Bldg. Comr.

Moscow, Idaho.—The M. E. Society is stated to be considering the erection of an edifice, to cost $25,000. Rev. W. T. Euster, Pastor.

Los Angeles, Cal.—The First Baptist Society is stated to be preparing to erect an edifice at Telegraph Ave. and Jones St., to cost $70,000.

San Bernardino, Cal.—It is stated that bids are wanted Jan. 28 for erecting a library. F. W. Gregg, Pres. Library Trus.

BUSINESS BUILDINGS.

Boston, Mass.—Plans have been filed for a 5-story brick building, 167x51 ft., for wool storage, to be erected on Summer and A Sts., So. Boston, for the Boston Wharf Co.; estimated cost, $60,000; contract not let; architect, M. D. Safford, 274 A St.

Plans have been filed for the erection of an 8-story brick and stone storage warehouse, 125x136 ft., on Beverly St., near Charles River, for Lovejoy's Wharf Trust, E. D. Codman, Trustee, 27 Kilby St.; estimated cost, $250,000; also for a shed, at same wharf, 100x131 ft.; estimated cost, $15,000. Builder, Whidden & Co., 19 Milk St.; architect, Stephen Codman, 31 Beacon St.

Brooklyn, N. Y.—It is stated plans are being prepared for an apartment hotel to be erected at Flatbush Ave. and Hawthorne St., to cost about $150,000 Clarence H. Tabor is reported interested.

Atlantic Highlands, N. J.—The Portland Hotel is reported destroyed by fire Jan. 4.

Homestead, Pa.—Dallowe Bros. are reported interested in the erection of a brick store and office building on 6th Ave., to cost $20,000.

Scranton, Pa.—J. D. Williams & Bro. will erect a store building, at a cost of $40,000.

Chester, Pa.—Benj. C. Fox is reported as having plans prepared for 2-story brick building, 20x100 ft., to be erected at 5th and Welsh Sts.

Philadelphia, Pa.—Furness, Evans & Co., Provident Bldg., are reported to be preparing plans for a 14-story brick and stone addition to the office building of the West End Trust and Safe Deposit Co., at Broad St. and S. Penn Sq.

Pittsburg, Pa.—H. L. Kreusler, 3215 Penn Ave., is stated to have received the contract for erecting a 4-story business building on Wood St. for Stanislaus Zock, at a cost of $25,000.

It is reported that John Goettman will erect a brick and steel warehouse at Penn Ave. and 18th St., to cost about $40,000.

Pittsburg, Pa.—Press reports state that bids will be received Jan. 17 for erecting the group of buildings for the Hale & Kilburn Co.

Washington, D. C.—Press reports state that the competition for the plans for the Masonic Temple to be erected on New York Ave., 13th and H Sts., has been extended from Dec. 30 to Jan. 30.

Dayton, O.—The United Brethren Publishing Co. is reported to have decided to remodel its present building, at a cost of about $300,000.

Laporte, Ind.—F. M. Garthwait, Chamber of Commerce Bldg., Chicago, Ill., is reported to have secured the contract for erecting the Planette factory buildings for the Laporte Land Co., at $29,990.

East St. Louis, Ill.—L. Pfeiffenberger & Son, Collinsville Ave., are reported to have prepared plans for a 3-story hotel, 75x125 ft., to be erected on Collinsville Ave., to cost about $35,000.

Alton, Ill.—The State Savings & Trust Co. will erect a $20,000 building.

Watertown, Wis.—The Masons are reported interested in the erection of a $25,000 building.

Battle Creek, Mich.—The 5-story office building of the Review & Herald is reported destroyed by fire.

South Bend, Ind.—The Studebaker Mfg. Co. is reported to have given the Y. M. C. A. $200,000 for the erection of a memorial building.

Chicago, Ill.—Marshall Field & Co. are reported interested in the erection of a 10-story warehouse on Ellsworth St.; probable cost, $250,000. Archts., D. H. Burnham & Co., Rookery Bldg.

La Crosse, Wis.—Frank Nixon and J. J. Hogan, of La Crosse, are reported interested in the erection of a hotel to cost $100,000.

Grand Rapids, Mich.—It is stated that Heystek & Camfield will erect a 6-story business building on S. Ionia St.

Clarington, O.—It is stated that bids are wanted Jan. 13 for erecting a building for the First National Bank. Julius Steiger, Cashier.

Athens, Tenn.—Fire is reported to have destroyed the 4-story brick building of Bayless & Moody on Dec. 27.

St. Joseph, Mo.—It is stated that the Elks of this city will erect a building, to cost $40,000. Frank N. Harlow is reported interested.

St. Louis, Mo.—Adam Bauer, 4366 W. Bell Pl., is stated to have secured the contract for erecting a group of 4 buildings for the Huttig Sash & Door Co., for about $93,000.

Ft. Smith, Ark.—It is stated that the Frisco R. R. Co. (C. D. Purdon, Ch. Engr., St. Louis, Mo.,) will erect a 2-story brick depot at this place, to cost about $60,000.

St. Louis, Mo.—Edward F. Nolte, 620 Chestnut St., is stated to have prepared plans for the erection of a 7-story hotel and theater building, at Grand Ave. and Olive St., to cost about $750,000.

A. F. Rosenheim, 717 Lincoln Trust Bldg., is reported to be preparing plans for a 12-story office building at 7th and Pine Sts., to cost about $400,000.

Kansas City, Mo.—L. N. Lester and J. M. Curtis are stated to be considering the erection of a 6-story business building at Baltimore Ave. and 10th St.

Meridian, Miss.—Bids will be received Jan. 17 by F. T. Lack, Archt., M. & O. R. R. Co., for erecting a joint freight depot for the M. & O. and Southern Ry. A. J. Alexander, Supt.

New Decatur, Ala.—It is stated that the Decatur Hotel Co. has been incorporated, with a capital of $25,000, to erect a hotel at Lafayette and Railroad Sts.

Beaumont, Tex.—Bids are wanted Feb. 2 for erecting a 5-story hotel. Mark Wiess, Pres. Threadneedle Hotel Co.

Omaha, Neb.—Walter Brandes is stated to have decided to remodel the building at 10th and Pacific Sts. as a hotel, at a cost of $70,000.

Seattle, Wash.—Plans are stated to have been filed for the erection of a 4-story brick building at Jackson St. and 3d Ave. S. for Herman Chapin; probable cost, $86,000. Contractor, M. Dow.

Los Angeles, Cal.—John Parkinson, of Los Angeles, is preparing plans for a 3-story business building, to be erected on Hill St., for the Los Angeles Lighting Co.

Riverside, Cal.—The Fraternal Brotherhood has in contemplation the erection of a 3-story brick building, to cost about $40,000.

Santa Cruz, Cal.—C. C. Tregmo is reported interested in the erection of a theater, to cost about $25,000.

Bismarck, N. D.—It is stated that John F. Philbrick will erect a hotel at 5th St. and Bway.

Wallace, Idaho.—The Wallace Hotel Co. is reported incorporated, with a capital of $100,000, to erect a hotel. F. F. Johnson, Pres. First Nat. Bank, is reported interested.

San Francisco, Cal.—Hemenway & Miller, Hearst Bldg., are stated to have prepared plans for the erection of a 10-story business building at 3d and Mission Sts., for A. Aronson, to cost about $400,000.

Aberdeen, S. D.—It is stated that bids will be received Feb. 2 by Jos. Schwarz, Archt., Sioux Falls, for erecting a 4-story and basement, 100x150 ft., brick warehouse for Jewett Bros.

NEW YORK.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

117 Ludlow St, 6-story br tenemt and store; c, $23,000; o & b, Packtman & Levin; a, G. F. Pelham.

Madison and Catharine Sts, 6-story br tenemt and stores; c, $45,000; o, Polak-Oransky; a, Horenburger & Straub.

BROOKLYN.

Dean St and Carlton Ave, 3-story br factory; c, $25,000; o, Estey Wire Works; a, F. H. Quinby.

DWELLINGS.

Bennington, Vt.—Plans are reported to have been prepared for 3-story stone residence for Fred. B. Jennings, of New York, N. Y., to cost about $250,000.

Bernardsville, N. J.—The residence of Geo. B. Post, Jr., is reported destroyed by fire Dec. 31.

St. Davids, Pa.—Edgar V. Seeler, Real Estate Trust Bldg., Philadelphia, is stated to have prepared plans for a residence for Helen L. Murphy, at St. Davids, to cost about $100,000.

Washington, D. C.—Geo. H. Huff is reported interested in the erection of a 46x67-ft. brick house at New Hampshire Ave. and Q St.; he also proposes erecting a residence for his own use on Sherman St.

B. Stanley Simmons, 523 9th St., N. W., is stated to have prepared plans for a 4-story brick apartment house to be erected at G and 8th Sts. for Jas. O'Donnell.

Ft. Worth, Tex.—E. B. Wharton is stated to be considering the erection of a residence on Pennsylvania Ave., to cost about $50,000.

Spokane, Wash.—Geo. C. Peck is reported interested in the erection of a 2-story brick flat, to cost about $50,000.

NEW YORK.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

713 and 715 E 9th St, 6-story br tenemt, c, $30,000; o, Julius Weinstein; a, Bernstein & Bernstein.

26th St and 8th Ave, 6-story br tenemt, c, $25,000; o, Louis J. Marx; a, Alfred E. Badt.

137th St and 5th Ave, 2 6-story br tenemt, c total, $60,000; o, M. S. A. Wilson; a, Sass & Smallheiser.

SCHOOLS.

Boston, Mass.—The following bids are stated to have been received by School House Comn. for school work, bidders all of Boston: For erecting a primary school on Horace and Byron Sts., East Boston—John J. Flynn, $96,615; Mack & Moore, $104,400; Conner Bros., $108,000; Whidden & Co., $111,000; Wheaton Bldg. & Lumber Co., $112,500; H. P. Cummings & Co., $114,880; Henry McGahey, $119,260; Holmes Bros., $130,500. For installing a plumbing system in school to be erected on Norman St., Ward 8—M. Ahern, $26,715; W. F. Atkinson & Co., $23,520; Robt. F. Brown, $20,900; J. P. Conlon, $25,000; T. Costello & Co., $19,300; D. A. Horgan, $25,823; Huey Bros., $19,947; Hussey & Co., $21,173; E. C. Kelley, $19,957; W. N. McKenna, $20,186; Pierce & Cox, $18,995; J. Tucker & Sons, $21,500. For heating and ventilating the new primary school to be erected at Kenwood Road and Huntington Ave.—Bradlee & Chatman Co., $15,606; Cleghorn Co., $13,090; A. B. Franklin, $12,497; Huey Bros., $11,697; Ingalls & Kendricken, $13,195; Pierce & Cox, $12,973; A. A. Sanborn, $13,462; J. Tucker & Sons, $14,300, and Walworth Construction & Supply Co., $13,967.

Lynn, Mass.—The citizens are stated to have voted to issue $30,000 bonds for the erection of a school.

Brookline, Mass.—See "Water."

Boston, Mass.—See "Power Plants, Gas and Electricity."

Brooklyn, N. Y.—Bids will be received Jan. 19 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures and electric bell system in Schools No. 130 and 142, Boro. of Brooklyn.

Schenectady, N. Y.—Bids are wanted Jan. 12 for erecting a high school. S. B. Howe, Secy. Bd. of Educ.

Washington, D. C.—Bids are wanted Jan. 15 for erecting a 4-room addition to the Cranch School. Henry B. F. MacFarland, Chmn. Comrs. of the D. C.

Albany, N. Y.—Maurice Mead, 237 Sheridan Ave., is stated to have secured the contract for erecting School No. 9, for $29,500.

Bayonne, N. J.—See "Water."

Philadelphia, Pa.—Local press reports state that the Bd. of Educ. is preparing plans for the Northeast Manual Training School and Mechanical Free Library, to be erected on the site of old Fairhill Reservoir. Plans will be ready for bids about Feb. 1. Horace Cook, Supervising Archt. of Bd. Educ.

New York, N. Y.—The following bids were opened on Jan. 5 by C. B. J. Snyder, Supt. of School Bldgs., for installing the ventilating and heating apparatus of addition to and alterations in Public School 89, Boro. of Manhattan: United Heating Co., $16,246; Blake & Williams, $16,148; Williams & Gerstle, $16,447; Francis Bros. & Jellett (Incp.), $17,250; Wm. N. Tobin, 109 W. 42d St., $15,414 (awarded); John Neal's Sons, $15,940; E. Rutzler, $15,912; Jas. Curran Mfg. Co., $17,550; The Baldwin Eng. Co., $17,110.

Bids will be received Jan. 19 by C. B. J. Snyder, Supt. of School Bldgs., for installing electric light wiring, fixtures and electric bell system in Schools No. 31 and 89, Boro. of Manhattan. Bids will also be received on that date for installing bath in the annex to Girls' Technical High School, No. 146, for alterations and sanitary work to the building for an annex to School No. 18 and for installing ventilating and heating apparatus of addition to and alterations in School No. 92, Boro. of Manhattan.

Baltimore, Md.—Local press reports state that plans have been completed for the administration building for the Maryland Agricultural College, at College Park, and bids will be received Jan. 17. Owens & Sisco, Archts.

Asheville, N. C.—It is stated that an additional building will be erected to the Asheville School, to cost $35,000.

Columbus, O.—Bids are wanted Feb. 3 for furnishing material and erecting an engineering building for the Ohio State University. Prof. J. N. Bradford, Archt. of University. Alexis Cope, Secy. Bd. of Trus.

Quincy, Ill.—Press reports state that bids will be received Feb. 25 by the Bd. of Educ. for erecting a school on the site of the present Webster School.

Bloomer, Wis.—Bids are wanted Jan. 20 for erecting an 8-room school. Robt. Cottington, Pres. Bd. of Educ.

Milwaukee, Wis.—Local press reports state that the contracts for plumbing and gas fitting in the 19th Ward School was awarded to Fredenfeld Bros., 2102 Vliet St., for $3,488, and for the plumbing and gasfitting of the 9th Ward School, to F. A. Ooll, 1227 State St., for $3,922.

The Bd. of Pub. Works will receive competitive sketch plans and outline specifications Jan. 24 for erecting an 18-room school at Cass St., including ventilating, steam heating, plumbing and an approved smoke-consuming apparatus; estimated cost, $75,000. Chas. J. Poetsch, Chmn. Bd. Pub. Wks. In a previous issue this item read bids are wanted, and should have been plans will be received.

Plymouth, Wis.—Plans are stated to have been prepared for a $20,000 school. E. W. Rowe, Secy.

Louisville, Ky.—The contract for erecting the girls' dormitory at the State College, is stated to have been awarded to Clark & Howard, of Lexington, for $40,000.

Dallas, Tex.—Bids are wanted Jan. 20 for erecting a 3-story brick building for Dallas Commercial College. John D. Mathews, Archt., 395 Main St.

Salt Lake City, Utah.—The Com. on Bldgs. & Grounds of the Bd. of Educ. on Dec. 26 opened the following bids for erecting a school at N. State St., not including ventilating and heating: Geo. W. Michel, $128,000; Alex. McDonald, $123,687; T. J. Armstrong, $131,789; Asper, Noall & Co., $134,000; Oliver Hodgson, $134,347; Schraven & Fisher, $146,400; Salt Lake Bldg. & Mfg. Co., $120,000.

Abercrombie, N. D.—It is stated that bids are wanted Jan. 27 for erecting a 2-story brick school. W. C. Albrant, Archt., Fargo. M. M. Borman, Clk.

STREET CLEANING AND GARBAGE DISPOSAL.

Hazleton, Pa.—See "Sewerage & Sewage Disposal."

Ft. Dodge, Ia.—Mayor Bennett and City Solicitor Mitchell are reported to have been empowered to contract with A. N. Talcott, representative of the American Underwriting Co., of Boston, Mass., the firm financing the International Waste Utilization Co. for the location in Ft. Dodge of a plant for the disposition of the city garbage and waste matter. The company will erect a plant of stone, brick or cement and, when fully equipped and in operation, will cost about $60,000.

St. Paul, Minn.—City Engr. L. W. Rundlett is reported to be visiting certain cities where he will inspect sprinkling wagons with a view to making purchases for the new municipal sprinkling plant which will be established early in the spring.

Ft. Brady, Mich.—The Municipal Eng. Co., 1123 Bway., New York, N. Y., have secured the contract for a garbage crematory and shed at Ft. Brady (bids opened Dec. 24), for $3,000.

Kansas City, Mo.—Bids will be received Jan. 20 by the Bd. of Health for the collection and disposal of garbage, and dead animals of said city. Edwin W. Davis, Secy.

Galveston, Tex.—J. D. Kelley, City Secy., writes that the contract for doing the scavenger work for 1 yr. (bids opened Dec. 27) has been awarded to P. J. Fitzpatrick, at the following bid: 75 cts. for 1 bbl. of 33 gal. or part thereof; 60 cts. for each additional bbl. not exceeding 4, and 50 cts. for each bbl. over 4.

GOVERNMENT WORK.

Boston, Mass.—The following bids were opened Jan. 5 by Lieut.-Col. W. S. Stanton, Corps of Engrs. U. S. A., for dredging, *a*, Weymouth River; *b*, Town River, and *c*, Cohasset Harbor, price given per cu. yd.: Eastern Dredging Co., *a*, 39.3 cts.; *b*, 32.3 cts.; *c*, 36.9 cts. Bay State Dredging Co., *a*, 43 cts.; *b*, 32 cts.; *c*, 34.75 cts. Simon J. Donovan, *a*, 37 cts.; *b*, 34 cts.; *c*, 38 cts. Bidders all of Boston.

Bids are wanted Feb. 10 for delivering 300,000 tons of rubblestone in breakwater at Sandy Bay. Capt. Harry Taylor, Corps Engrs.

Portland, Me.—See "Sewerage and Sewage Disposal."

Boston, Mass.—Bids are wanted Feb. 4 for dredging Plymouth Harbor. Lieut. Col. W. S. Stanton, Corps Engrs.

Newport, R. I.—Bids will be received at the U. S. Engr. Office Feb. 12 for dredging Providence Harbor, R. I., as advertised in The Engineering Record.

New York, N. Y.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., Feb. 3, for the construction of fire escapes in the U. S. Appraisers' Warehouse in New York, as advertised in The Engineering Record.

Ft. Wadsworth, N. Y.—Bids are wanted Feb. 2 for erecting 1 set of brick hospital steward's quarters. Address Lieut. Geo. L. Hicks, Jr., Q. M.

Washington, D. C.—Bids are wanted Jan. 13 for furnishing the Navy Yard with 1 feed water purifying machine, a quantity of steel, iron, etc. A. S. Kenny, Paymaster Gen., U. S. N.

Richmond, Va.—The following bids were opened Jan. 3 by Lieut. Col. Chas. J. Allen, Corps of Engrs., U. S. A., for dredging, removing rock and jetty and dike work in James River—A, J. Clements Shafer, Richmond, Va.; B, Maryland Dredg'g & Contg. Co., Baltimore; C, P. Sanford Ross, Inc., Jersey City, N. J.:

	A	B	C
Clear. & enlarg. channel—			
164,620 cu. yds.....	$0.28	$0.40	$0.39
3,189 cu. yds.....	.28	.42	.39
54,716 cu. yds.....	.28	.42	.39
23,481 cu. yds.....	5.00	6.10	5.75
Degrading jetties—			
4,560 cu. yds.....	.28	.42	.39
2,000 cu. yds.....	3.50	6.10	5.75
Item. excav. material—			
128,000 cu. yds.....	.16	.12	.15
6,226 cu. yds.....	.095	.12	.14
102,000 cu. yds.....	.18	.05	.03
Dike and jetty work—			
5,399 lin. ft.....	.27	.27	.24
2,441 lin. ft.....	.45	.40	.37
1,068 lin. ft.....	.45	.40	.37
23.7 M ft. timber.	48.00	50.00	42.00
4.5 M ft. timber.	48.00	50.00	42.00
93.4 M ft. timber.	34.50	40.00	32.00
40.5 M ft. timber.	48.00	50.00	42.00
Totals	$236,978	$278,758	$266,680

Savannah, Ga.—The following bids which are reported to have been rejected, were received Dec. 26 by Capt. C. E. Gillette, Corps Engrs. U. S. A., for dredging waterway between Savannah and Fernandina: Geo. W. Catt, of New York, N. Y., 20.3 cts. per cu. yd., or about $63,000; P. Sanford Ross, Jersey City, N. J., 21 cts. per cu. yd., and the Coastwise Dredging Co., of Wilmington, Del., 21.4 cts. per cu. yd.

Grand Rapids, Mich.—Bids will be received at the U. S. Engr. Office, Grand Rapids, Feb. 5, for repairs of piers and closing entrance to outer basin at Michigan City, Ind., and for repairs of north pier at Grand Haven, Mich., as advertised in The Engineering Record.

Ft. Caswell, N. C.—Bids are wanted Jan. 28 for constructing roads at this post; also on Jan. 31 for constructing, including heating, plumbing and wiring, the Guard House and Administration Bldg. Address Philip Yost, Q. M.

Key West, Fla.—Bids will be received Jan. 13 at the Bureau of Supplies & Accounts, Navy Dept., Washington, D. C., for furnishing at the naval station, Key West, a fire pump, pipe, pipe specials, valves and hydrants. A. S. Kenny, Paymaster Gen., U. S. N.

Milwaukee, Wis.—Wm. H. Gillen, of Milwaukee, is stated to have secured the contract for the improvement of Milwaukee Harbor, for $202,430.

Philadelphia, Pa.—Bids are wanted Feb. 7 for a sewerage and drainage system at the Navy Yard, League Island. Appropriation, $11,000. Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Mobile, Ala.—The following bids for dredging in Pascagoula River and Mississippi Sound were received by Capt. Spencer Cosby, Corps Engrs. U. S. A., Dec. 29: *a*, For material excavated from Section 1 by the hydraulic process; *b*, for material excavated from Section 2 by bucket or dipper dredges; *c*, for work covered by items *a* and *b* on basis of single contract for entire work; *d*, for entire work performed by hydraulic method: Geo. W. Catt, New York City, *a*, 17 cts.; *b*, 16 cts.; *c*, 17 and 15 cts. Rittenhouse Moore, Mobile, Ala., *b*, 17.5 cts. National Dredging Co., Wilmington, Del., *b*, 17.9 cts. Raymond A. Perry, San Francisco, Cal., *d*, 23 cts.

Galveston, Tex.—The Government Engrs. appointed by Ch. Engr. Gillespie to investigate the advisability of the Government extending the Galveston sea wall, to protect the Government reservations, have reported in favor of the proposed extension of the sea wall, and advocated the expenditure of a large sum for the purpose.

Little Rock, Ark.—Bids will be received at the U. S. Engr. Office, Little Rock, on Feb. 9 for furnishing large riprap stone for lock and dam, Upper White River, Ark., as advertised in The Engineering Record.

Ft. Ringgold, Tex.—It is stated that bids are wanted Jan. 15 for sinking an artesian well. John L. Olem, Dept. Q. M. Gen.

Galveston, Tex.—In connection with the bids reported last week for jetty work in charge of Capt. C. S. Riche, Corps of Engrs., U. S. A., those submitted for the whole work were as follows, using the notation in last week's note: Chas. Clarke & Co., *d*, $3.15; *e*, $4.30; *f* (1) $4.12, (2) $4.92, (3) $5.33; total, $284,176. Parker-Washington Co., *d*, $2.99; *e*, $4.14; *f* (1) $3.95, (2) $4.86, (3) $5.20; total, $276,530. The former bidder bid for Brazos River jetties as follows: *g* (1) 7,000 tons small riprap, *g* (2) 7,500 tons large riprap, *g* (3) 80,000 ft. logs in cribs and spurs; *g* (1) $3.60, (2) $4.95 (3) 46 cts.; total, $99,125; if given all the jetty work, *g* (1) $3.50, (2) $4.50, (3) 42 cts., making with the rest of the jetty work a total of $1,039,526. The latter bid *g* (1) $4, (2) $5.20, (3) 39 cts.; if given all the work, *g* (1) $3.39, (2) $4.25, (3) 39 cts.; total, $1,000,435. Isaac Heffron, Galveston, bid for the Brazos River work as follows: *g* (1) $3.74, (2) $4.70, (3) 41 cts.; total, $93,230.

San Francisco, Cal.—Bids are wanted Jan. 20 for furnishing material and rebuilding Oakland Harbor light station. Lieut. Col. Thos. H. Handbury, Corps Engrs., U. S. A., Light House Engr.

Ft. Apache, Ariz.—Bids are wanted Feb. 5 for furnishing material and constructing a sewer system at this post. Lieut. Col. J. W. Pope, Ch. Q. M., Denver, Colo.

Ft. Logan, Colo.—Bids will be received by Lieut. Col. J. W. Pope, Ch. Q. M., Denver, Colo., until Feb. 6 for furnishing material and constructing a steel tank on Balloon House Hill, Ft. Logan.

Ft. Duchesne, Utah.—Bids are wanted Jan. 29 for furnishing material and constructing a sewer system. Address Lieut. Col. J. W. Pope, Ch. Q. M.

MISCELLANEOUS.

New York, N. Y.—Bids will be received Jan. 16 by McDougall Hawkes, Comr. of Docks, for furnishing material for constructing a pier, with appurtenances, at the ft. of Albany St., North River, to be known as Pier 10; also for dredging on North River between W. 18th and 20th Sts.

Boston, Mass.—The following bids were opened Jan. 1 by the Boston Transit Comn. for constructing part of Section E, East Boston Tunnel:

Bidders.	5,500 cu. yds. earth excav.	1,330 cu. yds. Port. cem. conc.	125 cu. yds. of old foundation.	630 sq. yds. Port. cem. mortar.	630 sq. yds. pitch or asphalt.	630 sq. yds. tarred felt.	Supporting old State House.	Totals.
John Cavanaugh & Son, Boston..	$9.33	$20.00	$15.00	$1.00	$0.50	$0.20	$17,900	$103,466
McGawley & Coughlin, Boston....	7.25	14.00	8.00	1.00	0.50	0.50	18,000	83,090
H. P. Nawn, Roxbury.....	6.00	11.00	6.00	1.00	0.30	0.60	12,700	65,124
John Y. Mainland, Boston.....	3.60	13.90	5.40	0.84	0.40	0.60	13,848	58,089
Metropolitan Cont'g Co., Boston..	4.50	11.25	6.00	0.72	0.50	0.25	8,500	53,039
Jones & Meehan, Boston.....	5.00	12.00	...	0.80	0.50	0.30	5,000	53,038
P. McGovern, Roxbury.....	4.00	11.50	5.00	0.50	0.50	0.20	3,845	45,171
E. W. Everson & Co., Roxbury....	3.00	12.50	8.00	0.50	0.50	0.25	4,000	42,687
Woodbury & Leighton, Boston*...	2.00	7.50	6.75	0.75	0.35	0.50	12,000	39,102

*Awarded contract.

Syracuse, N. Y.—Local press reports state that John Kelley has transferred the contract for improving the channel of Onondaga Creek to Thos. F. Moore; the original contract amounted to $28,000.

New York, N. Y.—The only bidder Jan. 2, for furnishing 10,000 bbls. Portland cement for Dept. of Docks, was John P. Kane Co., 287 4th Ave., at $1.99 per bbl. Recommended for award.

The contract for removing 2 piers and building a new wooden pier at E. 86th St. and East River, Boro. of Manhattan, has been awarded to Bernard Rolf, 39 Cortlandt St., at $1.60 per cu. yd. for 3,000 yds. dredging and $16,333 for removing old piers and building new one.

Bayonne, N. J.—See "Water."

Buffalo, N. Y.—Bids will be received Jan. 17 by F. W. M. Heerwagen, City Compt., for $100,000 bonds for the abatement of nuisance of Main and Hamburg St. Canal.

Terre Haute, Ind.—The lowest bid received for the construction of the levee on the west bank of the Wabash, is stated to have been submitted by W. H. Harris, of Terre Haute, for $16,380.

Bossier City, La.—Bids will be received Feb. 5 by the Bd. of Comrs. of the Bossier Levee Dist. for constructing the following levee work: Dortch Levee, approximate contents, 110,000 cu. yds.; Mercer Levee, raising and enlarging approximate contents, 35,000 cu. yds., and Buckborn Levee, approximate contents, 25,000 cu. yds. T. N. Braden, Secy. of Bd., Curtis.

Sacramento, Cal.—Frank D. Ryan, State Comr. of Pub. Wks., in a report to Gov. Gage in relation to river improvement, recommends a new channel for the Sacramento River, from a point on Horseshoe Bend enlarging the channel past Wood Island and deepening and improving the river channel between Sacramento City and Knights Landing; he further states that a liberal allowance for cost of excavation would be 9 cts. per cu. yd., making a total of $522,000 to complete the work.

NEW INDUSTRIAL PLANTS.

The Garetson-Greason Lumber Co., Rialto Bldg., St. Louis, Mo., intends to build a sawmill and box factory at Campbell, Mo.

W. A. Jacobs, Manchester, Tenn., is putting in a flour mill to have a daily capacity of 50 bbls.

The Williamsburg, Pa., Paper Mfg. Co. expects to begin the construction, about April 1, of a mill to have a daily capacity of 40,000 lbs. of high grade material. Thad. E. Ragsdale, Supt.

The American Book Co., 317 Walnut St., Cincinnati, O., contemplates erecting a 5-story, 66x138-ft., office and administration building of steel construction, and a 4-story manufacturing building, probably of mill construction, and 225 ft. long, with 120-ft. wings at each end. The power plant will be situated between the wings of the building, and will probably have a capacity of about 365 H.-P.

The Cogniliard Wagon Works, operated for some time at South Bend, Ind., have been purchased by Henderson, Ky., capitalists, and will be removed there as soon as the buildings now being erected at that place are ready. Plans have been prepared for 80x300, 100x300 and 140x235-ft. buildings, with additional power plant, dry kiln and storage. The company is in the market for an automatic Corliss engine of 200 H.-P. at about 80 revolutions and two 100-H.-P. tubular boilers.

The Gadsden, Ala., Brick Co., capital $25,000, will erect a plant to have a daily capacity of 50,000, and is in the market for a 100-H.-P. boiler and engine. Brick machine has been bought. W. T. Christopher, Columbus, Miss., will have charge of the plant.

The Cameron, W. Va., China Co. has been incorporated, with a capital of $100,000, and will erect a four-kiln pottery, so arranged that it can be enlarged to a six-kiln plant. The building will be 400x80 ft., the glost ware-rooms and shipping department three stories high and the clay shops two. The company expects to install an electric lighting plant. The officers of the company are: Pres., M. L. Benedum; Vice-Pres., Alfred Hard; Secy., S. E. Strieklin; Treas., A. E. Fox.

BUSINESS NOTES.

The Charles L. Eidlitz Co., New York, has been incorporated, with a capital of $50,000, to install electric light, heat and power plants. The directors are: C. L. Eidlitz, F. M. Dyer and Roger Lewis, of New York.

The Ball Engine Co., Erie, Pa., reports the following among recent sales: Savoy Hotel, Kansas City, Mo., a 125-H.-P. direct-connected engine; Glauber Brass Mfg. Co., Cleveland, O., a 175-H.-P. engine; Monument Pottery Co., Trenton, N. J., 125 and 50-H.-P. direct-connected engines.

The American Elevator Co., 113 Cedar St., New York City, has been incorporated, with a capital of $25,000. Hollis J. Parks, President and General Manager; J. Diller Wilson, Vice-President and Treasurer; Carl M. Watson, Secretary and General Supt.

S. D. Warren & Co. have recently bought three induction motors, two of 100-H.-P. and one of 150-H.-P., from the Westinghouse Electric & Mfg. Co., to be installed in their paper mill at Cumberland Mills, Me. The two 100-H.-P. motors will be used for driving blowers furnishing mechanical draft, and the 150-H.-P. motor will drive paper-making machinery of various kinds.

The Hungarian Asphalt Paving Co., Ltd., of Budapest, Hungary, has just placed an order with The F. D. Cummer & Son Co., of Cleveland, for one of its complete Cummer semi-portable asphalt paving plants, to be erected at Budapest, Hungary.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Jan. 13.	Penngrove, N. J.	Jan. 10
Jan. 13.	St. Louis, Mo.	Jan. 3
Jan. 14.	Ardmore, Ind. Ter.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
Jan. 15.	Ft. Ringgold, Tex.	Jan. 10
Jan. 15.	Louisville, Ky.	Jan. 10
Jan. 15.	St. Paul, Minn.	Dec. 20
Jan. 16.	Georgetown, S. C.	Jan. 3
Jan. 20.	Evans, Colo.	Dec. 27
Jan. 24.	Middletown, N. Y.	Jan. 10
Jan. 28.	Filters, reserv'r, etc., Washington, D.C.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
Jan. 30.	Havre, Mont.	Dec. 27
Feb. 1.	Brinkley, Ark.	Jan. 10
Feb. 2.	Winnipeg, Man.	Jan. 10
Feb. 2.	Gillett, Wis.	Jan. 10
Feb. 6.	Wellsville, O.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Mar. 14.	Dillon, Mont.	Jan. 10
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Jan. 12.	New York, N. Y.	Jan. 10
Jan. 13.	New York, N. Y.	Jan. 10
Jan. 13.	Jersey City, N. J.	Jan. 10
Jan. 14.	Brooklyn, N. Y.	Jan. 3
Jan. 16.	Clay Center, Kan.	Dec. 20
Jan. 21.	Cincinnati, O.	Jan. 10
Jan. 23.	Decatur, Ill.	Jan. 3
Jan. 24.	Dixon, Ill.	Jan. 10
Jan. 26.	Cincinnati, O.	Jan. 3
Jan. 27.	Newark, O.	Jan. 10
Jan. 29.	Ft. Duchesne, Utah	Jan. 10
Jan. —	Walnut, Ill.	Dec. 13
Feb. 2.	New Orleans, La.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Jan. 10.	
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 7.	Philadelphia, Pa.	Jan. 10
Feb. —	Dixon, Ill.	Dec. 13
	BRIDGES.	
Jan. 12.	New York, N. Y.	Jan. 10
Jan. 14.	Camden, N. J.	Jan. 10
Jan. 14.	Pulaski, Pa.	Jan. 3
Jan. 15.	St. Paul, Minn.	Jan. 10
Jan. 15.	Tacoma, Wash.,	Jan. 3
Jan. 17.	Willowsprings, Ill.	Jan. 10
Jan. 20.	New York, N. Y.	Jan. 3
Jan. 27.	East Peoria, Ill.	Jan. 10
Jan. 28.	Springfield, O.	Jan. 10
Jan. —	Peoria, Ill.	Dec. 13
Feb. 1.	Jacksonville, Fla.	Jan. 10
Feb. 10.	Arkadelphia, Ark.	Jan. 10
Feb. 10.	Castroville, Tex.	Jan. 3
	PAVING AND ROADMAKING.	
Jan. 12.	New York, N. Y.	Jan. 10
Jan. 13.	New York, N. Y.	Jan. 10
Jan. 15.	Washington, Ia.	Dec. 27
Jan. 15.	Ft. Collins, Colo.	Dec. 27
Jan. 16.	New York, N. Y.	Jan. 10
Jan. 17.	Zanesville, O.	Jan. 3
Jan. 19.	Toledo, O.	Dec. 27
Jan. 19.	Cincinnati, O.	Dec. 27
Jan. 20.	Cleveland, O.	Jan. 10
Jan 23.	Cincinnati, O.	Jan. 10
Jan. 24.	Greenville, O.	Jan. 10
Jan. 26.	Jersey City, N. J.	Jan. 10
Jan. 27.	Cleveland, O.	Jan. 10
Jan. 29.	Cleveland, O.	Jan. 3
Jan. 30.	Owosso, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 1.	Burlington, Ia.	Jan. 3
Feb. 3.	Cleveland, O.	Jan. 10
Feb. 4.	Sandusky, O.	Jan. 10
Feb. 4.	Cincinnati, O.	Jan. 10
Feb. 14.	Lafayette, Ind.	Dec. 27
Feb. 17.	Three Rivers, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 23.	Fond du Lac, Wis.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
	POWER, GAS AND ELECTRICITY.	
Jan. 12.	New York, N. Y.	Jan. 3
Jan. 15.	Rome, Ga.	Oct. 11
Jan. 19.	New York, N. Y.	Jan. 10
Jan. 30.	Havre, Mont.	Dec. 27
Jan. —	South Norwalk, Conn.	Dec. 13
Feb. 1.	Brinkley, Ark.	Jan. 10
Feb. 12.	Guayaquil, Ecuador	Dec. 20
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Jan. 12.	Washington, D. C.	Dec. 13
	Adv., Eng. Record, Dec. 13, 20.	
Jan. 13.	Washington, D. C.	Jan. 10
Jan. 13.	Key West, Fla.	Jan. 10
Jan. 13.	Superior, Wis.	Dec. 20
Jan. 14.	Steel towboat, Memphis, Tenn.	Dec. 20
	Adv., Eng. Record, Dec. 20, 27.	
Jan. 14.	Helena, Mont.	Dec. 6
	Adv., Eng Record, Dec. 6, 13.	
Jan 15.	Ft. Ringgold, Tex.	Jan. 10
Jan. 15.	Duluth, Minn.	Dec. 20
	Adv., Eng. Record, Dec. 20 to Jan. 10.	
Jan. 15.	Los Angeles, Cal.	Dec. 20
Jan. 15.	Chemawa, Ore.	Dec. 20
Jan. 15.	Newport, R. I.	Dec. 13
	Adv., Eng. Record, Dec. 13 to Jan. 3.	
Jan. 15.	Norfolk, Neb.	Dec. 6
Jan. 15.	Machinery for dredge, Wash'ngton, D.C.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Dec. 13, Jan. 10.	
Jan. 17.	Charleston, S. C.	Dec. 20
Jan. 17.	Bldg., Philadelphia, Pa.	Dec. 20
Jan. 20.	San Francisco, Cal.	Jan. 10
Jan. 20.	Seattle, Wash.	Jan. 3
Jan. 21.	Los Angeles, Cal.	Jan. 3
Jan. 22.	Chattanooga, Tenn.	Dec. 27
Jan. 22.	Buffalo, N. Y.	Dec. 27
	Adv., Eng. Record, Dec. 27 to Jan. 10.	
Jan. 22.	Dredging, Boston, Mass.	Dec. 20
	Adv., Eng. Record, Dec. 20, 27, Jan. 10.	
Jan. 24.	Ft. Fremont, S. C.	Jan. 3
Jan. 26.	Chicago, Ill.	Jan. 3
Jan. 26.	St. Augustine, Fla.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
Jan. 27.	Creston, Ia.	Jan. 3
Jan. 28.	Ft. Caswell, N. C.	Jan. 10
Jan. 29.	Ft. Duchesne, Utah	Jan. 10
Jan. 29.	Philadelphia, Pa.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
Jan. 30.	Newport, R. I.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
Jan. 31.	Ft. Caswell, N. C.	Jan. 10
Feb. 2.	Ft. Wadsworth, N. Y.	Jan. 10
Feb. 3.	New York, N. Y.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 3.	San Francisco, Cal.	Jan. 3
Feb. 4.	Boston, Mass.	Jan. 10
Feb. 5.	Grand Rapids, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 6.	Ft. Logan, Colo.	Jan. 10
Feb. 7.	Sewer, Philadelphia, Pa.	Jan. 10
Feb. 7.	Dry dock, Philadelphia, Pa.	Dec. 20
Feb. 9.	Little Rock, Ark.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 10.	Boston, Mass.	Jan. 10
Feb. 12.	Newport, R. I.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
	BUILDINGS.	
Jan. 12.	School, Schenectady, N. Y.	Jan. 10
Jan. 12.	School, New York, N. Y.	Jan. 3
Jan. 12.	School, Long Island City, N. Y.	Jan. 3
Jan. 13.	Bus. Bldg., Clarington, O.	Jan. 10
Jan. 13.	Hospital, Sonyea, N. Y.	Jan. 3
Jan. 14.	Hospital, Gowanda, N. Y.	Jan. 10
Jan. 14.	Hospital, Fresno, Cal.	Jan. 3
Jan. 14.	College, New York, N. Y.	Jan. 3
Jan. 14.	Court House, Hickman, Ky.	Dec. 20
Jan. 15.	School, Washington, D. C.	Jan. 10
Jan. 15.	School, Salem, Ore.	Jan. 3
Jan. 15.	Court House, Cambridge, O.	Jan. 3
Jan. 15.	School, Bridgeport, Conn.	Jan. 3
Jan. 15.	Hospital, Toledo, O.	Dec. 27
Jan. 15.	School plans, Beaumont, Tex.	Dec. 20
Jan. 15.	Library, Winnipeg, Man.	Dec. 13
Jan. 15.	Library plans, Binghamton, N. Y.	Nov. 15
Jan. 16.	Plumbing, etc., Randall's Island, N. Y.	Jan. 3
	Adv., Eng. Record, Jan. 3, 10.	
Jan. 17.	Depot, Meridian, Miss.	Jan. 10
Jan. 17.	Bus. Bldgs., Pittsburg, Pa.	Jan. 10
Jan. 17.	School, Baltimore, Md.	Jan. 10
Jan. 17.	Roundhouse, Denaison, Tex.	Dec. 27
Jan. 19.	Pub. Bldg., Marion, Ind.	Jan. 10
Jan. 19.	School, New York, N. Y.	Jan. 10
Jan. 19.	School, Brooklyn, N. Y.	Jan. 10
Jan. 19.	Court house, Warren, Ark.	Jan. 10
Jan. 20.	School, Dallas, Tex.	Jan. 10
Jan. 20.	School, Bloomer, Wis.	Jan. 10
Jan. 20.	Pub. Bldg., Danville, Ky.	Jan. 3
Jan. 20.	Bus. bldg, Flint, Mich.	Dec. 20
Jan. 22.	Court house, Corsicana, Tex.	Jan. 10
Jan. 23.	Jail, Grand Junction, Colo.	Dec. 13
Jan. 24.	School plans, Milwaukee, Wis.	Jan. 10
Jan. 27.	School, Abercrombie, N. D.	Jan. 10
Jan. 28.	Court house, Centerville, Ia.	Jan. 10
Jan. 28.	Library, San Bernardino, Cal.	Jan. 10
Jan. 30.	Masonic Temple, Washington, D. C.	Jan. 10
Jan. 30.	School, Geneseo, N. Y.	Dec. 13
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Jan. —	Church, Marine City, Mich.	Dec. 27
Feb. 1.	Church, Springfield, O.	Jan. 10
Feb. 1.	School, Clarksville, Ia.	Jan. 3
Feb. 1.	Hospital, Springfield, O.	Jan. 3
Feb. 1.	Office Bldg., Flint, Mich.	Dec. 27
Feb. 1.	Pub. Bldg. Plans, Louisville, Ky.	Dec. 27
Feb. 1.	School, Dicksason, N. Y.	Dec. 6
Feb. 2.	Hotel, Beaumont, Tex.	Jan. 10
Feb. 2.	Warehouse, Aberdeen, S. D.	Jan. 10
Feb. 2.	City Hall, Houston, Tex.	Dec. 13
Feb. 3.	School, Columbus, O.	Jan. 10
Feb. 14.	Library, Norfolk, Va.	Jan. 10
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
	MISCELLANEOUS.	
Jan. 13.	Street sprinkling, St. Louis, Mo.	Jan. 3
Jan. 14.	Wharf, Boston, Mass.	Jan. 3
Jan. 14.	Dredging, Chicago, Ill.	Nov. 22
Jan. 16.	Pier & Dredging, New York, N. Y.	Jan. 10
Jan. 17.	Railroads, Beckley, W. Va.	Jan. 3
Jan. 20.	Garb. Disp., Kansas City, Mo.	Jan. 10
Jan. 24.	Breakwater, Halifax, N. S.	Jan. 3
Feb. 5.	Levee Work, Bossier City, La.	Jan. 10
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
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Many Congratulations and encouraging expressions of appreciation for the twenty-fifth anniversary issue have come to us by letter and otherwise, and so we wish to take this opportunity to acknowledge the receipt of these pleasant communications and to thank these kind friends of The Engineering Record for the inspiration which they have thus given us for the continuance in well-doing—for better doing—in the new year. To those friends, also, who have had the kindly thought, but who have lacked the opportunity for expression, we extend our thanks, trusting that their good-will will show itself in practical ways in the future. You can help us in many ways, but perhaps by no other means can an engineer so greatly enhance his own reputation and advance the common good of the profession as by the expressions of his opinions, brief narrations of his instructive experiences and thorough descriptions of interesting work well done, given through the columns of a high class engineering journal to his fellow practitioners and the officials of municipalities and corporations having need of professional services. Do not neglect this privilege of contributing to the progress of the profession which is doing so much for the material and moral advancement of the whole world because you are "too busy." Remember that the men who are enriching your store of knowledge are busy men. If you can not send finished literary productions, send what you can—notes, blue prints, specifications, photographs—and we will try to do the rest and submit the results for your approval, if desired. Despise not small contributions; for brief, pointed statements of experience and opinion are frequently most helpful, and doubtless a much larger number of persons read the short notes than wade through the long articles. An engineering journal is not the property of any man or corporation, nor can it be, although its physical appurtenances of necessity must be. The true property of the journal is vested in those who enrich its pages with their best thoughts and life energies; it belongs to the engineering profession.

Standard Pipes and Special Castings.

In no country, probably, have the practical advantages of uniform standards for processes and designs been more fully appreciated than in the United States. American manufacturers and engineers have usually been quick to see and to improve opportunities for standardization. In some fields, however, in which the benefits of standardization seem very patent there has been an unexpected tardiness. A marked illustration of this has been the manufacture of cast iron pipes and special castings so generally used for water-works. Apparently the end of the confusion and multiplicity of patterns which have prevailed for so long is now in view. The public-spirited endeavors of the New England Water Works Association to secure uniformity in engineering practice and in manufacture bore exceedingly valuable fruit in the standard specifications for cast iron pipes which were reported to the September meeting, by a special committee, after extended correspondence and conferences with a committee representing the pipe founders.

These specifications were reprinted in The Engineering Record of September 13, 1902, and were adopted by the Association, as stated at that time. But the good work did not stop with the adoption and publication of the standard specifications. The committee has gone forward with the preparation of a complete schedule of straight pipes and special castings, including curves, branches of various kinds, reducers, sleeves, caps and the other fittings required in connection with pipe lines. This schedule gives diagrams for all the forms of castings together with complete dimensions and the computed standard weights for all sizes and classes. A part of this schedule is printed in the December, 1902, issue of the "Journal of the New England Water Works Association," along with the complete report of the special committee and the full text of the standard specifications. It is announced that the remaining portion of the schedule will be published in the next issue of the "Journal," and that afterwards the schedule and specifications will be issued in pamphlet form for sale by the secretary of the Association. Tables I. and II. of the schedule, giving the dimensions and standard weights of straight pipes, were reproduced in our issue of September 13, from the report of the committee, but since that date slight changes have been made in a number of the weights, principally for the sake of greater consistency in the figures as tabulated.

In the preparation of the schedule of dimensions and weights, the Association has been aided by the engineering department of the Metropolitan Water and Sewerage Board, of Boston, of which Mr. Frederic P. Stearns is chief engineer, the work being done under the immediate supervision of Mr. Dexter Brackett, engineer of the Distribution Department of the Metropolitan Water Works and member of the special committee of the Association. Probably very few will realize the magnitude of the labor involved in the gratuitous services which these engineers and their assistants are thus rendering water-works people at large, for probably few if any others have undertaken the computation of weights for so complete a schedule of castings. The methods used have been principally analytical, although graphical methods have been used to some extent. All the work has been carefully checked by duplicate computations. The forms adopted for the castings are substantially identical with those previously used by the Metropolitan Water Works, the principal changes being those required to make the castings conform to the wider range of thicknesses and the slightly different external diameters of the straight pipes in the new schedule. Thus a further check on the new computations has been afforded, in many cases, by comparison with those made at an earlier date, by different men, in the engineering department of the Metropolitan Water Works; and many of these computed weights had been corroborated in a broad way by the weighed weights of measured castings. Hence there is sufficient reason for accepting the schedule with all confidence in its accuracy as to dimensions and weights.

The economy and convenience which will result from the general adoption of this schedule will be very great. Messrs. Coffin, Brackett and Forbes, the special committee of the Association, and the representatives of the pipe founders who have co-operated with them have done their work so thoroughly that it seems quite unnecessary for any other party to thresh over their straw. In order that the largest results may be gained from these painstaking labors it now remains for water-works officials and users of cast iron pipe generally and the pipe founders as well to adopt and use the excellent schedule and specifications which have been prepared. If this schedule be accepted, as it should be, there would seem to be no further need for water-works engineers to send to the foundries blue prints of the specials which they require, since the castings may be ordered from the schedule, and the foundrymen could make once for all standard shop drawings and patterns. It may even be possible, if there be sufficient demand for it, to prepare a universal telegraphic code for the standard special castings, or at least for those most frequently used, so that in cases of emergency castings may be safely and conveniently, as well as economically, ordered by wire. Such a code has been prepared by at least one large foundry for the castings of its own stock patterns and published in its catalogue.

The sages have cautioned us against the moral evils of borrowing and lending, but under the stress of such an accident as the breaking of the trunk main of a distribution system of a large section of a city or the only main of a town's supply, a superintendent is usually quite willing to fracture several such precepts, and with the adoption of a standard schedule of pipes and special castings it will be the more readily possible for him to meet a severe emergency in this way, for the water departments of nearby communities would then be able to assist one another from stock much more frequently than now. Furthermore, with the standards put into general use, the foundrymen will probably be able and willing to carry at least a small assortment of the more common sizes of the most frequently used castings, from which rush orders can be filled with despatch.

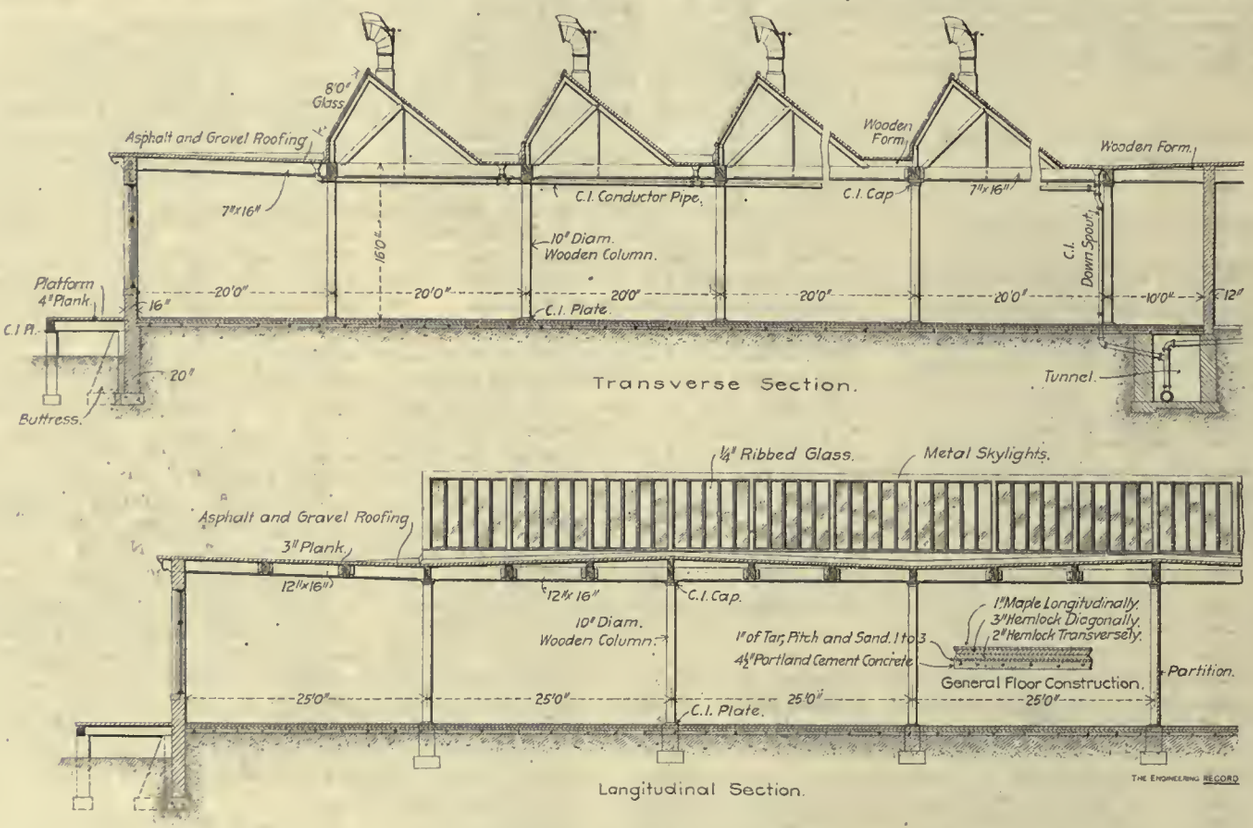
Protection of Sand Beaches from damage by wind storms is being accomplished by the Massachusetts Harbor and Land Commission by planting. About twenty varieties of plants have been tried at the end of Cape Cod, an unusually exposed portion of the coast. Trial shows that native pitch pine, Scotch pine, Austrian pine, common alder, black locust, bayberry and Scotch broom are best adapted to this situation.

Plant of the Atlas Tack Company, Fairhaven, Mass.

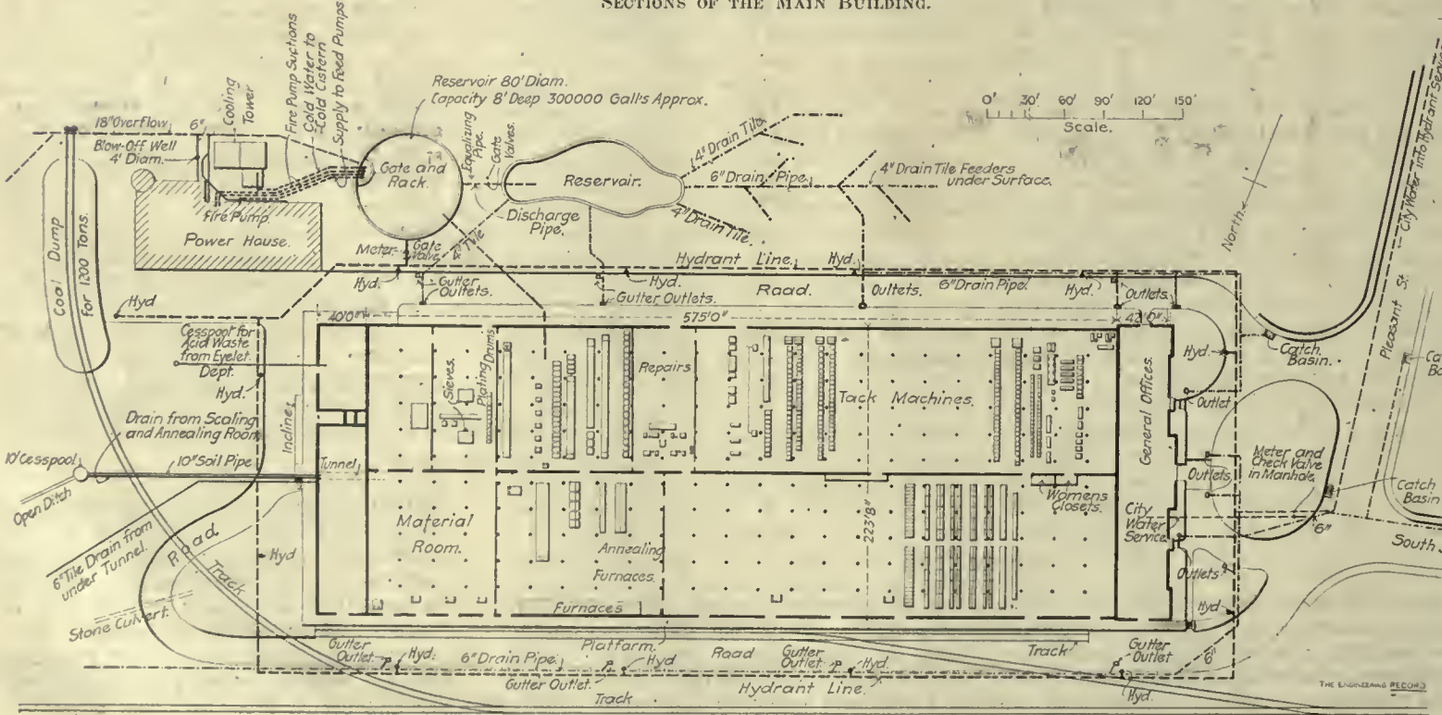
About the middle of May, last year, the Atlas Tack Company formally opened a new plant at Fairhaven, Mass., which is the outgrowth of an industry of tack making by machinery that has existed in that region since 1810. The company, which represents the consolidation of five tack-making concerns, has arranged for a concentration of manufacture at the new works, where economy of production is effected by the use of improved and largely automatic machinery, by the installation of a modern power plant and methods of power transmission and the provision of a carefully planned factory equipped for the convenience and comfort of its employes.

The plant occupies 15 acres of ground fronting on Pleasant Street in the outskirts of Fairhaven and extending alongside the New York, New Haven & Hartford Railroad. It consists of a main building, for the greater part of one story but with a two-story front and a three-story rear, and of a detached power house. The grounds have been graded with a view of improving the outside surroundings of the works, and roads have been built and a water system from the public supply mains, a fire system, with numerous hydrants connected both to fire pumps in the power house and to the public supply, and a drainage system for conducting both rain water and sewage have been constructed. Aside from the interest centering in the construction, equipment and arrangement of the works proper, a good illustration of modern power plant practice is afforded in the powerhouse. Though not located near an abundant water supply, the steam engines are operated condensing, a cooling tower and two large reservoirs being provided in that connection. Feed water being taken over and over again from the water store and from the returns from the warming system, no feed water heaters were inserted in the exhaust mains from the engines. Instead a feed-water heater has been installed only for the pumps and auxiliary apparatus and an economizer is employed for raising the temperature of the water beyond that possible with the utilization of the low-pressure exhaust steam.

The mill proper is 658x223 feet, and lies in an easterly and westerly direction. The two-story front comprises about 43 feet of the western end and is occupied by the various offices. The three-story end takes 40 feet and is devoted to the eyelet department. The mid-



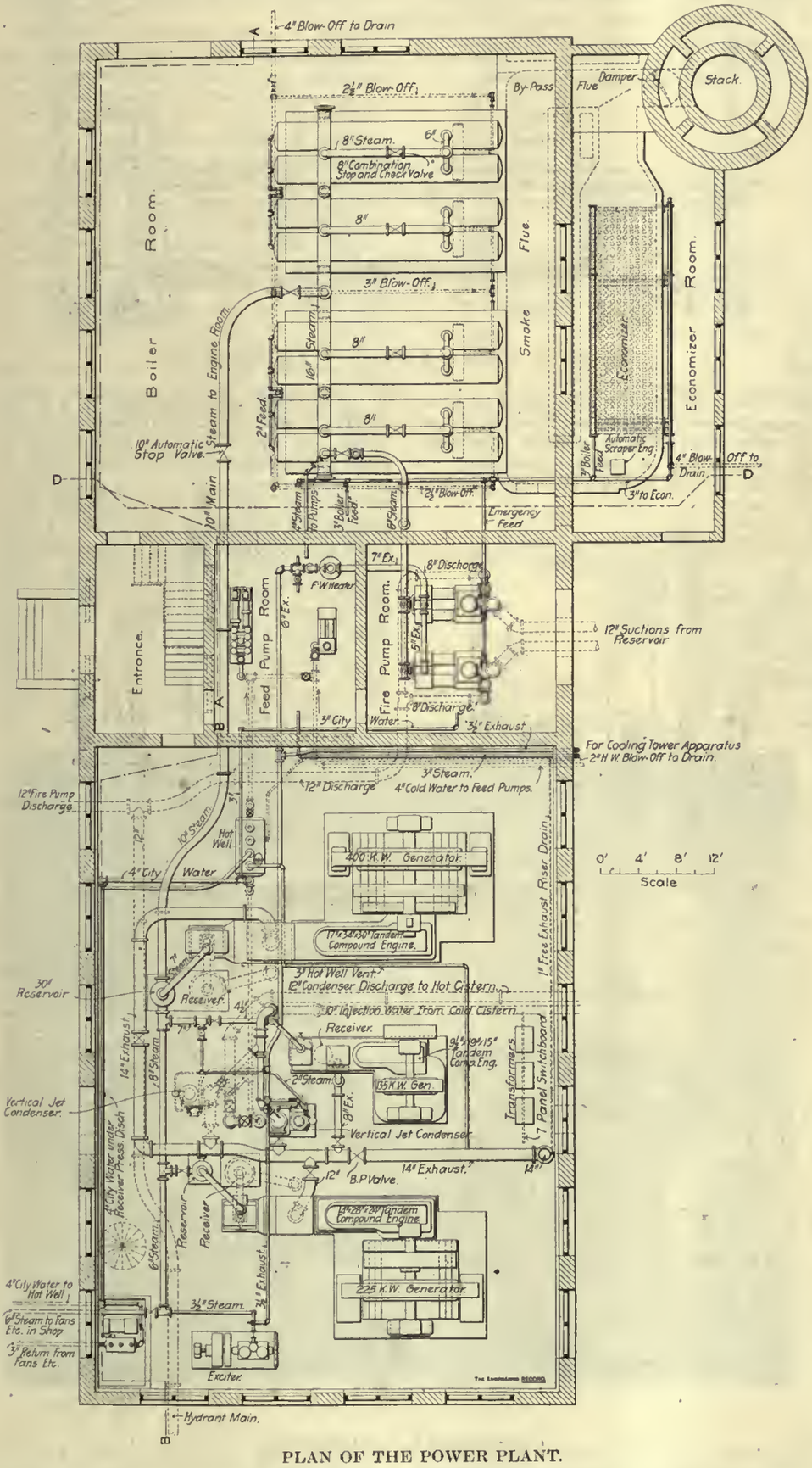
Sections of the Main Building.



WORKS OF THE ATLAS TACK COMPANY, FAIRHAVEN, MASS.
LOCKWOOD, GREENE & CO., ARCHITECTS AND ENGINEERS.

dle portion, which is thus 575 feet long, is divided longitudinally by a central fire wall and each half is subdivided into the different departments. On the one side are the tack machines and in addition staple, rivet and wire nail machines, plating and scaling departments and a repair shop. On the other are the departments for finishing, packing and shipping the product, including a large room where annealing, separating and polishing is done.

In the tack machinery portion of the building is most of the power and the group system of electric operation has proved very advantageous in its application to machines which individually require but little power. The entire motor and transmission plant is laid out on a uniform basis of 30-horse-power motors, with a uniform diameter of 1 15/16-inch shafting. The motors not only look well and present a uniform appearance in a continuous row along the ceiling, but they are uniform in all details, so that extra coils or repair parts in general can be kept on hand and will fit any motor of the entire equipment. The uniform size of the shafting throughout the entire plant in connection with split pulleys makes interchange of the pulleys an easy matter, all being of a uniform bore. The hangers are all equipped with Hyatt roller bearings.



PLAN OF THE POWER PLANT.

The main building is constructed of brick walls and a timber roof supported by wooden columns, as indicated in an accompanying part transverse and part longitudinal cross-section. The columns are spaced on 25-foot centers longitudinally and 20-foot centers transversely; they rest on brick piers and support 12x16-inch longitudinal timber girders which in turn carry crossbeams on 8 foot 4 inch centers. In each half of the building four divisions have the saw-tooth roof with ¼-inch ribbed glass facing in the usual way toward the north. This type of roof in each case is broken into lengths of about 135 feet (for convenience in getting about on all parts of it) with two cowl ventilators located near the ridge. The floor construction is shown in detail in the illustration; the roof consists of 3 inches of planking covered with Warren's Anchor brand of asphalt and gravel roofing. Through the center of the building underneath the floor is a tunnel in which are carried the steam and water pipes and electric wires.

The fan system of warming by circulating hot air has been adopted and there are three heater and fan units, with pipe coil heaters and engine-driven fans, the engine exhaust thus supplying a large amount of the heat required. The air is drawn chiefly from the outside, but may also be taken from the interior of the works, and it is driven through flues to distributed openings by means of the fan. One unit, with a 12-foot fan, supplies the whole shop, the second, the office building and the third, the eyelet department. They are all of the Sturtevant make. For general lighting there are some 80 Nernst lamps, two in alternate bays and one between, but for machine lighting, 16-candle-power incandescent lamps are used, one per machine. Altogether there are about 1,200 incandescent lamps supplied by the power plant. The building is equipped throughout with automatic sprinklers of the Grinnell type. Lockers of expanded metal are provided for the employes in the ground story of the office building.

The power plant is an interesting example of the class in which boiler and engine rooms are located end to end. This arrangement has made it possible to locate the economizer in an economizer room adjoining the boiler room, thus leaving the space above the boilers clear for piping, and to distribute the different sizes of generating units to good advantage with respect to economy of floor space and size of building without at the same time causing inconvenience by undue crowding. An unusual feature is the provision of two pump rooms separating the engine from the boiler room, one for feed pumps and the other for fire pumps.

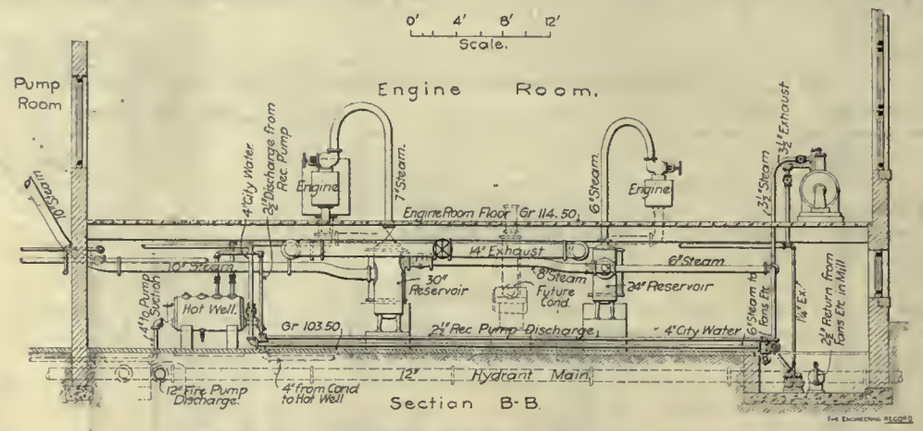
In general dimensions the building is about 144 feet long and 52 feet wide, not including 16 feet which is added to the boiler room for the economizer. At one corner of the economizer addition stands the chimney, which is a double-shell stack, and the economizer building is of the same length as the boiler room, that is 50 feet 4 inches inside. The fire pump room is 20 feet square, while the feed pump room is 15x20 feet. In front of the latter is an entrance hall, a portion of a power plant that usually does not receive much attention, and this leads to the engine room and to a store room over the pump rooms. The engine room is of the same width as the boiler room, and 67 feet 8 inches long. Its floor is 11 feet above the boiler room floor level and all piping and the condensers are located in a basement story below. This is on

the same level as the boiler and pump rooms and though but 10½ feet high, is painted white and has numerous windows so that it is quite light. The building walls are of brick and the roof of heavy planking supported by iron trusses. The floor of the engine room is of concrete reinforced according to the Ransome system. The rated horse-power of the station is 760 kilowatts, so that on the basis of the whole plant, 11 square feet of ground area were required per kilowatt, or 8.2 square feet per horse power. In the engine room itself the floor space is provided at the rate of 4⅓ square feet per kilowatt, or 3.25 square feet per horse power.

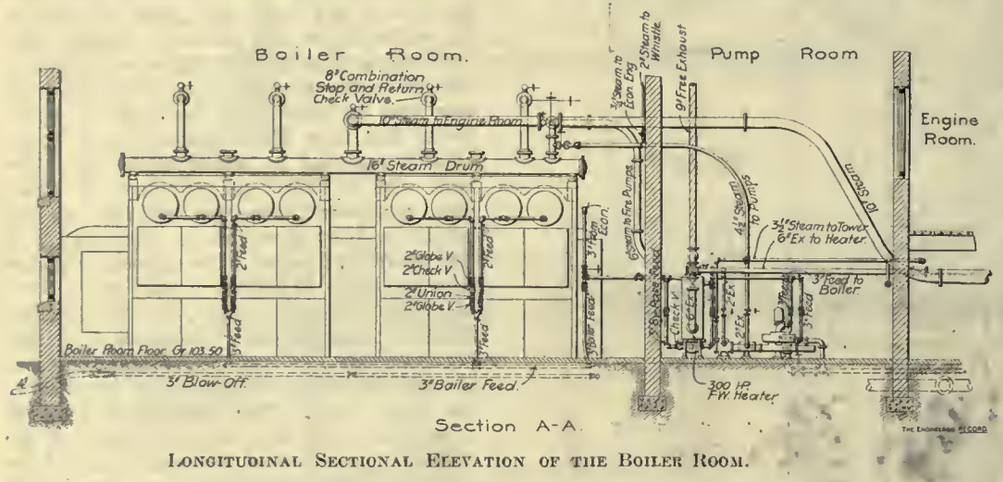
The boiler equipment consists of four water-tube boilers, set in two batteries of 407.4 horse-power each. They were built by the Aultman & Taylor Machinery Company and consist of 3-inch tubes set ten sections wide each nine tubes high, and of two 36-inch steam drums. They are fitted with Foster shaking grates and are hand fired from a firing space 19 feet wide. Coal is stored in the open outside the end of the power house, space being reserved for 1,200 tons, where, later, it is intended to have a railroad siding built on trestle work.

For the distribution of steam, which is generated at 130 pounds pressure, a 16-inch drum or header, 39 feet long, built of ⅜-inch steel, is supported on roller bearings across the top of the boilers. Each boiler supplies it by means of an 8-inch extra-heavy pipe, which springs in an upward bend from the boiler and drops in a similar bend into the top of the header. But one valve is used, which is a combination stop and check valve, placed in the high point of the connection between the bends. From the header are taken two steam mains for the two pump rooms adjacent and a 10-inch main for the engine room, this line provided with a stop valve at the header and with a Locke automatic safety valve also in the boiler room. The header has an area equivalent to the combined area of the four boiler connections to it. The steam piping is of full weight wrought iron with Walworth valves, and extra heavy fittings. All other valves are, in general, of the Pratt & Cady make.

The products of combustion from the boilers pass into a brick flue behind them, and from one end of this into the chimney through the economizer and from the other end into the chimney directly. The flue has a cross-sectional area of 37.9 square feet, which is practically equivalent to the area of the chimney, which is 7 feet in diameter and 180 feet high. The rear of the boiler settings form one wall of the flue, the other side wall is 8 inches thick, the bottom consists of a layer of bricks laid flat and the top of 10-inch brick arches sprung between cast-iron tee-shaped lintels laid crosswise of the flue on 3 feet 3-inch centers with 1 inch concrete above the crown of the arches. The economizer setting is similar in construction, the roof, however, being formed of two courses of brick, the lower laid on edge, and all supported by 4x4x½-inch tees on 9 inch centers. The economizer consists of 28 sections of tubes, 280 tubes in all, built by the Green Fuel Economizer Company. Space has been left for an equipment of 12 additional sections. The dampers at each end of the flue controlling the path to be taken by the smoke are 3/16-inch steel plate doors, operated from above the setting. The entrance to the stack is controlled by a butterfly damper of 3/16-inch plate mounted as shown in an accompanying detail drawing.



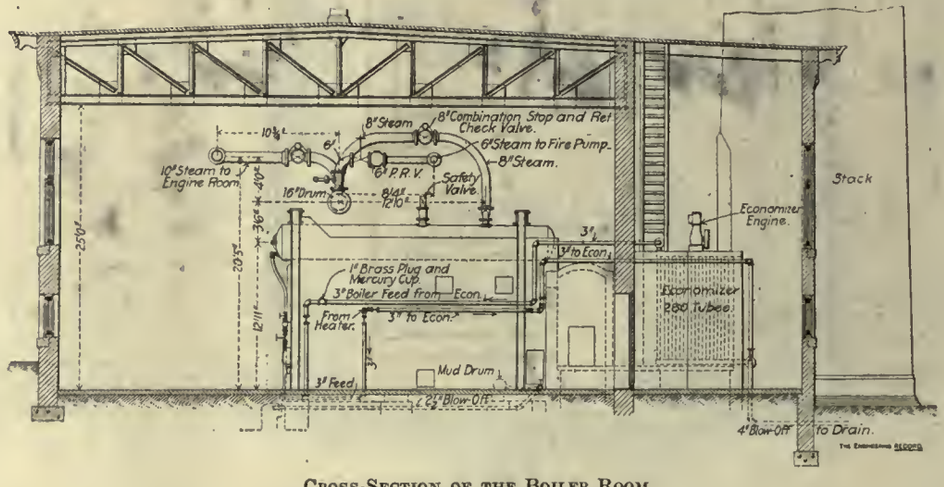
Longitudinal Sectional Elevation of the Engine Room.



Longitudinal Sectional Elevation of the Boiler Room.

The engine room contains three alternating-current generating units, two exciter units and the switchboard. The generating machinery consists of McIntosh & Seymour horizontal tandem-compound engines directly connected to Westinghouse 440-volt 60-cycle three-phase revolving field alternators. The units are of different sizes, as regards rated capacity, so that a given load can more readily be met with a combination near to the economical performance of the different engines. The largest is of 400 kilowatts and is operated by a 17 and 34x30-inch engine running 150 revolutions per minute; the middle size is of 225 kilowatts capacity and operated by a 14 and 28x24-inch engine at 171 revolutions; and the smallest is of 135 kilowatts with a 9.5 and 19x15-inch engine running 257 revolutions per minute. The exciters are 30-kilowatt 125-volt direct-current machines, and one is direct connected to a 9.5x9 engine and the other to a 45-horse-power induction motor. The switchboards are Westinghouse standard boards for direct and alternating current practice and from them are controlled some 21 induction motors, 19 of 30 horse-power each, one of 45 and one of 15 horse power.

As already stated, the steam piping is carried in the basement story. The size of the 10-inch main supplying the engines was calculated large enough so that when all three engines are running at the same time at their ordinary rated load, represented by about one-quarter cut-off, the velocity of the steam in it would not be greater than 20 feet per second, or 1,200 feet per minute. At one-half cut-off, representing a heavy overload, the velocity would be under 40 feet per second. The 10-inch main feeds a steam reservoir opposite the largest engine and from this the main is continued, supplying the smallest electric generating engine and feeding into a second reservoir from which the middle engine receives its supply and a main is taken to the exciter engine and to a pump in the basement. The first reservoir has a volume 6½ times that of the high-pressure cylinder of the large engine and the second reservoir a volume 5½ times that of the high-



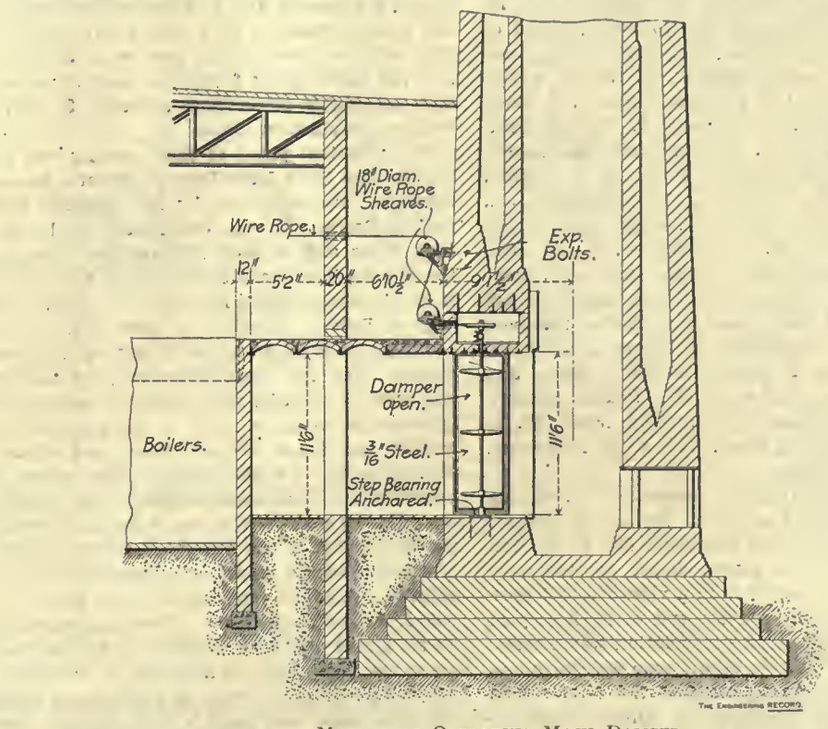
Cross-Section of the Boiler Room.

pressure cylinder of the middle-size engine. They are provided as equalizing drums whereby the inflowing steam is kept at the average velocity no matter how the engines may be momentarily drawing on it. The receivers between cylinders are, for all three engines, placed in the basement.

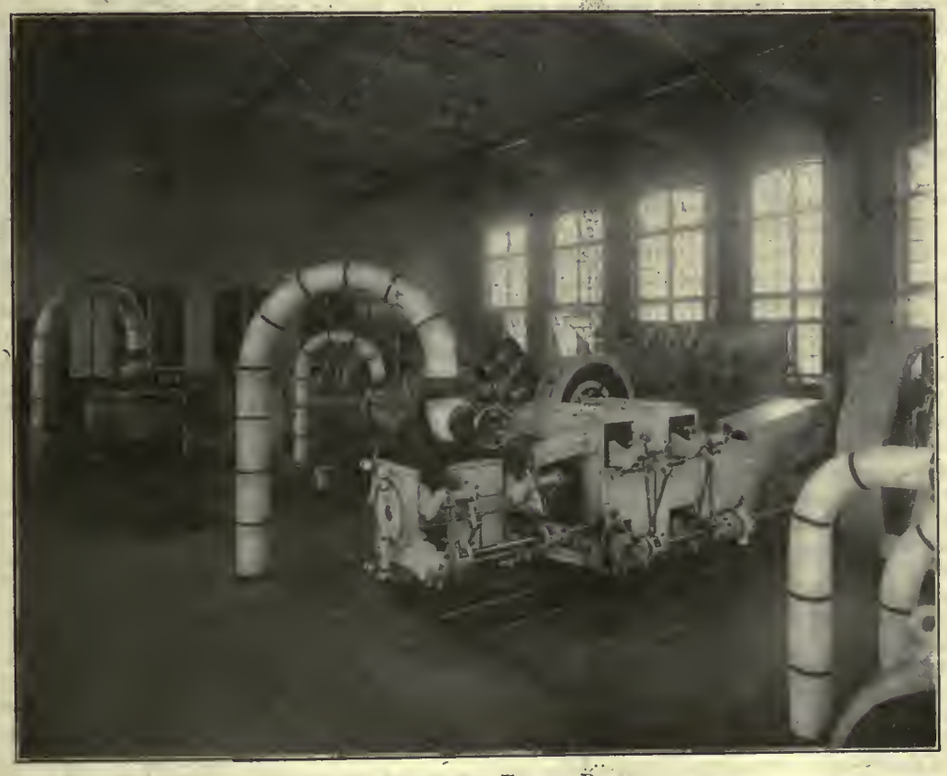
The central condensing system is employed, one condenser only having been installed at date, a second to come when the average power demand becomes nearer the maximum capacity of the plant than it does now. The condenser is a 10 and 16x22x15-inch vertical jet condenser built by Dean Brothers, of Indianapolis, which is arranged to condense its own exhaust. The exhaust steam from the engines is collected into a 14-inch exhaust main and there is the usual full-size free exhaust to the atmosphere, with back-pressure valve to allow an escape of steam when the condenser is out of commission. The condensing water is brought from the cold cistern of a cooling tower that was supplied by Messrs. F. H. & C. W. Boyer, of Somerville, Mass., while the condenser discharge is delivered to the hot cistern. The injection and discharge mains are 10 and 12 inches in diameter respectively, large enough for the two condensers of the complete installation.

For feed water, the discharge from the condensers is drawn from, together with the return water from the heating system during the winter. Whenever necessary, however, feed-water can be obtained from the water storage reservoirs on the company's property or from the public water supply mains. As the large units are operated condensing and the exhaust of the pumps and of the exciter engine in the power house is utilized to heat feed water, the fan heater units in the main building are supplied with live steam only from the power plant, an underground tunnel having been built between the buildings to carry both the piping and the electric wires. As stated, however, the fans are engine driven, so that the heater coils, except in severe weather, require nothing beyond the exhaust from the fan engines. Grease separators are installed at the engines and the condensation is returned by gravity through the tunnels to the power house to a return tank and pump in the basement of the power house. From this it is charged into a hot-well in the basement, this well consisting of a tank 6 feet long and 3 feet in diameter. Into this well is admitted the proper amount of water from the condenser discharge, and city water when necessary, under the control of an automatic valve.

For regular operation, a 7x4x10-inch Dean duplex plunger pump is used for boiler feeding, but this is installed in duplicate with a 7x4x10-inch Dean duplex piston pump, both in the feed pump room. The two pumps are cross-connected to draw from the hot-well (to which, as stated, the return water from the heating system is led, as well as the water from the condenser discharge and additional city water), and also from the company's own reservoirs, which have a capacity of 350,000 gallons. These pumps discharge through a Berryman feed-water heater of 300 horse-power rating located in the feed pump room, then through the economizer and into the boilers. Both the feed-water heater and the economizer can, of course, be by-passed. In addition to these sources of supply, an emergency feed line is provided from the fire pumps, which draw from the reservoirs.



METHOD OF OPERATING MAIN DAMPER.



VIEW OF THE ENGINE ROOM.

These are Knowles 1,000-gallon 18x10x12-inch Underwriter pumps, installed in duplicate, and discharge through a 12-inch main for the fire and hydrant system about the grounds. The boiler feed main is 3 inches in diameter and is carried underneath the floor in front of the boilers with a 3-inch riser carried upward between the two boilers of each battery; this subdivides into two 2-inch pipes, each going to the two steam drums of each boiler. This arrangement has left all valves at ready command of the fireman directly in front of the boilers.

The architects and engineers for the whole plant were Messrs. Lockwood, Greene & Company, of Boston. The arrangement of machinery was planned by Mr. Elbridge G. Paull, mechanical superintendent of the Atlas Tack Company. The B. F. Smith Company, of Pawtucket, R. I., was contractor for the erection of the mill; the New Bedford Boiler Company, for the piping, and the Rockwell Engineering Company, of New York, supplied the heating parts for annealing. Mr. George W. Weymouth is president and manager of the company, and Mr. Urban H. Broughton, secretary and treasurer.

The Cooper-Hewitt Mercury Vapor Lamp was recently exhibited in Europe for the first time, at the offices of the British Westinghouse Electric & Manufacturing Company, in London. In this lamp mercury vapor is made incandescent by the passage of an electric current very much as the carbon filament is made to glow in the Edison lamp, but a given amount of illumination is said to be obtained from the former with but a small fraction of the power required for the latter. On the same occasion the Cooper-Hewitt static converter also was shown. This device, which was in the shape of a small globe, converts alternating to direct current, it is claimed, without moving parts, efficiently.

Annual Meeting of the New England Water Works Association.

The New England Water Works Association held a very successful annual meeting in Boston on Wednesday, the 14th, at Hotel Brunswick. The attendance was about 105. After the lunch, at 1 o'clock, reports of officers and committees were presented and the reading of the technical papers followed. The committee appointed to canvass the letter ballots reported the election of the following board of officers for the ensuing year: President, Charles K. Walker, superintendent of water works, Manchester, N. H.; vice-presidents, V. C. Hastings, Concord, N. H.; George P. Wescott, Portland, Me.; Edwin C. Brooks, Cambridge, Mass.; E. W. Kent, Woonsocket, R. I.; H. N. Turner, St. Johnsbury, Vt., and J. C. Hammond, Jr., Rockville, Conn.; secretary, Willard Kent, Narragansett Pier, R. I.; treasurer, L. M. Bancroft, Reading, Mass.; editor, Charles W. Sherman, Boston, Mass.; advertising agent, Robert J. Thomas, Lowell, Mass.; additional members of executive committee, P. Kieran, Fall River, Mass.; George A. Stacy, Marlboro, Mass., and H. G. Holden, Nashau, N. H.; finance committee, E. J. Chadbourne, Wakefield, Mass., W. F. Codd, Nantucket, Mass., and A. R. Hathaway, Springfield, Mass.

Organized in 1882, the association is entering upon its twenty-first year. The interesting address of the retiring president, Mr. F. E. Merrill, of Somerville, Mass., clearly demonstrated that the organization is in a vigorous and prosperous condition. At the end of its first year the membership of the association was 43, and at the end of the twentieth year 587, including not only a large proportion of the water-works engineers and officials of New England, but also a considerable number of engineers and other men interested in water works in other parts of the country. Seven new members were elected at this meeting. The value to superintendents and other water-works officials of the regular monthly meetings with their technical papers and discussions, social intercourse and interchange of ideas was particularly pointed out, and it was even suggested that it would be a profitable expenditure, if necessary, for the smaller cities and towns to pay the charges for their superintendents and require them to attend the meetings regularly.

The "Journal," which is issued quarterly by the association is an unusually valuable publication, containing only the papers and discussions presented at the meetings, the reports of committees and records of the proceedings of the association, and deserves a much wider circulation that the membership. The "Journal" has been fortunate in having able editors, and many of the papers and reports printed in it have possessed great merit. According to the report of the editor, Mr. Sherman, the volume for 1902 contained 403 pages of text, and the actual payments on its account during the year exceeded the receipts by an amount equivalent to $1.09 per member; but if allowance be made for money due the "Journal" this deficit would be practically nil, in other words, the "Journal" is substantially self-supporting. The expenditures charged to the "Journal" include the cost of fifty copies of reprints of papers furnished free to the authors and many reprints of reports of special committees. A card index comprehending all the sixteen volumes is being prepared by the Library Bureau and when completed will be printed.

Among the valuable and far-reaching services which the association has rendered to water works men have been the reports of its special committees. Notable achievements in this line have recently been made by the committee on uniform statistics and the committee on standard specifications for cast iron pipes and special castings, previously mentioned in the pages of The Engineering Record. Another special committee is laboring upon the apportionment of charges for private fire protection, and the means of controlling the supply thereto, but has not yet rendered a final report.

The report of the secretary showed that at the close of the year the association had 522 active, 5 honorary and 60 associate members, a net total increase of 32 during twelve months. The cash receipts for the year were $5,088.75, and the expenditures $4,680.32, while there was still collectable on various accounts $1,274.18, with no outstanding debts.

The principal paper of this meeting was entitled, "The Echo Lake Dam at Milford, Massachusetts," and was read by Mr. Leonard Metcalf, of Boston. It was well illustrated by lantern slides and of such interest that arrangements have been made to publish an abstract of it in The Engineering Record. Mr. E. H. Gowing, of Boston, described a novel method for reducing pressure on a gravity system of water supply. The first case to which the method was applied was that of a village of about 1,500 inhabitants supplied from a pond 4½ miles distant and about 600 feet above the village. The quantity of water available was much in excess of the requirements and it was imperative that the superintendence for the system should be kept at the minimum. Consequently pressure reducing valves were deemed to be unsuitable. A 6-inch pipe was laid down the hillside from the pond to the village and extended by an 8-inch pipe to a reservoir about 200 feet above the village and on a hill on the side opposite the pond. At a point on the hillside about 300 feet below the pond a vertical riser was placed in the pipe line, and in the riser an inverted Y branch was set with its crotch at the elevation determined for limiting the pressure on the portion of the pipe line below the riser. From the point of the Y the riser was extended upward a few feet and its end left open. An overflow pipe was led from the other branch of the Y to a brook. The pipes were all buried deeply enough in the earth to be beyond danger from frost. The outlet gates at the pond are so adjusted that there is always admitted to the pipe line a greater quantity of water than is required for the supply of the town and consequently there is a continuous small discharge from the overflow pipe.

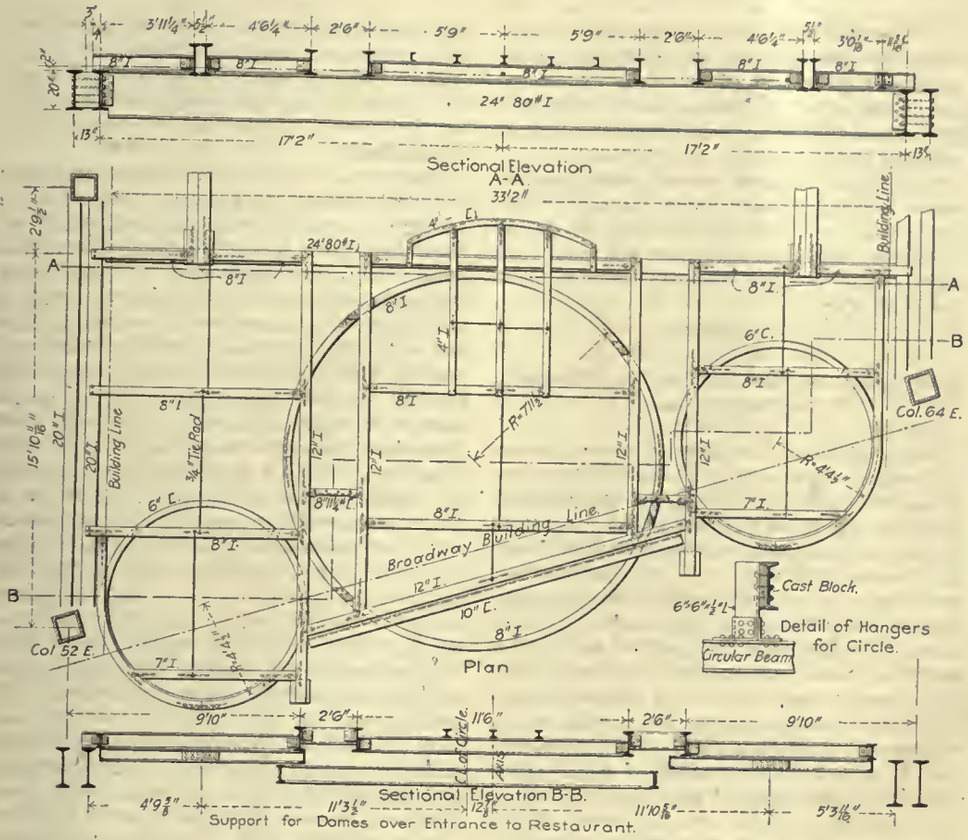
A similar riser and overflow was placed in the embankment of the reservoir with the crotch of the Y at the level of full reservoir. This scheme has been used in four other works and has proved satisfactory, although, as pointed out, it would not be suitable for places where it is necessary to husband the water. The chief advantages claimed for it are its extreme simplicity, low cost and absolute reliability. In the discussion which followed Mr. Gowing's talk, Mr. Dexter Brackett suggested that putting a pressure reducing valve in the pipe line just upstream from the riser would accomplish the saving of water in cases in which the constant waste could not be afforded and yet would not interfere with the advantages claimed for Mr. Gowing's scheme. He also stated that in the Metropolitan Water Works distribution system five pressure reducing valves had been in use for a few years and in the main had given satisfaction. One valve had given no trouble whatever, while another valve of the same kind under almost identical conditions had given considerable annoyance. A pressure reducing valve was found to be more likely to prove disappointing when placed next to a standpipe in which it was desired to regulate the water level closely within a few feet of the top than in some other situations. Also pressure reducing valves having a considerably varying pressure on the supply side are likely to give bother. Superintendent Brooks, of the Cambridge water works, said that he had had two 16-inch pressure reducing valves in use for several years and that they had proved highly satisfactory. Mr. J. Waldo Smith, of the East Jersey Water Company, stated that there were some fifty Ross pressure reducing valves of various sizes on his works and that he had no fault to find with them.

Structural Steel Work in the Ansonia Apartment Hotel, New York.—II.

In the issue of January 10 there was a brief description of the general structural arrangement of the Ansonia apartment hotel, which is to be supplemented with illustrations of special details, some of which are here described. The foot of the light court on the Broadway front is occupied by a public restaurant about 75 feet wide and 100 feet long, the central part of which is covered by a glazed, steel arched roof about 40 feet in extreme height above the sidewalk level. The long sides of the room are parallel to each other and perpendicular to the inner wall, and are intersected by the oblique line of the Broadway building front. The irregularity thus occasioned in the construction is chiefly comprised in the special framework of three steel and glass domes, which are supported by third-tier beams and girders cantilevered beyond the building line and carried by special one-story columns terminating at the second floor level.

At the rear end of the restaurant, the corners of the court are filled in with quadrant shaped horizontal platforms which have their outer edges carried by curved girders connected to the regular wall columns, which serve as wall girders to support the brick work and carry a portion of the floor. On each of the long sides of the restaurant there is a cantilever balcony about 5 feet wide over all which is accessible to guests and visitors, and apparently supports, on its outer edge, the arched roof trusses. At the level of this balcony there is another one, semi-elliptical in plan, for the musicians. It is 9 feet wide, 21 feet long and is carried by steel suspenders from the end roof truss. These features of the restaurant have required special treatment of the steel construction, and involve a number of interesting and unusual features in design and detail, which are entirely separate from the construction of the general framework, and make the restaurant essentially an independent structure.

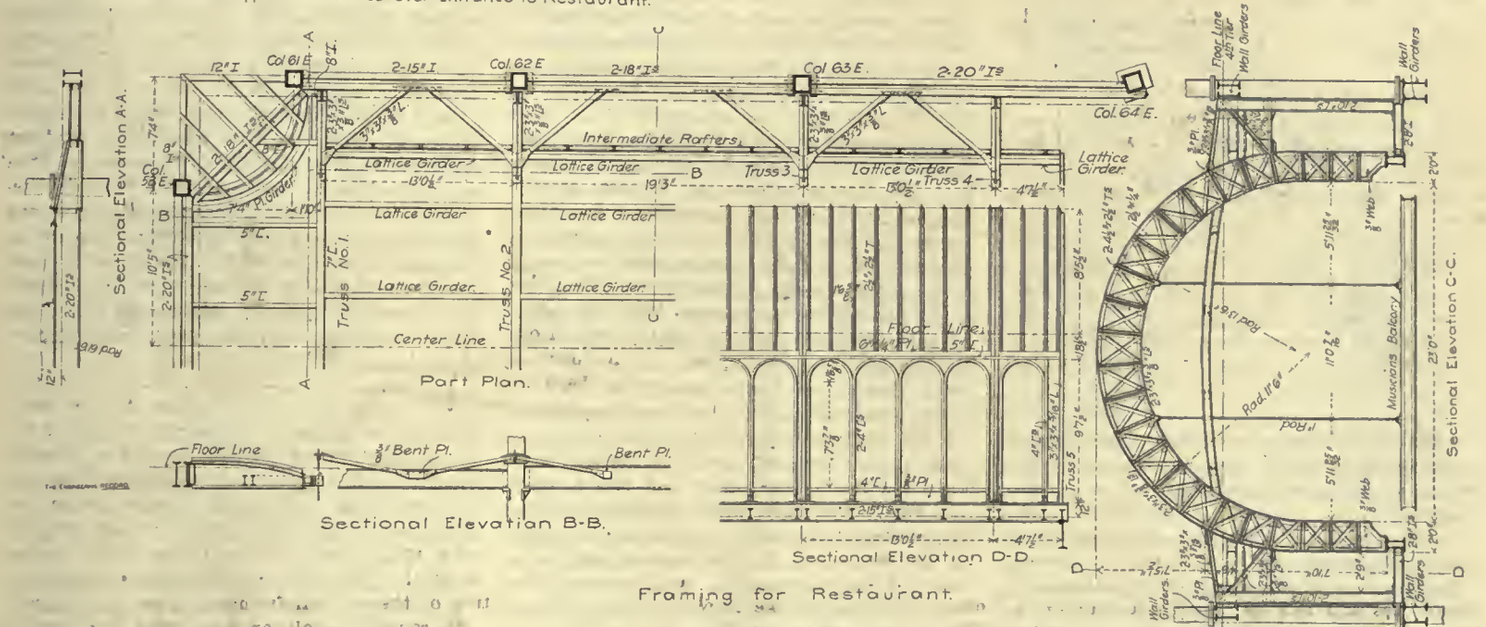
The main roof of the restaurant consists of a continuous skylight curved in the center to the segment of a cylindrical surface having a chord of about 24 feet, from the extremities of which there are flat surfaces 5 feet wide which slope slightly from the horizontal to the main side walls, the whole conforming to the extrados of the cross section shown in the general drawings. The glass is supported on a light steel framework carried by four lattice-girder arch trusses which have a radius of 11½ feet, rise of about 16 feet and span of 23 feet for the extrados. They are apparently seated at each end on a pair of 15-inch I-beams carried on the outer edge of the gallery at the second floor level. In reality, most of the weight and thrust is received above the springing line at points *A A* where the upper chord is connected to a cantilever bracket. This bracket is built with a long and heavy vertical post which is designed to transmit the reactions to the main columns near their second and third floor connections, as shown by the bearing plates there, and thus prevent a development of flexure at interme-

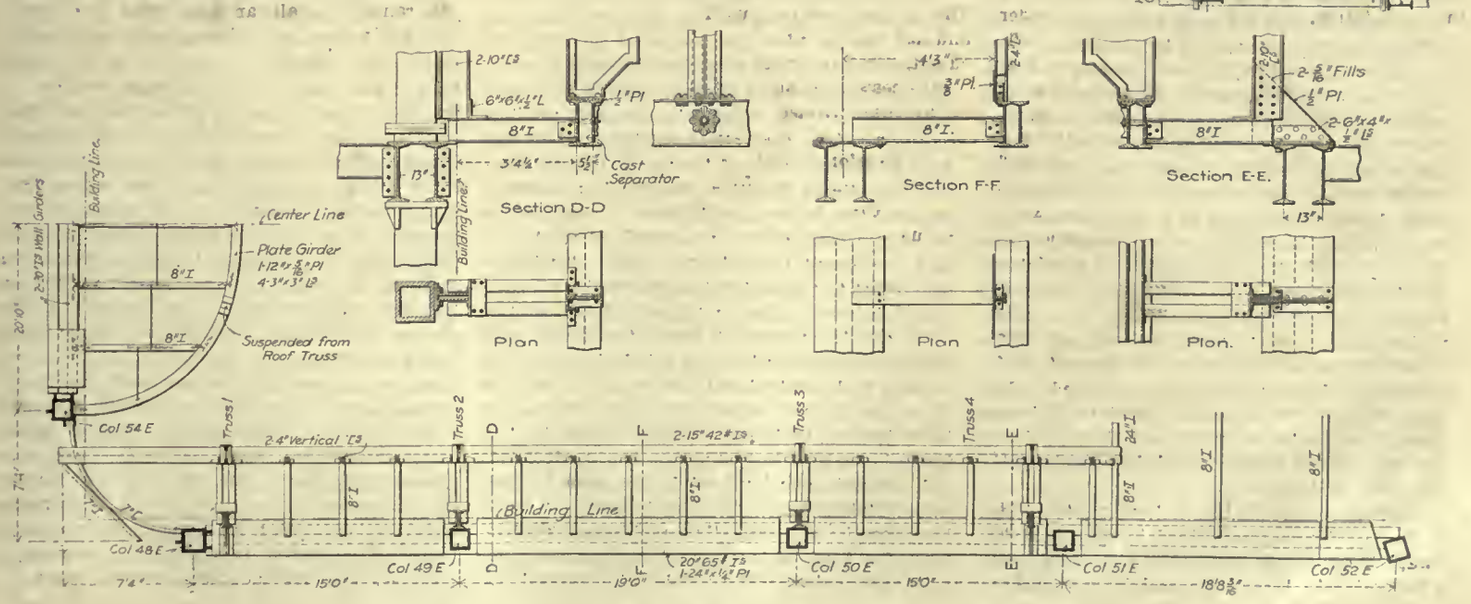


diate points of the cast-iron column sections.

The foot of the vertical post also supports the inner end of the short transverse gallery beam which is carried at the outer end by web-connection to the pair of 15-inch longitudinal I-beams which apparently support the ends of the arch trusses, but are in reality suspended from it. The arch trusses are connected by six lines of longitudinal lattice-girders in radial planes, with depths corresponding to those of the arch truss. These girders carry intermediate rafters made of curved T-bars about 18½ inches apart on centers, and supported at their feet, just below the third floor level, by a longitudinal girder made with a horizontal channel and vertical bent web plate, as shown in the side elevation of one corner of the roof. This girder is very light and is supported between the roof trusses by an arcade of light narrow arches made with single 4-inch channels having long vertical ends which extend to the second floor and are seated on the outside gallery beams there, and thus serve the additional purpose of an enclosure for the gallery. There is no lateral or diagonal bracing in the arched roof, but the ends of the trusses have the braces slightly inclined to the webs of the floor girders in the third tier of the main building.

The curved plate girder which supports the front of the musicians' gallery, at the end of the restaurant, is supported intermediately by two vertical suspenders from the end roof truss, and over it the roof is not a skylight; but has

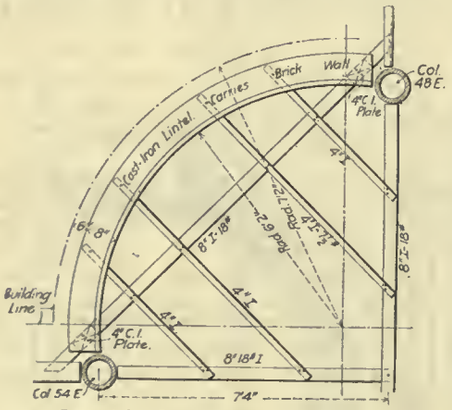




DETAILS OF STEELWORK IN RESTAURANT OF ANSONIA APARTMENT HOTEL, NEW YORK.

a copper sheathed cylindrical surface with its axis perpendicular to that of the main roof and is supported by curved longitudinal rafters, shown in the roof plan, connected at their upper ends to a slightly curved channel intersecting the extrados of the arch truss like a chord. This channel is supported from the end roof truss by the same suspenders which carry the balcony girder, and the space between it and the top chord of the truss is closed by glazed panels. The regular roof trusses are like the main truss which is shown in the sectional elevation, excepting that the curved channel and the vertical suspenders are omitted in the latter.

The second story wall girders, which support the ends of the gallery beams, carry a section of 30 feet of the main court walls on a wide cover plate which is riveted to the top flanges of the two 20-inch I-beams, composing the girders, and projects about 3 inches beyond the flange of the outer one to form a shelf upon which the end of the gallery girder is seated, and to which, at intermediate points, it is bolted with a reinforcing clip which engages the under side of the flange. Where the cantilever bracket posts are supported on these girders, they are connected to the gallery beams with vertical gusset plates which have horizontal lower flange angles bolted through the cover plate and both flanges of the wall girders as



Support for Curved Wall and Floor.

shown in the detail; and where the bracket is attached directly to the column, the gallery beam is neither bolted nor riveted to the wall girder.

Across the east end of the restaurant, at the second story level, there is a 24-inch 80-pound I-beam perpendicular to the wall girders on opposite sides of the court and supported by them. From these girders five main longitudinal beams extend to a little beyond the building line where they are connected to transverse beams and supported on the front wall. These girders are connected by short transverse beams which furnish supports for several points in each of the horizontal drums which carry the Guastavino domes over the entrance. The outer edges of these drums are tangent to a line parallel with the building line. The center drum is about 16 feet in diameter, and is made of two pieces of 8-inch curved I-beam. The side drums are about 9 feet in diameter and are each made with a single 6-inch channel, web-spliced. These drums are not seated on the top flanges of the supporting beams; but are suspended below them with vertical angles riveted to their top flanges and bolted through cast filler blocks to the webs of the beams and girders as shown in the detail and plan.

Above the roof of the restaurant, the inner corners of the court are filled in with quadrant shaped balconies at each story. These are nearly 9 feet wide in the center, and have cantilever floor beams, parallel with the center line, which are supported, as shown in the plan, on the top flange of a diagonal girder carried by the main wall girders just outside the corner columns. The inner ends are anchored to the floor beams, and the outer ends support a curved cast-iron lintel T-shaped in cross section.

Mr. Philip E. Raqué was the consulting engineer and Mr. Edward Raqué the engineer in charge for the builder and owner, Mr. W. E. D. Stokes. The structural steel and iron work was manufactured and erected by Messrs. J. B. and J. M. Cornell.

(To be continued.)

Recommendations for Repairing the Williamsburg Bridge Cables.

The commission of expert engineers appointed by Mayor Low to determine the injury sustained by the main cables of the Williamsburg bridge in the tower fire of November 10, 1902, to formulate specifications for their repairs and to recommend a system of fireproof flooring, has made a report under date of January 10 addressed to Hon. Gustav Lindenthal, commissioner of bridges, New York. Five hundred and fifty-four tests were made on twenty-eight wires, and it was found that in the worst cases the tensile strength had been reduced from an ultimate of probably 220,000 pounds per square inch to 80,000 pounds, the latter being about the ultimate strength of the steel from which the wires were drawn. Twenty-seven of the wires were taken from the outer four layers of the two injured cables, all but five of them being from cable *B*. The twenty-eighth wire was taken from the fifth layer and showed no deterioration.

Comparisons of the lowest values of elastic limit of the injured wires and of the highest values of the uninjured wires showed an average loss of 49 per cent. Similarly the ultimate strength showed an average reduction of 53 per cent. and the modulus of elasticity 2.3 per cent., from which it was deduced that the injured wires are capable of working with the others with a reduced margin of safety. Where the oil coating of the wires was unimpaired, the wires were assumed to be uninjured. In cable *A* two hundred injured wires were counted and all were in the upper part of the cable. In cable *B* two hundred and fifty injured wires were counted in the upper and two hundred and fifty in the under part of the cable. All of these wires have been permanently elongated by the heat of the fire and are assumed to be doing no work at present. It is recommended that all of the injured wires which are accessible, namely, those on the upper sides of the cables, should have the weakened portions cut out and replaced with new wires spliced to the uninjured portions of the old wires with sleeve nuts similar to those used in the cable making and effecting a theoretical efficiency of 95 per cent. of the strength of the wire. Owing, however, to the difficulties of securing uniform tension, the practical efficiency is assumed to be 90 per cent. of the unspliced wire. When this is secured the injury to cable *A* will be equivalent to the destruction of twenty wires.

The injured wires on the under side of the cable are inaccessible through the saddle and cannot be replaced; but can only be improved by cutting and tightening them so as to develop all of the strength which remains in them. It is estimated that one hundred wires in the lower layer have lost 60 per cent. of their original strength, one hundred in the second layer have lost 48 per cent. and fifty in the third layer have lost 15 per cent., thus making an equivalent of a total destruction of one hundred and thirty-four wires. The net loss in strength of cables *A* and *B* will thus amount to 2.5 and 6.5 per cent. respectively, but as the strength of the wires averages from 8 to 10 per cent. higher than the 200,000 pounds per square inch which was called for, the net strength of both cables will still remain greater than the specification requirements.

The stress in the cables is not uniform, but is a maximum at the saddles where the wires are injured, and it is therefore desirable to restore their strength at this point to the original value. To accomplish this, it is recommended that additional wires be attached to cables *A* and *B* over the saddles, to correspond in number with those which are considered destroyed. Making allowance for imperfect connections and for further developments of the actual amount of injury sustained, it is considered that about twenty-five additional wires must be connected to cable *A* and two hundred to cable *B*. These wires must be added to the tops of the cables where they pass over the saddles and will be adjusted at each end by bearing nuts on the steel friction collars through which they will pass. The collars will be made in halves clamped together with flange bolts under a stress of 20,000 pounds per square inch, so that the pressure of the band on the cable will be ten times the working stress of the wire. Only twenty wires will be attached to one band and each band will act independently of all others, excepting that there will be an additional band covering all wires. Every band should pass outside of all wires which are coupled to bands beyond it, thus giving additional friction to them. The last bands should be placed close to the first suspender clamps, and in the space between the bands and the saddles the cable should be wrapped with wire drawn as tightly as possible to increase the adhesion of the new wires to the old ones. It is recommended that special fire protection should be provided wherever it is necessary to store combustibles near the cables, and a report on fireproof flooring is promised at an early date. The report is signed by Mr. George S. Morison, Mr. C. C. Schneider and Mr. L. L. Buck. The fire on the bridge tower was described in The Engineering Record of November 15, 1902.

The Protection of a Watershed from pollution was described at the recent meeting of the Royal Institute of Public Health at Exeter, England. The supply of water for Torquay, Newton Abbot and several smaller places has averaged 170 million imperial gallons per annum since 1896. The total area of the watershed is 2,241 acres, upon which, according to "The Surveyor," there was a resident population of 115 persons in 11 farmhouses and 8 cottages before the property was purchased to insure the complete protection of the watershed. The whole of the farmhouses on the watershed have been removed, but the barns and sheds have been retained for the present, because store room is required for cereals and other crops. A zone fence has been erected at an average distance of 200 feet from all streams, so as to avoid pollution by cattle and sheep taken in to graze. Inside the zone fence a trench has been cut to take all water flowing over the surface of the land in winter, and in this manner it is filtered before reaching the stream. No fewer than 159,000 trees have been planted in various parts of the watershed, and it is the intention of the water committee to proceed with a certain amount of planting every year on land that cannot be grazed with profit. On the outlying portions of the watershed, and away from all streams, oats, hay, and roots are grown for feeding the corporation horses in Torquay. Grazing is allowed on all lands outside the zone fence.

Compressive Resistance of Concrete-Steel and Hooped Concrete.—IV.

Preceding sections of this translation from M. Considère's original paper appeared in the issues of December 20 and 27, 1902, and January 10, 1903.

XIII. *Factor of Safety.*—The preceding discussion has brought out the mechanical properties of hooped members in compression, but it has not established direct rules for the allowable working load with the provision of a sufficient factor of safety. There is no universally accepted principle for the determination of the factor of safety. Sometimes its value is based on the ultimate strength of the member and sometimes on its elastic limit. Concrete reinforced longitudinally only has no definite elastic limit, or, rather, this limit almost coincides with its ultimate strength. In hooped concrete, on the contrary, the elastic limit differs materially from the ultimate strength, as in ductile metals. The working stress which will be allowable for each system will, therefore, differ much according to the method used in its deduction.

Some possible faults which the factor of safety must insure against are common to all structures, as, for example, probable inaccuracies, possible increase in the loads or in other external forces, etc. The liability to rusting is the same, and it is very small for all well studied concrete-steel types. The direct effect of shock is less to be feared for hooped than for longitudinally reinforced concrete, since the amount of kinetic energy a member can absorb without breaking is represented by the area contained between the deformation curve and the axis indicating the shortenings, and this area, when plotted, is greater for the first type than for the second. On the other side, the indirect results of shocks, vibrations, have the less effect on structures the greater the mass is, and longitudinally reinforced concrete, necessarily, requires more mass; but this is really of small importance, since the hooped concrete structures have enough mass for all practical purposes. These considerations do not show much difference between the two types. It is only in approaching the stress acting in a structure that this difference becomes apparent.

It is known that the coefficient of elasticity of concrete varies with its mixing, especially with the amount of water used and the thoroughness of the tamping. The stresses are for the same deformation, proportional to the coefficients of elasticity, and they may, therefore, show much difference between different points of the same section, even when subjected to symmetrical deformation. Generally, the deformation of members computed to act symmetrically may, for many reasons, be irregular. Even in the most favorable cases, as in hinged arches or simple beams, much depends on the transverse connections, rigidity of connections, irregularity of work, etc. Frequently these simple structures will not be adopted because hinges are delicate things for structures of great weight and because the engineer does not wish to miss the advantages of a continuous structure. But the importance of the elasticity of the material is greater for fixed arches and continuous beams, because the deformation of the centers during construction and unequal settling generally cause stresses which are not provided for in the design of the structure and which may at some points considerably increase the total stress. Thus there are two kinds of stresses to be considered. The primary stresses are caused by the external forces in a structure of given form, are independent of the coefficient of elasticity, and depend only on the resistance of the material for the support of the structure. The secondary stresses are due to the irregularities of construction and the deformation of the original form. These are, evidently, the more dangerous, the less ductile the material is, and the sooner it breaks under deformation. Only the first kind of stresses can be anticipated and computed, but the other stresses must be provided for by a proper selection of the margin of safety. The high factor of safety used for masonry structures is mainly due to the incapacity of the material to resist considerable deformation. No such high factors of safety would be used for ductile materials having an elastic limit well below the ultimate strength.

Observations on the deformations of iron structures have shown that the elastic limit of the metal is the safe limit for structures, and that it is sometimes reached at some points of the structure without in any way endangering the structure. On the one hand, the exceeding of the elastic limit is the result of insufficient resistance, which, when due to excessive loading, can only become worse, and indicates approaching danger; on the other hand, it is the means by which the ductile materials free themselves of danger, if it is a result of excessive deformation. These considerations lead to the conclusion that the required margin of safety is greater for longitudinally reinforced concrete, which is brittle, than for the hooped concrete, which can undergo enormously greater shortening without failure.

There is no doubt that concrete-steel has a decided advantage over steel in structures in its resisting capacity to atmospheric influences. Concrete exposed to air or brackish water can be considered as having an indefinite life. Certain Roman mortars are in an absolutely good state to-day, and there is no indication that Portland cement gives worse results. Much evidence has also been brought out showing that metal embedded in an ordinarily good concrete undergoes no changes. The recent experiments of Breuilié, published in The Engineering Record of Sept. 20, 1902, prove that in certain cases heavy water pressures acting on intensely stressed concrete-steel change the concrete and then the ferric layer which surrounds the reinforcing steel, and destroy the adhesion, if the pressure is alternately put on and taken off. This is a very important fact which seems to prohibit the use of concrete-steel for water reservoirs. But there is no similarity between the conditions under which these experiments were made and those of ordinary structures exposed to the air and the rain. Countless examples of this character are existing at an old age showing no change of quality.

As to dynamic effects, concrete-steel structures show advantages. This was proved by numerous experiments the results of which M. Rabut communicated, in 1902, to the French Academy of Sciences. At the same time he established the fact that, due to the undeniable superiority of concrete-steel structures as to the intimate connection of their parts, stresses caused by concentrated loads are better distributed than in iron structures. Hooped concrete, with properly reinforced joints, has no weakened section, and the remarkable ductility shown by the experiments can be counted upon to exist at any point of a member. It may suffice to state that a riveted steel member 5½ inches in diameter will certainly not bend without fracture to a radius of curvature of 23.6 inches, as a hooped concrete member of the same dimension has done without breaking and still maintaining a degree of strength, as proved by final tests. While considering all these advantages of hooped concrete, its disadvantages should also be stated.

It is correctly claimed that the quality of concrete-steel structures depends to a large extent on the care exercised in their construction and that it is impossible to control the construction at every instant. Bad work can much reduce the resistance of compression members and the adhesion of the concrete to the metal, without which no reinforcing of concrete is effective. The importance of this serious objection is diminished if the completed structures are tested by loads appreciably higher than their working loads. But the objection still holds true, and it has added much to the weight of the author's proposition to build structures of single members or blocks which have been made in shops under continuous inspection and which will be tested, before being put in place, for much higher stresses than may occur in the finished structures. It is important to note that in hooped concrete members the influence of the quality of the concrete is, after the test load has been applied, quite secondary, and that their elasticity and column or crushing resistance depend almost exclusively on the reinforcing metal. It is easy to inspect and check the dimensions and sizes of the metal skeleton of each member before concreting. With the above methods of construction there will still result, in many cases, considerable economic advantages for hooped-concrete construction. The most important is that there need be no apprehension of bad work either in the joints, which can easily be made excessively strong, or in the main sections of the members manufactured and tested in the shop.

The logical conclusion of the above discussion would be the adoption for hooped concrete of a factor of safety smaller than that generally used for metal structures, which varies between 2 and 2.5 on the basis of the elastic limit. But concrete-steel, especially hooped concrete, has an indisputable drawback; it represents a novel method of construction which has not stood the test of years of experience. For this reason the author proposes a factor of safety of 3 to 3.5 for hooped-concrete structures. It should be noted that the factor of safety does not generally exceed 2 in concrete-steel structures in bending where the iron is stressed in tension from 11,000 to 14,000 pounds per square inch, and sometimes still more, while the elastic limit does not exceed 23,000 to 28,500 pounds. Considering this fact together with the considerably increased reliability as resulting from the proposed method of construction, the author believes his propositions to be more than safe. Referring to the column resistances given at the end of Section XII., it will be seen that the adoption of a factor of safety of 3 to 3.5 will stress the concrete from 950 to 1,100 pounds per square inch for structures concreted in place and from 1,850 to 2,000 pounds for structures built of blocks previously tested under sufficient loads.

XIV. *Types of Hooped Concrete.*—The good results of hooped concrete depend on the proper arrangement of the hooping. It is evident, at the start, that the hoops must be well locked and that they must not open under the internal pressure of the concrete. If the enclosing reinforcement is made of other material than metal, the stresses which it produces in the concrete must not injure its resistance to compression endwise, which is its main stress. The experiments reported earlier in this treatise have also proved that the hoops must be near to each other to give to the concrete a satisfactory coefficient of elasticity and column resistance. To duly appreciate the degree of regularity required for the spacing of the hoops a distinction should be made between the crushing resistance and the elasticity on which

the column resistance depends. It has been shown that hooped prisms always have a considerable excess of crushing resistance. It will, therefore, not impair the crushing resistance if the spacing of the hoops is not very regular. Of course, too much irregularity should be avoided and the omitting of a hoop, for instance, would prove dangerous. For the elasticity and column resistance the regularity of the spacing must not necessarily be perfect. The deformations measured over sufficient lengths depend on the average spacing for the modification of the column resistance.

Hoops of two completely different types may be used. One type consists of independent hoops, the other of continuous helicoidal spirals made of wire or rods as long as possible. If independent hoops are employed each one must be locked so strongly as not only not to open under the internal pressure of the compressed concrete, but also not to show any appreciable deformation in its connections. Practically it is impossible to connect the countless hoops which an important structure would contain. This has never even been attempted and it is generally limited to giving the ends of each rod an excess of length which overlaps and locks by the adhesion of the metal to the concrete. The ends can be tied together if the wire is of small gauge, but this is not good practice in all cases and is almost impossible with thicker rods. The introduction of the adhesion to the concrete causes a stress which can in nowise be neglected and which is produced near the circumference of the compression members where the pressure and the tendency to flexure require all the resistance that can be afforded. In addition it must be remembered that the regularity of spacing of the independent hoops is dependent on the care and attention of the workmen, on which it is impossible to count.

These inconveniences are avoided by the use of long wires or rods bent into helicoidal spirals. Drawn wires of great resistance can be obtained up to ½-inch diameter and steel bars ⅝-inch thick can be obtained in rolls 160 feet long. The thickest bars that may be required for hooping can be bought in rolls at least 80 to 100 feet long. With such lengths 10 to 40 spirals can be made continuous. To insure the transmission of the tension from one bar to another it is sufficient to embed between the last spirals of one bar the first spiral of the next and to curve in toward the center of the section the ends of the bars bent into crooks. The additional stress thus caused in the concrete acts in the central portion of the concrete where, being supported by the pressures acting in every direction and having a considerable excess of resistance, there is no danger. Experience has plainly proved the efficiency of this procedure. It could not be well used for independent hoops where the too numerous ends would crowd the section. When spirals have to be made for given prisms, an endeavor should be made to find the diameter and pitch which the metal, when left to itself, will retain, owing to its elasticity. Experience has shown that this is not difficult. The spirals once made and checked no important errors can occur while putting them in place and concreting.

It would seem that, since the elastic efficiency of the hooping increases with the closeness of the hoops, at least within certain limits, the ideal will be reached by the use of continuous tubes; but such is not the case for several reasons. The external layer of concrete which is necessary for the protection of the tube will crack off as do all covers applied to surfaces subject to high stresses. The tube would generally be riveted and pierced by numerous holes which would reduce its resistance not only by reducing the action, but frequently also by punching defects. In addition to these practical objections a fundamental objection must be taken into account. It has been seen that the metal of the hoops can resist the considerable deformations of the hooped prisms because its elongation is only a small fraction of the longitudinal shortening. It is far below its elastic limit when the reinforcing parallel to the axis already exceeds it. The longitudinal shells would be in the same condition as the longitudinal reinforcing rods. They would be stressed the same as these and would spread laterally the same as the concrete itself and would thus not be able to prevent its swelling. Concluding, it may be stated that independent rings show serious difficulties which increase with their closeness and the sizes of the iron used for them. Continuous shells, on the other hand, have little efficiency and are exposed to atmospheric action. The best type of hooping thus appears to be helicoidal spirals of suitable dimensions.

For the reported experiments a single volution was used which was cut by a plane perpendicular to the longitudinal axis in a single point. Two modifications of the same may be used. One consists in having two or three wires, instead of one, wound in a spiral doubling or tripling at the same time the pitch of the screw so as to maintain the same spacing of spirals. This can be done if it is not desired to rely on a single wire, though it has not been worked otherwise than by bending it in the spiral shape. The other modification consists in giving to the spirals different diameters, instead of the same for all, and having the direction of the spirals in the opposite direction. This would prevent any torsional tendency in the concrete, but torsion is evidently out of question in the structures discussed. From the above the author concludes:

To give to concrete a high ductility and to increase at the same time to a high degree its elastic limit and crushing as well as column resistance, the hooping must form close loops and have the least number of joints. These conditions lead to the use of helicoidal spirals combined with longitudinal rods forming a continuous skeleton which resists efficiently the transverse swelling of the concrete.

XV. *Method of Manufacture of Compression Members.*—Hooped concrete, the same as concrete-steel generally, will take many forms and have many applications which will determine the methods of its construction. Nothing general can be said on this subject and the following remarks apply only to columns or compression members of sections approaching to circles and intended to resist pressures endwise.

The importance in such members of elastic symmetry, that is, of the equality for the values of the coefficient of elasticity and the elastic limit at different points of the same section is easily understood. The lack of symmetry causes curving and invites flexure. But it is practically impossible to obtain elastic symmetry in members concreted while lying longitudinally and it is seen at once that there must exist differences between the upper and lower layers as to tamping and distribution of water, cement, sand and stone. By examining and sounding with a hammer different parts of a member appreciable differences can almost always be noticed in the compactness. This consideration tends to the adoption of vertical moulding for members compressed endwise; but it should be noted that this does not apply to beams whose horizontal layers are subjected to different stresses. For them the sum of their moments only is of importance and not the distribution over the section.

Vertical moulding has also other advantages. It tends to place the stones with their flat sides perpendicular to the direction of the pressure, the same as in well-built masonry. Horizontal moulding, on the contrary, places them in the most unfavorable position. The concrete being better confined in vertical moulds than in horizontal tamps more quickly and much better. In members reinforced by hoops and longitudinals pressing against the inner surface of the hoops the whole central portion is free for vertical ramming, and the tamping tool can strike the concrete without shaking the reinforcing and disturbing the previously tamped portions. If members which are to be built in a different position are moulded vertically they get the advantage of being made in improved moulds provided with stops for the spacing of the spirals and in a covered shop protected from the rain, which is dangerous during moulding, and the sun, which is not less dangerous during the early time of setting. Thorough inspection in a shop is easy and only a small number of selected workmen are required. For complete safety all members should be carefully examined and their quality judged by sounding with a hammer, which gives valuable information to the experienced man, and by weighing from which the density of the member could be computed and which would add additional information on the character of the concrete. Indeed, for a concrete of a given proportion the elastic limit and the resistance vary in the same sense as the density and are in proportion to the intensity of the sound. Members not up to the standard could then be rejected.

Vertical concrete members can be taken out of the moulds at the end of six days. The same moulds can then be used over again many times. Beginning sufficiently early with the making of the members, they will acquire all the desired resistance before being put in place. The members will be put during their hardening in conditions which are best fitted for them, in moist air or even in water. On the other hand, there are some disadvantages attached to the shop process and the vertical moulding. It may be feared that the tamping of the central portion does not compact the concrete in the annular space between the hoops and the external surface though experien shows that the cement and the finer sand and gravel flow into this space and fill it to a satisfactory degree. But it has been shown by the experiments reported in this paper that the central portion only is of real importance as to resistance. The external layer only protects the metal from atmospheric influences. After the removal of the moulds it is easy to see whether the metal will be well protected and, if required, the surface may get a finishing touch. Visible and easily repaired faults have only a relatively small value and no others can exist in hooped-concrete members moulded vertically. The second disadvantage of shop moulding consists in the required handling and transportation to the work. The increased cost due to this may in whole or in part be compensated by the saving of the forms used on the work. The third and, apparently, most serious objection to shop moulding is the inconvenience of assembling. Careful examination shows that this objection is not serious for hooped-concrete.

It is impossible to foresee with certainty the ways and means which practice will develop and adopt for the assembling of the members, but some indications may be given which, while open to improvement, will assure safe results. In consideration of local stresses of high intensity which may be induced at the joints, the ends of the members will be reinforced by

additional hoops of finer wire than that used for the regular hoops. The joints will thus be strengthened to any desired degree independent of the other parts of the structure. To give an idea of the efficiency of hooping after ramming it is sufficient to state that the prism tested at Quimper, whose crushing resistance, as given in section IV, had the high value of 10,500 pounds per square inch consisted of a mortar cylinder three months old which was then hooped and covered by cement and tested ten days later.

It will be generally useless to provide for the continuity of the longitudinal rods in hooped members since their duty is mainly to form with the hoops a network which will prevent the swelling of the concrete and they fulfil it perfectly by simply stopping at the joints. Cases may, however, occur in which it will be prudent to insure transmission of tensile stresses in the longitudinals which may be caused by bending moments. In such cases it will be easy to embed in the concrete at the ends of the rods while moulding iron tubes which will come opposite each other and in which metal rods of the same section as the longitudinals will be placed and grouted by cement. Or the longitudinal rods on the end of the member may be left projecting and the tubes be placed in the corresponding end of the other member. Joints made in this way will not, as in other structures, be weak points. If, due to settling of centers, irregular filling of joints or any other cause, unequal distribution of stress occurs, the great ductility of hooped concrete and the enormous excess of resistance at the ends of members will exclude all danger.

Concrete reinforced by longitudinal rods without hoops and made in single members will offer difficulties similar to masonry, at least when no hoops are used near the ends. But even when laid in place without joints the longitudinally reinforced concrete in long compression members has a defect which has not as yet attracted sufficient attention. In this type of construction the longitudinal rods make up a very important part of the resistance and the transmission of pressure through them must be perfectly assured. Their connection is generally made by placing the adjacent ends of the rods in very short tubes. These ends are cut very irregularly and are not generally in bearing contact except by some projection which yields under the pressure and allows the abutting ends to approach, producing thereby local deformations in the concrete whose magnitude and effect can not be foreseen.

To avoid this objection reliance is placed on the cement which penetrates into the tubes during the ramming, but this is quite uncertain and it is also to be noted that badly rammed cement will not be able to resist pressures of 11,000 to 17,000 pounds per square inch which the rods transmit to it. Sometimes another method is used. The rods are straddled over each other and reliance is placed on the adhesion of the concrete for the transmission of the pressure. This method is good for hooped-concrete because the rods have here a secondary function only and are embedded in a concrete which is protected from all danger by the hoops. But the same method is objectionable in structures in which the longitudinals perform a main function and in which there is nothing to prevent breaking up and crushing the concrete which is highly stressed by the transmission of the pressure.

Numerous reasons thus render advisable the making of hooped concrete members under cover, protected from weather and by selected workmen under a continuous inspection of responsible foremen. Referring to section VIII, it will be seen that to obtain the greatest efficiency from this type the members must, before being put in place, be subjected to preliminary pressures of higher intensities than they will be called upon to resist in the structure. Independently of the important guaranty which the preliminary testing of all members of the structure gives and the convenience of rejecting doubtful members, the preliminary testing results in a great increase of elasticity and column resistance.

Responsible contractors, to whom important structures are let, will not find any difficulty in providing the necessary testing apparatus and accessories. This will be cheaper than may be expected because the shortenings which will have to be produced in the tested members are quite small, less than 0.04 per cent., and the stress required is so small that a cylinder and piston of a hydraulic press with a hand pump worked by one or two men will be sufficient to test very strong members. Neither motors nor accumulators will be required. The methods of manufacture and erection which have been discussed in the above are similar to those used on metal structures and guarantee the good execution required for works of some magnitude. Of course, small structures will not require these methods, as has been proved by many existing structures.

(To be continued.)

A Commonplace Fire and Its Lesson.

A fire which occurred January 13 in the Taylor office building, Cortlandt Street, New York, was quickly subdued without loss of life or great damage to property and without impairing the safety of the building. It can hardly be said to have significance other than the interest which attaches to any fire in a tall office building in a congested street, except for the renewed exemplification of axioms of city building construction which The Engineering Record has repeated many times, namely, that solid, heavy construction, even if not fireproof, is enduring and is likely to very much retard the progress of a quick fire and allow it to be controlled before the whole building is destroyed, and that fireproof shutters are necessary for all outside windows, at least of rooms with inflammable contents. These truths and the dangers of light wood and glass partitions have been demonstrated by many fires in office buildings.

The fire originated in the rear of a large clothing and furnishing store on the street floor, destroyed considerable stock, consumed some furniture and woodwork, and spread into a low rear extension having a glass roof. Breaking through this roof, the flames shattered the rear windows and entered the rooms of the second story, where they destroyed furniture, trim and contents, but did not spread through the partitions to other parts of the same story and did not reach any of the upper stories. If the windows had been closed with fireproof shutters the fire would have been confined to the room where it originated. The adjacent building in the rear had a wing only about 6 feet distant with iron shutters on its windows. They were twisted and blistered by the heat, but protected the building from damage, while without them the flames would inevitably have set fire to the contents of the outside rooms. The walls of the Taylor building are of heavy brick and the columns are apparently of cast iron enclosed in plaster or other fireproofing, but they withstood the flames so well that they were not exposed so as to make their construction details evident. The floors were of wood and the ceilings of wooden lath and plaster and were not destroyed by the fire, but were cut through from above by the firemen to fight the first story flames.

The New York City Terminal of the Pennsylvania Railroad.

The desirability of direct entrance to New York City by the great railroad systems communicating with the West has long been recognized. A few years ago engineering talent was engaged upon the studies for a bridge with a span far beyond all precedent to carry the trains over the Hudson River. This method of approach proving impracticable, attention was directed to the feasibility of tunneling beneath the river. The officials of the Pennsylvania Railroad, having satisfied themselves that the tunnel scheme was within the possibilities of advanced engineering, sought from the New York municipal authorities the necessary franchise for the portions of the tunnel and terminal system within the city limits. The long delay experienced and the final successful issue of the endeavor to obtain the franchise are well known. The Board of Aldermen passed the franchise on December 16, 1902, and it was approved by the mayor on December 22.

Recently the daily press and some of the technical journals have published some information concerning the organization which will be charged with the execution of this great undertaking, but the first authorative statement was issued by the company this week. A brief preliminary outline of the work was printed in The Engineering Record of December 14, 1901, and it is still to early to give a description of details, for they have not been determined. The approach and terminal system comprises a double tunnel from the west side of Bergen Hill, in New Jersey, to Thirty-second Street, in Manhattan; a great underground station surmounted by an imposing superstructure occupying the site bounded by Thirty-first and Thirty-third Streets and Seventh and Ninth Avenues; and four tunnels extending from this station under the East River to Long Island City, where the railroad terminal facilities proper, with the accompanying yards, will be located; and involves the electrification of portions of the Pennsylvania Railroad in New Jersey, and of the Long Island Railroad and the erection and equipment of two great power houses, one in New Jersey and the other in Long Island. The franchise prohibits the use of a system of traction which will require combustion within the tunnel, as mentioned in our issue of December 20, 1902. The power houses will aggregate upwards of 100,000 horse-power.

The great magnitude of the undertaking and the urgent need for rapid construction demand a most comprehensive and efficient organization, and the difficulties to be surmounted and the imperative requirement for excellence of results necessitate the employment of the highest technical skill. It is evident that even the large engineering staff of the Pennsylvania Railroad with its recognized ability could not add so stupendous a burden to its other duties, which are at present unusually extensive and exacting. Consequently the railroad officials, with a comprehensive view and firm grasp of the situation, have created an organization which has some novel and most commendable features and which is noteworthy for its simplicity and effectiveness. It was recognized that the work could be divided into four main departments: the tunnels, the architectural work, the mechanical and electrical engineering, and the bringing of the railroad into and through the tunnels and terminals. Naturally, therefore, a commission of civil engineers was created to design and supervise the construction of the tunnels; architects were appointed to have charge of the superstructures and other architectural work; the mechanical and electri-

cal engineering was committed to an engineering concern with an unparalleled organization and experience; and to the chief engineer's department of the railroad was assigned the task of bringing the road into the tunnels and terminals.

The whole work is under the general direction of the management of the Pennsylvania Railroad. Col. Charles W. Raymond, U. S. Army, engineer of New York Harbor, is the chairman of the commission of civil engineers, the other members of which are Mr. Charles M. Jacobs, chief engineer North River section; Mr. Alfred Noble, chief engineer East River section; Mr. William H. Brown, chief engineer Pennsylvania Railroad, in charge of tracks and terminal yards; Mr. Gustav Lindenthal, bridge commissioner of New York City; Mr. George Gibbs, first vice-president of Westinghouse, Church, Kerr & Company, in charge of mechanical engineering, electric locomotives and traction. Thus the various parts of the work are definitely assigned to individual members of the commission.

Messrs. McKim, Mead & White, of New York City, who have had a wide previous experience in the design and superintendence of large structures, have been appointed the architects. For the mechanical and electrical engineering a comprehensive contract has been made with Westinghouse, Church, Kerr & Company, who have also been selected as the engineers of the architects, and have been commissioned to execute the electrification of the Atlantic Avenue Line of the Long Island Railroad.

The magnitude and variety of the engineering work which has thus been awarded to Westinghouse, Church, Kerr & Company is unprecedented in the annals of the profession and such an engagement is possible only because of the exceedingly broad experience, complete equipment and remarkable organization possessed by this company, together with the necessary financial resources. Their work is understood to include the complete mechanical and electrical equipment of the tunnels and terminals with their approaches and the large power houses; and comprises heating, ventilation, lighting, passenger, freight and baggage elevator service; refrigeration, hot water, and cooled water for the drinking supply; telephone, telegraph and pneumatic tube services; fire protection, and the switch and signal systems.

The magnitude of the whole work involved in the construction of the tunnels and the terminals is indicated by the immensity of one of the principal features. The Manhattan terminal station will require the excavation of a tract about 500x1,800 feet to a depth of some 40 or 50 feet, necessitating the movement of, roughly, 1,500,000 cubic yards of materials.

By means of the organization outlined, the conduct of the entire enterprise is established on the most harmonious and effective lines, while the already burdened operative departments of the railroad are relieved of that complexity and multiplicity of detail which might easily swamp and hamper so as to render ineffective the best organization based on any less comprehensive plan. The degree of independence in the working of each department and the full co-operation in combining the parts into the one complete system provided for by the scheme of organization seem highly satisfactory.

It will be apparent that the task of administration on the part of the Pennsylvania Railroad Company is much simplified by having only three bodies with which to deal, the commission, the architects and the engineers, upon whom is placed the whole responsibility and labor of the execution of the work. The responsibilities, though large, are well guarded by the character and ability of the men and the firms selected to bear them. The commission conducts its deliberations by meetings at regular intervals, following upon the individual work of its members. These meetings are attended by Mr. Mead, as the representative of the architects, while the mechanical and electrical engineers are represented on the commission by Mr. Gibbs. Within the Westinghouse, Church, Kerr & Company organization has been formed a special Pennsylvania Railroad Terminal Committee meeting at regular intervals and representing in its membership the various branches of engineering involved, whose proceedings constitute a continuous and systematic record of engineering development, design, decision and progressive work based upon the operations of the several departments whose heads are members of this special committee.

Up to the present time engineering activities have been restricted mainly to investigations and decisions concerning methods, quantities and the feasibility of numerous plans—the commission, the architects and the engineers giving independent attention to their several duties and conjointly harmonizing the various proposed features and methods. In this way a final set of plans which will come before the management of the Pennsylvania Railroad for final approval, and upon which the work of construction will then actively proceed is being elaborated. The labor involved in such a process for a work of great magnitude can be fully appreciated only by engineers who have had similar large problems to solve. Men who have had experience in such matters alone know that the work and talent expended upon the things not done often exceeds that applied to those which are performed.

To offset the delay caused by the political complications the commission has been at work since early last spring, while the architects and engineers have had a large corps of men actively engaged since June. There was, therefore, much more preliminary work accomplished prior to the passage of the franchise than has been commonly supposed.

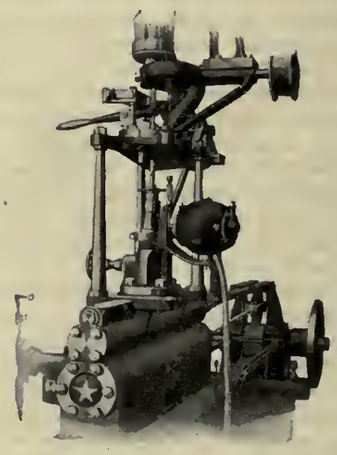
Westinghouse, Church, Kerr & Company have already substantially completed the plans for the Long Island power house, so that work upon it can be begun immediately. This was necessary in order to provide electric power for the Atlantic Avenue division of the Long Island Railroad, which will be completed for operation in advance of the tunnel construction. This power house and the one in New Jersey will jointly serve the entire traction system, and will be arranged so as to relay each other, and either one separately or the two conjointly will furnish current for the Manhattan terminal.

As this great undertaking progresses and its difficulties are encountered and successfully overcome there will, doubtless, be much of interest to narrate for the edification of engineers in many branches of the profession. At present the achievement to be chronicled is the masterly solution of the first problem of all extensive engineering enterprises, the organization.

An Electric Water Wheel Controller.

The tendency to design the electrical instruments in an electric generating station so that the machinery can be controlled from a central point has led to the development of an electric speed controller for Lombard water wheel governors, shown in the accompanying illustration.

The apparatus is extremely simple, consisting of two small push buttons on each generator panel on the switchboard or pilot switchboard, which connect through three wires to a small electric motor, which, through suitable mechanism, acts upon the valve stem of the governor in such a manner as to lengthen or shorten the connection between the centrifugal balls and the valve itself. The motor, which has the capacity of about 1/16 of a horse-power is, it is said, never called upon to exert more than 1/100 of a horse-power. Upon the armature shaft is mounted a small worm driving a worm gear on a vertical pinion shaft. This pinion transmits rotary motion to a gear which, being threaded through its hub, acts as a right and left coupling to draw together or push apart the two portions of the valve stem upon which it rotates. The pinion which drives the gear is long enough so as not to interfere with the up and down travel of the gear, and therefore the control of the valve by the centrifugal balls is not affected in any manner. The whole attachment may be fastened in place on the regulating valve in a few minutes' time. Heretofore, in bringing generators into synchronism it has usually been necessary for one man to watch the synchronizing lamps while an assistant stood by the side of the governor, gradually changing its speed according to signals received from the switchboard. With this machine a man at the switchboard with his fingers on the two push buttons can raise or lower the speed of the generator, which is to be thrown in multiple with others, without taking his eyes



for an instant away from the synchronizing lamps or corresponding device. If it is desired, the man at the switchboard can without leaving his post shut down any generator, bringing it to a complete stop, and afterwards start it again.

If it is desirable that a signal should be sent back from the governor to indicate the change in length of the valve stem, and thus indirectly the change in speed which takes place, an extra attachment can be furnished which will do this, and will also permit the operator to change the speed by a step-by-step adjustment of a predetermined amount, for example, ½ per cent. for each push of the button. Lombard governors can also be furnished with an automatic electric attachment which is not intended to allow variations in speed, but merely to completely stop and start the water-wheels from a distant point. In some instances it is desirable to use both attachments, viz.: the speed changing and the stopping and starting. In one very large power plant governors are arranged so as to start the turbines automatically when the exciting current is thrown on to the generator fields, and stop them when the field circuit is opened from any cause. At the same time control of the speed when the wheels are running is in the hands of the switchboard attendant in a distant part of the building. The apparatus described is made by the Lombard Governor Company, 36 Whittier Street, Boston, Mass.

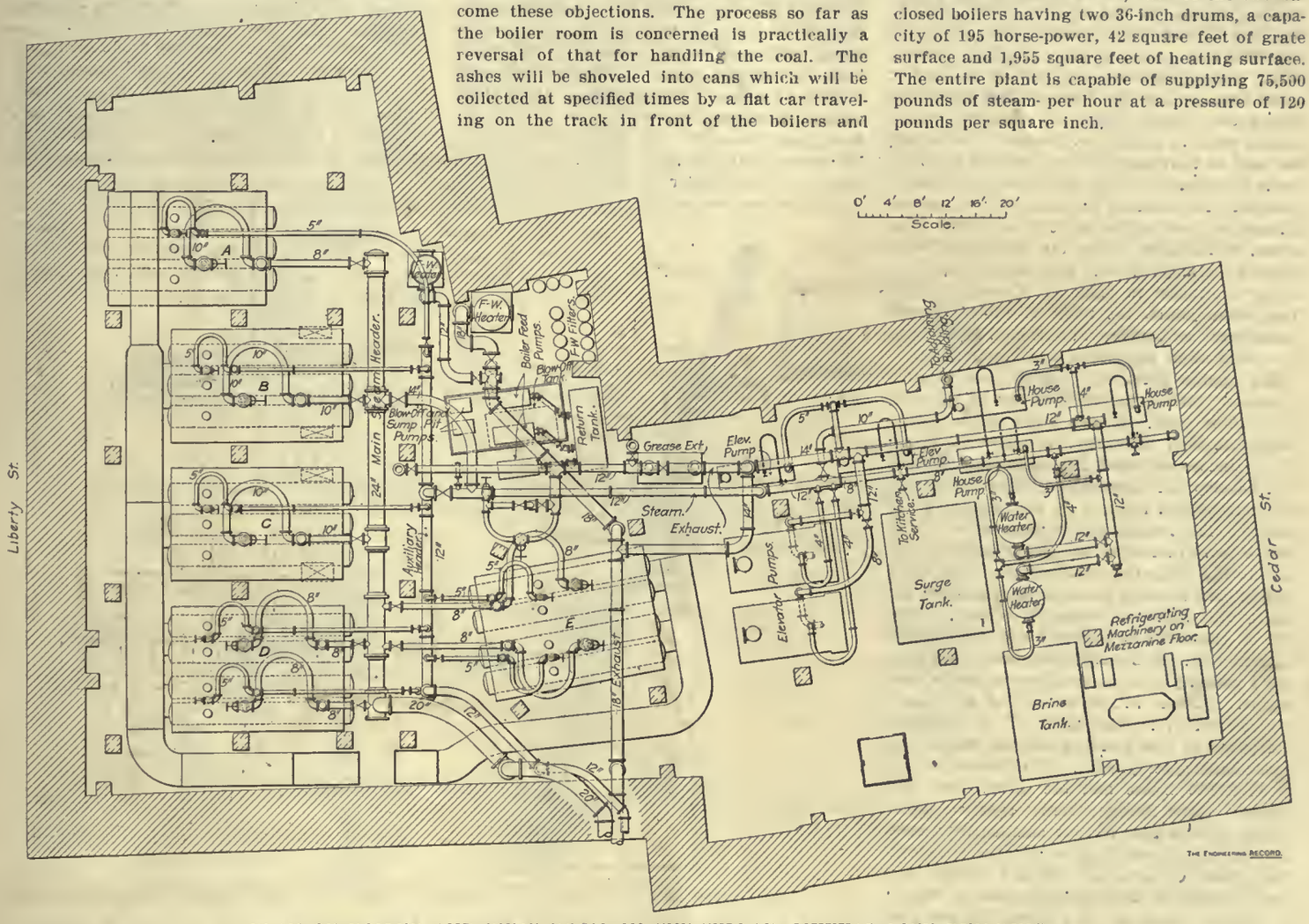
The New Mechanical Plant of the Mutual Life Building, New York.

The new mechanical plant, which is now being installed in the Mutual Life building on Nassau Street, New York City, occupies the underground stories of the additions which were built in 1901, and described in The Engineering Record of April 6th and 13th of that year. The extensions are in the form of wings, one of sixteen stories, on Liberty Street, and one of nine stories, on Cedar Street. Below the ground floor the complete rectangle enclosed by the building is utilized. The boiler and pump rooms are directly under the new extensions and the new engine room is below the court between the old and new parts. For an office building the plant is extensive and includes many noteworthy features, the most important of which are, the large boiler plant, the excellent lay-out of steam piping with precautions against the necessity for a complete shut-down, the generous sizes of the pipes for the steam heating, the extensive hydraulic elevator service and its operating plant, and the coal and ash-handling machinery.

In the new additions to the building there are four stories below the ground level, designated as basement, sub-basement, cellar and sub-cellar. The boiler room is two stories high, occupying parts of both the cellar and sub-cellar. The coal bunkers are located directly over the boilers and have a capacity of between 500 and 600 tons. An elevated elliptical track extends around the bin space half way between the center and the walls, passing over a scale platform at one end where the coal is delivered through chutes from the street. A dumping car receives the coal on the scale platform, and when loaded and weighed is pushed along the track to any desired point and dumped to one side or the other. The bottoms of the bunkers are inclined toward the middle so that the coal slides naturally through gated chutes to the boiler room. From the chutes the coal will be drawn into a special car which travels on a track along the front of the boilers. One side of the car opens out and down forming a shelf from which the coal may be shoveled directly from the car into the furnaces and need not be dumped on the floor.

The removal of ashes from a building in the heart of a crowded city is usually an expensive operation to the owners and a source of nuisance to the public, but the method here used for handling them has in a great measure overcome these objections. The process so far as the boiler room is concerned is practically a reversal of that for handling the coal. The ashes will be shoveled into cans which will be collected at specified times by a flat car traveling on the track in front of the boilers and will be conveyed to the foot of the elevating conveyor. Here they will be dumped into a boot below the floor level from which the buckets of the conveyor will lift the ashes to a point sufficiently above the ground to allow them to be delivered through a chute into an ash cart drawn up alongside of the curb. No obstructing of the sidewalk will be necessary as must be the case where ash cans alone are used. The peculiar feature of the conveyor is the provision for disposing of it when not in use. The accompanying sketch shows it in its extended position during use. When it is no longer needed the chute at the top is closed down in the position indicated and the supporting truss is buckled at the knee joints, as shown by the dotted lines. This shortens the apparatus sufficiently to let it down below the level of the sidewalk and allow the opening to be closed. Guide wheels are placed at the points of bending to keep the bucket chains taut and prevent their becoming disarranged. The conveyor was erected by Mr. A. J. Hemphill, New York.

The steam generating plant, with a total of 2,040 boiler-horse-power, consists of seven Babcock and Wilcox boilers, distinguished on the plan by the letters A, B, C, D and E. The boilers are of wrought steel construction and are faced with white enameled brick to match the walls and piers of the boiler and pump rooms. They are equipped with Potter mesh separators and McClave grates, furnished by James Beggs & Company, of New York. Each of the boilers A, B and C has three drums 36 inches in diameter, a capacity of 420 horse-power, a grate surface of 87.5 square feet and a total heating surface of 4,202 square feet. D and E are double batteries, each of the two enclosed boilers having two 36-inch drums, a capacity of 195 horse-power, 42 square feet of grate surface and 1,955 square feet of heating surface. The entire plant is capable of supplying 75,500 pounds of steam per hour at a pressure of 120 pounds per square inch.



PLAN OF BOILER AND PUMP ROOM, IN SUB-CELLAR, MUTUAL LIFE BUILDING.

From each boiler the steam is conveyed by separate branches into two headers parallel with the faces of the boilers. The larger header is 24 inches in diameter and is fed by 10-inch branches from boilers A, B and C, and by 8-inch branches from each of the four boilers contained in the batteries D and E. The auxiliary header is 12 inches in diameter and is fed by one 5-inch branch from each of the boilers. All branches start from the boilers with a large loop of U-form having a radius of curvature at the base of five or six times the diameter of the pipe. Besides the two regular stop valves, each branch contains a check valve which automatically prevents the steam from backing up into a disabled boiler, while being repaired. All fittings on the main and auxiliary headers are of gun metal.

A 12-inch main at right angles to the steam headers extends through the pump room from which branches are taken to the feed pumps, elevator pumps, etc. This main is taken direct

from the 12-inch header and may also be fed through a 14-inch branch from the 24-inch header. Near its middle point a 10-inch branch is taken for the supply of live steam to the Stokes and Queen buildings on the same block. These buildings use on an average 125 horse-power and a maximum of about 200 horse-power. In the opposite direction from a point near the middle a 4-inch branch leads to the kitchen and laundry, the steam being used in these places for the warming of food, heating of water and the steaming of clothes.

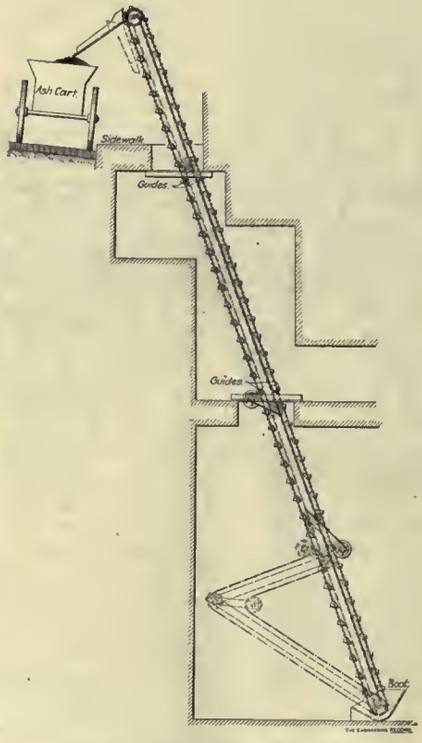
The new engine room, shown on another plan, is two stories above the boiler room floor and in an adjoining section. The engines are supplied through two steam mains; one 20 inches in diameter starts at the side outlet of a special tee at one end of the 24-inch header, and one 12 inches in diameter leads from the adjacent end of the 12-inch auxiliary header. After passing through the wall of the boiler room these mains rise about 25 feet before entering the engine room. The location of the engine room in relation to the boiler room and the lack of convenient access between the two, made the running of the pipe lines particularly difficult. The manner in which it was accomplished is best explained by the detail here given, which also shows the method of supporting the large risers. All high pressure piping over 6 inches in diameter is made up with Van Stone joints, the make of the Walworth Manufacturing Company, of Boston, Mass., who furnished all of the piping and large valves.

The engine plant will contain four engine-generator units. The engines are of the simple Corliss type and are being built by the Watts-Campbell Company, of Newark, N. J. The cylinders are 28x48 inches and the engines will develop 570 horse-power when cutting off at ⅓ stroke and running at 70 revolutions per minute. The frames of the engines are of the tangye form instead of the girder form usually used in the Watts-Campbell engines. The foundations will average 7 feet in depth under the entire unit and the 16-foot fly wheels, which will be assembled in segments will weigh about 40 tons each. A Bullock generator of 300 kilowatts capacity will be direct-connected to each engine. Current will be supplied at a pressure of 115 volts for the supply of the lighting and power of this building and the Stokes and Queen buildings adjoining. In all there will be about 22,000 lights and the power load will embrace three Sprague screw type elevators, six drum type and various smaller lifts, such as book lifts, sidewalk lifts, and private elevators. Most of these are in the Stokes and Queen buildings, there being but one or two in the Mutual building. The power for the ventilation mentioned in another part will also be included in the load on this plant.

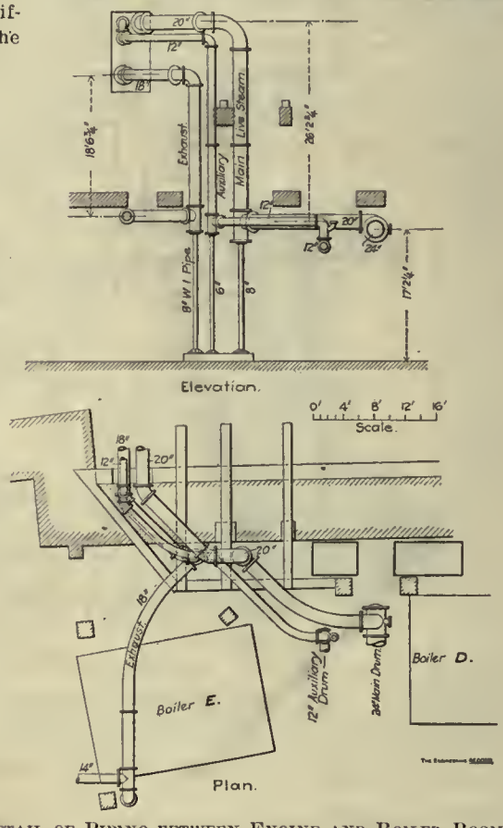
The units marked A and B on the engine room plan will be installed first and, when in working order, the old engine plant, now occupying the space where C and D will later be placed, will be removed. The old engines, four in number, are of the simple straight line type with cylinders 15x17 inches, rated at 200 horse-power when running at 230 revolutions, and are direct-connected to 100-kilowatt Siemens & Halske generators of the now obsolete form, having a ring-type armature revolving about the fields and the entire outer surface of the armature covered by a huge commutator.

In the new plant the branches to the engines will be of 9-inch copper pipe made on a large sweeping bend to allow for expansion. No expansion joints will be used in the high pressure piping. The exhausts from the engines pass under the floor through 12-inch branches into the exhaust main. The largest section of the exhaust main is 26 inches in diameter and contains a back pressure valve, beyond which it enters the base of the exhaust riser to the atmosphere. The riser is of the same size and is made up with Van Stone joints. It is over 250 feet in length and weighs roughly 25 tons. One hundred feet down from the top an off-set is made and support provided for the part above by two 15-inch 60-pound I-beams anchored in the walls. The pipe is free to expand upwards in the upper section, but the lower section being rigidly supported at the lower end it was necessary to insert an expansion joint just below the off-set.

The exhaust riser is surmounted by an exhaust head specially designed for the job. It is constructed of heavy plate copper, is 8 feet high and 6 feet in diameter, and weighs about one ton. The inner pipe, which forms an extension to the riser, is closed at the top, its sides being perforated with inwardly-lipped openings, so that the steam is deflected outwards through the many perforations. It is then obliged to change direction two more times before finally escaping. The condensation formed by contact with the walls of the head, and the moisture in suspension thrown down by centrifugal force, are drained from the bottom of the head and returned to the drip tank to be used again in the boiler feed.



COLLAPSIBLE ASH CONVEYOR.



DETAIL OF PIPING BETWEEN ENGINE AND BOILER ROOMS.

The other end of the exhaust main in the engine room returns to the boiler room as an 18-inch main and terminates in the two feed water heaters. The exhausts from the pumps are collected in a 12-inch main parallel to their supply main, which is connected near its middle point by a 14-inch branch to the 18-inch exhaust main. From the end of the smaller exhaust main in the pump room a 12-inch branch is led to the two hot-water heaters for the house supply, and at the opposite end it enters the base of a 12-inch riser for the heating of the Liberty Street section. The heating of the various other sections of the building is supplied by branches from the exhaust mains in the engine room, as will be seen on the plan. The supplies of adjoining sections are tied together, affording at least two sources of steam for each. Live steam may be admitted into the heating mains at two places, one in the boiler room and one in the engine room, either at a low pressure through reducing valves, or at full pressure through by-passes.

An ordinary two-pipe system of heating is employed throughout the buildings. The noticeable feature of the piping is the use of large sizes in the supplies and returns, the object being to keep the pressure necessary to operate the system as low as possible and thereby keep the back pressure on the engines comparatively low. So successful has the design proved that a pressure of one pound is claimed to be ample for a positive circulation through every piece of apparatus. All of the heating is done by direct radiation, hand-controlled, except in the library on the third floor of the Cedar Street annex, and in the president's offices on the seventh floor and throughout the ground floor of the Liberty Street section, where the Johnson system of thermostatic regulation is used.

The returns of the heating system and all clean drips are utilized in the make up of boiler feed. The return or drip tank is in the boiler room near the sump pit and is 11 feet long and 4 feet in diameter with a capacity of 135 gallons. The boilers are fed by three 10x6x10-inch feed pumps all delivering into the 4-inch main feed line, which contains a 6-inch Worthington hot water meter. Two are capable of furnishing the maximum amount required at any one time and one will handle the ordinary demands. The third pump serves as a reserve. The pumps are located side by side near the return tank from which they draw their supply. A 4-inch connection from the Croton supply furnishes the additional feed to compensate for the exhaust steam lost to the atmosphere.

From the return tank the water is pumped through Ward filters into the two feed water heaters. These are of the Berryman closed type as manufactured by I. B. Davis & Son, of Hartford, Conn. One has a capacity of 1,200 horse-power and the other 2,100 horse-power. The large heater is 58 inches in diameter and 228 inches high and contains 1,730 lineal feet of 2-inch seamless drawn brass tubing, through which the feed is passed. The smaller heater is 50 inches in diameter and 206 inches high

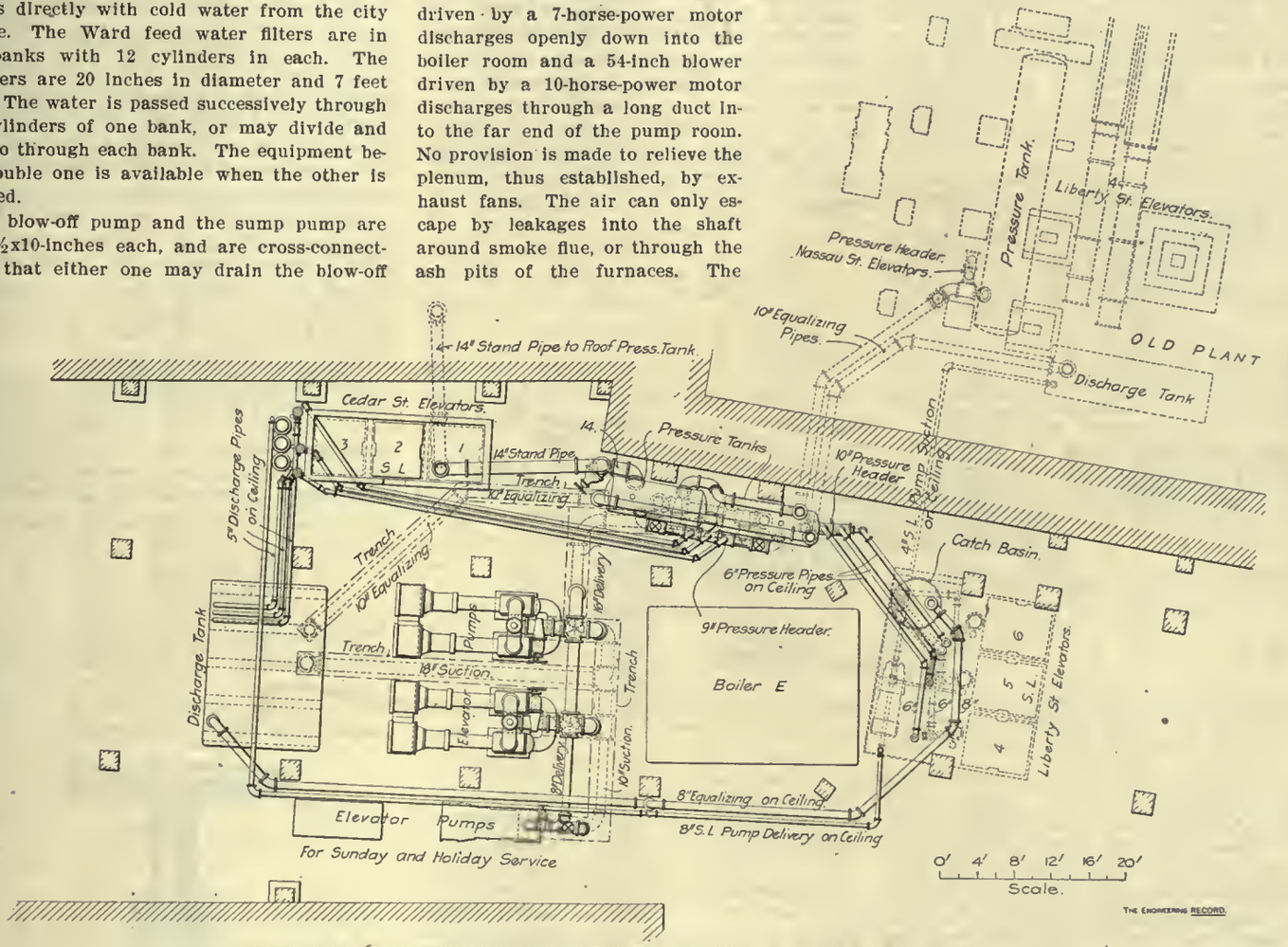
with 1,000 lineal feet of 2-inch brass tubing. The shells of both are made of ½-inch steel with heads 9/16-inch and ⅜-inch thick for the large and small ones, respectively. Steam is admitted at one side port 12 inches in diameter the other being capped. The water passes in and out through 4-inch connections and each heater is protected by water relief valves. In the winter when the returns are naturally warm, the smaller heater is ample to supply the desired amount of heat to the feed, but in summer when there are no returns from the heating system, and more cold water is used, the 2,100 horse-power heater is necessary. The exhaust steam condensed within the heater is returned to the blow-off tank from which it is wasted to the sewer. As an alternative means of feeding the boilers, two injectors of Eynon-Korting make are installed, which can feed the boilers directly with cold water from the city service. The Ward feed water filters are in two banks with 12 cylinders in each. The cylinders are 20 inches in diameter and 7 feet high. The water is passed successively through the cylinders of one bank, or may divide and part go through each bank. The equipment being double one is available when the other is disabled.

The blow-off pump and the sump pump are 7½x4½x10-inches each, and are cross-connected so that either one may drain the blow-off tank or the sump pit to the sewer. The pumps are placed vertically in the sump pit with the water cylinders down, the object being to prevent the steam cylinders from becoming submerged with water through a failure of the engineer to start the pump at the proper time. The blow-off tank, which receives the blow-off from the boilers and all greasy drips, is 4 feet 6 inches in diameter and 9 feet 6 inches long. When desired it may be emptied into the sump pit through a 4-inch connection in the bottom. It contains a coil of 100 lineal feet of 3-inch brass pipe through which the Croton water used to complete the boiler feed is passed before being pumped to the filters. Both the return and blow-off tanks are of No. 1 charcoal hardened iron, the heads being ½-inch thick and the shells 7/16. The level in each tank is controlled by Utility pump governors as manufactured by the Standard Steam Specialty Company, of New York.

The water supply for the sixteen-story section and the nine-story sections will be furnished by three 9 and 14x8x15-inch Worthington pumps which will be regulated by Ford pump governors. The pumps are cross-connected, and in order that they may be used interchangeably the nuts on the governors, which adjust the tension of the spring determining the pressure which will cause the valves to open, have been replaced by knurled wheels so that the change in adjustment may be made quickly. The hot-water supply will be heated by the two heaters previously referred to. These were furnished by I. B. Davis & Son, and are 87 inches high and 53 inches in diameter over all. They are similar in construction and operation to the feed water heaters.

The only mechanical ventilation is that used for the boiler and pump rooms. A Sturtevant disc fan 40 inches in diameter driven by a 7-horse-power motor discharges openly down into the boiler room and a 54-inch blower driven by a 10-horse-power motor discharges through a long duct into the far end of the pump room. No provision is made to relieve the plenum, thus established, by exhaust fans. The air can only escape by leakages into the shaft around smoke flue, or through the ash pits of the furnaces. The boiler room is noticeably free from the excessive heat usually experienced in steam plants. This is not due to the ventilation alone, but is largely afforded by the effective insulation of the boiler smoke connections. These are of black iron ⅛-inch thick, and are covered with a 2-inch magnesia lagging and surrounded by a casing of No. 14 gauge galvanized iron with an air space of 1½ inches between. The temperature within the flues is as high as 650 degrees at times, yet the heat radiated is so slight that the hand can easily be held on the hottest part without any discomfort. The greatest advantage of the insulating of the smoke connections, however, is experienced in the efficient draft obtained by the increasing of the chimney action through the retention of the heat usually lost by radiation, it being quite unnecessary to use mechanical means for producing the draft in the furnaces. The smoke stack inside of the brick casing is 7 feet 6 inches in diameter. At its largest point the smoke breeching is 48x150 inches. The smoke outlets from the larger boilers are 30x72 inches, and from the smaller ones 48x24 inches.

The building contains seventeen elevators disposed as follows: six in the Nassau Street section and one in the old Cedar Street annex, each having a travel of 150 feet; four in the old Liberty Street annex, and three in the new extension having a travel of 245 feet; and three in the new Cedar Street extension having a travel of 150 feet. The seven first mentioned will continue to be run by their old plant. This consists of two compound Worthington pumps 18½ and 28x16x18 inches, a pressure tank 12 feet long and 5 feet in diameter, and a surge tank. The elevators in the old Liberty Street annex have horizontal plungers with cylinders



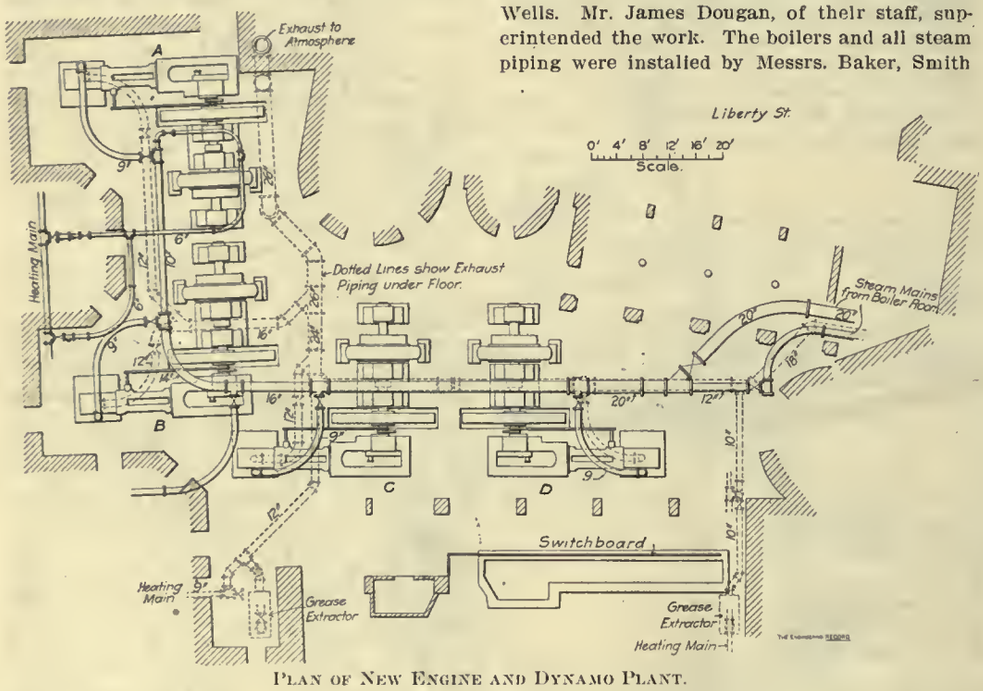
ELEVATOR EQUIPMENT FOR LIBERTY AND CEDAR STREET SECTIONS.

19 feet long. They were formerly operated by three pumps 14 and 20x11x15 inches, which pumped the water into a pressure tank 30 feet long and 5 feet in diameter. The discharge tank is 18 feet long, 5 feet 6 inches wide, and 5 feet 6 inches deep.

The new pumps are two of the Worthington compound type, 21 and 34x18x24 inches with 16-inch delivery, 18-inch suction, 4-inch steam and 8-inch exhaust connections, each being capable of serving the entire equipment to which they are connected. In addition to these there will be two others taken from the old plant, 14 and 20x11x15 inches with 8-inch delivery, 10-inch suction, 2½-inch steam and 5-inch exhaust connections for night and holiday service; and a fifth 10x5x10 inches with 3-inch delivery and 4-inch suction for safe lifting or other heavy freight service. The rods of the large elevator pumps are made in two parts for the steam and water ends, and are united by a coupling between the cylinders. The reason for this is

that the lack of lubrication in the water cylinders causes the water end rods to become worn and scored faster than the steam end rods, and having them in two parts it is not necessary to replace the entire rod while the steam rod is still fit for further use.

Four new pressure tanks have been installed which are placed in pairs end to end with one pair above the other and all connected by short necks. Each tank is 10 feet long by 4 feet in diameter, has a capacity of 900 gallons, and will be subjected to a pressure of 90 pounds on regular working conditions. The new and old pressure tanks have been connected together by a 10-inch equalizer pipe, and a 14-inch standpipe leads directly from the pressure tanks in the engine room to an auxiliary pressure tank on the roof which is 18 feet long, 6 feet diameter, and has a capacity of 4,000 gallons. Similarly the new and old surge tanks have a 10-inch equalizing connection located in a trench beneath the sub-cellar floor. The new discharge tank is 18x13x7 feet 6 inches deep, and has a capacity of 13,000 gallons. The complete outfit will operate the remaining ten ele-



Plan of New Engine and Dynamo Plant.

vators not included in the old Nassau Street plant. Elevator No. 2 on the Cedar Street side and No. 5 on the Liberty Street side are used for safe lifting and are connected by special 3-inch delivery pipes from the safe lift pump. The suction for this pump is taken from the old discharge tank through a 4-inch pipe on the basement ceiling. For safe lifting a pressure of about 150 pounds is used.

Instead of running a separate discharge pipe from the plunger of each elevator in the new Liberty Street annex, a catch basin, 5 feet 6 inches in diameter and 8 feet deep with a capacity of 1,500 gallons, has been placed near them into which they will drain. The contents of the basin will be conveyed to the new surge tank through a single 8-inch pipe. The Liberty Street elevators each have a 6-inch pressure pipe taken from a 10-inch header at one end of the pressure tanks and the Cedar Street elevators have 5-inch pressure pipes taken from a 9-inch header.

The air cushion in the elevator pressure drums is established by a two-stage air compressor with air cylinders 9x12 inches and 6¾x 9 inches, made by the American Air Compressor Company, of New York. After its first compression the air is passed through a cooler and back to the smaller cylinder from which it is finally delivered to the air receiver at a pressure of 150 pounds per square inch. The receiver is 4 feet in diameter and 8 feet long and tested to 200 pounds pressure. The compressed air will also be used for driving the boiler tube cleaners and blowing the dust out of the generator armatures. After the scale has been removed from the boiler tubes by the air driven cleaner they are washed out under heavy water pressure by one of the feed pumps which has auxiliary piping for that purpose.

The mechanical equipment includes a small refrigerating plant erected by the Isbell-Porter Company, of Newark, N. J. It operates on the absorption system, and has a capacity of 10 tons of refrigeration per day. The machine will only be used for making ice for use in the employes' restaurant and numerous water coolers about the building, as no attempt will be made to circulate cold drinking water.

The new additions to the building were designed by the architects, Messrs. Clinton and Russell, of New York, and the mechanical work has been done in accordance with the plans and directions of their engineer, Col. J. Hollis Wells. Mr. James Dougan, of their staff, superintended the work. The boilers and all steam piping were installed by Messrs. Baker, Smith & Company, of New York, and the elevators by the Otis Elevator Company of the same city.

The American Pacific Cable has been completed as far as the Hawaiian Islands, and the first message was sent from Honolulu to San Francisco on the evening of New Year's Day. The Commercial Cable Company are laying this cable and it is expected that the line will be completed to Manila, a total distance of about 4,900 miles, by the Fourth of July next.

Cars for the Rapid Transit Subway in New York are to be sheathed with copper, the advantages claimed being greater resistance to fire and weather. In the latter respect the maintenance has been found to be less costly than when paint is used. A few years ago the New York, New Haven & Hartford Railroad had some cars finished in this way, and they are reported to have given good satisfaction. The wainscoting of the passageways and some other woodwork in the Back Bay Station in Boston were similarly covered with copper. The dark tone of the natural oxide has a pleasing effect. About two months ago the Metal Plated Car and Lumber Company, of New York, was awarded a contract for sheathing 500 cars for the subway.

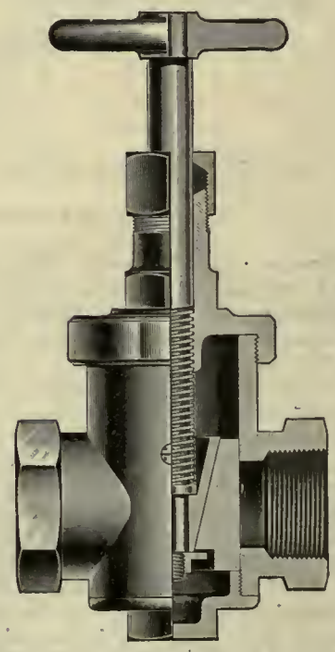
International Good Roads Conference.

An international conference upon the subject of good roads will be held in connection with the annual meeting of the American Road Makers, at Detroit, on February 13th and 14th. Representatives from several Mexican States, the Provinces of Canada, and every State in the Union, are expected to be present. The general topics for discussion will be, First, the proposed plan for inter-capital-connecting improved highways in the United States, Canada, and Mexico, to be constructed and maintained by the co-operation of the federal, state, county, and township governments, and, second, the bill which is now before Congress, introduced by Mr. Brownlow, of Tennessee, providing for the creation of a bureau in the Department of Agriculture, involving an appropriation of $20,000,000 for the purpose of co-operating with the various states, counties, and townships throughout the Union in the construction and maintenance of public highways. President Roosevelt, who has expressed hearty sympathy for this needed reform, has been invited to be the guest of the Road Makers on that occasion, and to deliver the principal address. Besides the various State and county good roads organizations, automobile club associations, and similar organizations will be invited to send delegates to this conference. The New York and Chicago Road Association, The Connecticut Valley Highway Association, The Automobile Club of America, have already signified their intention of being represented.

The American Road Makers has a paid membership limited to 450 members, ten for each State. The object of thus distributing the membership over the country is to prevent any one section dominating the other. The aim is to have the ten members in each State the most influential road enthusiasts that can be found.

A New Blow-off Valve.

The Ashton blow-off valve, which is shown in the accompanying cut, is made in the form of a split piston nicely fitted to a cylindrical chamber in the valve body. When the piston is screwed down to the bottom to close the valve,



an interior wedge expands the piston so that it fits the chamber absolutely tight. In opening the valve the first movement of the screw releases the expanding power of the wedge on the piston, and afterwards raises the piston,

giving a full straightway opening. This valve does not depend upon the pressure of the bolier to make it tight, nor does it stick when open or closed. It is made by the Ashton Valve Company, of Boston, Mass.

Personal and Obituary Notes.

Mr. James F. Fisher has been elected city engineer of Williamsport, Pa.

Mr. Samuel K. Peck has been elected water commissioner of Windsor, Ont.

Mr. Merritt W. Yeater has been reappointed city engineer of Beaumont, Tex.

Mr. J. H. Smith has been elected superintendent of the Mt. Carmel (Pa.) Water Co.

Mr. O. F. Wescott has been elected superintendent of streets in Haverhill, Mass.

Mr. John Van Den Bosch has been appointed street superintendent of Auburn, N. Y.

Mr. Paul Dato has been re-elected superintendent of water works of Hillsboro, Tex.

Mr. John Lindquist has been re-elected superintendent of water works of St. Paul, Minn.

Mr. Daniel E. Hoffman has been elected superintendent of water works of Lancaster, O.

Mr. Alex. Orr has been re-elected superintendent of water works of Gloversville, N. Y.

Mr. David H. Hoover has been re-elected superintendent of the Waynesboro (Pa.) Water Co.

Mr. George T. Ingersoll has been re-elected superintendent of water works of Schenectady, N. Y.

Mr. James B. Liggett has been appointed instructor in mechanical engineering in Leland Stanford University.

Mr. Andrew Rinker has been appointed city engineer of Minneapolis, Minn., in which position he formerly served for sixteen years.

Mr. John Ronan has been elected sperintendent of highways of Newburyport, Mass., and Mr. H. H. Landfort, superintendent of sewers.

Mr. W. H. Lawton has been elected city engineer of Newport, R. I., and Mr. William Hamilton, street commissioner and surveyor of highways.

Mr. T. F. Tracy has been appointed superintendent of public buildings in Cambridge, Mass., and Mr. John T. Shea, superintendent of streets.

Mr. George S. Hedge has been admitted to partnership in the firm of Harold L. Bond & Co., construction tools and supplies, 140 Pearl St., Boston.

Mr. J. A. Lockwood, assistant engineer, in charge of work upon the Lenox Avenue bridge, New York City, has been detailed to duty on the Manhattan Bridge over the East River.

Mr. Walter McCulloh has been reappointed city engineer of Niagara Falls, N. Y., with Mr. Norman S. Rae as his assistant; and Mr. C. R. Phelps has been appointed street superintendent.

Andrew McWilliams, superintendent of construction at the Edgar Thomson plant of the Carnegie Steel Co., was run over by a switch engine in the yards of the company January 9, and instantly killed.

Mr. John H. Church has been elected superintendent of streets of Taunton, Mass.; Mr. P. H. Core, water commissioner; Mr. H. N. Pierce, superintendent of public buildings, and Mr. G. A. King, city engineer.

Mr. W. K. McFarlin, chief engineer of the Delaware, Lackawanna & Western Railroad has resigned, to take a position February 1 with the T. A. Gillespie Co., engineers and contractors, of Pittsburg and New York.

Prof. William Halsey Ingersol died at his home in Northport, L. I., January 8. From 1875 to 1878 he was assistant in engineering at Columbia University, and from 1878 to 1881 he was assistant in mechanics and astronomy.

Messrs. John W. Maxcy and William E. Anderson have formed the firm of Maxcy & Anderson, civil and mechanical engineers, Binz Building, Houston, Tex., to do a general consulting engineering business, especially in irrigation plants.

Captain G. D. Fitch, Corps of Engineers, U. S. A., has been assigned to duty at the Military Academy, West Point; and Captain J. S. Sewell, Corps of Engineers, is to assume charge of the construction work pertaining to the quartermaster's department at Washington Barracks.

The directors of the Holyoke, Mass., water power company have elected Mr. J. M. Sickman clerk of the corporation and chief engineer and superintendent of the land department, and Mr. A. F. Sickman, hydraulic engineer. Both have been connected with the company for many years.

The Engineers' Society of Western Pennsylvania has elected the following officers for 1903: President, Chester B. Albree; vice-president for one year, James M. Camp; vice-president for two-year term, Samuel Diescher; directors, two-year term, Prof. S. M. Kintner and S. M. Taylor; treasurer, Prof. A. E. Frost; and secretary, C. W. Ridinger.

Gen. Samuel Thomas died at his home in New York City January 11. He was born at South Point, O., in 1840, early became interested in railroad and other engineering works, was one of the originators and constructors of the Nickel Plate road, and at the time of his death was a director in twenty-six companies and president of eight of them.

Rear Admiral George W. Melville, Chief of the Bureau of Steam Engineering, U. S. Navy, was placed on the retired list January 10, having reached the age limit, 62 years. By special authority of Congress Admiral Melville will continue as head of the Bureau until his commission expires, on August 9, 1903. He was appointed to the navy in 1861.

Mr. Thomas Rodd, chief engineer of the Pennsylvania Lines West of Pittsburg; Mr. J. W. Patterson, chief engineer of the Wabash extension, and William R. Browne, superintendent of the bureau of surveys of Pittsburg, have been appointed as a board of arbitration to settle the dispute between the Pennsylvania and the Wabash Railroads over the elevation of the tracks at Duquesne way, near Fourth Street, Pittsburg.

Civil Engineer R. C. Hollyday, U. S. Navy, has been ordered from Boston to the Brooklyn Navy Yard, to succeed Civil Engineer L. F. Bellinger as head of the Department of Yards and Docks. Civil Engineer C. W. Parks is transferred from the naval station at San Juan, P. R., to the Boston Navy Yard. Civil Engineer A. C. Lewerenz has been ordered from the naval station at New London, Conn., to the Navy Yard at Puget Sound, Wash.

Mr. Isham Randolph, chief engineer of the Sanitary District of Chicago, and Mr. Robert Douglas, bridge engineer for the Department of Railways and Canals of the Dominion Government, were in Niagara Falls, N. Y., last week, studying the water-power conditions of the Niagara River on the Canadian side, in connection with the alleged damage to the rights of the Canadian Niagara Power Co., by the proposed development of the Toronto Niagara Power Co. between the site of the Canadian company's plant and that of the Ontario Power Co.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 24 and 35.

WATER.

Maine.—It is stated that the cities of Gardiner, Brunswick and Winslow will ask the State Legislature for charters for municipal water works.

Salem, Mass.—F. F. Newell, Chmn. Water Works Com., in his report, is stated to have recommended that something be done looking to an additional water supply. He also advises that the Longham basin be excavated and made a storage basin, so that water may be turned into it in spring and fall.

Lawrence, Mass.—The Water Bd. is reported to be considering the construction of a new filter, at a cost of about $50,000.

South Manchester, Conn.—Cheney Bros. are reported to be negotiating with the Selectmen for the purchase of a site on Finley St. for an additional reservoir, the reservoir to cost about $100,000.

Chicopee, Mass.—Mayor Jas. H. Loomis, in his annual message, is reported to have recommended a new water supply, more road building and more schools.

Waltham, Mass.—See "Railroads."

Pascoag, R. I.—Chas. M. Whitaker, of Providence, Treas. of Pascoag Water Co., writes that Moses Joy has secured the contract for constructing the proposed water works. It will consist of a standpipe, pumping system and about 8 miles of pipe.

New York, N. Y.—Contracts for water works improvements are stated to have been awarded as follows: To Isaac Harris, for furnishing and laying water mains in Brooklyn Boro, for about $162,500; to Norton & Dalton, for the big Astoria mains, for $32,697; to Fred. N. Lewis, for distributing mains in the Astoria section, for $32,365; to Lloyd Collis, for the Hunters Point section, for $28,375, and to Peace Bros., for the Flushing and Whitestone section, at $14,829.

The Bd. of Estimate is stated to have approved the recommendation of Controller Grout, for the purchase of the property and plant of the New York & Westchester Water Supply Co., for $612,385. Robt. Grier Monroe, Comr. of Water Supply, has reported that the present supply in the district is inadequate, and new pumping stations will have to be created, at a cost of $50,000.

White Plains, N. Y.—The Consolidated Water Co. is stated to have filed in the County Register's office, in White Plains, notice of a mortgage of $10,000,000 for the purpose of controlling the suburban waterway, including the Pocantico River, in Mt. Pleasant. The company proposes expending about $9,000,000 in improving the water plants of the suburban districts of New York City.

Oyster Bay, L. I., N. Y.—The Nassau County Water Co. is stated to have purchased a site on the Mill River Hollow Road, about ½ mile southwest of this village, upon which they will drive a well and erect a standpipe to supply Oyster Bay with water; 75 hydrants will be put in the school district. Work will begin at once. Michael J. Grummong, Pres., N. Y. City.

Palmyra, Pa.—The citizens are reported to be considering a plan to bring Swatara Creek water into Palmyra, from a point at Kreider's, now Erb's, farm, at Lyonsville, 1½ miles distant. S. F. Engle and Gabriel H. Moyer are reported interested.

Lancaster, Pa.—A press report states that J. J. Deery, of Philadelphia, has presented a proposition to City Council for the filtration and purification of the city's entire water supply. He proposes to erect a plant and charge the city 1½ cts. per thousand gallons for filtered water, the city to buy the plant at the end of 30 years.

Farnhurst, Del.—The Bd. of Trus. of the Poor are stated to have petitioned the Levy Court at Wilmington, for an appropriation for a pumping plant, for the protection of the County Hospital Bldgs. at Farnhurst from fire; the cost of the plant is estimated at $7,000.

Baltimore, Md.—Contracts for water meters are stated to have been awarded as follows: For rotary meters to the Union Meter Co., of Worcester, Mass., at $9,501, and velocity and disc meters, to the Hersey Mfg. Co., of Boston, Mass., for $8,710.

Oakland, Md.—The Town Council is stated to have granted Fredk. T. Martin, of Fairmont, W. Va., a franchise for water works.

Black River, N. Y.—E. E. Grams, Village Clk., writes that nothing has yet been done in regard to constructing water works and a sewerage system. B. N. Scott, Village Pres.

Utica, N. Y.—Mayor Talcott, in his annual message to Common Council, is reported to have called attention to the needs of the city water supply for future as well as present use, especially for the use of manufactories.

White Plains, N. Y.—See "Sewerage and Sewage Disposal."

Atlantic Highlands, N. J.—Isaac T. Meyer, Room 53, No. 111 Bway., New York, N. Y., writes that the Highland Park Improv. Co. want estimates for water works and a sewerage system for about 20 houses on property at Atlantic Highlands, known as Highland Park.

Columbus, Ga.—The City Council is stated to have elected 4 Water Comrs, who, with Mayor Chappell, will form the board under whose supervision the new system of water works will be built, at a cost of $250,000. The board will determine the source of water supply and will have general charge of the details of building the system. T. E. Golden, E. F. Roberts, Geo. A. Pearce and John C. Cook are the 4 appointed.

Portsmouth, Va.—The stockholders of the Portsmouth, Berkley & Suffolk Water Co., which was recently purchased by a syndicate headed by Gustavus Ober, of Baltimore, Md., met in Portsmouth Jan. 10 and reorganized the company, with John L. Watson, of Portsmouth, as Pres.; Gustavus Ober, Baltimore, Md., Vice-Pres., and A. J. Phillips, Portsmouth, Secy. The company intends to make extensive improvements in the plant, which is at present valued at about $1,500,000. It has been decided to remove the general offices from Baltimore to Portsmouth.

Mt. Airy, N. C.—The citizens are reported to have voted on Jan. 6 to construct water works and an electric light plant.

Toledo, O.—The Bd. of Water Works Trus. are stated to have accepted the report as submitted by C. H. Benzenberg, Allen Hazen, and Wm. G. Clark. The Engineering Comn. recommends the continuance of the Maumee River as a source of supply; also that a purification plant be erected, and further, that if at any time the Miami & Erie Canal become available it be used as a source of supply; the estimated cost of making the improvements for a plant to meet conditions until 1920 is $773,190, and for a plant to meet the conditions for 40 years, $1,204,390.

Bay City, Mich.—The Water Comn. is stated to have decided to put in water meters at all the factories early in the spring.

Harrisville, Mich.—A press report states that the question of constructing water works is under consideration.

Ecorse, Mich.—According to press reports Pres. Sailiotte states that it will not require more than $20,000 to lay water mains from River Rouge Village through to this village. The Water Com. will probably be asked to at once make an estimate of the cost.

Ottumwa, Ia.—The Mayor on Jan. 5 was authorized by City Council to offer the City Water Supply Co. of New York $100,000, in full payment for its present water plant in this city.

The contract with the U. S. Pipe & Foundry Co. and the Des Moines Bridge & Iron Co. for furnishing cast iron water pipe and laying the same, were both approved by a majority at a special election held here Jan. 6. Immediately following the election the City Water Supply Co. secured a restraining order, preventing the execution of said contracts from Judge Smith McPherson, of the U. S. Circuit Court at Keokuk, Ia. J. T. Brady, City Engr.

Geneva, O.—Bids will be received Jan. 29 by the Village Clk for $5,000 water works bonds.

Milwaukee, Wis.—A correspondent writes that contracts will soon be let for 130 tons of 20-in., 30-in. and 36-in. water pipe and 30 tons of specials (45° curves and sleeves). Also 31 tons of 4-in., 113 tons of 6-in. and 346 tons of 8-in. pipe, with specials (hydrants, 4-way, 3-way curves, sleeves, etc.). The first lot is for tunnels under proposed track depression of C. & N. W. Ry. Co. on North and Prospect Aves., and the other for water pipe extension to North Milwaukee.

Marinette, Wis.—This city is reported to be considering the question of purchasing the water works.

Salix, Ia.—C. E. Smith, Town Clk., writes that at the spring election the citizens will be asked to vote on the question of constructing water works. About 3,900 ft. of mains will be required.

Kansas City, Mo.—Local press reports state that the following bids were opened by the Bd. of Pub. Wks. Jan. 2 for the installing of a 15,000,000 gal. high pressure water pumping engine in Turkey Creek Station, and a 25,000,000 gal. low pressure pump in Quindaro Station:

Allis-Chalmers Co., Milwaukee, Wis.: 15,000,000 gal. triple expansion, high pressure engine, 18 mos. delivery, $160,000; another same capacity, 10 mos. delivery, $160,000; 25,000,000 gal. low pressure engine, 12 mos. delivery, $97,000; high pressure expansion engine, 15,000,000 gal., 14 mos. delivery, $134,000; high pressure expansion engine, 14 mos., $118,000.

Barr Pumping Engine Co., Philadelphia, Pa.: 25,000,000 gal. vertical, low pressure, $87,000, 9 mos. delivery; alternate bid, 25,000,000 gal. low pressure, horizontal type engine, $78,000; 15,000,000 gal. high pressure engine, $122,000, 12 mos. delivery; 12,000,000 gal. high pressure engine, $115,000, 12 mos. delivery.

Henry R. Worthington Co., New York, N. Y.: 26-in. 25,000,000 gal. turbine pump, $27,274, 6 mos. delivery; 12,000,000 gal. triple expansion, high pressure engine, $76,000, 6 mos. delivery.

Curtis Cripen Engine Co., New York, N. Y.; DeLaval centrifugal turbine, 25,000,000 gal. total capacity, $34,884, 6 mos. delivery; 4 turbine, 15,000,000 gal. capacity, $65,280, 6 mos. delivery; 3 turbine, 12,000,000 gal. total capacity, $50,410.

Crowley, La.—John W. Maxcy, of Houston, Tex., has been employed by the Rice Irrigation & Improvement Assoc., of Crowley, to prepare plans and specifications for a system of dams and locks on Mermentau and Vermillion Rivers, to prevent the salt water back-flow from the Gulf; probable cost, $150,000.

Duncan, Ind. Ter.—The citizens on Jan. 5 are stated to have voted to issue $25,000 water works bonds.

Perry, Okla. Ter.—Water bonds amounting to $50,000 are reported sold. F. F. Busch, City Clk.

Nashville, Tenn.—Local press reports state that L. K. Davis, of Indianapolis, Ind., representing the U. S. Sand Filtration Co., has presented a proposition for the construction of a sand filter on Curry's Hill to Mayor Head, the Bd. of Pub. Wks., Engr. Southgate and the Bd. of Health. It is estimated that the cost of such a plant would be about $500,000. The present Legislature will probably be asked for permission to issue bonds for a purer water supply.

Natchez, Miss.—The Bd. of Aldermen is stated to have adopted a resolution on Jan. 8 to purchase the water works and sewerage plant of the Water Works Co., for $150,000. Thos. R. Quarterman, City Clk.

Tishomingo, Ind. Ter.—The City Council is stated to have granted H. Kirby Purdom and associates a franchise for water works.

Rayne, La.—Bids will be received Feb. 2 by the Mayor and Council for furnishing material and constructing a municipal water works and electric light plant for said Township. Address Wm. Mackintosh, Consulting Engr., Jennings.

Wessington Springs, S. D.—Geo. T. Bateman, Town Clk., writes that the date of opening of bids for sinking an artesian well has been extended to Feb. 2.

Denver, Colo.—The Denver Union Water Co. is stated to have purchased a tract of 100 acres of land on the banks of Platte River, across from its new sand filtration beds near the mouth of Platte Canon. Work will begin at once on the building of embankments to make a reservoir with a capacity of 300,000,000 gals. The reservoir will be used as a distributing basin and also as a temporary reserve.

Rocky Ford, Colo.—A new corporation, known as the Shockey Canal & Reservoir Assoc., is reported organized, with C. O. Hardey, Pres., and C. H. Sampies, Sec. The corporation has a reservoir site on the Big Sandy and Wild Horse Creeks, about 85 miles north of Rocky Ford. The reservoirs will cover about 10,000 acres of land.

San Francisco, Cal.—Local press reports state that the stockholders of the Bay Cities Water Co. have authorized the issue of $10,000,000 first mortgage bonds at 5 per cent., to run 45 years. Of this $1,000,000 is to be issued at once, and nearly the whole amount has been subscribed. The balance of the bonds will be issued as the work of construction requires. The company contemplates constructing dams, flumes, pipe-lines and reservoirs to handle large quantities of water from its 300-mile watershed in the upper end of Santa Clara valley, 260 ft. above sea level. Frank S. Washburn, Consulting Engr.

San Diego, Cal.—Chris. Froelich is stated to have secured the contract for furnishing 5,000 ft. of 10-in. water pipe at $39.99 per ton; total amount of contract about $10,000.

Rialto, Cal.—See "Power Plants, Gas and Electricity."

Waitsburg, Wash.—The Council is reported to be considering the question of constructing water works.

Sacramento, Cal.—Bids are wanted Jan. 26 for furnishing a pump, having a capacity of 1,000,000 gal. of water in 24 hours. M. J. Desmond, City Clk.

Winnipeg, Man.—Bids are wanted Feb. 2 for the supply and delivery of a pumping engine with a capacity of 5,000,000 imperial gals. per day, as advertised in The Engineering Record.

SEWERAGE AND SEWAGE DISPOSAL.

New Haven, Conn.—Local press reports state that the Engineer of Dept. of Bd. of Pub. Wks. is preparing plans for a sewer, to be called the Chestnut St. overflow. It will be of either brick or concrete and expanded metal; the Bd. of Finance has appropriated $13,500 for the work.

Bids are wanted Jan. 27 for furnishing the granite catch basin stone, sewer castings, cement, vitrified sewer pipe, bluestone Belgian blocks, etc., required by the Dept. of Pub. Wks. during the remainder of the year 1903. C. W. Kelly, City Engr.

Bridgeport, Conn.—The Sewer Com. is reported to have asked for an appropriation of $12,000 for the construction of the Noble Ave. trunk sewer, and $2,600 for a sewer in Wheeler Ave.

Fitchburg, Mass.—Mayor Chas. H. Blood, in his annual message, is stated to have recommended that $50,000 to $60,000 be appropriated for sewers, and that a new school be erected.

Marlboro, Mass.—Mayor Walker B. Morse, in his annual message, is reported to have recommended the improvement of the sewerage system, an increase in parks and a new city building.

Albany, N. Y.—Mayor Chas. H. Gaus in his annual message recommends the improvement of the river front by the construction of new dock walls and by the building of an intercepting sewer under Bway. from Tivoli to Gansevoort Sts.

Watertown, N. Y.—Mayor Pappa in his annual message recommends the construction of a trunk sewer in the 2d Ward, in the vicinity of Arlington and Academy Sts.

Williamsport, Pa.—City Engr. Snyder in his report to Council on Jan. 5 is stated to have estimated the cost of improving Grafius run north of High St. at $12,500. He also recommended sewer extensions especially in connection with the conduit, which he estimates at $28,000.

Erie, Pa.—Ordinances have been passed for main sewers in East Ave. and adjacent streets, aggregating an estimated cost of $53,000, most of which will be built the coming season.

Buffalo, N. Y.—Bids are wanted Jan. 21 for constructing a 12, 15, 18 and 20-in. tile sewer in portions of Cable St.; also a 24, 30 and 36-in. brick and 10-in. tile sewer in portions of Genesee St. Francis G. Ward, Comr., Dept. of Pub. Wks.

White Plains, N. Y.—Village Pres. John J. Brown, in a message to the Bd. of Trus., calls the attention of the Village Council to the need of a newer sewerage system in the village. It is proposed by the Trus. to construct new disposal works at a cost of about $50,000. The Water Comrs. are reported to have under consideration the taking of a large water shed between White Plains and Hartsdale, at an expense of about $25,000.

Watervliet, N. Y.—The State Supt. of Pub. Wks. is stated to have granted this city permission to construct a line of sewer pipe connecting with the Erie Canal near 2d Ave. and 25th St.

Black River, N. Y.—See "Water."

Millville, N. J.—The Council is reported to be considering the construction of a sewerage system.

Coalesville, Pa.—The Boro. Council is stated to have adopted a resolution providing for a vote on a loan of $40,000 for laying sewer pipes and improving the streets.

Washington, D. C.—Bids are wanted Feb. 14 for constructing sewers, as advertised in The Engineering Record.

Akron, O.—The Council has passed an ordinance providing for the construction of a main trunk sewer in Sewer Dist. No. 9.

Hartwell, O.—Mayor Gibson is reported to have recommended a bond issue of $35,000 for the construction of a sewerage system.

Bowling Green, O.—The Council is stated to have passed ordinances providing for the construction of sewers in Buttonwood Ave. and Clsy and N. Grove Sts.

Columbus, O.—The following bids were opened by the Bd. of Pub. Wks. (Julian Griggs, Ch. Engr.) on Jan. 6 for about 54,270 ft. brick and pipe sewers: *a*, 20 to S-in. pipe sewers in Richard Ave. main and branches; *b*, 24 to 36-in. brick and 10 to 20-in. pipe sewers, west side sanitary mains, Section A; *c*, 36 to 66-in. brick sewer in Walnut St. (1) brick, (2) concrete, (3) concrete and steel; *d*, 108 to 126-in. Section A of Central Relief Sewer, (1) brick, (2) concrete, (3) concrete and steel: John King, Tiffin, O., *a*, $55,738; *b*, $18,290. M. A. Talbot & Co., Logansport, Ind., *a*, $56,981; *b*, $20,570; c (2), $23,334; *d* (2), $83,872. E. Brentlinger, Dayton, O., *a*, $57,806; *b*, $20,285; c (1), $23,491; c (2), $22,669; *d* (1), $89,338; *d* (2), $83,687. D. E. Sullivan, Columbus, *a*, $58,000; *b*, $20,525. Adams Bros., Zanesville, *a*, $66,720; *b*, $20,651; c (1), $24,194; c (2), $24,194; c (3), $25,398; *d* (1), $81,153; *d* (2), $81,153; *d* (3), $84,974. Lee & Casey, Pittsburgh, Pa., *b*, $17,498. Louis Lind, Columbus, *b*, $18,605. I. O. Jones, Columbus, *b*, $22,167.

It is stated that bids are wanted Jan. 26 for constructing 18 and 24-in. sewer in portions of Broderick St. Clarence M. Addison, Clk. Bd. of Pub. Wks.

Peoria, Ill.—Local press reports state that plans have been completed for the East Bluff sewer system and that contracts for constructing same will be let about Mar. 1. H. Beasley, City Engr.

Rensselaer, Ind.—W. F. Smith, of Rensselaer, is stated to have secured the contract for constructing the Makemself pipe sewer for about $10,000.

Wheaton, Ill.—Mayor J. S. Peironnet writes that it is proposed to construct a sanitary sewerage and drainage system, at a cost of $100,000; plans have been drawn by W. H. Tarrant, of Champaign.

Chicago, Ill.—Local press reports state that Ch. Engr. Isham Randolph, of the Sanitary Dist., on Jan. 5 reported to the Trus. of the Dist. an estimate of the work that has been planned for 1903 and 1904 along Chicago River and in collateral construction. The Trus. will use this estimate in their efforts to get more money through an act of the legislature that is about to assemble. The estimate shows the following contemplated expenditures: Chicago River, dredging and docking, $2,154,883; Chicago River, new bridges, $1,932,424; North branch improvement, $183,000, and Miscellaneous (mostly for pumping machinery, etc., at 39th St., $432,900. If the estimated cost of the development of water power at Lockport and Joliet, $2,500,000, be added, to the estimate, it makes the total amount that the trustees wish to spend in the next two years about $7,203,208.

Rock Island, Ill.—Bids will be received at the office of Engineer Wallace Treichler, 47 Mitchell & Lynde Bldg., Jan. 31, for the construction of the Hampton-Zuma Drainage Ditch.

Concord, Ia.—A press report states that Hancock County has plans for a ditch system 32 miles in length, to cost about $132,000.

Cincinnati, O.—Bids are wanted Feb. 9 for improving portions of Observatory Ave. by constructing a trunk sewer and drains with the necessary appurtenances. Robt. Allison, Pres. Bd. Pub. Service.

Rockford, Ill.—Edwin Main, City Engr., writes that the City Council has appropriated $14,000 for trunk sewers; the Bd. of Local Improv. has passed on the 11th St. Sewer petition, approximate estimate 3,400 ft. of 20-in. sewer, and that there is a petition being circulated in the Kent Creek valley for about 5 miles of sanitary and storm sewer.

Toledo, O.—The Council Com. on Sewers, at its meeting Jan. 8, approved an ordinance providing for the purchase of a site for the erection of a sewage disposal plant to drain the Walbridge Park Dist. It is estimated that the cost of the land, the building of the proposed sewer and the installation of the sewage disposal plant will be about $70,000.

Sandusky, O.—Bids are wanted Jan. 23 for furnishing material and constructing sewers in portions of Campbell St. and Columbus Ave. Alex. M. Wagner, City Clk.

Cleveland, O.—Bids will be received Jan. 22 by the Bd. of Control for constructing an extension of the culvert at the intersection of Echo St. and Morgan Run; also on same date for constructing sewers in several streets: Chas. P. Salen, Dir. Pub. Wks.

Alton, Ill.—E. E. Rutledge, City Engr., writes that it is proposed to construct a 24-in. sewer in Ridge St., at a cost of $4,200, and pave Bluff St., at a cost of $4,360.

Ottumwa, Ia.—Bids will be received Jan. 19 by Thos. F. Keefe, Chmn. Street Com., for furnishing material and constructing the Richmond Ave. and Short St. culvert.

Springfield, Mo.—About 10,000 ft. of 8-in. district sewers will be constructed in the spring. Geo. W. Cutler, City Engr.

Lawton, Okla. Ter.—E. N. Ford, of Guthrie, is stated to have secured the contract for constructing a sewerage system, for $21,650.

Johnson City, Tenn.—E. E. Ellsworth, Chmn. Sewerage Com., writes that Saml. M. Gray, of Providence, R. I., is preparing plans for a sewerage system, to cost from $20,000 to $50,000.

Natchez, Miss.—See "Water."

Guthrie, Okla. Ter.—At a meeting of the City Council Jan. 8 the City Clerk was instructed to secure bids for the construction of a sanitary sewer in West Guthrie. This is the first sewer to be constructed in West Guthrie.

Lewiston, Idaho.—It is stated that bids are wanted Jan. 26 for constructing a 3,000 ft. 4 to 10-in. sewer, average cut 7 ft. City Engineer Briggs estimates the cost at about $21,000.

St. Louis, Mo.—The following bids were opened Jan. 9 by the Sewer Comrs. for constructing sewers in 9th St. Sewer District No. 2:

Items and quantities.	J. C. Finck, Jr.	Fred. Hoffman.	Hill-O'Meara Con. Co.	Skrainka Con. Co.	John F. McMahon.	Buehler-Cooley Con. Co.*	Rich Con. Co.
Earth excavation, 9,000 cu. yds	$2.00	$3.00	$2.00	$1.50	$3.00	$1.00	$2.00
Loose rock excavation, 480 cu. yds	1.00	2.50	2.00	1.00	3.00	1.00	2.00
Solid rock excavation, 480 cu. yds	4.50	3.00	5.00	1.00	3.00	1.00	3.00
Quick sand excavation, 10 cu. yds	6.00	20.00	5.00	10.00	20.00	10.00	10.00
Class "C" concrete, 10 cu. yds	2.75	10.00	7.00	10.00	8.00	6.00	9.00
Brick masonry, 1,300 cu. yds	15.00	18.00	20.00	26.40	13.00	17.00	15.00
Vitrified brick masonry, 330 cu. yds	19.00	20.00	25.00	32.00	16.00	18.50	16.00
6-in. pipe sewer, 10 lin. ft	.30	1.00	1.00	1.00	.20	1.00	.50
9-in. pipe sewer, 10 lin. ft	.35	1.50	1.00	1.00	.30	1.25	.60
12-in. pipe sewer, 1,300 lin. ft	1.00	1.50	1.50	3.50	.40	1.50	1.00
15-in. pipe sewer, 10 lin. ft	.40	2.50	2.00	3.00	.50	3.00	1.50
18-in. pipe sewer, 1,020 lin. ft	2.50	3.00	3.00	5.00	.70	3.00	2.00
Junctions on pipe sewers, 60 pieces	2.00	3.00	1.50	2.00	3.00	5.00	1.00
Junctions on brick sewers, 300 pieces	2.00	3.00	1.50	2.00	1.00	2.00	2.00
Cast iron, 43,000 lbs	.04	.06	.06	.05	.05	.06	.04
Wrought iron, 6,000 lbs	.05	.08	.10	.08	.06	.07	.05
Lumber in trench, 3,000 M ft., B. M.	30.00	45.00	50.00	15.00	25.00	35.00	30.00
6-in. ground water drain pipes, 1,000 lin. ft.	1.00	1.00	1.00	.50	.75	.50	.50
Totals	$63,098	$83,640	$80,500	$77,590	$64,824	$58,288	$60,916

*Contract awarded.

Colorado Springs, Colo.—The El Paso Consolidated Gold Mining Co. is stated to have secured the contract for constructing the drainage tunnel; probable cost, $150,000.

Long Beach, Cal.—The citizens are stated to have voted Dec. 30 to issue $35,000 bonds for a trunk sewerage system.

Spokane, Wash.—Bids are wanted Jan. 24 for constructing trunk sewers in Dist. No. 2. L. B. Handley, Secy. Bd. Pub. Wks.

Pueblo, Colo.—The Holme & Allen Pipe & Construction Co. is stated to have secured the contract for constructing a 3-mile ditch on the north side connecting the pumping station there with a point at Fairmount Park. It will be a 26-in. wooden main.

Sault Ste. Marie, Ont.—The City Clk. writes that the city voted on Jan. 5 to issue $80,000 sewer bonds and $10,000 City Hall bonds.

Winnipeg, Man.—It is stated that it is proposed to construct a sewer and branch drains in Wellington Crescent from Spadina Ave. to a point in Bridge St. C. J. Brown, City Clk.

BRIDGES.

Salem, Mass.—The City Government is stated to have under consideration the building of a bridge across Bass River.

Bridgeport, Conn.—P. Kennelly, Comr. Pub. Wks., has petitioned for a bridge to replace present structure across Berkshire Mill pond and estimates the cost of constructing a pile bridge at $10,213 and that of a steel bridge at $21,888.

Lenoxdale, Mass.—The R. R. Comrs. at Boston have granted the N. Y., N. H. & H. R. R. and the Berkshire St. Ry. Co. permission to construct an iron girder bridge in this town.

Fall River, Mass.—Local press reports state that Engr. Mace Moulton, of Springfield, estimates the cost of constructing the proposed bridge in this city as follows: A deck bridge erected just below the present bridge, including the approaches, from $850,000 to $970,000; a bridge in the same location, with trusses above the floor, from $800,000 to $920,000; a deck bridge in the more southerly location (nearly twice as long as either of the others), with approaches, from $1,520,000 to $1,700,000, and a truss bridge, with approaches, from $1,290,000 to $1,470,000. The cost of a bridge in a north location would be about the same as a deck-span on a center; that is, from $850,000 to $970,000.

Waterville, Me.—The citizens of this town and Winslow are reported to be contemplating the widening and strengthening of the Ticonic bridge, so that the proposed electric road may pass over it.

Harrisburg, Pa.—Local press reports state that the West Fairview & Harrisburg Bridge Co. is about to apply for a charter for the purpose of building a bridge at Maclay St. Harry M. Bretz is reported to be the attorney for said company.

Rochester, N. Y.—According to local press reports the replacing of the present bridge across the Erie Canal at Allen St., with a structure, to cost about $30,000, is contemplated.

Washington, D. C.—The Senate has passed a bill authorizing the construction of a bridge across Rainy river, in Minnesota.

Hoosick Falls, N. Y.—The Town Bd. has adopted a resolution to petition the State Bd. of R. R. Comrs. to eliminate the grade crossing at River St. Plans have been submitted by Engr. G. E. Baltimore, of Troy, for an overhead bridge at this street, estimated to cost $29,700, and The Boston & Maine R. R. Co. has submitted plans estimating that a 3 per cent. grade would cost $32,000 and a 6 per cent. grade, $34,000.

Williamsport, Pa.—Press reports state that the building of a bridge over the Potomac river from Williamsport into Berkeley county, W. Va., is again being agitated.

Camden, N. J.—J. J. Albertson, Co. Engr., writes that all bids opened Jan. 14 for constructing a bridge over Cooper Creek at Baird Ave. have been rejected, and new bids will be received. The lowest bid, according to press reports, amounted to $30,950.

Bethlehem, Pa.—Local press reports state that the Lehigh Valley Traction Co. has awarded to H. D. Folkenson, of Easton, and the American Bridge Co., the contract to lay a new floor system on the bridge crossing Monocacy Creek, joining Bethlehem and West Bethlehem, for $38,000. It is stated that new iron girders and an entire new walk are the most important features of the contract.

Pittsburg, Pa.—See "Railroads."

Syracuse, N. Y.—The following bids were received by the Bd. of Contract & Supply Jan. 6, for constructing a bridge at Butternut St.; United Construction Co., $19,519; Owego Bridge Co., $18,579; John Newell, Albany, $17,829; Rochester Bridge & Construction Co., $18,446.

Scranton, Pa.—The following bids were opened on Jan. 12 by the Dir. Dept. of Pub. Wks. (Jos. P. Phillips, Ch. Engr.) for constructing the West Lackawanna Ave. viaduct: Peter Stipp, Scranton, $69,000; Nelson & Buchanan Co., New York, N. Y., $87,497; Wynkoop & Braly, Cleveland, O., $69,840; E. L. Williams, Scranton, $64,737; Cement Paving & Const. Co., Jersey City, N. J., $60,000; Burke Bros., Scranton, $57,625 (awarded contract).

Albany, N. Y.—Bids are wanted Jan. 20 by Chas. S. Boyd, Supt. of Pub. Wks., for constructing a lift bridge over the Erie Canal at Church St. in Canajoharie.

New York, N. Y.—The following bids were opened Jan. 12 by L. F. Haffen, Bronx Boro. Pres., for building a bridge over the Bronx River at E. 177th St.:

Items and quantities.	Snare & Triest.	John G. Tate.	M. J. Leahy.	F. V. Smith. Contr. Co.	Wm. F Welch.
Excavation, 1,700 cu. yds	$8.50	$4.80	$4.00	$2.00	$2.00
Filling, 1,025 cu. yds	.60	.40	.50	.20	1.00
Foundation concrete, 490 cu. yds	7.20	8.60	7.50	7.00	7.00
16-in. cast iron pipe, 108 ft	4.80	4.00	4.00	3.00	4.00
1st class masonry, 20 cu. yds	64.80	60.00	70.00	45.00	45.00
2d class masonry, 700 cu. yds	12.00	15.50	15.00	9.00	.10
3d class masonry, 225 cu. yds	7.20	8.60	7.00	4.50	.07
Iron and steel erected, 373,500 lbs	.047	.042	.06¾	.06¼	.08
Ornamental railing, 200 ft	3.60	4.00	6.00	5.00	6.00
Lamp posts, 4	120.00	100.00	150.00	100.00	125.00
Asph. pavt., 670 sq. yds	1.80	2.00	.75	1.50	1.00
12-in. vitrified pipe, 70 ft	4.20	2.60	3.00	3.25	4.00
Macadam pavt., 320 sq. yds	1.20	2.00	3.00	1.00	4.00
Broken stone sidewalk, 130 sq. yds	1.80	1.50	1.25	.60	2.00
Granite block pavt., 150 sq. yds	.60	1.00	1.00	.40	2.00
New curb, 20 ft	1.20	2.00	2.25	.40	1.00
New flagging, 60 sq. ft	3.00	2.00	.68	.70	1.00
Gas pipe railing, 160 ft	.48	.30	.22	.23	.50
Timber, 10,000 ft., B. M.	48.00	50.00	50.00	.40	40.00
Removal of old bridge	500.00	200.00	350.00	1,000.00	500.00
Drop wells, 2	42.00	60.00	75.00	40.00	150.00

Erie, Pa.—Agreement has not yet been reached with Railroad Companies for overhead bridge on Buffalo Road at East Ave., estimated to cost $50,000.

Shamokin, Pa.—See "Electric Railways."

Milledgeville, Ga.—A bill has passed the House authorizing the Wadley & Mt. Vernon Ry. Co. to construct a bridge across Oconee River in Georgia.

Richmond, Va.—Local press reports state that the Virginia Passenger & Power Co. is contemplating the building of a bridge across James River, which will replace Mayo's structure.

Manatee, Fla.—The House has passed a bill granting permission to the United States & West Indies Steamship Co. to construct a bridge across Manatee River, Fla.

Keyser, W. Va.—The Co. Comrs. are reported to have under consideration the building of a bridge between Keyser and McCoole, Md.

Peshtigo, Wis.—The Co. Bd. has been petitioned to replace present wooden bridge across Peshtigo River on the Air Line with a steel structure, estimated to cost $7,000.

Oshkosh, Wis.—Local press reports state that the lowest bid received by the Bd. of Pub. Wks. Jan. 5 for constructing the abutments and superstructure of the proposed new Sawyer Ave. bridge was from the Wisconsin Bridge & Iron Co. of Milwaukee, at $7,780.

Duluth, Minn.—Local press reports state that steps are being taken toward the extension of Railroad St., which will necesaitate the building of a viaduct 33 ft. wide, 900 ft. long, with an approach of 400 ft. It is estimated that this improvement with the bridge built of steel, would cost $75,000, but if heavy timber construction should be used, the cost would not exceed $15,000.

Sioux City, Ia.—It is stated that the building of a bridge across Floyd River will be necessary, whether the river is straightened or not. Probable cost, $10,000.

Anderson, Ind.—The Co. Council is, according to local press reports, considering the building of an $18,000 bridge at Delaware St.

Casco, Mich.—Bids will be received Jan. 24 by John C. Hagen, Comr. of Highways of Casco Township, for constructing a 1-span steel bridge, 90 ft. long, over Belle river, north of Adair.

Napoleon, O.—Press reports state that the Co. Comrs. will replace present structure across the canal at Perry St. with an iron bridge, 26 ft. wide, and with sidewalks on either side, 8 ft. wide.

Saginaw, Mich.—Local press reports state that the Massillon Bridge Co., Massillon, O., has submitted the lowest bid for constructing the bridge across Cass River, at $14,110.

Bridgeport, W. Va.—The following bids are reported to have been received for constructing a bridge across Wheeling Creek at West St.: Riverside Bridge Co., Martins Ferry, $20,990; West Virginia Bridge Co., Glenwood, $34,555; Sumerville Engine Co., $21,000; Variety Iron Wks., Cleveland, $24,500; E. J. Lundar Co., Canton, $29,500.

Rockdale, Ia.—The Co. Bd. of Superv. has been petitioned to construct a bridge in Rockdale.

Northport, Wis.—John Wilson, Designing Engr., writes that all bids received for bridge work at Ostrander Jan. 7 have been rejected, and new bids will be received on Jan. 20 for stone approaches and abutments, and on Jan. 21 for the superstructures. The mason work of the 2 bridges will cost from $3,000 to $4,000.

Chicago, Ill.—See "Sewerage and Sewage Disposal."

Bay City, Mich.—Bids will be received by the Bay County Bridge Comn., Bay City, until Feb. 14 for furnishing material and reconstructing the floor system of the Lafayette Ave. bridge, as advertised in The Engineering Record.

Kingston, Tenn.—J. L. Johnston, Asst. P. M., writes that it is proposed to construct 3 bridges; one over Tennessee River near Kingston, another over Clinch River near Kingston, and the third across Poplar Creek; total cost, $100,000. W. T. Gallaher, of Wheat; H. Crumbliss, of Kingston, and J. D. Roberts, of Harriman, are on the bridge committee.

Gainesville, Tex.—See "Paving and Roadmaking."

Colfax, Wash.—H. H. Wheeler, Co. Aud., writes that A. Valk, of Pullman, has secured the contract for a 200-ft. bridge across South Palouse River (bids opened Jan. 6) for $6,868.

Fredericton, N. B.—It is stated that bids will be received Feb. 9 by the Provincial Dept. Pub. Wks. for rebuilding Shepody River bridge (masonry substructure and Howe truss superstructure) and for repairing the Cole's Island bridge and Welch bridge in Queens Co.

Wingham, Ont.—It is stated that bids are wanted Jan. 24 for constructing the superstructure of a 3-span steel bridge over Maitland River, to be 378 ft. long, with a 16-ft. roadway. John Ansley, Co. Comr.

PAVING AND ROADMAKING.

Rockland, Me.—A resolution has been adopted by the City Government authorizing the Mayor to purchase a steam road roller and rock crusher, to be delivered by May 1, 1903, to cost about $2,200.

New Haven, Conn.—Local press reports state that the Paving Comn. will pave Cedar St. with crushed stone. Amount available for this work is $14,000.

Cambridge, Mass.—The Bd. of Surveys is reported to be contemplating the building of a boulevard, 80 ft. wide, from the Charles River parkway to Quincy Sq. by way of De Wolf and Bow Sts. It is stated that Harvard College graduates and friends of the institution have pledged $40,000 toward the carrying out of this project.

Nantucket, Mass.—The Committee on Cliff road recommends the rebuilding of said road from Cheater St. to North Liberty, with concrete, at a cost of $11,364.

Chicopee, Mass.—See "Water."

Waltham, Mass.—See "Railroads."

Millville, N. J.—The City Council is reported to be contemplating paving the streets of this city, but have not, as yet, decided upon the kind of pavement to be used.

Newark, N. J.—The Essex and Hudson Boards of Freeholders have reached an agreement whereby the Newark Plankroad is to be improved as soon as possible. The present idea, according to local press reports, is that the road be widened to its full extent of 48 ft., and paved with Belgian blocks along its entire length.

Brooklyn, N. Y.—The Brooklyn Heights Bd. of Local Improv. has decided to recommend the carrying out of the proposition to widen Livingston St. from Flatbush Ave. to Court St., Brooklyn. An engineer of the Dept. of Pub. Wks. estimated that the street could be widened to 110 ft. and paved with asphalt at a cost of $1,800,000.

Jersey City, N. J.—Local press reports state that The M. T. Connolly Constructing Co. has secured the contract to pave a portion of 17th St. Engineer's estimate, $8,303.

Rochester, N. Y.—The Flower City Driving Club is reported to have under consideration the building of a speedway, ¾ of a mile long.

Buffalo, N. Y.—Bids are wanted Jan. 22 for macadamizing portions of Fairfield St.; also for repaving portions of Superior and Spring Sts. Francis G. Ward, Comr. Pub. Wks.

Syracuse, N. Y.—The Common Council is contemplating paving portions of several streets with vitrified brick.

Chester, Pa.—The St. Com. has recommended to the Select Council that bids be asked for paving portions of Welsh, East Graham, Second and Vevan Sts.

Oakmont, Pa.—The Boro. Council is considering the paving of the streets of the Boro. and will probably submit to a vote of the citizens the question of issuing $40,000 bonds for said purpose.

Meadville, Pa.—A resolution has passed Common Council providing for the paving of State St. with brick, at a cost of $14,580, including curbing and storm sewer complete. W. A. Doane, City Engr.

Coatesville, Pa.—See "Sewerage and Sewage Disposal."

Baltimore, Md.—The City Council is considering paving a portion of Fairmount Ave. with vitrified brick.

New York, N. Y.—The following bids were opened Jan. 12 by L. F. Haffen, Pres. Bronx Boro., for repaving with asphalt on concrete foundation E. 149th St., from Bergen to Brook Aves.—A, Sicilian Asph. Pavg. Co.; B, Asphalt Constr. Co.; C, Century Const. Co.; D, Barber Asph. Pavg. Co.; E, Phoenix Construction & Supply Co.; F, Pan-American Co.:

Bidders.	Asph., 15,700 sq. yds.	Concrete, 2,420 cu. yds.	New curb, 4,550 ft.	New flags, 7,000 sq. ft.	Old flags, 6,000 sq. ft.	Recv. basins, rebuilt, 13.
A.....	$1.30	$5.00	$0.90	$0.25	$0.06	$150
B.....	1.40	5.75	.85	.25	.05	100
C.....	1.26	5.25	.79	.26	.03	95
D.....	1.22	4.90	.78	.24	.03	115
E.....	1.75	5.00	.80	.24	.03	135
F.....	1.56	5.50	.85	.23	.10	95

Bids were opened at the same time for grading, paving, etc., on Crescent Ave., from Arthur Ave. to E. 187th St., as follows—A, F. Thilemann, Jr.; B, John J. Hart Co.; C, F. V. Smith Constr. Co.:

Bidders.	Excavation, 300 cu. yds.	Filling, 18,600 cu. yds.	New curb, 2,310 ft.	New flag, 8,600 sq. ft.	New bridge-stone, 2,110 sq. ft.	Dry rubble, mas'ry, 750 cu. yds.	Lumber.	Macadam, 6,030 sq. yds.
A...	$0.00	$0.60	$0.70	$0.24	$0.55	$2.00	$0.00	$0.70
B...	1.00	.50	.70	.24	.60	2.50	45.00	.67
C...	.50	.50	.70	.23	.60	1.50	40.00	.70

New York, N. Y.—The following bids were opened Jan. 12 by L. F. Haffen, Pres. Bronx Boro., for grading, etc., in Morris Ave., from Tremont Ave. to Field Place—A, F. Thilemann, Jr.; B, D. W. Moran; C, John J. Hart Co.; D, F. V. Smith Contr. Co.:

Bidders.	Earth exc., 7,200 cu. yds.	Rock exc., 1,900 cu. yds.	Filling, 33,500 cu. yds.	New curb, 6,880 ft.	New flag, 27,200 sq. ft.	New bridge-stone, 2,260 sq. ft.	Dry rubble, mas'ry, 300 cu. yds.
A.....	$0.40	$1.50	$0.70	$0.70	$0.24	$0.50	$1.50
B.....	.00	1.50	.38	.85	.28	.65	1.00
C.....	.52	1.40	.45	.67	.24	.60	2.50
D.....	.00	1.75	.50	.70	.23	.60	1.50

In E. 173d St., from Weeks Ave. to Grand Boule.—A, D. W. Moran; B, Uvalde Asphalt Pavg. Co.:

Bidders.	Earth exc., 260 cu. yds.	Rock exc., 110 cu. yds.	Filling, 19,260 cu. yds.	New curb, 1,870 ft.	New flag, 7,330 sq. ft.	New bridge-stone, 1,010 sq. ft.	Dry rubble mas'ry, 160 cu. yds.	Lumber, 1,000 ft. B.M.
A....	$0.00	$1.50	$0.50	$0.70	$0.25	$0.60	$2.00	$20
B....	.20	1.25	.34	.70	.24	.60	1.25	1

In Vyse St., from West Farms Rd. to E. 172d St.—A, F. Thilemann, Jr.; B, D. W. Moran; C, Walter J. Ford; D, M. J. Leahy; E, John J. Hart Co.; F, Geo. J. Bailey:

Bidders.	Earth exc., 6,800 cu. yds.	Rock exc., 10,000 cu. yds.	Filling, 7,500 cu. yds.	New curb, 4,625 ft.	New flag, 18,600 sq. ft.	New bridge-stone, 450 sq. ft.	Dry rubble mas'ry, 500 cu. yds.
A.....	$0.50	$1.60	$0.00	$0.65	$0.23	$0.55	$1.50
B.....	.55	1.65	.00	.65	.23	.55	1.00
C.....	.50	1.50	.00	.70	.23	.60	1.50
D.....	.25	1.50	.50	.69	.22	.60	1.40
E.....	.40	1.37	.02	.70	.24	.60	2.00
F.....	1.00	1.00	.25	.66	.22	.60	1.40

Erie, Pa.—Ordinances have been passed and are now awaiting the annual appropriation in April, for 6 pieces of pavement comprising 5,800 yds. stone, 3,600 yds. sheet asphalt and 22,550 yds. of brick. Paving 10th St. Boule. is also being agitated.

Portsmouth, Va.—The Southern Paving & Construction Co., of Chattanooga, Tenn., has secured the contract for 41,300 sq. yds. of sheet asphalt on 5-in. concrete base, at $1.92 per sq. yd. Bascom Sykes, City Engr.

McKees Rocks, Pa.—See "Electric Railways."

Charlotte, N. C.—The building of 110 miles of county roads, probably macadam, is being considered, and the question of building same will likely be submitted to the voters in the near future.

Sioux City, Ia.—Local press reports state that among the improvements contemplated for next year are the building of 6 1/3 miles of paving, at a cost of $295,000; 15 miles of sidewalks, at a cost of $50,000, and combined curbing and guttering, at a cost of $12,000.

Bids are wanted Jan. 20 for paving with 1 course of vitrified brick on a 6-in. natural cement concrete foundation, portions of 6th, 7th and W. 3d Sts., requiring in all about 24,832 sq. yds.; also for setting stone curbing. L. L. Cathcart, Chmn. Paving Com.

Portland, Ind.—It is stated that bids are wanted Feb. 4 for constructing 2¾ miles of gravel road; probable cost, $7,200. Jay Griffith, Engr.

Des Moines, Ia.—The City Council has authorized the paving of a portion of 13th St. with asphalt.

Battle Creek, Mich.—The Common Council is reported to be contemplating considerable brick paving during this year, including 2,000 ft. on Marshall St.

Menominee, Mich.—An additional 20 miles of roads are to be built in Menominee County this year.

Kalamazoo, Mich.—The City Council has been petitioned to pave a portion of So. Park St. with asphalt block.

Springfield, Ill.—About a mile and a half of paving is contemplated.

Chicago, Ill.—The Bd. of Local Improv. has authorized the paving with asphalt of Archer Ave., from Ashland to Western Aves., at an estimated cost of $69,000; also the paving with asphalt on portions of Fulton, Lytle and No. Mozart Sts., estimated to cost $33,500, $21,000 and $23,500 respectively.

Cincinnati, O.—William Heffron is stated to have secured the contract for paving a portion of East Pearl St. with granite, at $4,275.

Toledo, O.—Wm. McMahon is reported to have submitted the lowest bid for paving with Athens block on 11th St., 2,130 sq. yds.; at $1.58 per sq. yd. for paving and 22 cts. for grading. The lowest bid received for paving a portion of Willow Ave., 3,810 sq. yds., is reported to have been from O'Sullivan & Sheehan, at $1.06 for Wassal block and 25 cts. for grading.

Newark, O.—Bids will be received Feb. 10 by F. T. Maurath, City Clk., for furnishing material and improving portions of Cedar St. by excavating, preparing foundation, laying paving brick and setting stone curbing. Estimated quantities: 12,580 sq. yds. paving, 6,246 lin. ft. curbing.

Akron, O.—Bids will be received Jan. 13 by the Bd. of City Comrs. for improving portions of Rose Ave. by grading, curbing, and guttering with concrete, paving with brick, laying cement sidewalks, and constructing a sanitary sewer. Chas. H. Isbell, Clk.

Toledo, O.—Bids will be received Jan. 26 by Chas. H. Nauts, City Clk., for furnishing material and improving portions of Warren St. by repaving with either creosoted wood block, asphalt block or sheet asphalt, on a concrete foundation or on the present sand foundation; also on Feb. 9 for furnishing material and improving portions of Peck and Auburn Sts. by paving and repaving portions of 21st St. with blocks on a concrete foundation or on a sand or broken stone foundation; also for furnishing material and improving portions of Orange St. by paving with blocks, Medina block stone, or sheet asphalt, on a concrete foundation.

Marinette, Wis.—The Bd. Pub. Wks. is contemplating paving portions of several streets with brick and macadam, at a total cost of $26,550.

St. Paul, Minn.—The following bids for asphalt paving were received by the Bd. Pub. Wks., R. L. Gorman, Clk., Jan. 5—*a*, 9th St.; *b*, Nina Ave.; c, Capital Boule.: Barber Asphalt Paving Co., New York, N. Y., *a*, $26,378; *b*, $3,565; c, $6,765. R. F. Conway Co., Chicago, Ill., *a*, $31,500; *b*, $4,500; c, $8,500. Jas. Hanley, Detroit, Mich., *a*, $29,962; *b*, $4,384; c, $7,884.

Duluth, Minn.—The Business Men on Tower Ave. are petitioning the Common Council to pave with asphalt instead of cedar block.

Boone, Ia.—The City Council has recently ordered the paving of Story, Greene, 9th and 3d Sts. and Alleys in Blks. Nos. 77 and 78; approximately, 18,000 sq. yds. Chas. E. Russell, City Engr.

East Liverpool, O.—It has been decided to improve Calcutta Road 1¾ miles in extent lying in St. Clair Township, Columbiana Co., by paving with brick. Jno. A. George, Engr. in Charge.

Alton, Ill.—See "Sewerage and Sewage Disposal."

Gainesville, Tex.—The issuing of $150,000 bridge and road bonds to be used in the construction of bridges and macsdamized roads throughout the county is reported to be under consideration.

Ft. Worth, Tex.—The paving of Houston St. with asphalt is contemplated.

Guthrie, Okla. Ter.—Contractor E. N. Ford has awarded to the Pittsburg (Kan.) Brick Co. a contract to furnish 2,500,000 brick to be used in the paving contract in this city, secured by Contractor Ford.

Greenville, Tenn.—The Greene Co. Court has authorized an election to be held to determine whether the county shall issue $150,000 road bonds.

Jonesboro, Tenn.—The Washington Co. Court has asked the Tennessee Legislature for permission to hold an election to issue $100,000 road bonds.

St. Louis, Mo.—Local press reports state that Chmn. Geo. B. Leighton, of the Boulevard and Park Comn., has received from George E. Kessler, of Kansas City, landscape architect of the World's Fair, plans for the improvement of King's highway. The plans relate to the proposed boulevard from O'Fallon Park to Carondelet, a distance of about 7 miles.

St. Joseph, Mo.—Local press reports state that the paving, with asphalt, brick and macadam, of about 85 streets, is proposed during the coming year.

Clarksville, Tenn.—The City Council is considering paving with bituminous macadam the streets of the city. A committee has been appointed to consider the advisability of issuing bonds for street improvements.

Nashville, Tenn.—The Co. Court has appropriated $41,200 for the maintenance of the county turnpikes.

Ottawa, Kan.—The Town Council has voted to pave 8½ of the principal blocks in the main part of this town.

New Orleans, La.—Local press reports state that the bid of the Louisiana Improvement Co., for repairing asphalt pavements on which maintenance guarantee has expired, has been accepted.

Springfield, Mo.—About 4,000 sq. yds. brick pavement, with concrete foundation, will be laid in the early spring. Geo. W. Culler, City Engr.

Vicksburg, Miss.—The Village of Speeds Addition is agitating the question of constructing about a mile of either asphalt or bituminous pavement on its principal street. H. M. Marshall, Mayor, Vicksburg, Miss., is seeking information as to cost, etc.

Geo. W. Culler, City Engr., writes that about 2,700 yds. of brick pavement, with a concrete base, will be let on Feb. 3d.

Kooskia, Idaho.—Press reports state that the Business Men's Asso. announces that in the spring it expects to construct a wagon road up the middle fork of Clearwater and Newsome Creek to the Elk City and Newsome Creek mining district.

Boise, Idaho.—The building of about 3 miles of cement sidewalks is being considered.

Denver, Colo.—Local press reports state that F. Roberts submitted the lowest bid for constructing sidewalks in So. Bway. Sidewalk Dist. No. 1, at $16,594. Engineer's estimate was $27,030.

Bids will be received by the Bd. of Pub. Wks. until Jan. 23 for furnishing material and constructing and reconstructing sidewalks in So. Bway. Sidewalk Dist. No. 2. R. W. Speer, Pres.

San Diego, Cal.—The Street Com. has decided to recommend to the City Council the paving of a portion of 5th St. with asphalt, on an asphalt concrete base.

Seattle, Wash.—It is stated that bids are wanted Jan. 27 for grading Galer St.; estimated cost, $57,000. R. H. Thomson, City Engr.

Lindsay, Ont.—It is stated that bids will be received Jan. 20 by F. Knowlson, Town Clk., for constructing about 45,000 sq. ft. of cement sidewalks.

POWER PLANTS, GAS AND ELECTRICITY.

Boston, Mass.—The shareholders of the Massachusetts Gas Companies are stated to have voted to increase the capital stock of the companies from $30,000,000 to $50,000,000, with a view to acquiring additional gas plants.

Middletown, Conn.—The petition for a charter for an electric light company has been filed with the Secretary of State by Saml. Russell and Louis De L. Hubbard, of Middletown.

Jewett City, Conn.—It is reported that at a recent town meeting the Warden and Burgess were authorized to take steps for the reconstruction of the electric light plant, at a cost of $15,000.

Oyster Bay, L. I., N. Y.—Michael J. Grummong, of N. Y. City, Pres. Nassau County Water Co., is stated to have secured the franchise for a gas plant.

Binghamton, N. Y.—The Superv. are stated to have selected I. G. Perry, 3 Cheuango St., to prepare tentative plans for the county heating and lighting plant, to cost about $4,565.

Port Henry, N. Y.—A press report states that surveyors from the State Engr.'s office at Albany have been in the North Hudson vicinity surveying for a State dam to be constructed across Schoon River to furnish power for mills further down the stream. The location of the dam has not as yet been decided upon.

Franklinville, N. Y.—The Empire Electric Co., of Franklinville, has been incorporated, with a capital of $2,500, to erect, maintain and operate an electric light plant in Franklinville. Directors: G. E. Spring and S. W. G. Ferris.

Trenton, N. J.—The Council on Jan. 6 passed a $40,000 bond ordinance providing for placing the fire alarm and police telegraph wires underground.

Jamesburg, N. J.—The Council is stated to have granted the Jamesburg Electric Heat & Power Co. a franchise to string wires through the borough.

Cambridge Springs, Pa.—A. F. Moses, Boro. Clk., writes that two applications have been received for the franchise for an electric light plant. Action deferred until Jan. 19. The plant will probably cost from $20,000 to $25,000.

Turtle Creek, Pa.—The Boro. Council is reported to be considering the question of constructing a municipal electric light plant.

Monongahela, Pa.—An ordinance has been introduced in Council requiring that all telephone, telegraph, fire alarm and electric wire, or overhead wires, be placed underground, and that all poles be removed from the public streets before the expiration of one year.

Carlisle, Pa.—Charters have been granted to the following electric light companies to furnish electricity for light, heat and power in the eastern end of Cumberland County, each with a capital of $500: The New Cumberland Light, Heat & Power Co.; Lower Allen Light, Heat & Power Co.; Upper Allen Light, Heat & Power Co.; East Pennsboro Light, Heat & Power Co.; Shiremanstown Electric Light, Heat & Power Co.; Camp Hill Light, Heat & Power Co.; and Hampden Light, Heat & Power Co. The companies are to furnish electricity in the boroughs and townships from which they take their names. Incorporators: Geo. W. Cumbler, Steelton; John D. Landes, Mechanicsburg, and others.

Donora, Pa.—The Donora Light, Heat & Power Co. is reported to have been organized, and has made application to the Governor for a franchise. W. Cooper Siebert, of Allegheny, is reported interested.

Laurel, Del.—A press report states that the town of Laurel proposes to issue $20,000 bonds for the purpose of establishing an electric light plant.

Rochester, N. Y.—The contract for gas lighting is stated to have been awarded to the Rochester Gas & Electric Co., at 8 cts. a lamp if more than 100 are in use and for 8½ cts. a lamp if less than 100 are in use. The city at present has 142 gas lamps.

Stockbridge, N. Y.—Dewitt C. Hadcock is stated to have acquired water rights in Stockbridge and Smithfield. It is proposed to build at least one dam across the creek, forming a reservoir that would have an area of 8 acres, and to construct an electric plant about a mile below and east in the town of Stockbridge; the power generated will be transmitted to Oneida by way of Munnsville, Stockbridge and Kenwood, and another line will probably be constructed by the way of Peterboro, Clockville, Oakhill, Chittenango and Fayetteville to Syracuse.

Sellersville, Pa.—The Council is stated to have granted a franchise for an electric light plant to Morris A. Glymer.

Leechburg, Pa.—The Pittsburg & Allegheny Valley R. R. Co. is stated to have closed the purchase of 4 electric light plants of this district and the franchise of the Leechburg & Apollo St. Ry. Co. The plants are the Parnassus Electric Light & Power Co., the Leechburg Electric Light & Power Co., the New Kensington Electric Light & Heat Co., and the Apollo Light, Heat & Power Co. The street railway will be built from Apollo to Vandergrift, Leechburg, Braeburn, Arnold, New Kensington and Parnassus, a distance of 20 miles, and will connect with the Pittsburg Rys. Co. The company has a capital of $1,500,000, and is organized by John Q. Cochrane, Pittsburg; Dr. J. D. Orr, Leechburg, and others.

Frederick, Md.—A. Beadle, and others, of Baltimore and Philadelphia, Pa., are stated to have purchased the plant of the Isabella Gas Works of Frederick. It is reported that it is proposed to improve and enlarge the plant. Richard C. Congdon has been appointed Mgr.

Richmond, Va.—It is stated that an ordinance will be introduced in Council providing for the appointment of a committee, to investigate and report on the cost of installing an electric light plant in the City Hall.

Mt. Airy, N. C.—See "Water."

Gainesville, Ga.—Chas. F. Howe, of Gainesville, writes that it is proposed to develop the power of Ocmulgee River near Macon, for electrical purposes, and contracts will probably be let in March or April.

Rome, Ga.—J. D. Hanks, Mayor, writes that the building of an electric plant by the city has been postponed for a year, as the City Electric R. R. Co. has agreed to extend its line to Lindale (5 miles) this year, and the contract for lighting the city for the year has been awarded to this company.

North Amherst, O.—The following are reported to be the contracts awarded for the installation of an electric light plant, bids for which were received by F. E. Kaser, City Clerk, Dec. 18: Fisher Elec. Co., Toledo, for pole line, $3,150; National Meter Co., Chicago, Ill., for gas and gasoline engine, $4,350, and Warren Electric Co., Sandusky, for dynamo, transformers, switchboard and lamps, $2,950.

Sheboygan, Wis.—The Council is stated to have passed a resolution providing for the appointment of a committee including Mayor Dennett and Aldermen Pfister and Geisler, to investigate the advisability of the city constructing and owning its own electric light plant.

Neenah, Wis.—Local press reports state that a proposition will be submitted shortly to the City Councils of Neenah and Menasha by Freyhoff & Weyland, Electrical, Mechanical & Consulting Engrs., of Milwaukee, for the establishment of a lighting plant to be operated jointly by these cities.

Beloit, Wis.—The Council is stated to have passed a resolution ordering the City Engr., the St. Light Com. and Ald. Clarke to prepare a map for a pole line and power plant, together with plans, specifications and estimated cost of same.

Janesville, Wis.—The City Council is reported to be considering the establishment of an electric light plant.

Green Bay, Wis.—The Knox Construction Co. is reported to have decided to construct a gas plant at Green Bay.

Greenville, Mich.—Under the name of the Greenville Gas, Electric Light, Power & Fuel Co. the electric light and gas plants of Greenville will be merged, the properties having been acquired by Cass T. Wright, John J. Foster of Greenville, and others. About $20,000 will be expended in improvements and extensions.

Ann Arbor, Mich.—John Kenney and Wm. Clancy, of Ann Arbor, are reported to have petitioned the Council for a franchise for a heating plant.

Winona, Minn.—The following bids were opened by the City Recorder Jan. 5 for constructing an electric light plant, G. P. Coleman, Engr.—the first three bidders bid on work complete, the second figures on each being less if incandescent plant is left out: Arnoid Electric Power Co., Marquette Bldg., Chicago, Ill., $49,133, less $3,720; W. I. Gray & Co., of Minneapolis, $46,025, less $3,480; J. G. Robertson, St. Paul, Minn., $50,228, less $3,670; Fairbanks, Morse & Co., of St. Paul, bid $710 for a high speed engine and $815 for an incandescent generator; the Minneapolis Steel & Machy. Co., of Minneapolis, bid $1,075 for a high speed engine; John Lohse, of Winona, bid $6,357 for the erection of the building, and Crowley & Co., of Duluth, bid $36,146 for equipment and $6,337 for building, foundations, etc.

Tenstrike, Minn.—S. S. Barber is stated to have secured a franchise for an electric light plant.

Princeton, Ind.—The Inter-State Oil Co. is reported interested in the installation of an artificial gas plant at Princeton. Saml. Bean, Pres.

Piqua, O.—H. T. Bailey, of Piqua, has secured a franchise for the construction and operation of an electric light plant in connection with a hot-water heating plant, for which he was granted a franchise Nov. last. Work to begin not later than Apr. 1, and be ready for operation not later than Oct. 1, 1903; estimated cost, $175,000. H. E. Whitlock, City Engr.

St. Paul, Minn.—Bids will be received Jan. 19 by the Bd. of Co. Comrs. for furnishing gas and electric fixtures for the new jail in this city. Address W. R. Johnson, Co. Aud.

St. Joseph, Mo.—John L. Zeidler, of St. Joseph, and John I. Rinaker, Jr., of Springfield, Ill., are stated to have petitioned the Council for a franchise for a hot water heating plant.

Vicksburg, Miss.—The city will let a new franchise for gas for the city and use of the streets for mains at the expiration of its present franchise with the United Gas Co., which is reported to be in February. It is understood that the franchise will go to the company making the best offer. W. L. Trowbridge, Mayor.

A charter is reported to have been granted to the Vicksburg Gas Co. E. S. Butts, Pres.

Dallas, Tex.—C. L. Wakefield, Mgr., writes that it is proposed to construct an electric light and power plant, at a cost of $150,000, and is ready now to receive bids.

Granbury, Tex.—Earl Cogdell, of Granbury, writes that he will be ready to receive bids about Feb. 10 for an electric light plant, to cost $5,000.

Wartrace, Tenn.—Col. W. S. Waite is reported to be considering the construction of an electric light plant to furnish lights to the town.

Rayne, La.—See "Water."

Birmingham, Ala.—The American District Steam Co., of Lockport, N. Y., is stated to have secured the contract for constructing a steam heating plant for the Birmingham Ry., Light & Power Co., for about $100,000.

La Moure, N. D.—C. J. Alister writes that no definite action has as yet been taken in regard to constructing an electric light plant.

Helena, Mont.—J. H. Kent is stated to have prepared plans for a power distributing station for the Helena Light & Traction Co. R. A. Wilson, Supt. of Construction.

Ft. Collins, Colo.—Geo. J. Spear is reported to have petitioned the Council for a franchise for a gas plant. He is Secy. of the gas plant at Greeley, Colo.

Florence, Colo.—Peter English, of Boulder, is about to petition the City Council for a franchise for a gas plant.

Rialto, Cal.—A press report states that ex-Judge Campbell, of San Bernardino, who received a franchise from the Lytle Creek Water & Improv. Co., of Rialto, for a term of 30 years for electrical power purposes, has succeeded in placing bonds for the development work, and the building of a large reservoir for equalizing heads of water in irrigating, will be commenced at once.

Mitchell, S. D.—M. M. Doyle is reported interested in the construction of a gas plant.

Kalispell, Mont.—F. W. Tiukel, Secy. Big Fork Electric Light & Power Co., writes that it is proposed to purchase a 400-Kw., 2 phrase generator, turbine for same, 2 exciters and 2 small turbines working head 100 ft., steel penstock about 60-in. diameter by about 150 ft. long.

Richfield, Utah.—Nelson and Arthur Baker are reported interested in the construction of an electric light plant.

Corona, Cal.—The Corona Power & Water Co. is reported to be negotiating for the purchase of an electric generating outfit, and an engine with condenser and separator. This machinery will serve as a duplicate of the plant already at Ethanac, where it will be installed.

ELECTRIC RAILWAYS.

Brimfield, Mass.—The Hartford & Worcester Electric Ry. Co. is reported to be surveying a route from Brimfield to Palmer to connect with its line at a point about two miles from the village.

Jamesville, N. Y.—The Syracuse & Suburban R. R. Co. is stated to have completed plans for extending its line from Orville to Jamesville; it will cost about $50,000 with equipment. E. R. Canfield, Gen. Mgr., Syracuse.

Sheridan, N. Y.—The Lake Shore Traction Co. is stated to have secured a franchise through the town, a distance of about 7 miles.

Walden, N. Y.—It is stated that the Boards of Trade of Walden and Montgomery will ask the Orange County Traction Co. to construct its line between these towns. C. H. Brown, Ch. Engr., Newburgh.

Far Rockaway, L. I., N. Y.—The Ocean Electric Ry. Co. is reported to be considering the extension of its line from Rockaway Park along the boulevard through Seaside, Hollands, Hummels and West Arverne.

Amsterdam, N. Y.—The Amsterdam St. R. R. Co. is stated to have filed a certificate in Albany, of an extension of its line to form a double track on E. Main St., and a connection between its W. Main St. line and its Division St. line. J. Ledlie Hees, Pres., Fonda.

Lysander, N. Y.—The Highway Com. is stated to have granted a franchise to the Syracuse and Ontario R. R. Co.

Irvington, N. J.—The Town Council is stated to have granted a franchise to the Essex Cross Ry. Co.

Perth Amboy, N. J.—The Elizabethport, Perth Amboy & Long Branch Ry. Co. has been incorporated to build an electric railroad from Elizabethport to shore points in Monmouth. Incorporators: W. Parker Runyon, Perth Amboy; Edwin Furman, of Sayreville, and others.

Boyertown, Pa.—It is stated that a new trolley line will be built from Boyertown to Paim. The road will form a loop around Boyertown and New Berlinville. Dr. Thos. J. B. Rhoads, Pres.

The Town Council is stated to have granted a franchise to the Ringing Rocks Traction Co. Ralph E. Shaner, Gen. Mgr.

Apollo, Pa.—It is stated that the Pittsburg & Allegheny Valley St. Ry. Co. is to construct a line from Apollo through Vandergrift, Hyde Park, Leechburg, Arnold, New Kensington and Parnassus, a distance of about 20 miles.

Lancaster, Pa.—Application has been made to the State Dept. for a charter by the Lancaster & Rocky Springs Ry. Co., which will build a line through the city to Rocky Springs Park. It will be a double-track road about 4 miles in length. Wm. B. Given, Pres.

McKees Rocks, Pa.—The McKees Rocks & Allegheny Electric Ry. Co. is stated to have secured a franchise to lay tracks from River Ave. to the proposed Ohio River bridge. The company is required to pave the street with vitrified brick.

Shamokin, Pa.—The Council has passed on first reading the ordinance granting the Shamokin & Edgewood St. Ry. Co. a franchise to construct a short line to Edgewood. It will construct a bridge over Carbon Run Creek.

Lock Haven, Pa.—It is stated that the Williamsport & Lock Haven Traction Co. will construct a trolley line between Lock Haven and Oak Grove.

Kennett Square, Pa.—The Borough Council is stated to have granted the West Chester, Kennett & Wilmington Electric Ry. Co. a franchise to lay tracks on W. State St.

Sharon, Pa.—H. G. Hamilton, of Youngstown, O., is stated to have secured the contract for building the Sharon-Middlefield St. Ry. The line will be 45 miles long, and will connect at Middlefield with a line from Cleveland, O.

Leechburg, Pa.—See "Power Plants, Gas and Electricity."

Newark, O.—The Arthur E. Appleyard Co., 50 State St., Boston, Mass., is stated to have secured the contract for building the interurban road from Newark to Zanesville for the Columbus, Buckeye Lake & Newark Traction Co.

Marion, Ind.—The Co. Comrs. are stated to have granted the Bundy-Clark Co. a franchise to build an electric road from this city to Kokomo. Work on the line will begin in the spring.

Wrightstown, Wis.—The Village Bd. is stated to have granted a 50-year franchise to the Knox Construction Co. to build an electric railway through the village on the west side of the river.

Otsego, Mich.—The Chicago & Grand Rapids Ry. Co. is stated to have secured a franchise to build a road through this township. The road will be built between Grand Rapids and Kalamazoo, and later to Chicago. W. H. Patterson, Pres.

Kenton, O.—The Kenton & Southern Ry. Co., of Kenton, has been incorporated, with a capital of $600,000, by Richard Emory, Emmitt Tompkins, and others, to build an electric railway from Kenton to Bellefontaine.

Cincinnati, O.—The Miami & Erie Terminal Ry. Co. has been incorporated, with a capital of $10,000, to build a surface electric railroad connecting link between the terminal of the Miami & Erie Canal Transportation Co. at Cheapside and the Ohio River. Incorporators: Thos. N. Fordyce, Dani. J. Ryan, of Columbus, and others.

Granville, O.—The Council is stated to have granted a franchise to the Newark & Granville Ry. Co.

Lebanon, Ind.—R. P. Woods has completed survey and location from Lebanon to Crawfordville, Ind., for extension of Indianapolis & Northwestern Traction Co.

Johnson City, Tenn.—A. M. Young & Co., of New York, are about to petition the City Council for a franchise for an electric railway.

Beaumont, Tex.—The Beaumont Traction Co., of Beaumont, has been incorporated, with a capital of $600,000, to construct and operate street railroads and suburban railroads and belt lines within and near the city, and also to construct and operate a union depot. Incorporators: Ben Johnson, Natchez, Miss.; Morris Block, Beaumont; Harry K. Johnson, Greenville, Miss., and others.

Chattanooga, Tenn.—S. W. Divine, of Chattanooga, is reported interested in the Ducktown, Cleveland & Chattanooga Electric Ry. Co., which proposes constructing a line from Chattanooga to Ducktown through Cleveland.

Canon City, Colo.—The City Council is stated to have granted franchises to Thos. Robinson, of Florence, representing the Florence & Canon City Electric Ry. Co., and to H. F. Whiting, representing a Denver syndicate.

Ogden, Utah.—Geo. H. Matson and Chas. H. Kircher are stated to have petitioned the Co. Comrs. for a franchise for an electric railway through Ogden canyon.

Whittier, Cal.—It is stated that the Pacific Electric Ry. Co. will soon begin the construction of its line between Los Angeles and Whittier.

Ritzville, Wash.—Surveyors are about to begin the work of laying out a route for an electric railway to run from Washtucna through Ritzville and Odessa. The proposed line will be about 45 miles long. C. Lunchford, R. C. Clark, and others, of Ritzville, are reported interested.

Fairfield, Cal.—The Superv. of Solano County are stated to have granted J. W. Hartzell, of Vallejo, the franchise for constructing about 60 miles of electric railways.

Pasadena, Cal.—Press reports state that A. & C. S. Campbell-Johnston have applied for an electric railway franchise and bids for said franchise will be received Feb. 3.

RAILROADS.

Boston, Mass.—Bids will be received Jan. 20 by the Boston Transit Comn. for completing the construction of Section C of the East Boston Tunnel. Howard A. Carson, Ch. Engr.

Waltham, Mass.—Mayor M. D. Clement, in his annual message, is reported to have recommended the abolishment of grade crossings, the introduction of water meters and the paving of a portion of Moody St. with bituminous macadam.

Pittsburg, Pa.—Local press reports state that contracts, according to present plans, for the construction of the Greene County R. R. (Wabash) will be awarded early in April; 55 miles of single track road, exclusive of sidings and possible small branches, are included in the project. Along the route are 5 tunnels, one large river bridge, and many smaller structures.

Philadelphia, Pa.—See "Bridges."

Frederick, Md.—A preliminary survey for an extension of the Monocacy Valley R. R. from Catoctin Furnace to Frederick is being made by Prof. Geo. E Waesche, of Purdue Univ., Indiana. L. R. Waesche, Supt., Thurmont, Md.

Philadelphia, Pa.—Local press reports state that the Pennsylvania R. R. Co. contemplates relieving the congestion of the road between Philadelphia and Pittsburg by constructing a low grade freight line from the Susquehanna River to the Delaware, which will include the building of a bridge across Susquehanna River, and will cost $3,000,000.

Norfolk, Va.—A press report states that the Chesapeake Transit Co. will expend about $1,900,000 to construct a tunnel under Smith's Creek and Elizabeth River for a connection with the Southern Ry., the Atlantic Coast Line, the docks and wharves of the New York, Philadelphia & Norfolk Ry. and the Seaboard Air Line. It will bring all of these lines into Norfolk to a union station, which will be established, probably in the neighborhood of Granby St. and Smith's Creek.

East St. Louis, Ill.—A charter has been granted to the St. Louis Valley Transfer Ry. Co. to build a railroad from the intersection of the Waterloo and East Carondelet turnpike with the St. Louis Valley R. R. to the Mississippi River; also, a branch from Prairie du Pont Commons to Du Pont, all the locations being in St. Clair County; capital, $10,000. Incorporators: W. S. Forman, H. L. Browning, and others, all of East St. Louis.

Centralia, Ill.—The Chicago, Burlington & Quincy R. R. Co. is reported to have a corps of surveyors at work on a line, which will run over the old Jacksonville route from Centralia, southwest into Franklin and Williamson Counties and then to Thebes. Geo. Harris, Pres., Chicago.

Effingham, Ill.—Engineers are reported to be surveying a line for the Toledo, St. Louis & New Orleans R. R. to start at Effingham and connect with the Wabash and reach to Thebes.

Gilbert, La.—A corps of surveyors representing the Memphis, Arkansas & Louisiana Ry. are stated to have begun a survey, starting at Gilbert, La., and have progressed as far as Como, La. This line will follow an air line from Gilbert, via Como, Crowville, Lamar, Delhi, Goshion, Floyd and Oakgrove, to an intersection of the main line at Tripper Lake Village, Ark.

Harlem, Mo.—A press report states that the Burlington has completed plans for expending $1,250,000 in the construction of freight yards, freight houses and round houses at Harlem across the river from Kansas City. Geo. B. Harris, Pres., Chicago, Ill.

Jacksonville, Ala.—The Seaboard Air Line is reported to have begun a survey from Jacksonville, Ala., to Anniston, and in a northwesterly direction back to the old main line of the East & West Road at the point where it crosses Coosa River. N. D. Maher, Gen. Supt., Portsmouth, Va.

Ft. Smith, Ark.—It is reported that the Asher-Oklahoma Central R. R. Co., recently chartered to build 400 miles of railroad from Ft. Smith, Ark., to Vernon, Tex., announces it will be ready to put surveying corps and graders in the field in February.

Lawton, Okla. Ter.—It is stated that the Orient R. R. Co. will build an extension from the main line at Barton, through Hobert and Cooperton, to Lawton, a distance of 100 miles.

Muskogee, Ind. Ter.—The Kenewick & Kaln Co. is stated to have secured the contract for the construction of 118 miles of road for the Moskogee Southern R. R. Co.

Pauls Valley, Ind. Ter.—The Santa Fe R. R. Co. is stated to have decided to construct a line from Pauls Valley to Coal Gate, Ind. Ter., a distance of 75 miles. Jas. Dun, Ch. Engr., Chicago, Ill.

Oklahoma, Okla. Ter.—The contract for constructing the branch line of the Missouri, Kansas, Texas R. R. from this place to Coalgate, I. T., a distance of about 130 miles, is reported to have been awarded to McArthur Bros., of Chicago, Ill.; it is estimated that the line will cost about $3,000,000.

Wichita Falls, Tex.—A charter is stated to have been granted to the Wichita, Oklahoma & Northwestern R. R. Co., with a capital of $2,000,000, to build a road from Wichita Falls, northwest through the Counties of Comanche, Kiowa and Greer, Okla., to Miama, Tex., a distance of 200 miles.

Kirkland, Tex.—Geo. W. Hall, Gen. Supt. in Oklahoma for the Kansas City & Oklahoma Central R. R., is reported to have announced that the road will be built. It is being surveyed for the Missouri Pacific from Peru Junction, Kan., to Kirkland, Tex., through Guthrie. H. Rohwer, Ch. Engr., St. Louis, Mo.

Stephenville, Tex.—A railroad 125 miles long is to be built from the Red River to Stephenville, Tex., by the Oklahoma, Texas & Southern Ry. Co. This corporation has lately been reorganized with W. A. Squires as Pres. and E. E. Churchill, Gen. Mgr. Principal office to be at Montague, Tex.

Denver, Colo.—A press report states that plans are being prepared, and contracts will soon be let, for the construction of a tunnel through James peak for the Denver Northwestern & Pacific R. R.; it will cost about $1,000,000.

Spokane, Wash.—The Moran Prairie R. R. Construction Co., in which J. J. Browne and Mark F. Mendenhall are interested, will apply to the City Council for a 25-year franchise for a new street railroad to Moran prairie. The application provides for building lines over several routes in the southeast part of the city to connect with existing car lines.

Santa Cruz, Cal.—The Santa Cruz, Capitola & Watsonville R. R. Co. is stated to have filed its certificate of bonded indebtedness in the amount of $75,000, the bonds to be issued to raise money to extend the line and furnish equipment. M. V. McQuigg, Pres.; O. Z. Hubbell, Secy.

PUBLIC BUILDINGS.

Concord, N. H.—Lee Bros., of Concord, have secured the contract for ventilating, heating and plumbing the new city building, for $11,025.

Melrose, Mass.—The contract for erecting the Melrose Public Library is stated to have been awarded to Geo. M. Tufts, of Boston, for $28,097.

Derby, Conn.—It is stated that the Dirs. of the Derby Hospital fund announce that about $50,000 is now available for the construction of an emergency hospital.

Marlboro, Mass.—See "Sewerage and Sewage Disposal."

Kings Park, Long Island, N. Y.—Bids will be received Jan. 28 by the State Comn. in Lunacy, Albany, for installing air compressor at the Long Island State Hospital. G. L. Heins, State Archt., Albany; T. E. McGan, Secy.

Brooklyn, N. Y.—Bids will be received Jan. 21 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and erecting 3 underground public comfort stations, one at Manhattan and Greenpoint Aves., another at the junctions of Hamilton Ave. and Richards St., and the third at Liberty and E. New York Aves.

Philadelphia, Pa.—The Bd. of Mgrs. of the Protestant Episcopal Hospital is stated to have recommended the erection of a separate dispensary building, at a cost of $75,000.

Henry Phipps, of New York City, is stated to have contributed $300,000 for the erection of the Free Hospital for Consumptives. Dr. L. F. Flick, Pres.

Utica, N. Y.—A correspondent writes that there will be a competition for plans for the new court house some time after Jan. 15; probable cost, $150,000. Address F. T. Proctor, Chmn. of Com., 4 Second Natl. Bank Bldg.

Albany, N. Y.—The Dirs. of the Homeopathic Hospital are stated to have authorized the construction of a building, to cost between $20,000 and $30,000. Architect, Marcus T. Reynold, 59 N. Pearl St. F. W. Ridgeway, Chmn. Bldg. Com.

Camden, N. J.—The plans of the new Court House have been received from the 5 competing architects and award will be made about Feb. 15. Prof. of Architecture of Pa. Univ., Prof. Laird, is expert advisor to Com. of Freeholders; probable cost, $550,000.

Paterson, N. J.—Wm. Vermeulen is reported to be preparing plans for a police station, to cost about $30,000.

Pittsburg, Pa.—Edw. Stotz, Monongahela Bank Bldg., is stated to have prepared plans for a 3-story brick building for a home for the sisters and nurses of the Passavant Hospital, to be erected at Reid and Roberts Sts., to cost $20,000.

Homestead, Pa.—The Congregation of the Slavish R. C. Church is reported to be considering the erection of an edifice, to cost about $50,000. Rev. Anthony Yonda, Pastor.

Richmond, Va.—J. E. & A. L. Pennock, 812 E. Main St., have secured the contract for erecting the R. C. Cathedral, for about $125,000. Architect, Jos. H. McGuire, New York, N. Y.

Athens, Ga.—This city has $50,000 with which to build a city hall and desires the services of an Architect. Particulars can be had by addressing J. W. Barnett, City Engineer.

Jackson, Mich.—Bids will be received Jan. 27 by the Library Com. for the erection of the Carnegie Library. Ferry & Clas, Archts., Milwaukee, Wis.; B. L. Carlton, Secy.

Port Huron, Mich.—The contract for erecting the Carnegie Library is stated to have been awarded to Wm. Maxwell, of Elkhart, Ind., for $48,933.

Waukesha, Wis.—The County Bd. is stated to have awarded contracts for work on the County Insane Asylum, as follows: Ventilating and heating, C. B. Kruse & Co., Milwaukee, $7,100; plumbing and sewage, A. G. Haynes, $4,468; lighting plant, Keelyn & Smith, $2,319; deep well pump, H. Lorienber Co., Oconomowoc, $690.

Bristol, Tenn.—Drs. Geo. E. Wiley, L. H. Gammon and H. B. Edmonson, of Saltville, Va., are reported interested in the erection of a hospital at Moore and Cumberland Sts., to cost about $60,000.

Texarkana, Ark.—It is stated that the Methodist Church, South, will erect an edifice, to cost $20,000.

Mineral Wells, Tex.—Plans are stated to have been adopted for a sanitarium to be erected in this city, to cost $50,000.

Lawrence, Kan.—The Co. Comrs. have approved plans of Haskell & Gunn, Archts., for the $80,000 court house, and it is stated that bids will be received Feb. 10.

Oklahoma, O. T.—It is stated that a court house and jail will be erected at Main and Colcord Sts., to cost $15,000 and $25,000 respectively.

Carrollton, Ky.—Bids will be received until Feb. 17 by the Rev. I. M. Ahmann for erecting the superstructure of the St. John R. C. Church.

Selma, Ala.—Bids will be received Feb. 18 by Ernest Lamar, Chmn. of Bldg. Com., for erecting the stone church for Selma Baptist Church of Christ. Chas. C. Wilson, Archt., Columbia, S. C.

Colorado.—The State Bd. of Charities and Corrections is stated to have recommended the erection of a hospital for insane in Northern Colorado; an appropriation of $50,000 for the completion of the building for women patients at Pueblo Asylum, $60,000 for the erection of buildings for the State Home for dependent children; $52,700 for an industrial school for girls.

Sault Ste. Marie, Ont.—See "Sewerage and Sewage Disposal."

Libraries.—Andrew Carnegie is stated to have made the following cities offers for public libraries: Camden, N. J., $100,000; New Orleans, La., $250,000; Wausau, Wis., $30,000; Manitowoc, Wis., $25,000; Vallejo, Cal., $20,000.

BUSINESS BUILDINGS.

Boston, Mass.—Plans have been filed for a 9-story hotel to be located at Bowdoin and Allston Sts.; it will be a steel frame fireproof, brick, stone and terra cotta building; estimated cost, $300,000. Owner, Commonwealth Hotel Trust; Office, Exchange Bldg.; Builder, Commonwealth Construction Co., 7 Water St.; Architect, Clinton J. Warren, Winthrop Bldg.

Springfield, Mass.—The Springfield Odd Fellows have purchased a site on Pynchon St., 133x104 ft. No plans have been made for the building as yet.

Brooklyn, N. Y.—The Crescent Athletic Club is stated to have accepted the plans of Frank Freeman, 132 Nassau St., New York City, for its new club house, to be erected at Pierrepont and Clinton Sts., and cost $400,000.

Albany, N. Y.—Collin Bros., Bensen Bldg., are reported to have received the contract for erecting an addition to the plant of Burdick & Son at Hamilton and Mosher Sts. The cost of the alterations and improvements is $50,000.

Pittsburg, Pa.—It is stated that a 6-story building will be erected at 5th Ave. and Washington St. for the Washington Natl. Bank, to cost about $75,000.

John D. Allen & Co., 900 Chestnut St., Philadelphia, and Benj. Marshall, 218 La Salle St., Chicago, Ill., are stated to have prepared preliminary plant for a theater for Nixon & Zimmerman, to cost $250,000.

New York, N. Y.—Plans are stated to have been prepared for the erection of an 8-story building at 5th Ave. and 46th St., for the club composed of the men of the Sunday School of the Fifth Ave. Baptist Church; probable cost, $250,000.

Rome, N. Y.—It is stated that the New York Central Ry. Co. and the Ontario & Western R. R. Co. will erect new freight houses and depots in Rome. Probable cost of the improvements reported to be about $800,000.

Baltimore, Md.—The Belvedere Bldg. Co. is reported to have awarded the contract for ventilating and heating the Hotel Belvedere to Crook, Horner & Co., 303 N. Howard St., for $61,750.

Pittston, Pa.—Plans are being prepared by 9 architects of this section for the construction of a building for the Y. M. C. A., to cost complete, $25,000.

Cleveland, O.—The Y. M. C. A. Bldg. at Prospect and Erie Sts., is reported to have been damaged by fire Jan. 8.

Sheboygan, Wis.—The Sheboygan Theater Co. (W. E. Talmadge, Pres.,) is reported to be considering the erection of a theater here, to cost $35,000.

Waukesha, Wis.—The Ovitt Realty Co. is reported incorporated, with a capital of $50,000, to erect a business building. Lee S. Ovitt and T. E. Ryan are stated to be interested.

Minneapolis, Minn.—C. E. Haglin, 228 Lumber Exchange, is stated to have received the contract for erecting an addition to the Glass Block, for $100,000.

Canton, O.—Local press reports state that the Auditorium & Market House Bd. has rejected all bids received for the construction of its building, and new bids will be received Jan. 23. The lowest bid was about $134,747.

Des Moines, Ia.—The contract for the erection of the Chamberlain store and office building has been awarded to Ed. Tousaint, for $25,000.

Alton, Ill.—The Illinois Glass Co. will erect a warehouse, 350x180 ft.

Louisville, Ky.—It is stated that Otto Seelbach will erect a hotel at 4th Ave. and Walnut St., to cost about $1,000,000.

St. Louis, Mo.—The Century Architectural Co., Carleton Bldg., is reported to be preparing plans for the Louisiana Hotel, to be erected at Jefferson Ave. and Olive St., to cost between $65,000 and $80,000.

Greenville, Miss.—It is stated that a 3-story office building will be erected on Poplar St. for the Bank of Washington, to cost about $25,000.

Shreveport, La.—Press reports state that a union depot, to cost $450,000, will be built at Shreveport. L. S. Thorne, of Dallas, Tex., Vice-Pres. Texas & Pacific R. R., is said to be interested.

Waco, Tex.—J. E. Flanders, of Dallas, is reported to have been selected to prepare plans for a temple for Masonic Grand Lodge, to cost about $150,000.

Topeka, Kan.—The plans of W. W. Rose, of Kansas City, Kan., are stated to have been accepted for the erection of the Kansas Bldg. at the St. Louis Exposition. The building will measure 70x100 ft., and cost $30,000.

It is stated that bids received for the construction of the Railroad Y. M. C. A. Bldg. for the Santa Fe were rejected, as all were in excess of the probable cost, which is $30,000.

New Orleans, La.—The Reunion Com. is reported to have accepted the plans of Thos. Sully, 1103 Hennen Bldg., for the auditorium building. Contracts for the erection will soon be let.

Fargo, N. D.—The Edwards Bldg. is reported destroyed by fire Jan. 9.

Omaha, Neb.—The Beebe & Runyon Furniture Co. is reported as having plans prepared for a 198x132 ft. 8-story warehouse, and a 66x132 ft. factory, to cost about $200,000.

Salt Lake City, Utah.—The Watkins Contract Co., of Provo, is reported to have received the contract for erecting the plant of the Utah Ice & Cold Storage Co., for $31,000.

San Francisco, Cal.—Building permits have been granted to Scott & Van Arsdale for the erection of a 7-story building at 4th and Mission Sts., and to the Wilcox Realty Co. for the erection of a 85x100 ft. 6-story building at 3d and Mission Sts.

Mandan, S. D.—It is stated that bids will be received at the office of the First National Bank until Jan. 23 for a 50x84 ft. 2-story and basement bank and office building.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Broome and Ridge Sts, 6-story br tenemt and stores; c, $40,000; o, Levine & Davis; a, Bernstein & Bernstein.

Madison and Clinton Sts, 6-story br tenemt and stores; c, $40,000; o, Chas Friedman; a, Bernstein & Bernstein.

Washington Pl and Mercer St, 11-story br loft bldg: c, $225,000; o, H & H Sonn; a, H Fouchaux.

Ave C and 7th St, 6-story br tenemt and stores; c, $60,000; o, Wachsman & Hoffberg; a, Horenburger & Straub.

Ave C and 6th St, 2 6-story br tenemts and stores; c, total, $50,000; o, Isaac Kleinfeld; a, Horenburger & Straub.

338 and 340 E 21st St, 6-story br tenemt and stores; c, $35,000; o, Saml. Parnass; a, Horenburger & Straub.

115th St and Pleasant Ave, 7-story br loft and store bldg; c, $50,000; o, Simon Epstein; a, Suss & Smallheiser.

Bway and 130th St, 7-story br stable; c, $30,000: o, Loton Horton; a, F. A. Rorke.

DWELLINGS.

Philadelphia, Pa.—Joseph F. Myers, 516 Willow St., is stated to have received the contract for erecting a 5-story brick addition to the Bienheim Apartment House, at 17th and Chestnut Sts., for $43,000. J. W. Hallahan is the proprietor.

Wilmington, Del.—Edwin C. Biddle, of Philadelphia, Pa., is to erect 90 brick dwellings, 2 story, 7 and 8 rooms, on Vandever Ave. and Locust St., at a total cost of $135,000. Agent, Jas. L. Carpenter, 823 Market St., Wilmington.

Horace Trumbauer, Land Title Bldg., is stated to have prepared plans for the erection of a 12-story apartment house at 213 to 225 S. 16th St., to cost $1,000,000. Owner, John Stafford.

Nashville, Tenn.—It is stated that J. C. McLanhan is preparing to erect an apartment house at Vine & Union Sts., to cost $100,000.

San Francisco, Cal.—Maurice Rosenthal is reported interested in the erection of an apartment house at Stanyan and Oak Sts.; probable cost, $55,000. Architect, W. M. Koenig, 120 Sutter St.

Denver, Colo.—It is stated that an apartment house will be erected on S. 15th St. and W. 14th Ave., to cost $40,000. Jerome S. Riche is reported interested.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

237 and 239 W 43d St, alterations to 7-story br tenemt; c, $28,000; o, Frank L Delisle; a, Frank A Rooke; m, Richd Deeves & Son.

SCHOOLS.

Boston, Mass.—Bids will be received by the Schoolhouse Comrs. until Jan. 21 for erecting a primary school on School St., West Roxbury, and for installing electric work in the Lowell Dist. Grammar School, Roxbury. Bids will also be received Jan. 26 for erecting a grammar school on Heath St., Lowell Dist. R. Clipston Sturgis, Chmn.

Fitchburg, Mass.—See "Sewerage and Sewage Disposal."

Chicopee, Mass.—See "Water."

Brooklyn, N. Y.—Plans have been filed for the erection of a 3-story brick school at Ave. K and 39th St., to cost $140,000. Archt., C. B. J. Snyder, Park Ave. and 59th St., New York City.

New York, N. Y.—The following bids were opened by C. B. J. Snyder, Supt. School Bldg., N. Y. City, Jan. 12, for ventilating and heating schools: *a*, Long Island City High School, Queens Boro.; *b*, School 31, Boro. of Manhattan: Jas. Curran Mfg. Co., *a*, $25,000; *b*, $27,000. Walker & Chambers, *a*, $24,727; *b*, $28,344. E. Rutzler, *a*, $23,800; *b*, $27,000. United Htg. Co., 366 W. Bway., *a*, $23,241 (awarded). Williams & Gerstle, 1st Ave. and 44th St., *a*, $23,995; *b*, $23,995 (awarded). John Neal's Sons, *a*, $23,992.

The following bids were opened Jan. 14 by the Bd. of Trus. of College of City of N. Y. for terra cotta work for the new buildings to be erected at St. Nicholas Terrace, 140th St., Amsterdam Ave. and 138th St.: Perth Amboy Terra Cotta Co., $246,300; Excelsior Terra Cotta Co., $256,565; Conkling-Armstrong Terra Cotta Co., $258,000; N. Y. Architectural Terra Cotta Co., $280,000.

Bids were also opened at the same time and place for the excavation, rock blasting and foundation walls, as follows: *a*, work complete as specified; *b*, if the walls are built of rubble masonry: V. J. Hedden & Sons, 13 Bank St., Newark, N. J., *a*, $145,250; *b*, $133,789. Herman Probst, *a*, $190,300; *b*, $178,500. T. E. Crimmins, *a*, $199,280; *b*, $154,704. John Slattery, *a*, $285,374; *b*, $252,954. Wells Bros. Co., *a* and *b*, $219,547. Alex. Brown, Jr., *a*, $190,647; *b*, $175,611. John J. McQuade, *a*, $172,000; *b*, $157,000. Thos. Cockerill & Son, *a*, $192,950; *b*, $182,000.

Plans have been filed for the erection of a 4-story brick school for the Church of Our Lady of Good Counsel, 90th St. near 3d Ave., to cost $100,000. Archt., T. A. de Meuron.

Bids will be received Jan. 26 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work in School No. 130, Boro. of Brooklyn.

Ligonier, Pa.—Bids will be received Feb. 2 by the Ligonier Boro. School Bd. for $20,000 school bonds. H. L. McMurray, Secy.

Syracuse, N. Y.—Bids are wanted Jan. 19 for erecting the 19th Ward School. Wm. H. Jones, Clk. Bd. Contract and Supply.

Watertown, N. Y.—Bids are wanted Jan. 19 for furnishing material for steel ceilings and electric wiring the new high school. C. M. Rexford, Chmn. Bldg. Com. Bd. of Educ.

Pittsburg, Pa.—It is stated that plans are being prepared and contracts will soon be let for an addition to the Carnegie Institute, to cost about $3,600,000. W. N. Frew, Pres. Bd. of Dirs.

Allentown, Pa.—It is stated plans are being prepared for the buildings for the Greater Muhlenberg College to be erected west of the city limits of Allentown, to cost about $250,000.

Norfolk, Va.—The Common Council is stated to have adopted an ordinance appropriating $35,000 for the purchase of a site and the erection of an additional school.

Toledo, O.—Bids will be received Feb. 7 by the Bd. of Educ. for furnishing material and erecting an 8-room addition to the East Side Central Bldg. Franklin Hubbard, Clk. Bd. of Educ.

Cleveland, O.—The Bd. of Education on Jan. 6 sold $250,000 school bonds.

Huntington, Ind.—Bids will be received Jan. 23 by John D. Miller, Trus. of Union Township, for furnishing material and erecting an addition to brick school in Dist. No. 5. A. D. Mohler, Archt., Huntington.

Darien, Wis.—Bids are wanted Feb. 2 for erecting a high school in Dist. No. 7. Address H. J. Heyer.

Ames, Ia.—The Trus. of the Iowa State College are stated to have adopted the preliminary plans of Proudfoot & Bird, of Des Moines, for the erection of the central building; cost, $225,000.

Des Moines, Ia.—Mrs. D. R. Ewing has donated $25,000 to Drake University, for a library building.

Normah, O. T.—The University Science Hall is reported destroyed by fire Jan. 6.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids will be received Jan. 20 by F. W. Gibson, Deputy & Acting Comr. of Street Cleaning, for furnishing and delivering 100 ash carts; also 100 combination can and bag carriers for the Boroughs of Manhattan and Bronx.

Wilmington, Del.—According to local press reports the following are the lowest bids received by the City Council Jan. 8 for collecting and removing the garbage for the next 3 years, beginning Feb. 1: For the entire city, J. Edw. Fahey, $31,000; 1st district, B. & W. F. Donohue, $4,968; 2d district, J. Edw. Fahey and John Logue, each $7,500; 3d district, J. Edw. Fahey, $8,750, and 4th district, A. G. B. Anderson, $14,750.

GOVERNMENT WORK.

Boston, Mass.—Bids are wanted Feb. 12 for constructing breakwater at Gloucester harbor. Capt. Harry Taylor, Corps Engrs.

Bids are wanted Feb. 16 for constructing a breakwater at Rockport Harbor, Mass. Capt. Harry Taylor, Corps Engrs., U. S. A.

Shamokin, Pa.—U. S. Senate has passed a bill providing for a public building for Shamokin, at a cost of $100,000.

Ft. Howard, Md.—Bids are wanted Jan. 26 for furnishing material for grading and roadmaking at this post. Capt. Wm. E. Horton, Q. M., Baltimore.

New York, N. Y.—Bids will be received at the U. S. Engr. Office, New York, Feb. 16, for dredging in Passaic River, N. J., as advertised in The Engineering Record.

Philadelphia, Pa.—Bids are wanted Feb. 21 for constructing a brick and steel building for machine, boiler and blacksmith shops at the Navy Yard, League Island, Pa. Appropriation, $307,650. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

St. Augustine, Fla.—Bids will be received at the U. S. Engr. Office, St. Augustine, Feb. 12, for constructing jetties at the entrance to St. Johns River, Fla., as advertised in The Engineering Record.

Norfolk, Va.—Bids will be received at the Engrs. Office, U. S. Army, Room 2, Custom House, Norfolk, until Feb. 13 for dredging harbor at Cape Charles City, Va.

Chicago, Ill.—Bids will be received at the U. S. Engr. Office, Chicago, Feb. 10, for dredging in Calumet River, Ill., as advertised in The Engineering Record.

Burlington, Ia.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., Feb. 19, for the construction of an extension to the U. S. Post Office at Burlington, as advertised in The Engineering Record.

Creston, Ia.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Feb. 25, for the installation of a conduit and electric wiring system for the U. S. Post Office at Creston, as advertised in The Engineering Record.

Superior, Wis.—Bids are wanted Feb. 9 for dredging trench for proposed new south pier, Superior Entry, Superior, Wis. Capt. D. D. Gaillard, Corps Engrs., U. S. A., Duluth, Minn.

Ft. Riley, Kan.—Bids will be received here by Capt. G. O. Cress, Q. M., until Feb. 16 for grading, as advertised in The Engineering Record.

Memphis, Tenn.—Bids will be received at the U. S. Engr. Office, Feb. 12, for levee construction in 3d Dist., improving Mississippi River, involving about 1,850,000 cu. yds. of earthwork, as advertised in The Engineering Record.

National Military Home, Kan.—Bids are wanted about Jan. 24 for furnishing material and constructing headquarters building, combination barracks and chaplain's quarters. J. G. Rowland, Governor.

Bids are wanted Feb. 10 for levee work in Upper and Lower St. Francis, White River, Upper Yazoo and Steel foot Levee Dists. Capt. F. W. Van C. Lucas, Corps Engrs.

Algiers, La.—Bids are wanted Feb. 4 for constructing a marine barracks and officers' quarters at the Naval Station, Algiers. Col. F. L. Denny, Quartermaster, U. S. M. C., Washington, D. C.

Boise City, Idaho.—The C. B. Kruse Htg. Co., of Milwaukee, Wis., is stated to have secured the contract for the ventilating and heating plant for the U. S. Government Bldg. at Boise City, for about $12,000.

San Diego, Cal.—Bids are wanted Feb. 9 for constructing a hospital; also for heating, plumbing and electric wiring several buildings; also for plumbing and wiring several other buildings. Address Capt. H. Rolfe, Q. M.

San Francisco, Cal.—Bids are wanted Feb. 18 for constructing 5 magazine buildings, renewal of water mains, repair to wharf and other works at the naval magazine, Mare Island, Cal. Blank proposals, with plans and specifications, will be furnished by the commandant of the Navy Yard on deposit of $25 to secure their return. Chas. O'Neil, Ch. Bureau of Ordnance, Navy Dept.

MISCELLANEOUS.

Marlboro, Mass.—See "Sewerage and Sewage Disposal."

New York, N. Y.—The lowest bid for building Jefferson Park is stated to have been submitted by Bart. Dunn, 444 E. 68th St., for $146,958.

Thos. Cockerill & Son, 147 Columbus Ave., are stated to have submitted the lowest bid for erecting a pavilion in Wm. H. Seward Park, for $78,000.

Bids will be received Jan. 22 by the Park Bd. for furnishing and delivering a portable stone crushing plant, trucks and carts for parks; also for furnishing and delivering cement, lime and brick in Bronx and Claremont Parks, Boro. Bronx. Wm. R. Wilcox, Chmn. Comrs. of Parks.

Bids will be received Jan. 22 by Thos. Sturgis, Fire Comr., for furnishing and delivering 20 steel heaters for use in the Boroughs of Manhattan and Bronx.

Bids will be received Jan. 27 by McDougall Hawkes, Comr. of Docks, for furnishing material required for the construction of a pier with appurtenances on the westerly side of Blackwell's Island, in the vicinity of Metropolitan Hospital, East River.

Brooklyn, N. Y.—The Union Terminal Co. has been incorporated, with a capital of $40,000,000, to construct a tunnel to connect the trolley and steam lines of Jersey City with Union Square and the Bushwick section of Brooklyn. The promoters include Francis H. Leggett, of Morristown, N. J.; Appleton D. Palmer,

of 100 Bway., New York, and Kenneth L. MacLaren, of Jersey City, N. J.

Bids will be received Jan. 26 by C. B. J. Synder, Supt. of School Bldgs., N. Y. City, for furnishing and delivering plumbers', steamfitters', etc., supplies to the workshop of the Dept. of Educ. for the year ending Dec. 31, 1903.

Grand Ledge, Mich.—Saml. Jarvis, of Lansing, is reported interested in the construction of a dam at the Beach site, 3 miles above Grand Ledge. A steam plant will also be instituted.

Shreveport, La.—Bids are wanted Feb. 4 for constructing the following levee work in the parish of Caddo: Simpson Lake levee, 15,000 cu. yds.; Hurricane Bluff levee, 40,000 cu. yds.; Upper Eagle Bend levee, 10,000 cu. yds.; Bagley levee, 25,000 cu. yds.; Long Point levee, 40,000 cu. yds.; Woodlawn levee, 15,000 cu. yds.; Ashwood levee, 25,000 cu. yds.; Upper Pascagoula levee, 30,000 cu. yds., and Whitehall levee, 25,000 cu. yds. Address State Engr. S. N. Kerley, Secy. Bd. of Comrs.

Marysville, Cal.—E. J. Thorp, a prominent rancher of this section, is reported to have devised a plan for relieving the vast Sutter County tule basin of flood waters; his plan is to cut a 300-ft. wide canal from the Southern Pacific trestle southwesterly to the junction of the Feather and Sacramento Rivers. An appropriation to dig the proposed canal will be asked from the State.

Winnipeg, Man.—Bids are wanted Feb. 17 for about 15,000 to 20,000 bbls. of cement, as advertised in The Engineering Record.

NEW INDUSTRIAL PLANTS.

The Roberts, Johnson & Rand Shoe Co., 13th & Mullanphy Sts., St. Louis, Mo., will erect a 5-story, 200x60-ft. factory building. Electric transmission of power will be used, and an engine of about 250-H.-P., with a direct-connected dynamo of about 175-Kw., and boilers of proportionate capacity, will be required.

The Standard Rock Candy Co., St. James Bldg., New York, has in course of erection at Nos. 445 to 457 West 31st St., New York, a 6-story, basement and sub-basement, fireproof factory of mill construction, which will be equipped with Corliss tandem condensing engines, dynamos, motors, compression refrigeration, etc. The mechanical engineering of the plant is in charge of P. R. Moses, 35 Nassau St., New York, and P. J. Carlin & Co., Brooklyn, are the principal contractors for the building.

The Challenge Machinery Co., 2529-2555 Leo St., Station W, Chicago, will at once commence the erection of a 2-story factory, to be about 50x500 ft., with a 50x60-ft. power house, at Grand Haven, Mich. A 125-H.-P. engine and boilers of 200 H.-P. will be installed.

The Standard Food Co., Binghamton, N. Y., will erect a 3 and 4-story, 44x134-ft. factory and install a 100-H.-P. engine and a 150-H.-P. boiler.

The Christy Fire Clay Co., St. Louis, Mo., will erect a 4-story building to be about 60x200-ft., the basement to be devoted to preparing and tempering clay batches, and the main and upper floors to making clay products. Provision will be made in the basement for grinding and conveying machinery and there will be two elevators running to the upper floors. The plant will be provided with the necessary kilns, railroad tracks and storage facilities.

The Belleville, Ont., Portland Cement Co., Ltd., will begin the construction of a 2,500-bbl. mill as soon as the weather permits. The buildings will be built of stone and include a 125x220-ft. kiln room, 60x165-ft. engine room, 115x165-ft. mill room, stone and coal houses, storehouses, machine shop, etc. The power plant will consist of four 400-H.-P., tandem compound engines direct-connected to line shafts, two 400-H.-P. engine generator units, and two 100-H.-P. lighting engines. C. B. English, mechanical engineer.

The Lawrenceville, Va., Mfg. Co. will erect a furniture factory and install an electric light plant of 300 incandescent and 30 arc lights. The company will need boilers, engines, dynamos, motors, etc. Hugh C. Risdon, Secy.

The Hartford Dairy Co., 49 Catlin Bldg., Hartford, Conn., has let the contract for a new building, and is in the market for boilers of 200 H.-P. and a 25 to 30-ton refrigerating plant. The ice machinery, including the well and brine pumps, and the separators and clarifiers, will be driven by steam, and other special machinery will be driven by electric current furnished by the Hartford Electric Light Co.

George A. Stevens, Hartsville, Mass., is erecting a 2-story, 100x44-ft. box shop and saw-mill and a 30x50-ft. foundry at Great Barrington. The capacity of the power plant will be 60 H.-P.

The Champion Tool & Handle Works, Evart, Mich., will erect a branch plant at Cairo, Ill. The main building will be 90x40 ft., and gasoline engines will be installed.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., reports the following among recent sales: Cleveland, O., Worsted Co., 175-H.-P. tandem compound engine; Pittsburg, Pa., Spring & Steel Co., two 160-H.-P. engines.

The Sprague Electric Co. supplied a large amount of flexible metallic conduit and steel armored conductors for the new addition to the White House in Washington, and has also received additional orders for ventilating outfits for the same building.

Among recent orders received by the American Blower Co., of Detroit, Mich., are mentioned six large steel plate fans with electric motors for public baths in New York City; heating and ventilating apparatus for a school at Delray, Mich.; for schools Nos. 26 and 53, Buffalo, N. Y.; Hibernian Bank & Trust Co., New Orleans; the Deming Co., Salem, O.; Arbuckle Bros.; Mishawaka, Ind., Woolen Mfg. Co.; M. B. Martin Co., Grand Rapids, Mich.; also mechanical draft apparatus for the American Brewing Co., Indianapolis, and the Douglas, Ariz., Improvement Co., and drying outfits for the Palmer Mfg. Co., Detroit; cooperage plant of Arbuckle Bros., New York City; Wisconsin Veneer Co., Rhinelander, Wis.; Harbison & Walker Co., Hays Station, Pa.; and the Canton & Malvern Fire Brick Paving Co., Akron, O.

The Robinson Merrill Pottery Co., The Robinson Bros. & Co., The Crown Fire Clay Co., The Royal Sewer Pipe & Fire Brick Co., The Lock Haven Sewer Pipe Co., and The Canton & Malvern Fire Brick Paving Co. have been merged into The Robinson Clay Product Co., of Akron, O., which will own and operate the above named properties. The personnel of the management will be unchanged.

The New York Continental Jewell Filtration Co. reports that it has received an order from the York, England, Water Works for an additional filter plant, to have a daily capacity of 2,000,000 imperial gallons. The company installed a filter plant at York last year with a daily capacity of 4,000,000 gallons, which is now to be increased to 6,000,000 gallons. The company also reports an order from the Hungarian Government for the equipment of the Royal Hungarian R. R. near Buda Pesth, and an order for an addition to the boiler feed water purifying plant at the 179th St. pumping station of the Manhattan Department of Water Supply, New York.

The Equitable Building, Boston, which was partially destroyed by fire on Jan. 9, will be entirely rewired by Sargent, Conant & Co., of that city, who had a crew of men at work making temporary connections within twenty minutes after the fire was under control. It may be noted that this company, whose old offices were entirely gutted, was transacting business in new quarters with a complete office equipment, telephone service, etc., in less than twenty-four hours after the fire was extinguished.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Jan. 20.	Evans, Colo.	Dec. 27
Jan. 24.	Middletown, N. Y.	Jan. 10
Jan. 26.	Sacramento, Cal.	Jan. 17
Jan. 28.	Filters, reserv'r, etc., Washington, D.C.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
Jan. 30.	Havre, Mont.	Dec. 27
Feb. 1.	Brinkley, Ark.	Jan. 10
Feb. 2.	Wessington Springs, S. D.	Jan. 17
Feb. 2.	Pumping Engine, Winnipeg, Man.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 2.	Rayne, La.	Jan. 17
Feb. 2.	Winnipeg, Man.	Jan. 10
Feb. 2.	Gillett, Wis.	Jan. 10
Feb. 6.	Wellsville, O.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Mar. 14.	Dillon, Mont.	Jan. 10
———	Metera, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Jan. 19.	Ottumwa, Ia.	Jan. 17
Jan. 21.	Buffalo, N. Y.	Jan. 17
Jan. 21.	Cincinnati, O.	Jan. 10
Jan. 22.	Cleveland, O.	Jan. 17
Jan. 23.	Sandusky, O.	Jan. 17
Jan. 23.	Decatur, Ill.	Jan. 3
Jan. 24.	Spokane, Wash.	Jan. 17
Jan. 24.	Dixon, Ill.	Jan. 10
Jan. 26.	Columbus, O.	Jan. 17
Jan. 26.	Lewiston, Idaho	Jan. 17
Jan. 26.	Cincinnati, O.	Jan. 3
Jan. 27.	New Haven, Conn.	Jan. 17
Jan. 27.	Newark, O.	Jan. 10
Jan. 29.	Ft. Duchesne, Utah.	Jan. 10
Jan. 31.	Rock Island, Ill.	Jan. 17
Jan. —	Walnut, Ill.	Dec. 13
Feb. 2.	New Orleans, La.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Jan. 17.	
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 7.	Philadelphia, Pa.	Jan. 10
Feb. 9.	Cincinnati, O.	Jan. 17
Feb. 14.	Washington, D. C.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Mar. 1.	Peoria, Ill.	Jan. 17
	BRIDGES.	
Jan. 20.	Albany, N. Y.	Jan. 17
Jan. 20.	Substructure, Northport, Wis.	Jan. 17
Jan. 20.	New York, N. Y.	Jan. 3
Jan. 21.	Superstructure, Northport, Wis.	Jan. 17
Jan. 24.	Casco, Mich.	Jan. 17
Jan. 24.	Wingham, Ont.	Jan. 17
Jan. 27.	East Peoria, Ill.	Jan. 10
Jan. 28.	Springfield, O.	Jan. 10
Jan. —	Peoria, Ill.	Dec. 13
Feb. 1.	Jacksonville, Fla.	Jan. 10
Feb. 9.	Fredericton, N. B.	Jan. 17
Feb. 10.	Arkadelphia, Ark.	Jan. 10
Feb. 10.	Castroville, Tex.	Jan. 3
Feb. 14.	Bay City, Mich.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
	PAVING AND ROADMAKING.	
Jan. 20.	Sioux City, Ia.	Jan. 17
Jan. 20.	Lindsay, Ont.	Jan. 17
Jan. 20.	Cleveland, O.	Jan. 10
Jan. 22.	Buffalo, N. Y.	Jan. 17
Jan. 23.	Denver, Colo.	Jan. 17
Jan. 23.	Cincinnati, O.	Jan. 10
Jan. 24.	Greenville, O.	Jan. 10
Jan. 26.	Toledo, O.	Jan. 17
Jan. 26.	Union, N. J.	Jan. 10
Jan. 27.	Seattle, Wash.	Jan. 17
Jan. 27.	Cleveland, O.	Jan. 10
Jan. 29.	Cleveland, O.	Jan. 3
Jan. 30.	Owosso, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Jan. 31.	Akron, O.	Jan. 17
Feb. 1.	Burlington, Ia.	Jan. 3
Feb. 3.	Springfield, Mo.	Jan. 17
Feb. 3.	Cleveland, O.	Jan. 10
Feb. 4.	Portland, Ind.	Jan. 17
Feb. 4.	Sandusky, O.	Jan. 10
Feb. 4.	Cincinnati, O.	Jan. 10
Feb. 9.	Toledo, O.	Jan. 17
Feb. 10.	Newark, O.	Jan. 17
Feb. 14.	Lafayette, Ind.	Dec. 27
Feb. 17.	Three Rivers, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 23.	Fond du Lac, Wis.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
	POWER, GAS AND ELECTRICITY.	
Jan. 19.	St. Paul, Minn.	Jan. 17
Jan. 19.	New York, N. Y.	Jan. 10
Jan. 30.	Havre, Mont.	Dec. 27
Jan. —	South Norwalk, Conn.	Dec. 13
Feb. 1.	Brinkley, Ark.	Jan. 10
Feb. 2.	Rayne, La.	Jan. 17
Feb. 10.	Granbury, Tex.	Jan. 17
Feb. 12.	Guayaquil, Ecuador	Dec. 20
———	Franchise, Vicksburg, Miss.	Jan. 17
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Jan. 20.	San Francisco, Cal.	Jan. 10
Jan. 20.	Seattle, Wash.	Jan. 3
Jan. 21.	Los Angeles, Cal.	Jan. 3
Jan. 22.	Chattanooga, Tenn.	Dec. 27
Jan. 22.	Buffalo, N. Y.	Dec. 27
	Adv., Eng. Record, Dec. 27 to Jan. 17.	
Jan. 22.	Dredging, Boston, Mass.	Dec. 20
	Adv., Eng. Record, Dec. 20, 27, Jan. 10, 17.	
Jan. 24.	Ft. Fremont, S. C.	Jan. 3
Jan. 24.	National Military Home, Kan.	Jan. 17
Jan. 26.	Ft. Howard, Md.	Jan. 17
Jan. 26.	Chicago, Ill.	Jan. 3
Jan. 26.	St. Augustine, Fla.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
Jan. 27.	Creston, Ia.	Jan. 3
Jan. 28.	Ft. Caswell, N. C.	Jan. 10
Jan. 29.	Ft. Duchesne, Utah.	Jan. 10
Jan. 29.	Philadelphia, Pa.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
Jan. 30.	Newport, R. I.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
Jan. 31.	Ft. Caswell, N. C.	Jan. 10
Feb. 2.	Ft. Wadsworth, N. Y.	Jan. 10
Feb. 3.	New York, N. Y.	Jan. 10
	Adv., Eng. Record, Jan. 10, 17.	
Feb. 3.	San Francisco, Cal.	Jan. 3
Feb. 4.	Algiers, La.	Jan. 17
Feb. 4.	Boston, Mass.	Jan. 10
Feb. 5.	Grand Rapids, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10, 17.	
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 6.	Ft. Logan, Colo.	Jan. 10
Feb. 7.	Sewer, Philadelphia, Pa.	Jan. 10
Feb. 7.	Dry dock, Philadelphia, Pa.	Dec. 20
Feb. 9.	San Diego, Cal.	Jan. 17
Feb. 9.	Superior, Wis.	Jan. 17
Feb. 9.	Little Rock, Ark.	Jan. 10
	Adv., Eng. Record, Jan. 10, 17.	
Feb. 10.	Chicago, Ill.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 10.	Memphis, Tenn.	Jan. 17
Feb. 10.	Boston, Mass.	Jan. 10
Feb. 12.	Memphis, Tenn.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 12.	St. Augustine, Fla.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 12.	Boston, Mass.	Jan. 17
Feb. 12.	Newport, R. I.	Jan. 10
	Adv., Eng. Record, Jan. 10, 17.	
Feb. 13.	Norfolk, Va.	Jan. 17
Feb. 16.	Ft. Riley, Kan.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 16.	New York, N. Y.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 16.	Boston, Mass.	Jan. 17
Feb. 18.	San Francisco, Cal.	Jan. 17
Feb. 19.	Burlington, Ia.	Feb. 17
	Adv., Eng. Record, Jan. 17.	
Feb. 21.	Bldg., Philadelphia, Pa.	Jan. 17
Feb. 25.	Creston, Ia.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
	BUILDINGS.	
Jan. 19.	School, Watertown, N. Y.	Jan. 17
Jan. 19.	School, Syracuse, N. Y.	Jan. 17
Jan. 19.	School, New York, N. Y.	Jan. 10
Jan. 19.	School, Brooklyn, N. Y.	Jan. 10
Jan. 20.	School, Dallas, Tex.	Jan. 10
Jan. 20.	School, Bloomer, Wis.	Jan. 10
Jan. 20.	Pub. Bldg., Danville, Ky.	Jan. 3
Jan. 20.	Bus. bldg, Flint, Mich.	Dec. 20
Jan. 21.	Pub. Bldgs., Brooklyn, N. Y.	Jan. 17
Jan. 21.	School, Boston, Mass.	Jan. 17
Jan. 22.	Court house, Corsicana, Tex.	Jan. 10
Jan. 23.	School, Huntington, Ind.	Jan. 17
Jan. 23.	Pub. Bldg., Canton, O.	Jan. 17
Jan. 23.	Bank, Mandan, S. D.	Jan. 17
Jan. 23.	Jail, Grand Junction, Colo.	Dec. 13
Jan. 24.	School plans, Milwaukee, Wis.	Jan. 10
Jan. 26.	School, Brooklyn, N. Y.	Jan. 17
Jan. 26.	School, Boston, Mass.	Jan. 17
Jan. 27.	Library, Jackson, Mich.	Jan. 17
Jan. 27.	School, Abercrombie, N. D.	Jan. 10
Jan. 28.	Hospital, Kings Park, L. I., N. Y.	Jan. 17
Jan. 28.	Court house, Centerville, Ia.	Jan. 10
Jan. 28.	Library, San Bernardino, Cal.	Jan. 10
Jan. 30.	Masonic Temple, Washington, D. C.	Jan. 10
Jan. 30.	School, Geneseo, N. Y.	Dec. 13
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Jan. —	Church, Marine City, Mich.	Dec. 27
Feb. 1.	Church, Springfield, O.	Jan. 10
Feb. 1.	School, Clarksville, Ia.	Jan. 3
Feb. 1.	Hospital, Springfield, O.	Jan. 3
Feb. 1.	Office Bldg., Flint, Mich.	Dec. 27
Feb. 1.	Pub. Bldg. Plans, Louisville, Ky.	Dec. 27
Feb. 1.	School, Dickinson, N. Y.	Dec. 6
Feb. 2.	School, Darien, Wis.	Jan. 17
Feb. 2.	Hotel, Beaumont, Tex.	Jan. 10
Feb. 2.	Warehouse, Aberdeen, S. D.	Jan. 10
Feb. 2.	City Hall, Houston, Tex.	Dec. 13
Feb. 3.	School, Columbus, O.	Jan. 10
Feb. 7.	School, Toledo, O.	Jan. 17
Feb. 10.	Court house, Lawrence, Kan.	Jan. 17
Feb. 14.	Library, Norfolk, Va.	Jan. 10
Feb. 17.	Church, Carrollton, Ky.	Jan. 17
Feb. 18.	Church, Selma, Ala.	Jan. 17
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
	MISCELLANEOUS.	
Jan. 20.	Garb. Disp., New York, N. Y.	Jan. 17
Jan. 20.	Railroad, Boston, Mass.	Jan. 17
Jan. 20.	Garb. Disp., Kansas City, Mo.	Jan. 10
Jan. 22.	Supplies, New York, N. Y.	Jan. 17
Jan. 22.	Steel Heaters, New York, N. Y.	Jan. 17
Jan. 24.	Breakwater, Halifax, N. S.	Jan. 3
Jan. 26.	Supplies, Brooklyn, N. Y.	Jan. 17
Jan. 27.	Pier, New York, N. Y.	Jan. 17
Feb. 3.	E. Ry. franchise, Pasadena, Cal.	Jan. 17
Feb. 4.	Levee Work, Shreveport, La.	Jan. 17
Feb. 5.	Levee Work, Bossier City, La.	Jan. 10
Feb. 17.	Cement, Winnipeg, Man.	Jan. 17
	Adv., Eng. Record, Jan. 17.	
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. —	R. R. Work, Creeda, Colo.	Jan. 10
———	R. R. work, Cincinnati, O.	Dec. 20

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The Resistance or Strength of Metals under High Temperatures.

In the consideration of the strength or resistance of structural metals the condition of ordinary temperature is so closely associated with the values commonly employed in engineering work that the effect of either very high or very low temperatures is frequently lost sight of. In the exigencies of modern construction much more than formerly, the influence of extreme temperatures is frequently of the greatest moment. Up to the present time the effect of very low temperatures is of little consequence, although the old idea that iron or steel would become excessively brittle at the extremely low temperatures of this latitude still holds in some quarters in spite of the fact that such results were chiefly, if not entirely due to the presence of an amount of phosphorus not now tolerated in structural iron or steel. Undoubtedly those directions in which the effect of unusual temperatures are of the most consequence lie in the field of such structures as one subject to high temperatures induced by conflagrations.

This latter observation is especially applicable to the beams and columns employed in the construction of high office and other similar buildings. It was but a very few years ago that the Building Department of the City of New York conducted a number of tests of cast iron and steel columns at various temperatures, running up to at least 2,000 degrees Fahrenheit, with results that attracted much attention in consequence of their important bearing upon building construction. These columns were loaded while subjected to high temperature. It is difficult to draw perfectly definite conclusions from the results of such tests in consequence of the variety and complication of attending conditions, but probably it may be stated with essential accuracy that the stiffness or strength of either cast iron or steel columns is not sensibly affected under 500 or 600 degrees Fahrenheit. It has been the common impression that cast iron columns would be less affected by high temperatures generated in burning buildings than the same class of members built of steel. The results of the tests by the Building Department of New York City, to which allusion has already been made, do not justify that opinion.

Other and earlier tests, chiefly in tension, of iron and steel in small sections have clearly demonstrated that those structural metals lose no essential part of either their elasticity or strength below 500 to 600 degrees Fahrenheit. Indeed in some tests the greatest resistance has apparently been found considerably above ordinary temperatures. The results of these tensile tests confirm those derived from the testing of columns, and indicate that by the modern operations of fire-proofing with casings of clay products or similar materials it is perfectly feasible to insure the full resisting capacity of metal members in all ordinary conflagrations.

A most interesting and, indeed, a most remarkable test of structural metal at high temperatures occurred in the recent spectacular fire at the top of the Manhattan tower of the Williamsburg Bridge across the East River, now in course of construction. The character and results of this fire were fully described in The Engineering Record of November 15th of last year. The effects of that fire on the wire cables of the bridge were of such crucial importance to their carrying capacity that a commission of engineering experts was appointed by the Commissioner of Bridges to report upon the condition of the cables and recommend such measures of reinforcement as might seem advisable. The conclusions and recommendations of that commission will be found in The Engineering Record of January 17th. The report indicates that comparatively little damage was done to the wires of any of the cables. This will be realized when it is stated that the diminution of strength of the two cables most affected was but 2.5 and 6.5 per cent. respectively, and was more than made up by the excess of strength of the wires above specification requirements. The exposure of these cables in the vicinity of the saddles to the direct effect of the hot fire immediately about them reduced the ultimate resistance of the outside wires from a probable value of 220,000 pounds per square inch to 80,000 pounds per square inch, the latter value being about the ultimate resistance of the original steel rods from which the wires were drawn. In other words, the fire subjected these outside wires to a kind of annealing process only, which removed the hardening and strengthening effects of the cold drawing to which the metal was subjected in the process of manufacture. Intrinsically it might be said that the quality of the metal was not injured at all, in that the ultimate resistance was simply reduced to its original value. Indeed, it would be interesting to ascertain whether cold redrawing would not restore the ultimate resistance to its wire value.

It is further important to observe that the commission of experts reports that in the most injured wires the modulus of elasticity was practically unaffected as the loss was but a little more than 2 per cent. This has a most important bearing upon leaving a number of the injured wires in the cables where they were inaccessible. This result means that the elastic properties of the wire were essentially unchanged by the heat so that even the wires most injured would act under loading in a perfectly concurrent manner with those uninjured, as the maximum intensity of stress would in no case nearly equal the elastic limit. The results of the fire on the Manhattan tower of the Williamsburg Bridge therefore add decidedly to our knowledge of the effect of high temperatures on the steel wires of suspension bridge cables. They show, while replacement and readjustment may be necessary, that under ordinary circumstances of a conflagration even, the metal will not necessarily be so affected as to become really dangerous.

Continued Growth of the American Society of Civil Engineers.

The almost phenomenal advancement of the American Society of Civil Engineers, which called forth comment and congratulations a year ago, has continued during the year just closed, as shown by the report of the Board of Direction just rendered. The increase in membership very nearly equals the record-breaking figures of 1901. During the twelve months 362 applications were received and 328 persons were elected to the various classes of membership, while 90 applications still await action. The net gain for the year was 185; that for 1901 was 191 and for 1900, 138. The loss by death was 32. The average gain for the last four years has been 154. There are now 665 members of all classes residing within 50 miles of the post-office in New York and 2,048 non-resident members, which make the total membership 2,713. These "vital statistics," as they may be called, certainly indicate a vigorous condition and the probability of continued healthful growth.

The library was increased by 1,116 bound volumes, 2,968 unbound volumes, 3,095 specifications and 307 maps, photographs and drawings, making the total accessions 7,486, not counting the 489 duplicates and 234 numbers of periodicals required to complete files. The growth for 1902 has, therefore, exceeded that of 1901 by 1,459 accessions. The library now contains 47,597 books, specifications, maps, etc. This rapid growth of the library has made it wise to prepare a second volume of the classified catalogue, the first volume of which was published in 1900. It is expected that the second volume will be ready for distribution to members in about a month. The inventoried value of the library is $48,425.

The high quality of the Society's publications has been fully maintained and the usual ten numbers of the "Proceedings" have been issued, but it has been necessary to publish three volumes of the "Transactions," instead of two, as usual. The Society now has on hand a stock of its various publications amounting to 119,850 copies, which have cost $13,904. These are kept for the convenience of members and others wishing to purchase them. The publications for the year have contained 3,045 pages, 92 plates and 468 cuts, and the cost of publication has been $11,309. $5,039 have been received for advertisements and other publications sold, making the net cost $6,270.

On January 15, 1903, a payment of $10,000 on the principal of the mortgage on the Society's house, authorized by the Board of Direction, reduced the debt to $55,000, which now bears interest at 4 per cent. $30,000 has been paid upon the permanent debt in four years. The receipts from all sources during the year amounted to $62,497.85, the disbursements amounted to $52,193.77, and the balance on hand December 31, 1902, was $26,297.39, so that the financial showing at the end of the year just closed is better than that of the preceding year, when the balance on hand was $15,993.

The Omaha Interstate Bridge.

The Omaha Bridge and Terminal Railway Company's bridge is about 1,620 feet long between abutments and crosses the Missouri River from East Omaha to Council Bluffs, Iowa. When completed in 1893 it consisted of a steel draw span 520 feet long, three 192-foot fixed through spans and 550 feet of timber trestle. The draw span was of permanent construction designed to carry two railroad tracks between the trusses and for the future addition of outside cantilever roadways for electric cars, highways and pedestrian traffic. The remainder of the structure was of temporary construction designed for a single track railroad and was floored to permit vehicular traffic. The pivot piers had two concentric steel cylinders filled with concrete and sunk to bed rock about 120 feet below low water by open dredging, as described in The Engineering Record of March 3, 1894. The rest of the substructure consisted of piles which are still in good condition although three of the piers are located in the channel where they have withstood high water and have been subjected to great scour, which displaced them only a few inches before the movement was stopped by riprapping and submerged bracing.

When the bridge was built it was intended to replace, in about 7 years, all but the draw span with a permanent steel structure and to facilitate this its axis was located at an angle of 10 degrees and 53 minutes with that of the permanent structure intersecting it in the center of the pivot pier as indicated by the accompanying plan. This arrangement enables the new structure to be erected without interrupting the traffic on the old one and permits the original draw to be thrown into service in the new alignment by simply swinging it a few degrees to clear the old end piers and rest on the new ones. It was originally intended to build a permanent 560-foot fixed span adjacent to the draw span; but as the river channel is constantly changing it has been decided to build a second draw span, substantially duplicating the first one, adjacent to it on the west, and its cost, including the substructure, is found to be considerably less than for the alternative fixed span. With this arrangement the main channel must remain underneath the draw spans unless it moves entirely beyond its present banks.

The new substructure will contain about 15,600 cubic yards of masonry, 20,000 linear feet of piles and 580,000 pounds of steel. It will include two masonry and concrete pivot piers with steel shells; two masonry and concrete piers on pneumatic caissons; one masonry pier with concrete base, and two abutments and seven piers of concrete on pile foundations. Concrete deposited under water is made of Portland cement and ¾-inch broken stone in the proportions of 1:2:3. All other concrete is made with 2½-inch broken stone in the proportions 1:3:5. All copings are made of granitoid one part Portland cement, two parts coarse granite sand and three parts ½-inch granite chips.

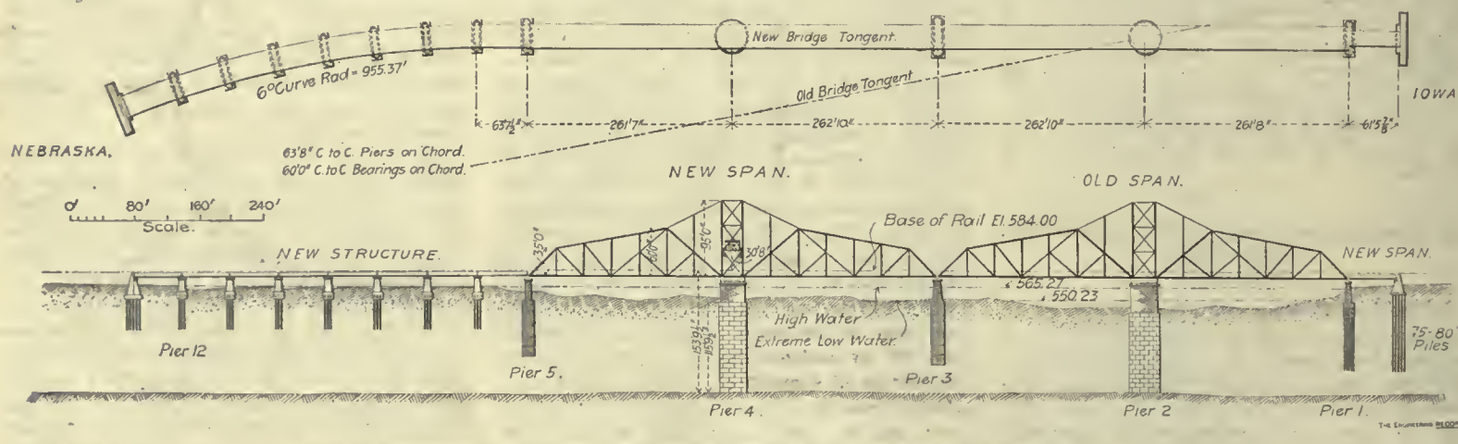
Pier 4, which is the new pivot pier, is practically a duplicate of the old pivot pier and like it will have concentric 20 and 40-foot vertical steel cylinders united by a conical diaphragm at the bottom and filled with concrete up to low water level. The cylinders will be braced by steel struts instead of temporary wooden ones which were used in the old pier. The outer cylinder is built of ½-inch and the inner one of ⅜-inch plates both in courses 6 feet high spliced with single horizontal and vertical cover plates and single horizontal flange angles on the inside only. The rivets in the cutting edge are countersunk on the outside but others are driven with full heads. Twenty 3-inch vertical pipes are carried down inside the outer cylinder to the cutting edge to provide for the operation of hydraulic jets to assist the sinking of the cylinders, which will be filled with concrete and have their upper courses built on as they are sunk by means of open dredging in the inner cylinder. The radial tie rods between the inner and outer cylinders remain in place while the corresponding struts which alternate with them are removed when the concrete is deposited there.

Pier 5 has its foundations built in a pneumatic caisson and cofferdam, similar to that shown for pier 3; but somewhat smaller, being 16x47 feet in plan instead of 18x53 feet. Each caisson has a 2½-foot material shaft and a 3-foot main shaft and has a cutting edge formed of an 8x8x¾-inch angle spiked to the lower side of the bottom timber and reinforced on the vertical flange by an 18x½-inch plate extending up over the outside of the wall. The inner corner of the 12-inch vertical timber to which it is spiked is beveled 45 degrees from the edge of the flange and has 3x½-inch bent straps bolted over it and the angle flange 2 feet apart. At the corners the horizontal flanges of the cutting edge angles are mitered and riveted to a triangular splice plate. The vertical flanges are spliced by outside bent cover plates.

The walls and roof of the working chamber are ceiled with 3-inch sheeting and all the principal timber is 12 inches square faced on all sides and fastened together with ⅞x22-inch drift bolts 4 feet apart. Each working chamber is crossed by three equi-distant transverse braces like the one shown in the plan and cross section, and the ends of the caisson are reinforced by three horizontal steel strips, which are carried 6 feet beyond the corners of the sides of the caisson. The permanent cofferdams above the working chambers are sheathed with 2-inch vertical planks and braced with longitudinal and transverse struts extending through from wall to wall in every fourth course. For pier 3 the cofferdam is 80½ feet high above the cutting edge and for pier 5 it is 70½ feet high.

Above the tops of the cofferdams the masonry piers are faced with Kettle River sand stone and have concrete backing. The faces are battered 1:24 and the ends are rounded to semicircles. On top of pier 4 there are nine courses of masonry with a vertical face 38 feet in diameter and a concrete backing.

The masonry for pier 1 resembles that for piers 3 and 5; but is seated on a concrete foundation in a timber crib 16 feet wide, 48 feet long and 20 feet high which, during construction, was extended 9 feet higher by temporary cofferdams. Its walls are made of solid courses of 12x12-inch timber and the 75 piles within it reach 16 feet above the lower edge and are surrounded by concrete thoroughly rammed. Piers 6 to 12 inclusive are made with concrete foundations about 4 feet wider and longer than the bases of the shafts. The foundations are 10 feet high and the piles which are about 3 feet apart on centers extend 7 feet above the lower surface of the foundation concrete. The sides of the shafts are battered 1:24 and are covered 6 inches deep with 1:3:5 Portland cement concrete, the body of the pier being made of 1:2:3 concrete. All the corners of the coping are rounded to a 3-inch radius and those of the shaft to a 6-inch radius. The insides of the forms were lined with sheet iron. The concrete abutments are faced with 6 inches of special concrete similar to that in the piers.



Permanent Old and New Structures of Omaha Interstate Bridge.

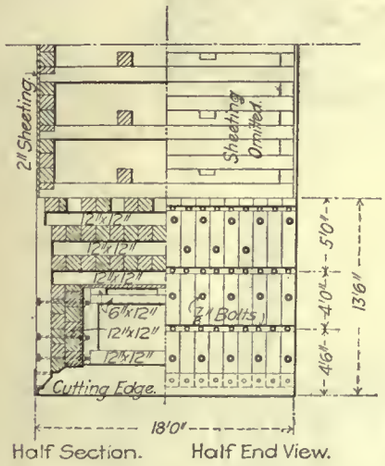
The old draw span was designed for live loads of 5,180 pounds, 4,150 pounds and 4,500 pounds per linear foot per track for the stringers, floor beams and trusses respectively and for a dead load of 6,100 pounds per linear foot for the whole bridge. The new draw span is designed for live loads of 8,450, 6,320 and 5,590 pounds per linear foot per track for the stringers, floor beams and trusses respectively, and for a dead load of 9,020 pounds per linear foot for the whole bridge. The total weight of steel in the old span was 2,768,000 pounds and in the new span and approaches will be 3,900,000 pounds and 1,773,000 pounds respectively, inclusive in all cases, of the weight of the cantilever floors which will not be erected at present.

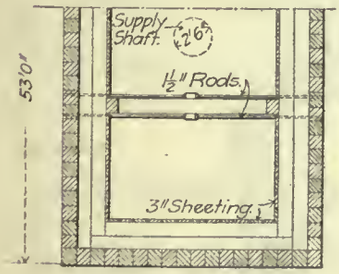
The 960-foot approach spans at the west end of the bridge have their axes in the chords of a 6-degree curve and consist of two lines of plate girders 9 feet deep and 28 feet apart on centers, which are connected by end and intermediate floor beams 7 feet deep and about 20 feet apart on centers. The girders have ½-inch web plates, 8x8x1-inch flange angles and 18-inch flange reinforcement plates built up to a thickness of 1 11/16 inches in the center of the span. The

web plates are about 15 feet long and their ends are planed and spliced with four vertical rows of rivets through two 12½x½-inch vertical cover plates. The flanges are spliced by the projecting ends of the top and bottom horizontal reinforcement plates and by pairs of 12¾x⅜-inch plates 3¼ feet long riveted over the webs of the flange angles. The splices are made so as to develop a camber of 1/1200 part of the length of the span. Cast iron shoes with three vertical webs are riveted to the lower flanges of the girders and take bearing on 7-inch pins through corresponding cast iron pedestals, which are shown in the detail. The expansion rollers have two grooves 12 inches apart to engage longitudinal strips on the base of the pedestal. There are no corresponding ribs on the cast iron base plate which, however, has braced vertical flanges on all sides which enclose the roller nests.

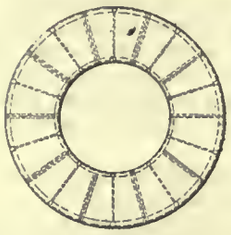
The floor beam webs are full length 7/16-inch plates and the flanges are pairs of 6x6x9/16-inch angles with two 14-inch cover plates. They are connected to the girders by sixty field-driven rivets at each end and carry four lines of stringers 3½ feet deep with ⅜-inch webs and pairs of 6x6x½-inch flange angles and 3½x3½-inch vertical web stiffener angles about 3¼ feet apart. Each stringer is connected to the floor beams with twenty-six field driven rivets at each end. Each panel between floor beams and main girders is X-braced by pairs of 3½x3½x⅜-inch angles riveted together back to back and having their horizontal flanges upwards and field-riveted across the lower flanges of the stringers and to connection plates riveted to the webs of the floor beams and girders, thus bringing the lateral system near the neutral axis of the girders and floor beams. 8x10-inch ties 13 inches apart on centers are hook-bolted to the tops of the stringers and are covered with a diagonal layer of 2-inch yellow pine plank and an upper transverse layer of 2½-inch plank spiked on between and outside of the rails.

The floor is carried across the space between the rounded ends of the draw spans on a special box girder supported by two vertical columns on the center line of pier 3. The columns are

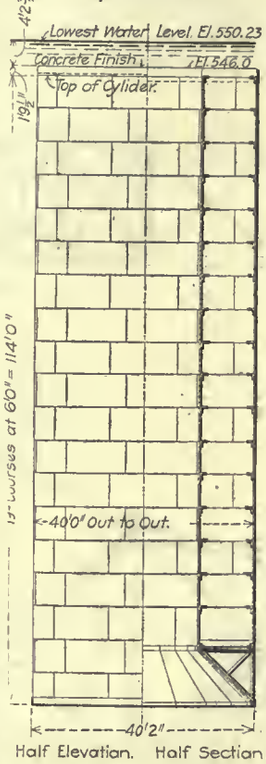




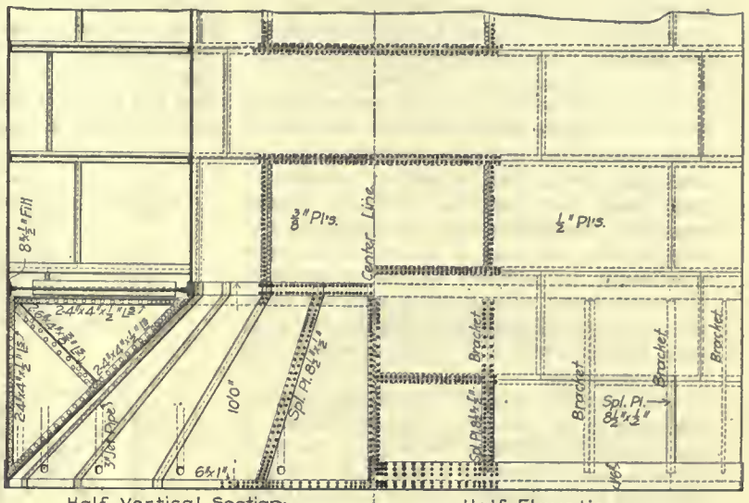
Part Sectional Plan.
Caisson for Pier 3.

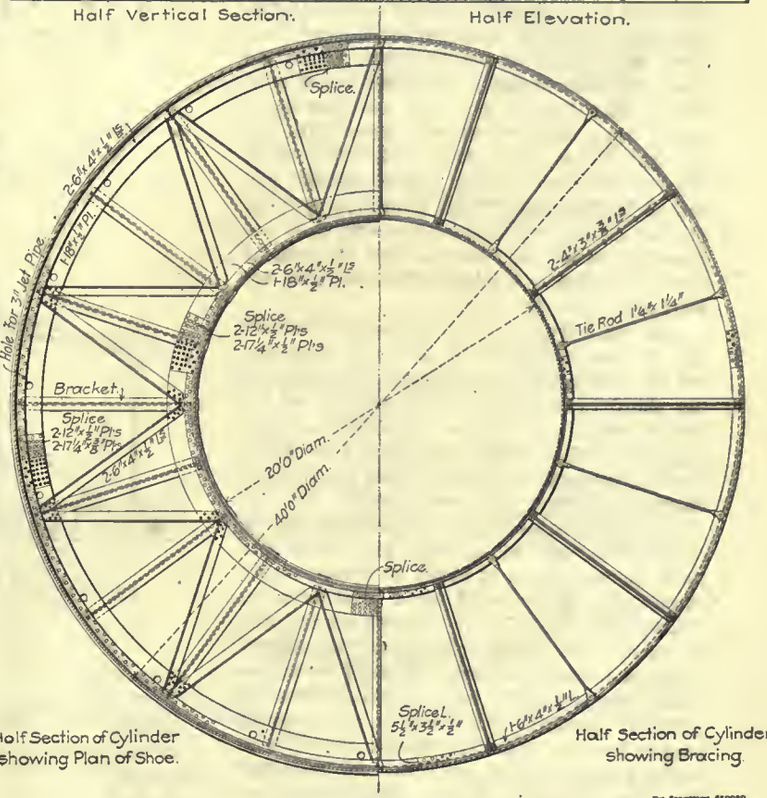


Top Plan of Shaft.

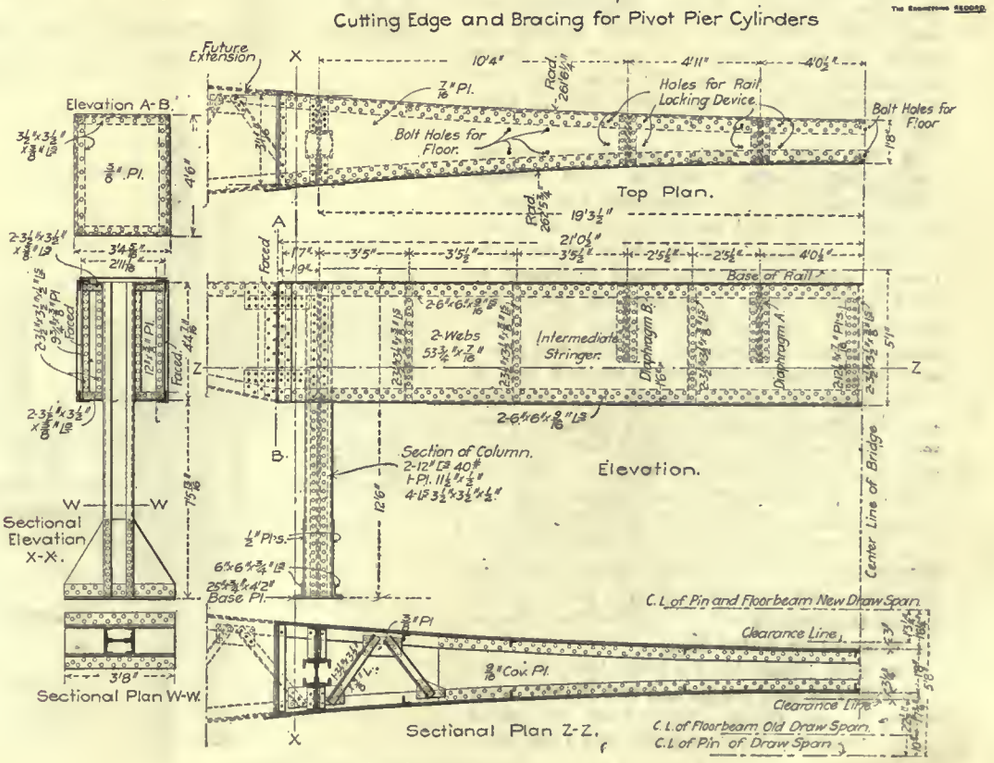


Half Elevation. Half Section.
Pivot Pier Cylinders.





Cutting Edge and Bracing for Pivot Pier Cylinders.



Platform over Pier between Old and New Spans.

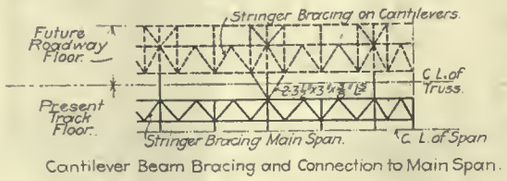
38 feet 7 inches apart on centers and have at the top, on each side, solid plate brackets 4½ feet deep and 3 feet wide from out to out, parallel with the bridge axis. These brackets are riveted to the solid webs of the girders, which project 21 inches beyond them to receive the future connection with the cantilevers for the roadways and sidewalks and are closed by longitudinal diaphragms as shown in the end elevation. The girder webs are curved to correspond with the curves of the old and new draw spans, are stiffened by four intermediate diaphragms and have a full length top cover plate and bottom plate extending nearly to the ends, beyond which the flanges are connected by lattice angles.

The outlines, general construction and dimensions of the new draw span correspond in most respects to those of the old; but the spans differ in several material points. The new live loads are much greater and the span is correspondingly heavier; all lateral and sway bracing is more rigid in the new than in the old span; all castings in the new span are of steel and in the old are of iron; the new span has a double drum and two sets of rollers, while the old span had a single drum and single set of rollers; the new drum is loaded through ball and socket bearings which were not used for the old drum; the ends of the new span are raised by wedges and those of the old span by toggles; the roller tracks for the new span are more rigid than for the old one.

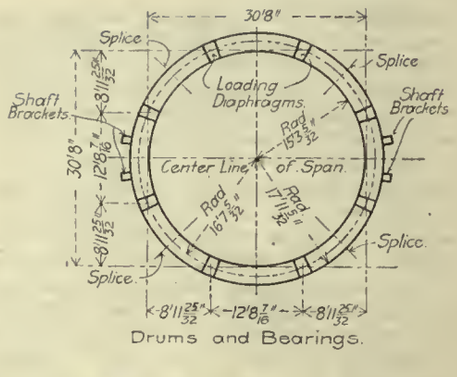
Each main truss is virtually composed of two side trusses supported on the end piers and the pivot pier and connected over the latter by top chord eye-bars to the upper ends of the tower posts. All truss members are pin-connected and all lateral and sway bracing has riveted connections, except the longitudinal diagonals between the tower posts. The top chord is of standard cross section with 36-inch cover plates and 3-inch webs and has a uniform sectional area of about 96 square inches throughout, proportioned for a total stress of 531,000 pounds tension or 1,700,000 pounds compression. The bottom chord has two 33-inch webs and a maximum cross section of 104 square inches proportioned for a total stress of 1,045,000 pounds compression or 1,184,000 pounds tension. The flanges are latticed with 3x3-inch angles which are also used to stiffen the edges of the tie plates. The inclined end posts have cross sections similar to the top chord, but differ from it in having six flange angles; one 6x6-inch on the lower edge and two 3½x3½-inch on the upper edge of each web.

In the plane of each truss there are six 12x1$^{7}/_{16}$-inch eye-bars with a total section of 103.5 square inches connecting the tops of the tower posts, and the inclined eye-bars connecting this panel with the hips of the side trusses which have their areas increased to 115.5 square inches to correspond with the inclination. Lattice-girder portals with knee braces connect both pairs of inclined end posts, and transverse struts and X-bracing are in every panel of the top chords. All of these are compression members with I-shaped cross sections made with two pairs of angles riveted together back to back and latticed. The portals are made with 6x4-inch angles and the lateral struts with 4x3-inch and 3½x3½-inch angles. The towers are connected by the X-bracing shown in the longitudinal transverse elevations and by 30 and 32-inch plate girders on all faces which carry the machinery house as indicated by dotted lines.

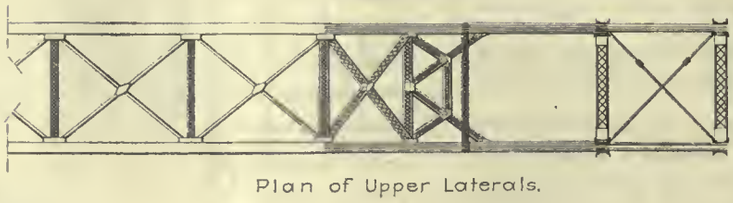
The floor beams have a 96x½-inch web and two 8x8x9/16-inch angles and two 16-inch cover plates in each flange. All of them are seated on the inner flanges of the lower chord and field-riveted through their end web stiffener angles to the vertical posts as shown in the general cross section. They support four lines of stringers 3 feet and 9½ feet from the bridge axis and are made with a 62x⅜-inch web plate and four 6x6x¾-inch angles. Panels between the

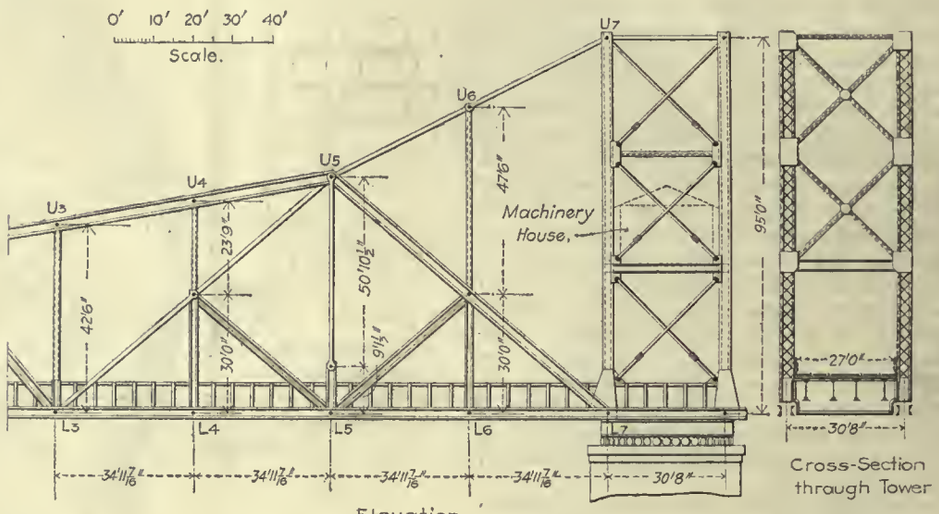


Cantilever Beam Bracing and Connection to Main Span.

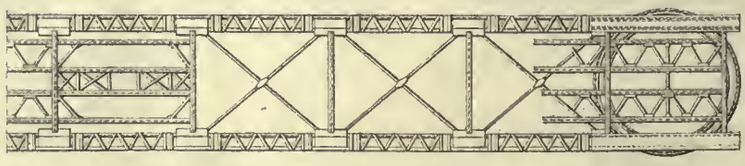


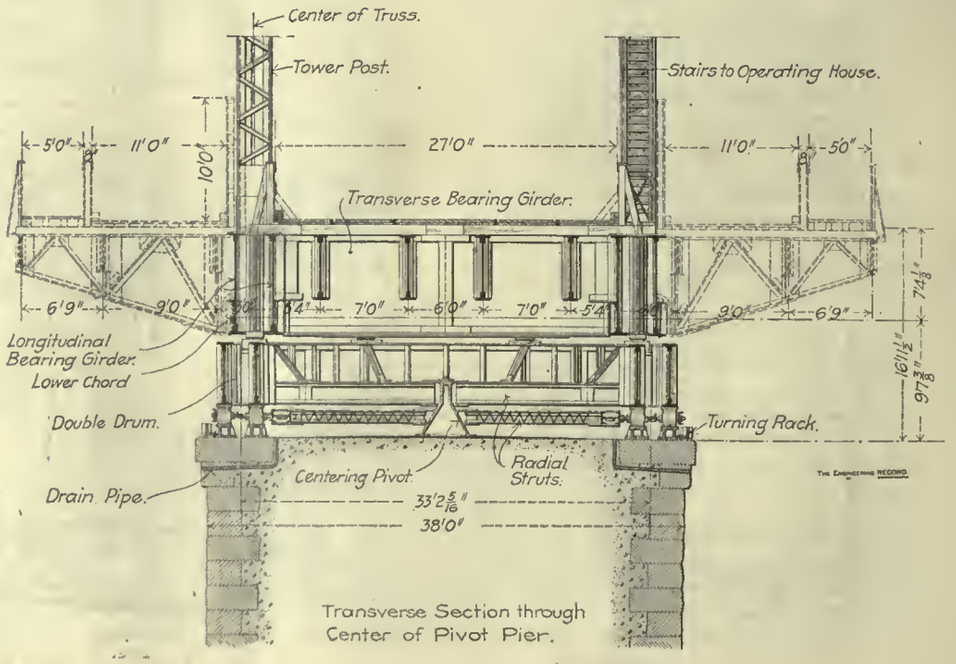
Drums and Bearings.


Plan of Upper Laterals.



Elevation.
Cross-Section through Tower

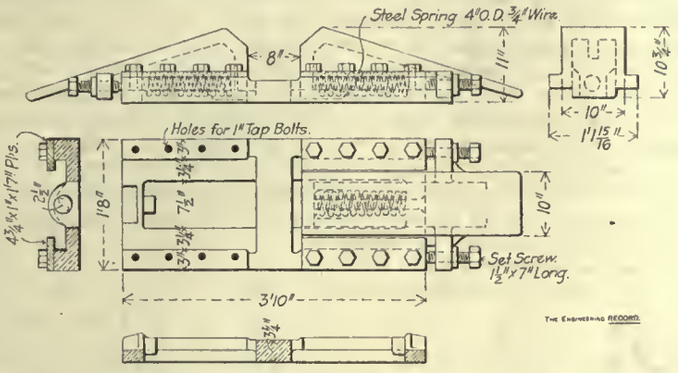

Plan of Lower Laterals.



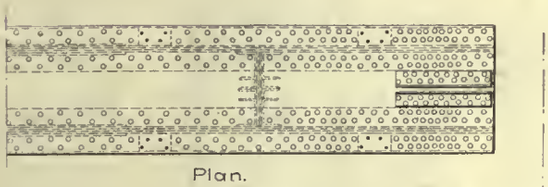
Transverse Section through Center of Pivot Pier.

lower chords and the floor beams are X-braced with struts, each consisting of four 5x3½x⅜-inch angles. All rivet holes in stringer and floor beam connections are reamed to cast iron templates. All intermediate vertical web stiffener angles are crimped and all end web stiffener angles are fillered. In the middle panel on each side of the pivot pier the stringers are braced with transverse struts and diagonal members on the center line as shown in the last full panel at the left of the general drawing. The remainder of the stringers are braced, with zigzag angles, as indicated at the extreme left. Each half of the main truss is cambered between the pivot pier and the end pier so as to have a maximum height of 4½ inches above the former and to have a height of 3½ inches above the latter. When the wedges are drawn the deflection is 2¼ inches, including ½ inch for temperature.

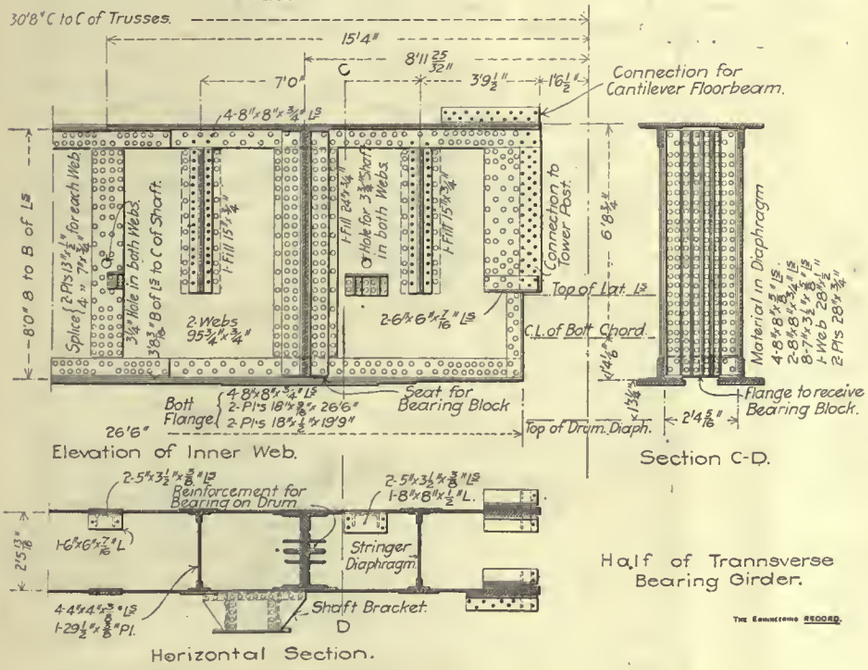
The four vertical posts forming the tower above the pivot pier are 30 feet 8 inches apart on centers both transversely and longitudinally and are riveted to wide and deep gusset plates in the planes of the webs of the lower chords.



Latch Catch.



Plan.

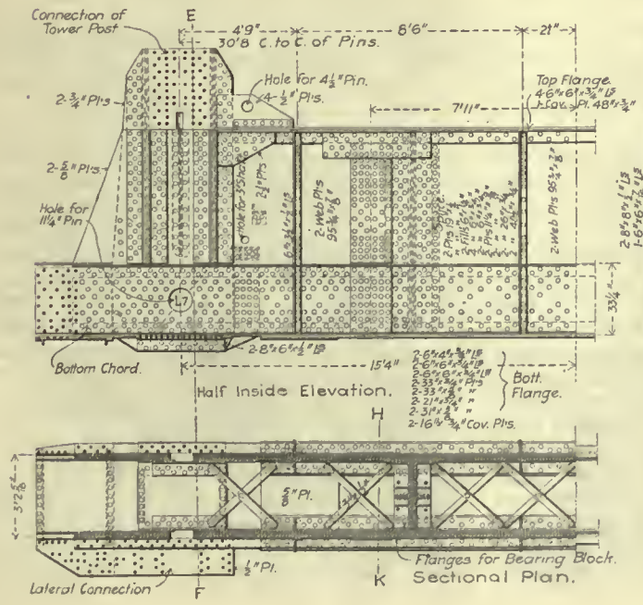


Elevation of Inner Web.

Section C-D.

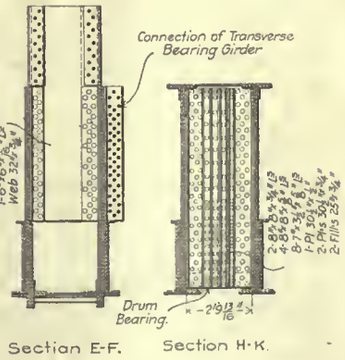
Horizontal Section.

Half of Transverse Bearing Girder.



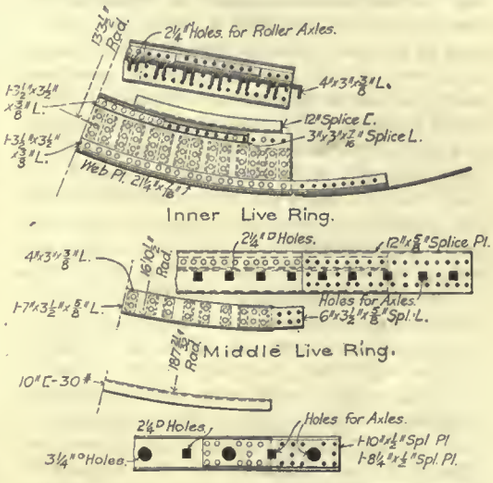
Half Inside Elevation.

Sectional Plan.

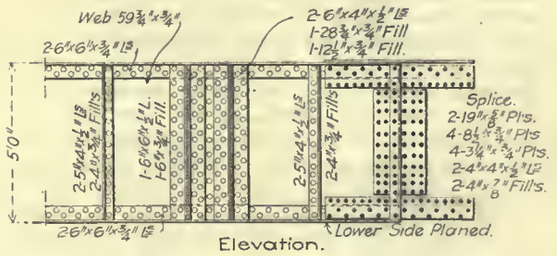


Section E-F. Section H-K.

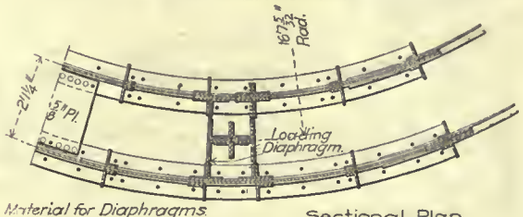
Half of Longitudinal Bearing Girder



Rings for Roller Frames.



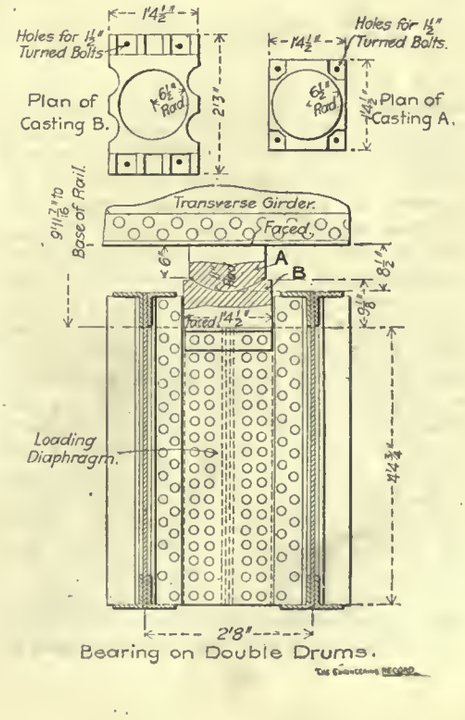
Elevation.



Material for Diaphragms.

Sectional Plan

Section of Double Drum.

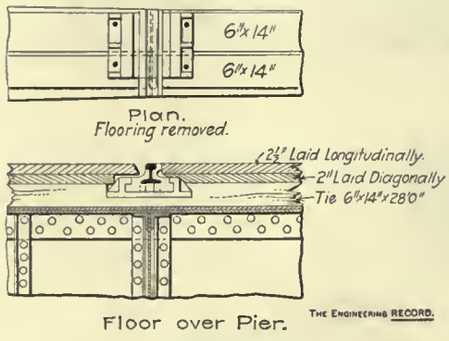


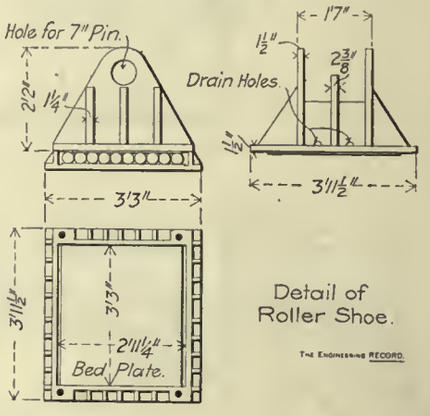
Bearing on Double Drums.

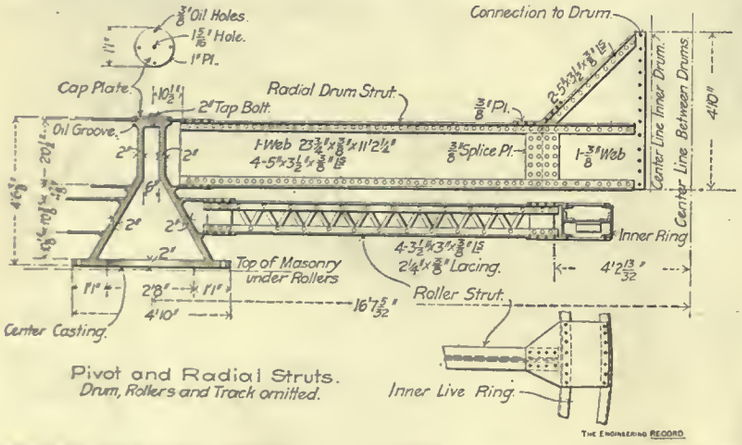
The lower chords are continuous across the top of the pivot pier; but are there reinforced by very deep web plates which practically make heavy longitudinal box girders of these sections. At the feet of these vertical posts the regular floor beams are replaced by special ones with deep double webs which form transverse box girders corresponding to the longitudinal box girders and with them constituting a very rigid square loading-frame, which receives the truss reactions at the corners and transmits load to the drums at eight equi-distant points, two of them intermediate between the ends of each of the four girders. The drums are 2 feet 8 inches apart on centers and the outer one has a radius of 17 feet 11 5/32 inches. Each has a 59¾x¾-inch web and two 6x6x¾-inch in each flange. They are each made in four sections with web splice-plates having field driven rivets on both sides as shown in the part plan and elevation. They are connected by double radial diaphragms at the loading points and each is seated on 56 rollers with a 14-inch face 17 inches in diameter on the center line.

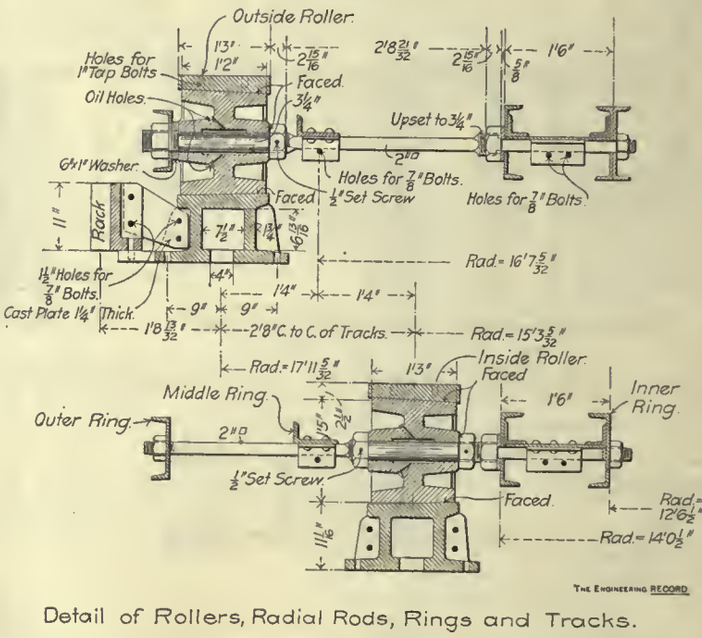
The longitudinal girders which connect the feet of the tower posts at points *L* 7, *L* 7 are box girders 8 feet deep and 4 feet wide over all. The webs are ⅞ inch thick throughout and nearly 4 inches thick in the lower part. Both top and bottom flanges are made with pairs of 6x6-inch angles so that each part of the girder resembles two complete plate girders united by a solid cover-plate on top, and by lattice bars and tie plates on the bottom flange. Two triple-web vertical diaphragms are riveted between the girder webs about 6½ feet from the center to transmit the weight of the span, which is received from the tower posts, to the upper blocks of the ball and socket bearings which distribute the load between the two drums of the turn table. These diaphragms are heaviily reinforced with bars and double pairs of vertical angles and have bottom flanges to receive bolts in the cast steel blocks. At the panel points the girder is reinforced by triple transverse vertical diaphragms, which stiffen the extended end sections of the web to which the vertical posts are field-riveted. The transverse bearing girders intersect the longitudinal ones on the center lines of the vertical posts and are web-connected to them by field-rivets through double pairs of 6x6-inch vertical angles shop-riveted to the longitudinal girders through the diaphragm angles. Each end of the transverse girder is thus secured by eighty-two 1-inch rivets in double shear. On the opposite side of the longitudinal girder in the center line of the transverse girder there is a single similar but smaller connection for the future addition of the cantilever roadway bracket.

The transverse bearing girders are similar in construction and dimensions to the longitudinal ones, but are made with four 8x8-inch angles in each flange and one full length 48-inch cover plate on top and two on the bottom. There are two symmetrical vertical transverse diaphragms about 12 feet 8 inches apart reinforced with stiffener angles, like those in the longitudinal girders, to receive the drum bearings, and on each side of them the bottom flanges are reinforced by additional cover plates 13⅓ inches wide, which clear the castings. The girders are slightly notched at the ends and are seated there on the upper flanges of the continuations to the lower chord angle, besides having the web connections of the longitudinal girders. At the upper end of the top flange there is a pair of horizontal angles to receive the future field-riveted connection of a tension bar anchoring the top of the roadway cantilever. The relative positions of transverse and longitudinal girders, future cantilever extensions and the ball and socket bearings on the double drums, together with the radial trusses which connect the drums and the roller rings to the pivot, are clearly shown in the cross sectional elevation at the top of the pivot pier.









Detail of Rollers, Radial Rods, Rings and Tracks.

In order to distribute the loads equally between both drums, they are applied to longitudinal diaphragms connecting the pairs of transverse radial diaphragms which unite the inner and outer webs. These diaphragms are reinforced by four 6x6-inch vertical angles riveted together back to back and forming a kind of column on their center lines, as shown in the cross section. The upper ends of these angles are planed to receive the bases of cast bearing blocks which are bolted to flange angles on the transverse diaphragms and have concave bearings for the spherical surfaces on the under side of corresponding blocks which are seated under the bottom flanges of the transverse and longitudinal bearing girders and thus provide abundant surface, uniform pressure and equal distribution of stress regardless of deflections or irregularities in loading. The drums are centered on the pivot castings by eight radial struts which are 24-inch plate girders riveted to horizontal discs at the center and to vertical knee brace gusset plates connected to the web stiffener angles of the inner drum.

Both top and bottom track plates are of cast steel. The rollers revolve between them on radial axles about 7 feet long, which engage three live rings and, unlike the usual custom, do not extend to the pivot. Each axle carries only one roller and those for the inner and outer circles alternate. The hubs of the rollers are as long as the faces and are chambered in the center so as to take bearing only at the ends. All of the axles are cylindrical at the inner end where they pass through 2¼-inch holes in the inner ring and are square where they pass through 2¼-inch square holes in the middle ring. The nuts beyond outer rings are screwed up against washers at the ends of the roller hubs and the inner rings are centered by eight radial struts riveted to horizontal jaw plates across their flanges and to revolving discs on the pivot castings. The middle rings are not centered, but they are kept in place by flange angles on the under side which engage the square parts of the axles and are locked to them with horizontal bolts. Similar angles riveted to the webs of the inner ring receive the inner ends of the axles. The rack and track segments were each about 7 feet long, cast separately and bolted together with their ends accurately faced.

The draw spans will each be operated by duplicate 60-horse-power electric motors making 250 revolutions per minute, and capable of raising the ends and turning the spans 90 degrees in 2½ minutes, under ordinary conditions. Many of the cranks, jaws, links, etc.,

are made of cast steel instead of forgings and all shafts are cold rolled with Babbitted bearings. All high speed gearings have cycloidal teeth. The motors are installed on the floor of the operating house above the roadway, in the tower, and are coupled with friction clutches to driving shafts running diagonally across the floor and connected with miter gears to three vertical shafts which transmit the power below the floor of the bridge, where their miter gears connect with a system of transverse longitudinal and horizontal shafts, which operate the turning gear and the lifting mechanism, the rails and the latch being raised by apparatus driven simultaneously from a worm gear at each end of the bridge connected to the transverse shafts which drive the wedges. The end wedges have a slope of 5 to 1 and have polished grooved faces bearing on the corresponding surfaces of pedestals bolted to the masonry and shoes bolted to the trusses, the latter having guide angles at each end, which project beyond the sides of the castings to retain the wedges at the ends of their strokes.

The latches engage bent plates bolted to the pier masonry. These plates, as shown in the detail, have a wide notch to receive the latch and sloping approaches to it between which the foot of the latch travels. These side pieces which receive the lateral thrust from the inertia of the bridge are made movable against a horizontal spiral spring which can be adjusted to vary the stiffness and absorb the impact without undue stress.

The motors and signals are installed in a house about 24 feet square which is set in the tower above the roadway, over the pivot pier. The house has a floor of 3¼-inch flat slabs of cinder concrete mixed 1:2:4 with Portland cement and finished with ¾ inch of 1:2 Portland cement mortar. The 2½-inch roof is similar and the walls are made with light steel framework covered with steel lath and plastered with Portland cement mortar. The ceiling is also made of plaster on steel purlins suspended from the roof beams.

The total weight of the superstructure will be about 8,441,000 pounds. The total cost of the new work will be about $600,000.00, and the contract time for its completion is June 1st, 1903. Messrs. Waddell & Hedrick, consulting engineers, have designed and are superintending the work. The Foundation and Contracting Company of New York are the contractors for, and Mr. George Adgate is in charge of, the substructure. The American Bridge Company is the contractor for the superstructure.

Lehigh University, at South Bethlehem, Pa., has 581 students from 27 States and 6 foreign countries. In the 37 years of its existence it has sent out 1,248 graduates. Like other technical schools, Lehigh is growing.

A Large Hydro-Electric Power Plant is being built near Mishawaka, Ind., on the St. Joseph River, by the St. Joseph & Elkhart Power Company. The works include a dam and power house and will supply electric light and power to South Bend, Mishawaka and Elkhart. The electrical equipment will include four 1,000-kilowatt, 13,200-volt, revolving field alternators, two 125-kilowatt direct-current exciters and a high tension switchboard fitted with electrically operated oil break switches furnished by the Westinghouse Electric & Mfg. Company. All the generators will be direct connected to horizontal turbines made by the Trump Manufacturing Company, of Springfield, O. Messrs. Sanderson & Porter, of New York City, are the consulting engineers and general contractors for the plant.

The Echo Lake Dam, at Milford, Mass.

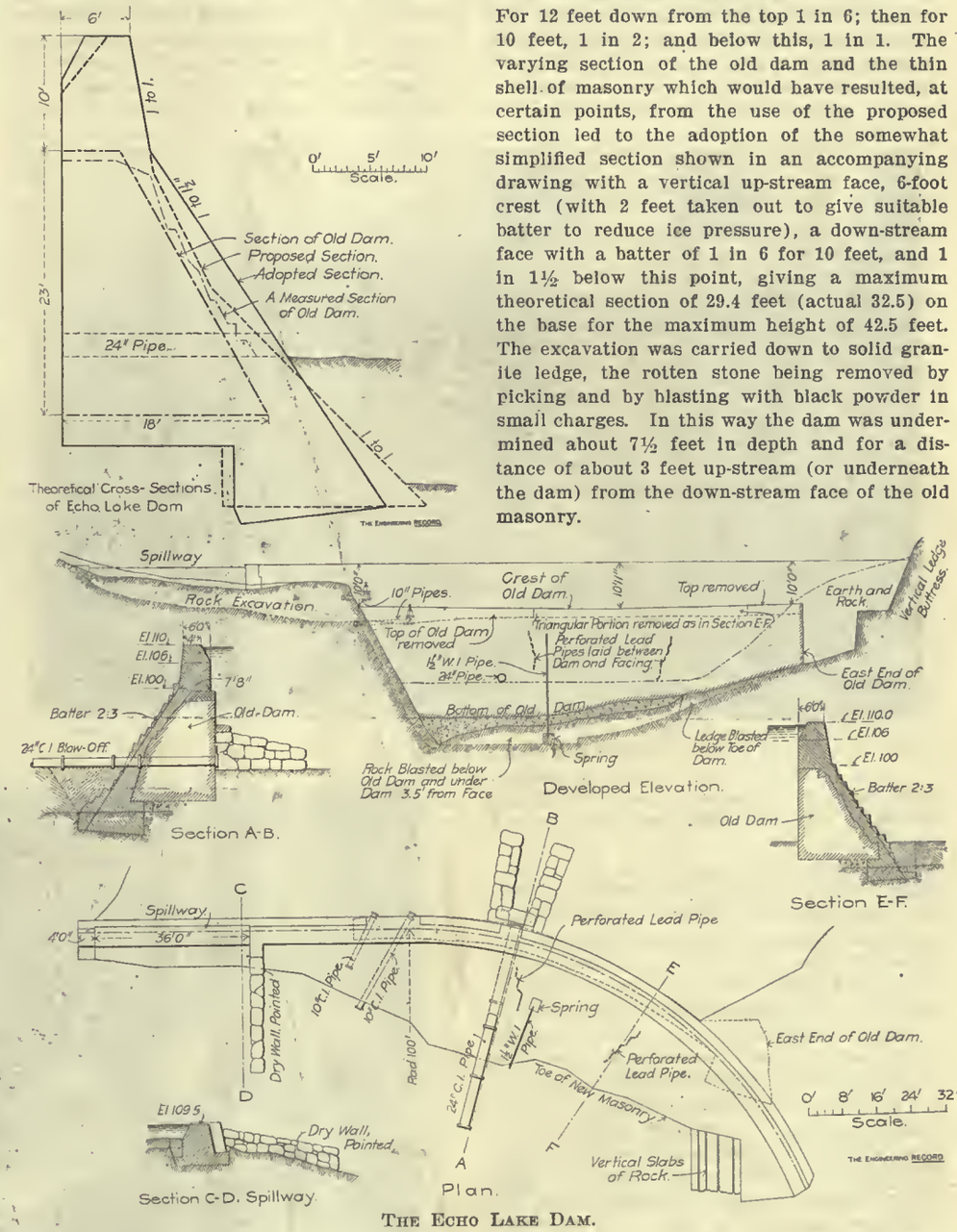
Abstract of paper by Mr. Leonard Metcalf, of Boston, to be published in forthcoming issue of the "Journal of the New England Water Works Association." Read at the annual meeting of the Association January 14, 1903.

The Milford Water Company, of Milford, Mass., has recently found it expedient to increase its supply by increasing the height of an existing dam at Echo Lake 10 feet.

While the section of the old dam, which was of the arched form, upon a radius of about 90 feet, indicated the possibility of increasing its height without reinforcement, the uncertainty as to the character of its foundation and the very serious damage that would result from a breach in the masonry, or from the undermining of its foundation, owing to the increase in the head upon it, made it necessary to determine the character of the foundation. Inquiry unfortunately developed but little definite information and that to the effect that the dam was founded on rock, except for a distance of about 30 feet (actually 48 to 60 feet) in the center of the valley where it was carried down into impervious hard-pan for a depth of about 4 feet, and that two-thirds of the masonry was laid in Rosendale cement mortar, the remaining third in Portland cement mortar.

Test pits were dug below the dam at the lowest points in the valley. One of these pits disclosed a footing of disintegrated granite; the second of very fine sand; the third of hard-pan, underlaid with loose ledge. Plans were, therefore, drawn for reinforcing and partially underpinning the old dam, and the water in the lake was drawn down in September from 7 to 8 feet below the crest of the dam. This gave opportunity for the construction of a coffer dam at the narrows about 175 feet above the dam.

The section first proposed for the new dam involved a maximum height of 41 feet, base 32 feet, crest 6 feet, with the upstream face vertical except near the crest, where a triangle was to be cut off to reduce ice pressure, and with the down-stream face battered as follows: For 12 feet down from the top 1 in 6; then for 10 feet, 1 in 2; and below this, 1 in 1. The varying section of the old dam and the thin shell of masonry which would have resulted, at certain points, from the use of the proposed section led to the adoption of the somewhat simplified section shown in an accompanying drawing with a vertical up-stream face, 6-foot crest (with 2 feet taken out to give suitable batter to reduce ice pressure), a down-stream face with a batter of 1 in 6 for 10 feet, and 1 in 1½ below this point, giving a maximum theoretical section of 29.4 feet (actual 32.5) on the base for the maximum height of 42.5 feet. The excavation was carried down to solid granite ledge, the rotten stone being removed by picking and by blasting with black powder in small charges. In this way the dam was undermined about 7½ feet in depth and for a distance of about 3 feet up-stream (or underneath the dam) from the down-stream face of the old masonry.



THE ECHO LAKE DAM.

The material which was thus uncovered under the main body of the old dam in the center of the valley for a distance of about 48 to 60 feet was a good dense hard-pan, partially underlaid with a layer of free sand and gravel. The westerly shoulder of the dam abutted upon a hard, though somewhat seamy, ledge; but the easterly end was found to have been built against the hard earth and vertical slabs of granite, a peculiar natural formation clearly shown in one of the accompanying views. All loose material was removed to hard rock. A suitably rough inclined footing was blasted out of the ledge in the bottom of the valley; a

trench or shoulder was cut well into the ledge on the westerly side, for a skewback for the dam arch, while the easterly end of the dam was abutted against an ideal ledge skewback, or buttress, of hard granite, with vertical face, normal to the thrust of the arch.

By a small amount of earth stripping and blasting of ledge, a spillway was built clear and free from the main portion of the dam, the water passing over it being deflected by means of a short dry wall so as to flow over the natural rock surface in a waterfall or cascade into the valley at a point about 50 feet below the main structure. Owing to the topography of this westerly hillside, it was necessary to locate this spillway on a tangent to the main portion of the dam which spans the gorge, and for this reason the latter was reinforced at its junction with the side walls of the valley, and very carefully bonded into the solid ledge.

While the water was drawn off below the coffer dam the opportunity was taken for repointing the up-stream face of the old masonry.

Two points in the method of construction adopted involved serious considerations: First, the possibility of an upward pressure over a considerable area of the foundation or bottom of the old dam, owing to the fact that it was not founded upon ledge; and, second, the possibility of a bursting pressure between the old and new layers of masonry, owing to leakage of the old structure and the practical impossibility of obtaining a perfect bond between the old and new walls. Both the old and the new sections of the dam were designed as gravity sections, without allowance for the additional stability afforded by the arched form, and even with an upward pressure over a portion of the footing of the old dam, the line of resistance would fall well within the new base. As an additional precaution, however, a small dry well was left underneath the dam just up-stream from the new masonry, with a 1½-inch wrought-iron pipe passing through the masonry and discharging freely down-stream. This well was located at a point where a spring was found coming up through a seam in the ledge, and measurements were made of the amount of water percolating through the pipe. Since the completion of the work the flow of water through this pipe has been observed from time to time, but no evidence of increased seepage has been found. Several springs of this sort were encountered in laying the footing masonry, but their origin appeared to be in ground water from the hillside above, rather than from the lake.

As regards the bonding of the two layers of masonry, it should be noted that the foundation of the reinforcement was exceedingly well bonded into the footing ledge, that it is further assisted by the thrust of the dam under pressure of the water, that both ends of the dam abutting upon the slopes of the valley were reinforced and unusually well bonded into the ledge, and that a portion of the top of the old dam was removed and the new work was bonded into and over the old masonry. Moreover, the effect of the arch is, probably, to bring the faces of the old and the new masonry tightly into contact. As an additional precaution, however, two perforated 1-inch lead pipes were laid against the down-stream face of the old structure, following this face vertically, and built into the new masonry, so that in case of the development, through leakage or other cause, of a considerable area of hydrostatic pressure between the two layers of masonry, this seepage water may be drained out. Up to this time no leakage has been apparent in these pipes, but the fact should not be overlooked that the lake has not yet had opportunity to fill to the new flow line.



Building Reinforcing Masonry.



Echo Lake Dam after Changes.

Masonry is cut off the up-stream face (2 feet on the crest and 4 feet vertically down) giving a batter to the face of 1 in 2, in order to reduce the danger from ice pressure; and the bottom at and near the spillway is protected by paving with large granite blocks for the same reason. After completion the crest of the dam was cut and dressed to line and all joints were pointed with 1 to 1 Portland cement mortar. It may be of interest to note that the cement used amounted to 0.83 of a barrel per cubic yard of masonry (which is equivalent to 1.2 cubic yards of masonry per barrel of cement), based upon the entire work, including all foundation work, pointing, grouting, etc., while the rubble masonry itself required in the mass work about 0.7 barrel of cement per cubic yard of masonry.

The author takes pleasure in acknowledging his indebtedness for hearty co-operation and assistance to Mr. J. William Kay, superintendent of the Milford Water Company, to Mr. A. T. Safford, consulting engineer, of Lowell, and to Mr. William T. Barnes, resident engineer on the work.



Echo Lake Dam.
Natural Rock Slabs at East End of Old Dam.

Compressive Resistance of Concrete-Steel and Hooped Concrete.—V.

Preceding sections of this translation from M. Considère's original paper appeared in the issues of December 20 and 27, 1902, January 10 and 17, 1903.

XVI. *Influence of the Character of the Materials.*—Most builders use for the concrete the same proportions, 500 pounds of cement to 1.2 cubic yards of sand and gravel, which yields one cubic yard of concrete put in place and tamped. In floors and beams and other members subjected to bending, the tensile resistance of the concrete is not taken into account. There is, therefore, little advantage in improving the character of the concrete in the parts in tension. It seems that such is not the case in the compressed portions where the concrete supplies the most, if not the whole, of the resistance. But the two following points should be considered. If the concrete for the space between the main beams is made richer, this will be done in order to decrease their thickness, but the moment of resistance decreases as the square of the thickness while the volume of the concrete decreases as its first power only. The cost decreases still more slowly than the volume because certain expenses remain the same, as, for instance, that of the moulds. The conditions are similar if not identical for the main beams. Finally, it is known and the author has proved it by exact facts, that the cracks which appear in tension members exposed to dry air and especially to the sun while under the partial load which they carry during their hardening period are the more important the richer the concrete is.

Neither of these reasons holds true for compression members, except the first in the quite rare case where the members are so long as to require provision against flexure. On the contrary, for compression members which will not be tested in advance, there is a decided reason for richer concrete. For the first load imposed on concrete the elastic limit, which has a considerable influence on the column resistance increases in a high degree with the proportion of cement when the same is increased from 500 to 1,000 pounds. This fact is shown by all of the author's experiments and an example can be seen by comparing the deformations reported in section VIII, for three prisms of 1,000 pounds and one of 500 pounds of cement.

No doubt, the importance of the initial elastic limit decreases after the testing of the members before putting them in place but it does not vanish altogether. This method of construction will only be used when high resistances with all possible guaranty will be desired and the small increase in cost of a richer concrete will be willingly paid. The whole difference is not more than 10 to 17 per cent. of the cost of concrete. The author believes that in any case for members subjected to great stresses 750 pounds and frequently 1,000 pounds of cement per cubic yard of concrete laid in place should be used for a mixture of sand and gravel so balanced as to have the least amount of voids.

The choice of the metal to be used also deserves attention and it should be here remembered that the longitudinal rods are compressed beforehand by the shrinking of the concrete and reach rapidly their elastic limit while the hoops must be compressed before taking tension and that their stresses are small when the longitudinal reinforcing is already at the end of its resistance. The elongations of the hoops increase therefore about three times as slowly as the shortenings of the longitudinals. The experiments show that the greatest shortenings which will have to be considered, not for working stresses but for dangerous limits, do not exceed 0.2 to 0.3 per cent. and it is certain that the corresponding elongations of the hooping metal do not reach 0.07 to 0.1 per cent. and thus remain below the elastic elongation of common wrought iron and soft steel. The elastic limit and the ultimate resistance of the hoops is therefore not important and their effect depends solely on the coefficient of elasticity. But it is known that the coefficient of elasticity of soft steel is on the average 10 per cent. higher than that of wrought iron and that for the high carbon steels it does not have any higher value. Drawn wire will thus for hooping be inferior rather than superior to bars. These considerations lead to the use of high-carbon steel for the longitudinal reinforcing and of soft steel or wrought iron for the hoops, according to the cost of the metal.

The rolling into spirals is facilitated by the use of malleable metals. It is now understood why the author has not attached much importance to the fact that the hooping of the tested prisms was made of drawn iron wire. No doubt, with bars the ultimate resistance would not have shown such an enormous and useless excess of crushing strength, but the interesting period of the deformation would have been exactly the same and the conclusions which have been based solely on facts observed during this period would not have been different.

It may be concluded that for hooped concrete intended to resist high pressures it is proper to use concrete containing 750 to 1,000 pounds of cement per cubic yard of concrete laid in place, and to use high-carbon steel for the longitudinal reinforcing and wrought iron or soft steel for the helicoidal spirals which form the hooping. Generally it will suffice to make the metal between 1 and 2 per cent. of the volume for the longitudinal reinforcing, and between 2 and 3 per cent. for the hoops. This will give a high ductility and a resistance which will exceed all requirements.

XVII. *First Cost.*—The question of first cost is a very delicate one and to find a complete solution for it long discussions are required. The author will only attempt here to furnish some first thoughts on the subject. The study of first cost must lead to a comparison of the cost of the different types of construction, among which the engineer must choose. Hooped concrete must evidently be compared to concrete-steel as ordinarily reinforced and to riveted steel.

If the structure considered is to be such as can be built of concrete-steel of any of the old types the advantages which the substitution of hooped concrete under the most economic conditions will offer will have to be considered first. Then investigation should determine the desirability of adopting the more or less expensive methods which can be applied in the making of hooped-concrete. For concrete of the same proportions and same grade and percentage of metal, hooping will give much more resistance than longitudinal reinforcing and will at the same time modify the fragility to a very high ductility, which will allow of a reduction in the factor of safety. It does not seem that the cost per cubic yard containing the same materials should appreciably differ for the two types of construction. There are, however, two reasons which might outweigh the general advantages of hooped concrete and lead to the adoption of the other type. The first of these reasons is that it is somewhat inconvenient to introduce for the columns a method of construction different from that used for beams, and to which the workmen are not accustomed.

The second reason is that for columns or supports carrying light loads the least section is generally fixed by practical considerations and is frequently sufficiently strong with any kind of reinforcing. It is the shop manufacture of hooped-concrete members that must be mainly considered. It may be made in big shops with the special care and economy resulting from the employment of skilled labor and mechanical means. Columns and other members of hooped concrete with longitudinal reinforcing rods projecting out at the ends, so as to assure the connection between them and the beams or other parts of the structure, of high efficiency could then be manufactured.

More difficult is the comparison of hooped-concrete to riveted construction. It will be limited to some indications of the cost of the materials of which the hooped concrete is made and the additional cost of its making. The cost of the hooped-concrete in place so determined will then be compared to the total cost of the steel construction of the same strength. It will then be seen whether the difference in cost is sufficient to cover the handling, erection and falsework required for hooped-concrete as well as the contractor's profit. The fact must also be considered that the longer the spans the heavier will be the weight of the hooped-concrete as compared to steel, and that the fixed load of the structure will therefore be proportionately increased and its required resistance will have to be proportionately higher. But it will be found on closer examination that the difference in weights does not have the importance which it may seem to have at first sight. On the other hand, it should be considered whether the hooped-concrete structures do not have the advantage over the steel structures as to maintenance, length of service, solidarity of parts and, for short distances, rapid absorption of vibrations and resistance to impact.

To make a rough comparison riveted construction of ordinary soft steel will be assumed. It can be bought for 3 cents a pound, which is a low value for present prices. An allowable working stress of 10,000 pounds per square inch will be assumed on the steel. The gross section of the members will exceed the net section by 10 to 20 per cent. and if in addition the weight of rivets and details will be considered the allowable unit stress of 10,000 pounds is reduced to 7,500 pounds per square inch of gross section as far as weight is concerned. For hooped-concrete, as given in section XIII, a unit stress of 950 to 2,150 pounds may be allowed according whether the concrete has been moulded in place without extra care and reinforced with a low percentage of metal or whether it has been made in the shop with extra care and strict supervision of a good concrete and a higher percentage of metal and has been previously tested above its working load.

Omitting the cost of the moulds, staging, etc., the cost of the concrete may be taken at $10 per cubic yard, which is a high figure and is taken to be on the safe side. For the same reason the higher unit pressures mentioned in the above as being allowable for hooped-concrete will not be used and the following will be assumed:

Allowable pressure in pounds per square inch.....	900	1,350	1,800
A block or short column 1 square foot in section will carry a load, in pounds, of	129,600	194,400	259,200
A steel member of same resistance at 7,500 pounds per square inch will have a section, in square inches, of	17.3	26.0	34.6
It will weigh, per linear foot, in pounds	59	88.5	118
At 3 cents per pound, it will cost, per linear foot.....	$1.77	$2.66	$3.54

Adding to the cost of the concrete the cost of the reinforcing steel, the cost of the hooped-concrete members will be found. The percentage of the metal varies between 3 and 6 per cent. of the concrete, which gives 400 to 800 pounds of steel per cubic yard at a cost of $12

to $24. The total cost of the hooped concrete will then be $22 to $34 per cubic yard. Per cubic foot it will be $0.82 to $1.26. Comparing this to the above table it is seen that more than a sufficient margin is left for the cost of moulds, scaffolding, etc.

XVIII. *Conclusions.*—Hooped concrete has a high ductility, its crushing resistance is very high and exceeds the sum of the resistance of the concrete used for it, the resistance of longitudinal reinforcing rods stressed up to their elastic limit and the resistance at the same rate of imaginary longitudinals representing a volume of 2.4 times that of the hooping metal. If the concrete were very poor and had only the cohesion strictly necessary to prevent crumbling away between the spirals, its resistance consisting of the two latter elements would still be very great. The danger due to poor work in concreting which forms an objection to concrete-steel constructions is hence almost altogether avoided by the use of hooping. Under the first load the hooping has much less influence on the coefficient of elasticity than on the crushing resistance, but even for the most ordinary concretes the value of this coefficient is sufficient to prevent flexure under high loads in structures having members of usual sizes. When a hooped-concrete member is subjected to a test load its elastic limit increases up to the value of this load and likewise the coefficient of elasticity under a heavy load is increased in a high degree and the more so the less satisfactory its value has been previously.

The concrete is thus improved to any required degree by the hoops which, due to their mode of action and coefficient of efficiency, 2.4, can produce a high resistance without being much stressed themselves. The adhesion of the concrete to the metal which has such an important effect on members in bending is almost of no importance in hooped-concrete in compression. It is called into action at the ends of the spirals only, which are bent in towards the center of section where its resistance is much assisted by the considerable friction developed in the core by the strong pressures exerted on all sides. To obtain this result it is necessary to space the hoops closely enough to each other to prevent the crumbling of the concrete between them. This object is attained, without spacing the hoops excessively close, by placing against the inside surface of the hoops longitudinal bars which in their turn also increase the tensile resistance.

The necessity of having the hoops sufficiently close to each other leads to making them of wire or bars bent to spirals and embedded in the concrete near the surface. The reduced number of joints is made by simple overlapping of the adjacent spirals and bending their ends into the hooped core. The strength of the joints is thus made equal to the strength of the members. The spirals are made beforehand and it is therefore easy to check their dimensions before concreting and to make sure of the high character of the reinforcing which, as has been shown in the above, will suffice to secure the safety of the member even if the concrete should turn out of a lower grade than could have been foreseen. By decreasing the spacing between the spirals at the ends of the members a local excess of crushing strength can be obtained of any desired amount and also a considerable ductility. It is also easy to assure the transmission of tensile stresses from one member to another and practical methods have been pointed out showing how to attain this result in a simple manner. The serious objections which are attached to joints in masonry and usual concrete-steel constructions can thus be entirely eliminated.

It appears that for structures for which it is desired to obtain the highest resistance and safety together with the least weight the method of building by members made in the shop will have the following advantages: Elastic symmetry; execution of the work under supervision in well prepared moulds by a few experienced workmen; continuous inspection and protection from the sun and the rain; possibility of keeping the members in water or in moist air to prevent cracks; opportunity to sound with the hammer, to weigh and even to test all the members and to reject those below the standard; beginning the making of the members at the starting time of preliminary operations; putting the members in place after they have been hardened. Where the members will be tested they will greatly improve in elasticity and column resistance. The deformations after the removal of the falsework will be much reduced, even with considerable working pressures. The necessary rules to compute the resistance and elasticity of a hooped member of any proportions have been given.

The high ductility of hooped-concrete, its resistance to impact and atmospheric influences and the general solidarity of the parts in concrete-steel structures logically lead to the adoption for hooped-concrete of factors of safety in regard to the elastic limit and column flexure below 2 or 2.5 as are generally used for steel structures. But because of the novelty of this type of construction 3 to 3.5 has been proposed, even indicating the probability of beginning with factors of safety still higher. The reasons which sometimes prompt the use of smaller proportions of cement for concrete in tension or bending do not hold for compression members and it is proper to use richer concretes for these members. It is advantageous to make longitudinal reinforcing rods of the highest steel that can be used without trouble. For the hooping, on the contrary, wrought iron or soft steel are perfectly suitable.

Of two concrete members made of the same quantities of the same materials and costing the same, the one which is hooped will have more strength and a very much higher ductility than the one made according to any of the usual types. The approaching danger will in the first be heralded by the scaling off of the surface which has no influence on the strength. In the second nothing will announce the coming failure or, at best, heavy injuries which will endanger the structure will indicate it.

The cost of members made of hooped-concrete is appreciably less than one-half of the cost of steel members of same resistance. In each case the fixed load of the structure must be considered, the cost of erecting the hooped-concrete members must be calculated together with the general expenses and profits and the different methods of construction then compared. Finally, the properties of hooped-concrete appear to insure for it a place as a material for compression members between ordinary concrete and longitudinally or transversely reinforced concrete, on one side, and riveted steel members, on the other.

Wireless Telegraph Messages were successfully transmitted by Mr. Marconi on January 19 from Wellfleet, Mass., on Cape Cod, to Cornwall, England, a distance of about 2,800 miles.

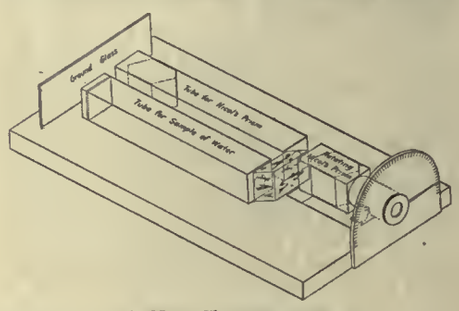
The Ice Gorges and freshets in the upper Hudson valley are to be investigated by the board of army engineers, of which Col. S. M. Mansfield, Corps of Engineers, is chairman. A public hearing will be held January 28 at Albany to consider plans to be laid before Congress by which the annual annoyance and loss from these gorges may be prevented.

A New Turbidimeter.

The principal methods that have been employed in the determination of the turbidity of water were summarized by Mr. Charles Anthony, Jr., of Hereford, England, in a paper read before the New England Water Works Association last September (published in the "Journal" of the association for December). Of the thirteen methods noted, which include several colorimeters that have been improperly used as turbidimeters, the platinum wire method of Mr. Allen Hazen (described in The Engineering Record of June 14, 1902), is mentioned as the most practical, although it has its drawbacks.

It was thought by Mr. Anthony that some simple photometric method of measuring the absolute amount of light absorbed by a given thickness of water was the most rational and convenient method of estimating the degree of turbidity of a water, and with this object in view he designed the instrument illustrated in the accompanying drawing.

It consists of a couple of parallel tubes of standard length, say 50 centimeters, one of which, closed at the ends by plates of glass, contains the water to be examined. Light transmitted preferably through ground glass reaches the eye, in part through this water and in part direct after passing through a Nicol's polarizing prism. These two sources of light are observed through an eyepiece containing another Nicol prism. The field of view is thus seen neatly dichotomized. By rotating the eye-



A New Turbidimeter.

piece, the illumination of that half of the field which received its light direct, seeing that it has already passed through a Nicol prism, can be varied until it matches the half receiving light through the standard thickness of water under examination. And though the inevitable difference in tint introduces some error due to personal equation in estimating equal obscuration, the extremely convenient manner in which the lights from the two sources are seen in absolute juxtaposition in the same field of view, allows of more accurate comparison than by any of the methods hitherto suggested. Further, seeing that the obscuration varies, according to a well-understood relation, with the angle through which the eyepiece is rotated, the instrument can be made to indicate, on a properly graduated disc, the degree of obscuration, that is, turbidity, to a rational scale, in which 1 represents perfect transparency and 0 total obscuration. The instrument is most easy to handle, gives accurate results to a rational scale, and is independent of the source of light. For these reasons Mr. Anthony believes it well adapted to fill the long-felt want of a ready and standard means of making turbidity observations.

The North Carolina Water Works Association was organized at Raleigh on January 14, according to local press reports. Mr. J. C. Michie, of Durham, was chosen president, and Mr. E. B. Bain, of Raleigh, secretary. The next meeting is to be held at Durham in July.

The Garvin's Falls Station of the Manchester Traction, Light and Power Company.

By W. V. Batson.

The station described in this article is one of several water power plants operated by the Manchester Traction, Light and Power Company, of Manchester, N. H., which was formed about two years ago by the union of several companies which furnished light and power, and operated the street railway system, in and about the city of Manchester. This is the largest, or one of the largest hydro-electric power systems in New England. On the site of the Garvin's Falls station there has stood for many years a mill which was operated by the water power. The dam and canal leading the water to the station have seen many years of service and a portion of the canal played an important part in the transportation of merchandise between the interior of New Hampshire and Boston.

In 1793 a charter was granted for the construction of a canal which ran from the Charles River, at Charlestown, to a point on the Merrimack River, where the city of Lowell is now situated. The men interested in this canal organized the Bow Locks and Canal Company, which secured the right to build a navigable route along the Merrimack River from Concord, passing the falls and rapids by locks.

The station recently completed on the west bank of the Merrimack River, about ¼ mile below the dam is of 2,000 horse-power capacity, covering an area of about 66x78 feet and is of brick on a granite foundation. The fore-bay wall, 10 feet thick at the wheel room floor level and 7 feet thick at the usual water level in the canal, forms one side of the wheel room. The foundations of the building are arched, so as to permit the tail water to flow away beneath the wheel room. One end of the building from a point 8 feet above the floor level is of wood, which will be removed when the station is enlarged. As the back water during freshets has been known to reach a point above the level of the generator floor, the floor and the walls to a point 8 feet above the floor level have been carefully waterproofed. To take care of any water that might leak in and also the water used in washing the floor, there is an iron tank with perforated top set in the floor, with an outlet in its bottom controlled by a valve operated by hand and a check valve opening outward. From this tank a 3-inch pipe leads to the suction side of a No. 2½ Goulds centrifugal pump having a capacity of 200 gallons per minute, which is direct-connected to a General Electric 2-horse-power, 440-volt, form K induction motor, operated from transformers which reduce the potential from 12,000 volts. By using this arrangement it is possible to operate the potential for the lights and motors in the station, also the generator rheostats. These rheostats are operated by hand wheels on the front of the board to which they are connected by sprocket chains. The transformers for the phasing lamps and for the voltmeters are on the back of the wall immediately above the opening into the bay.

In the end wall of the building which abuts upon the tracks of the Southern Division of the Boston & Maine Railroad, there is a clock having a ground glass dial 32 inches in diameter, which is illuminated by lamps placed behind it, and inside the station there is a 24-inch dial with hands driven by the same movement. The clock was installed by the E. Howard Clock Company of Boston.

The station is equipped with a hand traveling crane having a span of 31 feet and 20-feet hoist, with a capacity of fifteen tons, furnished by the Whiting Foundry Equipment Company.

On top of the fore-bay wall there is a pent house containing apparatus for operating the main gates. A shaft runs the length of the house, from which the pinions engaging the racks on the gates are driven by a worm and wheel and sprocket chains. The gearing for operating each gate may be connected to or disconnected from the main shaft by means of Worrall clutches. The main shaft is driven by a 5-horse-power, 440-volt induction motor which



GARVIN'S FALLS POWER HOUSE, VIEW FROM TAIL-RACE.



FOREBAY AND GATES OF GARVIN'S FALLS POWER HOUSE.

The entrance of the old ship canal was located not far from the headgates of the present power canal, which includes the old canal.

The river has a drainage area at this point of about 2,400 square miles and Lake Winnipiseogee and some large ponds furnish ample storage. The maximum available head is about 30 feet and the ordinary head about 25 feet. The usual low water flow is 1,000 cubic feet per second, which, with wheels of 80 per cent. efficiency, will give over 2,500 horse-power on the wheel shaft. The minimum flow in a dry time will yield not less than 2,000 horse-power. The minimum power during nine months of the year is about 3,000 horse-power, and during six months about 6,000 horse-power.

The first dam on this site was of stone and was finished Sept. 5, 1859. Two hundred feet of the middle of this dam were swept away on March 5, 1860, and were not rebuilt until 1879, when a wooden center section was built. The existing dam consists of stone work near each end, having a total length of about 150 feet, and a wooden crib section about 300 feet long. The plans for the complete development of this water power call for a new dam at a point nearer the station than the present one, and an enlarged canal capable of supplying water to wheels of a combined capacity of about 6,000 horse-power.

motor, even if the station is shut down, by supplying current for it from Manchester.

In addition to the wheel and generator rooms there is a boiler room for the heating apparatus, with a coal storage place adjoining. At the other end of the building there is a store room and a toilet room in which there is a centrifugal pump. The wheel room has a roof of planks covered with a fireproof compound and supported by steel girders. It has a wooden floor, is well lighted both naturally and artificially, and is provided with platform and steps to afford access to all parts of the wheel cases. The three wheel cases are built through the fore-bay wall and thus take water directly from the canal. Each case has two draft tubes reaching to a level 30 feet below the usual water level in the canal.

The generator room is 30 feet high, with its floor 15 feet below canal water level, and from one corner there is a bay built out into the lower part of a tower which is one of the prominent features of the building. In the opening to the bay is set the switchboard, and on the outer wall of the bay, high above the floor, are the lightning arresters, above which the transmission lines leave the station.

Along the wall and carried on supports resting on the floor are the transformers for reducing from the line potential to the proper

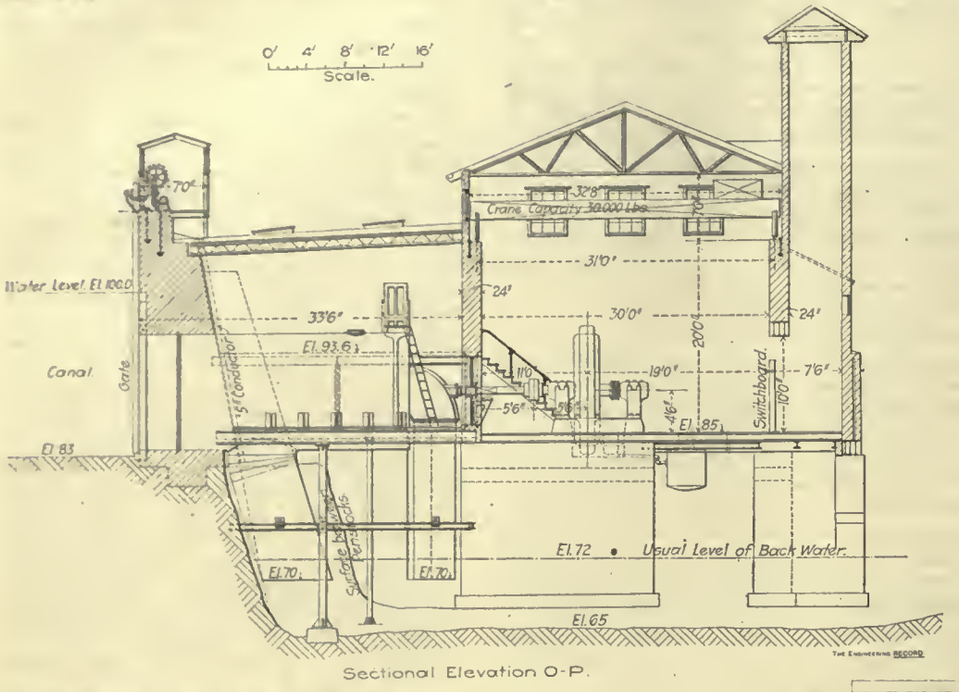
is back geared to drive the shaft at a speed of 150 revolutions per minute. Each main gate has a wicket or filler gate operated by hand, and the main gates are arranged so as to be operated by hand if necessary. The building was erected by the Head & Dowst Company of Manchester.

There are two turbine units for driving alternating-current generators and one for driving an exciter. Each of the large units consists of three 39-inch wheels on one horizontal shaft, to which the generator is coupled. The small unit consists of two 12-inch wheels on a horizontal shaft, to which the exciter is directly coupled. All wheels are of the McCormick design with cylinder gates without fingers, and were built by the Rodney Hunt Machine Company, of Orange, Mass. The cases for the larger units are 12 feet in diameter and the exciter turbine case is 5 feet in diameter.

The specification for the large wheels required them to develop 1,035 horse-power at 25 feet head, 1,099 horse-power at 26 feet head, 1,162 horse-power at 27 feet and 1,228 horse-power at 28 feet, the speed to be 180 revolutions per minute. The exciter wheel runs at 600 revolutions per minute and develops 75 horse-power at 26 feet head. To maintain constant speed at various loads there are two type B Lombard governors, one for each large wheel,

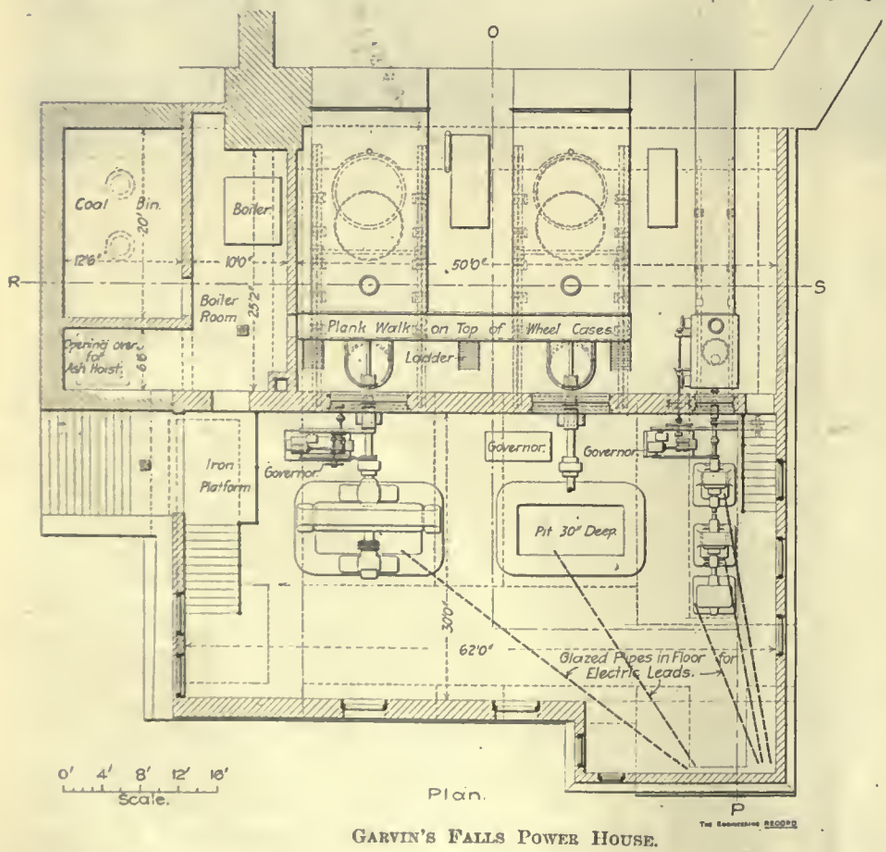
and a type D governor of same make for the exciter wheel. These governors are set on foundations of concrete faced with white enameled brick.

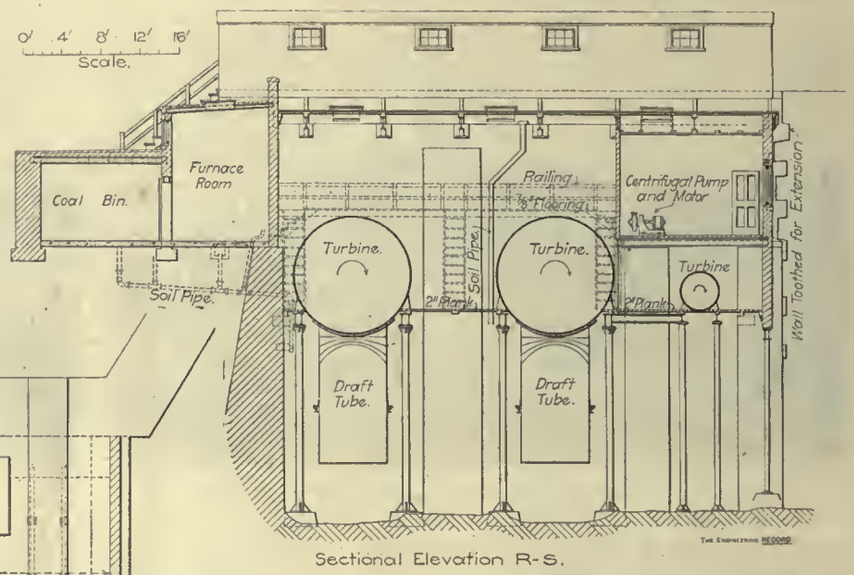
direct-current generator connected to the 12-inch wheel previously mentioned, and a similar generator direct-connected to a 75-horse-power General Electric form K 440-volt induction



Sectional Elevation O-P.

There are two 650-kilowatt three-phase generators of the revolving field type. They are non-compound wound and generate alternating-current of 60 cycles at from 11,400 to 12,600 volts. Their efficiencies are 94 per cent. at full load, 93 per cent. at three-quarter load, and 91 per cent. at half load, and the machines are guaranteed not to rise in temperature above 40 degrees centigrade after 8 hours' run at rated load and speed, nor above 55 degrees centigrade after 3 hours at 25 per cent. overload,





Sectional Elevation R-S.

Garvin's Falls Power House.

with the surrounding air not over 25 degrees centigrade.

To excite these machines there is a 50-kilowatt General Electric multi-polar, 110-125-volt motor. Each exciter is of sufficient capacity to excite four machines. When the station is completed it will contain six 650-kilowatt generators and three 50-kilowatt exciters.

The switchboard for receiving and distributing the output of all the machines and controlling the operation of the auxiliary motors is located in the opening to the bay as previously described. The board consists of six panels of blue Vermont marble 2 inches thick set in an oak frame, chemically treated to make it slow-burning, each panel having a marble sub-base, and the whole being surmounted by a marble cornice. The switchboard is 7 feet 5 inches high and 17 feet 4 inches long. The panels in order from left to right are: First, feeder panel; second and third, generator panels; fourth, switches and instruments for operating lights and motors in the station, and fifth and sixth, exciter panels. On each exciter panel there are the necessary switches, an Elden single pole direct-current circuit breaker, a back connected field rheostat, a voltmeter, and an ammeter. There are two sets of bus bars for the exciter, and either machine can be run on either set of bars or both machines run on the same bars. On the station panel there are oil switches for connecting the lighting and the motor transformers to the high tension bus bars, and two jack knife switches so connected that in case of the failure of the lightning transformer or of the generator being shut down, the lights can be fed from either set of exciter bus bars.

Each motor circuit before leaving the board passes through an automatic overload three-pole oil circuit breaker. There is an alternating current ammeter for the lights and one for each motor, also a 175-volt and a 500-volt alternating current voltmeter. Each generator panel has two sets of high tension bus bars, to either of which both generators may be connected by means of three-pole double-throw oil switches. The high tension current reaches the generator switches through automatic overload oil circuit breakers. For each generator there is an ammeter and voltmeter, an indicating wattmeter and a direct current ammeter in field circuit. The generator field switches are 150-ampere double-pole double-throw with auxiliary resistance on the break, and are so connected that the machines may be excited from either of the exciter bars. There is a single pole circuit breaker in the generator field circuit.

All direct-current circuit breakers are provided with a locking device by means of which the breakers may be made inoperative. This is of advantage when one or more machines are loaded and such operations as adding a new exciter or generator are to be performed. By locking the breaker of the exciter in operation and leaving all others free to act there is no

danger of shutting down the plant through an operator's mistake in handling the direct-current switches. There are also two phasing lamps on each generator panel. The machines are in phase when the lamps are dark. On the feeder panel there are two three-pole, double-throw oil switches for connecting the two feeders to either set of high tension automatic overload bars. Each feeder is protected by a three-pole oil circuit breaker. There is an ammeter in one leg of each feeder. On this panel there are two 10,000-volt three phase ground detectors, one being connected permanently to each set of high tension bus bars.

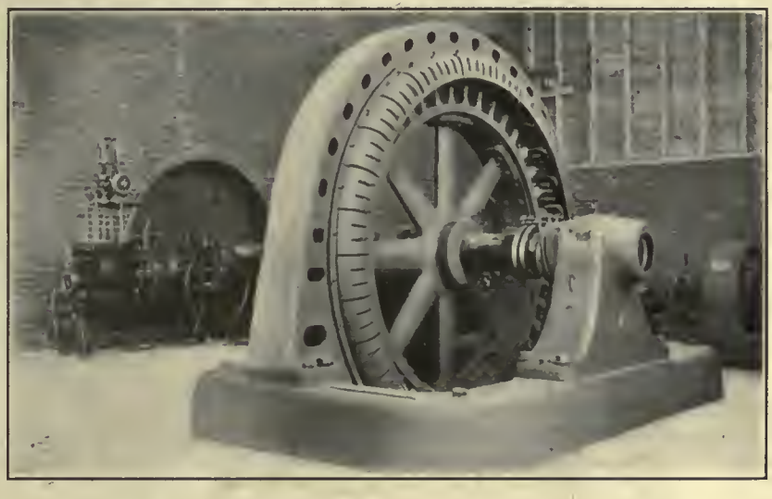
All instruments are in cases with a dull black oxidized finish, and all except those on the exciter panel are the General Electric horizontal edgewise type. All oil switches and oil circuit breakers are of Elden make, and are built to operate at 10,000 volts. The direct-current circuit breakers are of the same make. All wiring on the board is done with Washburn & Moen's crown brand of fireproof insulated wire. The board was built and installed by S. B. Condit & Company, of Boston, who manufacture the Elden apparatus. The transformers used for lights and motors are the General Electric type H transformer reducing from 12,000 to 110 or 440 volts as required.

The feeders, each consisting of three No. 0 copper wires, pass out of the station through glass insulators set in holes in marble slabs built into the wall of the station, the wires being supported on either side of the wall so that they pass through the center of the holes. These feeders run on a pole line 13.5 miles long, all wires being carried on a single cross arm. Throughout a large part of its length the pole line passes over a private right of way to the central station of the company in Manchester. The transmission lines from the several water power plants are brought to a sub-station near the main station, which is operated by steam power. The current passes through General Electric air blast transformers by which the potential is changed to 2,000 volts. The current from the secondary side of the transformers is carried to a single switchboard from which its energy is distributed to the light and power circuits about the city.

The steam station contains direct-current 500-volt railway generators, alternating-current generators and arc machines all driven by belts from counter shafts driven by the engines through clutches. The counter shaft can also be divided into sections by means of clutch couplings.

The operation of the entire system is as follows: During the day the water power stations feed into the central station, and the alternating-current generators in this station are operated as synchronous motors to drive the counter shafting and railway generators. Late in the afternoon the engines are started, and all work together to carry the evening load, and when the load falls off the engines are shut down and the entire load is carried by the water-power plants. All the steam driven alternators are controlled from the switchboard in the sub-station, and it is interesting to note that all these stations operated by steam and water power, separated from each other by several miles and containing several sizes of machines operate in multiple without difficulty.

The Garvin's Falls station was planned and its erection superintended by Messrs. Hollis French and Allen Hubbard, consulting engineers, of Boston. The photographs illustrating this article were taken by their engineer in charge of the work, Mr. E. B. Richardson, from whom much of the matter used in the preparation of this article was obtained.



GENERATOR AND GOVERNOR IN GARVIN'S FALLS POWER HOUSE.

The Fifth Annual Meeting of the American Ceramic Society will be held in Boston February 2, 3 and 4 and will be followed by the seventeenth annual convention of the National Brick Manufacturers' Association. Numerous technical papers will be presented, of which, among others, one entitled "Recent Investigations of Portland Cement" will be of interest to engineers. There will be several excursions to visit works.

Stevens Institute of Technology, Hoboken, N. J., will celebrate the inauguration of its new president, Mr. Alexander C. Humphreys, on February 4 and 5. On the 4th the Alumni Association will give a reception in the Carnegie Laboratory of Engineering, which will take the place of its usual midwinter meeting. On the 5th the inauguration ceremonies will take place, in the same building, at 2 o'clock; and at 7 in the evening there will be a reception and dinner at Sherry's, New York City, tendered by the Alumni Association.

The Relation between Public Health and Privies was forcibly presented by Mr. E. Nuttall, chief sanitary inspector of Stretford, England, at the recent congress of the Sanitary Institute at Manchester. He stated that statistics had been compiled for one locality which showed that in houses where typhoid occurred 72 per cent. had privies, but only 5.25 per cent. had water closets. The necessity for the proposed conversion of all privies to water closets was amply proved, yet the efforts of the local authorities to effect that conversion met with serious obstacles.

The Salford Sewage Purification Experiments.

The city of Salford, England, has become widely known among persons interested in the problems of sewage treatment for its extended experiments with a number of special methods. Recently the borough engineer, Mr. J. Corbett, read a paper before the Sanitary Institute Congress, at Manchester, in which he summarized the results gained since the beginning of experimentation, in 1889. An abstract of this paper was published in "Engineering," and some of the experiences recorded will interest readers of The Engineering Record.

The requirements at Salford are governed by the fact that the sewage to be treated is that of a manufacturing town of nearly a quarter of a million inhabitants, where trade wastes in great variety are admitted to the sewers, and where a large quantity of mere land water enters the sewers also. The sewage works were constructed about twenty years ago, on a site of only 34 acres, and any additional land would be very costly and difficult to acquire. But the borough has the great advantage of a wharf on the Ship Canal, adjoining the sewage works, from which sludge, etc., may be shipped to sea at a moderate cost.

Webster's electrolytic process of sewage purification was in many points the most unique, most scientific, and most successful of the processes tried. Its cost was somewhat high, though by no means the highest considered practicable, and it would have been adopted for the Salford sewage works but for the inability of the company promoting it to finance so large a scheme. In this process no chemical precipitants are used, but the sewage is passed between cast-iron plates, alternately connected with the positive and negative wires of a dynamo. The effect of this is much like that of chemical precipitants, the sewage being separated into clear liquid and flocculent particles, which subside into sewage sludge in ordinary precipitation tanks. The tank effluent is clear and non-putrescible, but contains fine particles of sesquioxide of iron, which give it a rust tint, and this can be readily removed by rapid filtration through a fine sand and gravel filter, the result being a perfectly bright and almost pure filtrate. About half the cost of working is for power to produce the electricity required; this process might therefore be cheap in a place where water-power is available.

The "international" process, using "ferozone" as a precipitant and "polarite" in the filters, was tried three times very exhaustively. In the opinion of the writer of the paper, the promoters of this process did much good by convincing people that sewage-tank effluent could be satisfactorily purified by filtration; but the experience gained at Salford has been that "polarite" has not the valuable qualities claimed for it, and that better results can be obtained from the cheapest available materials, such as crushed clinkers, cinders, and coke-breeze.

A great number of precipitation processes, depending on special chemical precipitants, were tried, generally on the full daily flow of 8 to 10 million imperial gallons in the old precipitation tanks, twelve in number, of about five million gallons capacity; six tanks only, in series, were generally used, giving 2,500,000 gallons, or about one quarter of a day's flow of working capacity; the other tanks being meantime emptied of sludge. Other experiments were tried in small tanks made to a scale of one-hundredth the capacity of the large tanks and used with a proportionate flow of gallons per day. The results obtained in the small tanks with some of these special

precipitants were really excellent, almost reaching the standard of the Mersey and Irwell Joint Board, of one grain of oxygen required per imperial gallon in a 4-hour permanganate test. But no process produced equally good results in the large tanks, though the writer thinks that in some cases this was merely due to not having efficient machinery for mixing the precipitants with the sewage.

Spence's aluminoferric, in comparison with lime, was thoroughly tested, especially as to the alleged great reduction in the sludge from the use of this special precipitant. The results proved that the density of the sludge was considerably decreased, but the bulk of sludge was proportionately increased, while the tank effluent was very similar. In Salford this was a disadvantage, as the sludge is shipped to sea in a sludge steamer, where the bulk of sludge is the basis of cost, and the density of the sludge, within ordinary limits, does not affect the cost of disposal.

The best and cheapest results have been obtained by the use of lime and a salt of iron either sulphate of iron (copperas), or chlorate of iron, or some special salt of iron. The lime is now prepared very carefully by the help of special machinery, first slaking the lime in circular pans with revolving stirrers; then passing the pan contents through a screen to separate out any stones, etc., and thence to other pans like mortar mills, with crushing rollers, which promote the slaking of any hard granules of lime; the milk of lime being finally mixed with the whole flow of sewage in a tank with a revolving mixer, and where a great turmoil is made by the flow from the pumping engines, by which about 85 per cent. of the flow of sewage has to be raised 30 feet to the precipitation tanks. The salts of iron are dissolved in a small tank by the help of steam, and then added to the flow of sewage about 700 feet from the lime-mixer; the stream passing from the iron mixing almost directly into the precipitation tanks.

The above-described precipitation system may seem antiquated in this era of septic tanks and contact beds, but the special circumstances render it more economical than any alternative yet studied. The writer has to deal with an old sewage works with precipitation tank of adequate size, and with only a moderate area available for filter beds or other appliances. It is therefore of the utmost importance to concentrate the work within a limited area; and as sludge can be sent to sea, it is cheaper to dispose of it thus than by the use of extensive contact beds, tanks, or other apparatus entailing heavy cost for construction, and the use for valuable land. The ultimate purification of the sewage by filters, or bacteria beds, is also materially affected by the necessity for concentrated action. The author of the paper stated that he had come to the conclusion that for all densely-populated districts tanks and filters of one kind or another were preferable to sewage farms, and were more economical. He also definitely concluded that no patent material for the construction of sewage filters is worth its cost, and that mere cinders, which can be obtained cheaply anywhere where coal is the ordinary fuel, are probably the very best material for such filters or bacteria beds.

The filters have always been used on the trickling system, with open outlet for filtrate and spent air. The system of filling, standing full, and then emptying, was never tried, as it seems illogical, and does not deal with so large a flow as the trickling system. After about twelve months' comparison of couples of filters each of 14 square yards area, formed respectively of gravel, of coke-breeze, and of cinders, the cinders proved slightly the most efficient. Distribution over the filter surface by embedded troughs and a 3-inch top of fine sand was also tried, but this soon got clogged and had to be renewed each month or two. Troughs about a foot above the surface, with small holes about a foot apart, and bits of board to break the small streams into drops over the surface, were then tried. These did very well, but hindered the daily raking of the filter surface, which was found requisite to insure proper aeration. The roughing filters were used; these were made of a 3-foot depth of gravel, or of small broken granite, to intercept any particles of wood, rag, straw, etc., in the precipitation tank effluent, and thus prevent their choking the surface of the final aerated filter-beds. Finding the distribution by sprinklers very efficient, the former top stratum of sand was removed and all the future filters were made of one grade from top to bottom; that is, between screens of two wires and of six wires to the lineal inch, but with a few inches of coarser material on the floor tiles.

Sprinkler jets were also tried, set in pipes about 1 foot above the surface, and worked under about 4 feet head of water. This system proved far the best in every way, but the first jets, though very efficient, were imperfect, in that they dribbled somewhat, and formed pools on the surface below each jet; these were simple upright nozzles, about ⅜-inch in diameter, with brass discs or cones over them to break the stream into drops. The second type of sprinkler jet was formed with two ¼-inch holes inclined towards each other, like an old-fashioned gas jet; this was somewhat better, but dribbled slightly. Ultimately a jet was obtained by which the water was set whirling, by passing through inclined holes in the lower part of the jet before reaching the top outlet; and this whirling movement throws out the water in a very fine spray over a circle of about 12 feet in diameter. As the jets are spaced 10 feet apart north and south, and 5 feet 2 inches apart east and west, the whole surface is very evenly sprinkled. But these jets are rather more difficult to clean out than the simpler ones, and they all show a slight tendency to become coated with lime, more especially if a large quantity of this material is used as a precipitant.

Filters about 5 feet deep were further experimented with, some with three ventilated spaces in the height, some with two, some with one, and some ventilated only at the floor outlet; also filters 8 feet deep, one with three intermediate ventilated floors and the outlet floor, the other with only the outlet floor. These floors were made of tiles or slates supported on bricks, and with couples of vent-pipes to each floor. The best results were obtained from the filters without any intermediate floors.

Filters in one height of cinders were tried, one of 3 feet 6 inches in depth, one of 5 feet, and one of 8 feet depth. The 8-foot one proved definitely the best, more especially when reasonably worked; but when overworked with a somewhat foul tank effluent all the filters gave inferior filtrates, and for a time the 8-foot was worse than the 5-foot, but on the average it was decidedly the best.

From the first, 500 gallons per square yard per day, or about 2,500,000 imperial gallons per acre, were proposed as the standard flow to be treated; but after gradually raising the daily flow, during about twelve hours, to this pitch, it was increased with two of the 5-foot filters up to 1,400 gallons per day, or 7,000,000 gallons per acre, before the filtrate became definitely below the standard of one grain of oxygen per gallon in a four hours' test. Two 8-foot filters were worked for about a year at 500 gallons in twelve hours, leaving twelve hours' resting time per day. They were then worked about 23 hours per day at 1,000 imperial gallons per square yard for a year, with a few slight intermissions during repairs of the steam pump supplying them. The filtrate channel from these filters became coated with a bright green growth, considered to be a sign of a good filtrate; but a small quantity of sewage fungus appeared at times in the outlet pipes.

The quality of the tank effluent put on the filters had a very direct effect on the quality of the filtrates, so much so that the efficiency of the filters for the very heavy flows here recorded depended on their having a fairly good tank effluent to deal with, and therefore various ways of using the tanks were tried in order to obtain the best possible tank effluent. The author found definitely that whenever sludge was allowed to accumulate in the tanks an inferior effluent resulted. This appeared to be due firstly to the loss of tank capacity from the mass of sludge collected in the tanks, and secondly to the putrefaction of this sludge, and its rising on gas bubbles into the upper part of the tanks, thus seriously fouling the sewage in the tanks. The best results would be obtained by removing the sludge from the tanks daily, and this should be done while the tanks are in use, by suitable apparatus, of which several types are available.

Having originally a dozen precipitation tanks, arrangements were made for using eight or ten of them separately, each with one-eighth or one-tenth the flow of sewage; the use of four couples of tanks, each dealing with one-fourth of the flow, was also tried, the remaining tanks being meantime cleared of sludge. The tanks were generally used, however, in series of six, the other six being meantime cleaned. They were once tried all twelve in series. The chemical analyses showed but slight differences in the effluents from these various systems, and slightly the best effluent was obtained from six tanks used in series. The tanks, in each set of six, had originally a fall of 3 inches from tank to tank; but this appeared to interfere with the precipitation, and a great improvement was effected by constructing a dam at the outlet of one set, so as to submerge these falls, and make one pool from end to end of the six tanks. All the tanks were eventually altered by lowering their division walls about 3 feet, so as to make a very quiet pool from end to end; but as two tanks were required for use as roughing filters, each tank is now made from five of the original tanks. The result has been remarkably successful; less than half the chemical precipitants formerly used now proves sufficient to give a satisfactory effluent. This is with sludge removal once a week, in place of once a fortnight or once a month, as previously practised. So it seems certain that if the sludge were removed once a day still better results would be obtained.

This tank effluent is passed through roughing filters of gravel 3 feet deep, similar to those used during nearly all the filtration experiments. The special use of these roughing filters is to intercept particles of rag, wood, straw, etc., which would tend to choke the surface of the final filters. During the experiments it was found that 75 per cent. of the matters in suspension were thus removed from the tank effluent. This result was attained when the roughing filters had a reversed current upward washing each day, and had the gravel dug out and washed under a stream of water about three times a week. Up to the present time the permanent roughing filters have not been provided with washing appar-

atus, except mere upward washing, and recent analyses showed that they are intercepting only from 25 to 50 per cent., instead of 75 per cent., of the matters in suspension. Thus the sewage works are still incompiete, and the excellent results attained during the many years of experimenting are not yet attained in the daiiy working on a large scaie..

When the requisite machinery is provided for removing sludge from the precipitation tanks and for washing and raking the roughing fiiters and bacteria beds, the writer has no doubt that results as good as those from the experiments will be obtained with the whole flow of sewage, and even with a considerabie addition of storm-water at times; and thus these long-continued experiments will result in a sewage purification system more economical in first cost, and probably also in working cost, than any system yet adopted in a largé manufacturing town.

The Charles River Dam, Boston.

The citizens of the Boston metropolitan district have shown a commendable intelligence and enterprise in recognizing, reserving and improving spots of natural beauty for park purposes. One prominent natural feature, however, in the very midst of the district has hitherto been allowed to continue in such condition as to be almost a nuisance instead of having been developed into a place of public enjoyment and municipal adornment, as is within the possibilities of the situation. In 1894 a joint board consisting of the Metropolitan Park Commission and the State Board of Health presented a scheme for damming the Charles River near its mouth so as to form a large fresh-water basin to be kept at a constant level so as to avoid the unpleasant results of tidal fluctuations in the estuary. This report eventuated in no action, the improvement being opposed by certain influential citizens whose property on the Boston side of the stream it affected, although it was heartiiy approved by many organizations and prominent citizens not oniy in Boston but in Cambridge and other towns on the shores of the basin.

In 1901 a special committee, consisting of Dr. Henry S. Pritchett, president of the Massachusetts Institute of Technology; Col. Samuel M. Mansfield, Corps of Engineers, U. S. A., and Richard H. Dana, Esq., was appointed to consider the advisability of constructing a dam across the Charles River between Boston and Cambridge, and, in accordance with the terms of its appointment, rendered its report to the legisiature on January 14. After a careful review and extended study of the work previously done and the conditions to be fulfilled, this committee recommends that a dam be built at the site of the present Craigie bridge in Boston and Cambridge; that the dam be made high enough to exclude ali tides and provided with a lock 350 feet long between gates, 45 feet in clear width, with a depth of 13 feet over the siil; that ali objectionable drainage on both sides be intercepted by marginal drains and carried into the river below the dam, and that certain portions of the banks of the basin should be improved and a small amount of dredging done. The dam is to be 130 feet wide on top with a roadway and a park strip affording an open-air resort for the crowded districts of the adjacent cities. A drawbridge will be provided over the lock at a sufficient height to allow barges and tugs to pass without opening the bridge, the top of the dam being graded to give a suitabie approach. It is thus intended that the dam will supply the need for a new bridge at this location, for which a number of studies have already been made. The water in the basin is to be maintained at a level between 8 and 9 feet above mean low tide in Boston Harbor and all salt water is to be excluded.

The total cost of the work recommended by the Committee and properly chargeable to the improvement of the basin by a dam is estimated at $1,236,000, but this does not include certain collateral work which will be required for other reasons and paid for from other funds. The cost of the dam would be off-set to a considerable extent by the saving in expenditure for certain improvements now in progress to the extent of $810,000, thus making the estimated net cost of the dam and its contingent improvements $426,000. Various estimates for a new bridge to replace the old Craigie bridge have ranged from $864,000 to over $2,000,000. The Committee suggests that the expenditures should be distributed among the communities principally benefited as follows: Boston, 7/12; Cambridge, 3/12; Newton and Watertown, each 1/12. The report proposes that the work should be committed to a board composed of the mayors of Boston and Cambridge and the members of the Metropolitan Water and Sewerage Board. The engineering corps of this board, of which Mr. Frederic P. Stearns is chief engineer, is peculiarly well fitted to carry out this work. Mr. Stearns was the engineer for the joint board which reported on the Charles River Improvement in 1894. Mr. John R. Freeman was the engineer for the Charles River Dam Committee.

Directory of National Engineering Societies.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st Street, New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, R. W. Pope, 95 Liberty Street, New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Convention at Albany, N. Y., February 17th, 18th and 19th. Secretary, R. W. Raymond, 99 John Street, New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Elmira, N. Y.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 235 Water Street, New York.

The business session of the American Society of Civil Engineers on the 21st was attended by 450 members. It was voted to co-operate in the establishment of a congress of engineering at the St. Louis Exposition. A resolution of respect to Abram S. Hewitt was passed in recognition of the high purposes of his life, which had been devoted to those interests which have advanced the profession of the civil engineer. Wednesday afternoon a large number of the members visited the Rapid Transit Subway under guidance of Chief Engineer William Barclay Parsons, Division Engineer Alfred Craven. The annual reception was attended by about 350 members and guests. On Thursday a steamboat excursion was made to engineering works of interest in the vicinity of New York, and on Friday members and guests of the society inspected the filtration plant of the East Jersey Water Company, at Little Falls, and were entertained there by Chief Engineer J. Waldo Smith and Resident Engineer William B. Fuller. The attendance exceeded previous records.

The Capacity of Cast-Iron Sectional Steam Boilers.

At the meeting of the American Society of Heating and Ventilating Engineers, held this week in New York City, a paper was presented by Mr. J. J. Blackmore, in which he proposes a feasible basis for establishing a standard rating for sectional cast-iron heaters in such terms as to enable the engineer to compare the performance of various makes. The following is the paper substantially as given:

One of the great difficulties of the heating engineer is to determine the relative values of cast-iron boilers as offered by the different manufacturers. Many of the manufacturers give no measurements in their catalogues, of heating surface in boilers of their production, while some do give it, and in cases where it is given the engineer can with some thought select a boiler suitable for his work without relying on the capacity as given in the catalogues of the makers. There is a difficulty here, however, and that is, how was the surface measured, and has the boiler the heating surface marked for it in the catalogue? There has long been a desire to have some standard adopted by which cast-iron sectional boilers could be rated by any engineer in the same way as water tube and tubular boilers are rated for power purposes. The construction engineer has been compelled, for want of such information, to rely on the manufacturer's rating of a boiler, and to make a liberal discount on that to be on the safe side.

The cast-iron sectional boiler has undoubted advantages for heating purposes, over steel constructions, as is evidenced by the rapid increase in their use. This is no doubt due to the small units from which they can be made up, thus making the boiler portable, easy to repair, easy to add to for future increases, and above all, safe, due to the steam being kept in several compartments of small capacity instead of one large steam chamber as in a tubular boiler. There should be some recognized standard of measurement for all cast-iron sectional boilers, and it should be so simple and equitable that all makers and engineers would mutually adopt it for computing the heating surface. The quantity of surface being computed, then it becomes a simple matter to adopt a ratio of boiler heating surface to the radiation it is to supply.

In the measurement of heating surface in a sectional cast-iron boiler having vertical sections, it is best to consider each section as a flat surface having two sides and imagine the walls of the flues folded out to fill in the space made in the section to form the fire-box and flues. Various tests have shown that the fairest way to get this is to take the outside width of the flues across the section, the extreme height of the section from the grate line to the top. A question then arises that all sections are not of the same thickness, and to provide for that, the thickness of the section is to be added to the width. Again, it is found that there is a difference in the height of a boiler with a heater or steam drum. If we are to take the measurement of the section only and ignore the drum, the measurement would not be fair to the boilers of the push-nipple type, as the drum on top of the section does in a measure increase the capacity of a boiler by allowing a higher water line to be carried. Careful comparisons have shown that this condition can be met in perfect fairness to both by adding 10 per cent. to the height of section in all header boilers. In the case of the push-nipple type of boiler the rule would be as follows:

$$X = 2 (W + D) H \div 144.$$

In the case of the header type of boiler the rule would be modified as follows:

$$X = 2 (W + D) 1.1 H \div 144.$$

In which W represents width across flues in inches at water line of heater, D represents depth of section in inches, H the height in inches from grate line to top of section and X the result, or measurement in square feet of heating surface per section.

The question of the value of the front and back sections must now be considered. It is quite manifest that the front part of the front section performs no work and the same is nearly so of the back section; this being the case, the surface should be considered as only half for each of the front and back sections. By this deduction we would count the value of one section off each boiler and would figure the surface of a five-section boiler as that contained in four sections and that of a seven-section boiler the surface of a six-section, and so on.

By adopting such a rule as a standard, all sectional cast-iron boilers can be safely measured and their value can be easily determined. It may be said that such measurement will not accurately determine the value of all the various makes of this type of boiler. This may, in a measure, be correct, but any difference in this respect can be adjusted in settling the ratio of boiler surface to radiating surface supplied by the different boilers. To determine the ratio of boiler surface to heating surface it is well to refer to the standards adopted by engineers to determine the value in horse-power of tubular and water-tube boilers. A horse-power as applied to the capacity of a boiler is equivalent to the evaporation of 34.5 pounds of water per hour from and at 212 degrees, this being equivalent to 33,316 B. T. U. per hour. To compare this we will consider the heat lost by 100 square feet of radiation in a room with 70 degrees as the average temperature. As a foot of steam radiation loses approximately 275 units of heat per square foot per hour, this would be equal to 27,500 units for 100 square feet of radiation, which would make a rated boiler horse-power equal to 122 square feet of radiation.

In power-boiler practice, engineers require 10 square feet of heating surface per horse-power for water-tube boilers and 12½ square feet for tubular boilers. As the cast-iron sectional type of boiler has a good deal of flue surface, it approximates more nearly the value of a tubular construction than of the water-tube type, and to be on the safe side it is better to rate on the basis of the tubular type, which is approximately equal to one square foot of boiler surface to 10 square feet of radiation supplied. This, however, must be modified to give a smaller ratio to boilers of small capacity in which the rate of combustion is slow, of one square foot of boiler surface to eight of radiation, and progressively 1 to 9, 1 to 10, 1 to 11 and 1 to 12 for boilers having a larger proportion of direct fire surface. With a standard for measurement of cast-iron sectional boilers on this basis and a definite ratio for different sizes and constructions established, one of the greatest of the difficulties of the constructing engineer will have disappeared.

Personal and Obituary Notes.

Civil Engineer E. R. Gaylor, U. S. N., has been ordered to the Norfolk Navy Yard.

Mr. Charles L. Goodhue has been re-elected water commissioner of Springfield, Mass.

Mr. Joseph R. Jewell has been elected superintendent of the water-works of Summit, Miss.

Col. W. S. Nock has been elected president of the Board of Water-Works Commissioners of Covington, Ky.

Mr. J. W. Barnett has been re-elected city engineer of Athens, Ga., and Mr. W. L. Wood, superintendent of water works.

Mr. Frank P. Cobb has been reappointed city engineer of Chicopee, Mass., and Mr. Maurice Kennedy superintendent of streets.

Mr. W. D. Dickenson has resigned as superintendent of the Street Railway Co. and Electric Light Co., at Great Falls, Mont.

Mr. C. T. Coley, a graduate of Stevens Institute of Technology, has been appointed instructor in electrical engineering at Union College, Schenectady, N. Y.

Mr. F. A. Manley has resigned as chief engineer of the Union Pacific Coal Co., with headquarters at Rock Springs, to devote his time to hydraulic and mining engineering in Idaho.

The Engineers' Club, of Portsmouth, N. H., has elected the following officers: President, Lee Treadwell; vice-president, W. B. Hayes; secretary, H. L. Hilton; treasurer, J. J. Ruckes, Jr.; executive committee, H. W. Hobbs, F. O. Holmes and C. F. Carman.

Naval Constructor F. W. Hibbs, U. S. N., since 1900 in charge of the department of construction and repair at the Puget Sound navy yard, has resigned to engage in shipbuilding at Seattle, Wash., and he is to be succeeded by Naval Constructor R. P. Hobson.

Robert Poole, president of the Robert Poole & Son Co., iron founders, of Baltimore, Md., died at his home near that city on January 15, aged 75 years. He erected the dome of the Capitol in Washington and built many cannon for the federal army during the Civil War.

James Oscar Nixon, engineer and manager of the silent chain department of the Link-Belt Engineering Co., of Philadelphia, met an untimely death December 27, at the age of 23 years, from typhoid fever. He was graduated from Tulane University in 1897, and during the last two years or so succeeded in developing and successfully introducing the Renold silent chain in this country.

The Lehigh University Club of New York held a banquet in that city on January 10, at which the following were among the speakers: President Alexander C. Humphreys, of Stevens Institute, "Theory and Practice in Technical Education"; President Thomas M. Drown, of Lehigh University, "Individuality in Technical Education"; Hon. William C. Redfield, commissioner of public works in Brooklyn, "The Opportunities of the Employer."

The American Society of Civil Engineers elected the following officers at its annual meeting this week in New York City: President, Alfred Noble, New York; vice-presidents, L. F. G. Bouscaren, Cincinnati, James D. Schuyler, Los Angeles, Cal.; treasurer, Joseph M. Knap, New York; directors, Alfred Craven, Yonkers, N. Y.; Joseph O. Osgood, Plainfield, N. J.; George S. Davison, Pittsburg, Pa.; E. C. Lewis, Nashville, Tenn.; Hunter McDonald, Nashville, Tenn.; Elwood Mead, Cheyenne, Wyo.

The American Society of Heating and Ventilating Engineers elected the following officers at its convention in New York City this week: President, H. D. Crane, Cincinnati, O.; first vice-president, Wm. Kent, Passaic, N. J.; second vice-president, Reginald Pelham Bolton, New York; secretary, Wm. M. Mackay, New York; treasurer, J. A. Goodrich, New York; board of governors, A. E. Kenrick, Brookline, Mass.; Prof. R. C. Carpenter, Ithaca, N. Y.; John Gormly, Philadelphia; C. B. J. Snyder, New York.

The following railroad appointments have been reported: Messrs. Charles E. Lindsay, Charles E. Buchholz and Allen W. Carpenter, division engineers on the Middle, River, and Pennsylvania Divisions of the New York Central & Hudson River Railroad. Mr. J. N. Shannahan, general superintendent of the Fonda, Johnstown & Gloversville Railroad. Mr. Leroy H. Byam, supervisor of bridges and buildings of the Pennsylvania Division of the New York Central & Hudson River Railroad. Messrs. R. W. Hudson, Walter Hale, and D. E. Maxwell, superintendents of the Fourth, Fifth and Sixth Divisions of the Seaboard Air Line. Mr. C. S. Churchill, chief engineer of the Norfolk & Western Railway. Mr. F. W. Egan, general superintendent of the Colorado & Southern Railway. Mr. F. E. Dewey, general superintendent of the St. Louis & Gulf Railway, with headquarters at Cape Girardeau, Mo.

Estevan Antonio Fuertes, a distinguished civil engineer, and for nearly 30 years director of the College of Civil Engineering, Cornell University, died January 16 at his home in Ithaca, N. Y., after an illness of three days, though he had not been well for several years. He was born in San Juan, Porto Rico, May 10, 1838, received an academic education, taking the degree of Ph.D., and afterward came to United States and graduated from the Troy Polytechnic Institute in 1859. From 1861 to 1863 he was employed in the Public Works Department of Porto Rico, and then became assistant engineer, and from 1864 to 1869 engineer of the Croton Aqueduct Board, New York. During 1870 and 1871 he was engineer-in-chief of the U. S. Ship Canal Expedition to Tehuantepec and Nicaragua. During the succeeding two years he was established in New York City as consulting engineer, giving up his practice in 1873 to accept the appointment in Cornell University. Under his directorship the department of civil engineering grew from a very small school to one of the most important engineering colleges. Through his independent efforts was established the New York State Weather Bureau service, which, during 16 years, he personally directed, contributing for the purpose valuable apparatus and a large proportion of the funds required for the payment of the employes. Later the U. S. Bureau took possession of the records and continued the work. He was the first to advocate laboratory work in civil engineering schools, and at Cornell developed one of the most extensively equipped laboratories in the world for testing materials and for performing field, geodetic, astronomical and other engineering work, the latest addition to this equipment being the new hydraulic laboratory. Of his other works, the most important was a report upon the improvement of the sanitary condition of Santos, Brazil, covering water supply, sewerage, drainage and paving, disposal of garbage and refuse, drainage of swamps surrounding the city, establishment of quarantine stations, disinfecting stations and hospitals for yellow fever and small-pox, as well as regulations for plumbing and proper sanitary construction of buildings. He became a member of the American Society Civil Engineers in 1869, and was elected a director in 1892. His name was also on the active and honorary membership lists of many other American and foreign technical and scientific societies. The high grade and wide scope of his abilities, his conspicuous devotion to duty, his social graces and his lovable personality have endeared him to an unusual degree to his friends, associates and to the great number of students who have cherished his friendship and counsel in the profession of which it was his noble aim to make them manly and capable members.

The Norman Medal of the American Society of Civil Engineers has been awarded to the paper describing the experiments at Detroit, Mich., on the effect of curvature on the flow of water in pipes, by Gardner S. Williams, C. W. Hubbell and George H. Fenkell; and the Thomas Fitch Rowland prize to the paper describing Coos Bay, Oregon, and the improvement of its entrance by the Government, by Capt. W. W. Harts, Corps of Engineers, U. S. A.

Abram Stevens Hewitt died at his home in New York, January 18. To record the achievements, analyze the personality and forecast the influence of one who worked for so much good for the whole world is a task which The Engineering Record feels altogether unable to undertake. It realizes, moreover, how incommensurate is any obituary it may be able to print with the man's place in the world's history, but on that account it is gratified that it has from time to time noted the fruitful results of his labors toward the solution of industrial and educational problems. He will always be remembered as a pre-eminently successful manufacturer, a conscientious and highly esteemed employer, a faithful servant of the people and a philanthropic educator. Though eighty years of age on July 31 of last year, he remained actively engaged with his affairs to January 8, when he became seriously ill. He was born in Haverstraw, N. Y., after his father, who came to this country as a representative of the English engine builders, Boulton & Watt, had lost a comfortable fortune. He received his early education in the public schools, and securing a scholarship, on the basis of a competitive examination, entered Columbia University. Although forced to engage in tutoring during his course he was graduated in 1842 with many honors and became a University tutor in mathematics. During this period he studied law, being admitted to the bar in 1845, but by overwork he had impaired his general health and eyesight, and in 1844, in company with Edward Cooper, son of Peter Cooper, went to Europe. In this trip, during which they experienced the hardships of a shipwreck, was cemented a friendship which shaped Mr. Hewitt's subsequent career. It resulted in his association with Edward Cooper in the establishment of Cooper, Hewitt & Co., under the auspicious backing of Peter Cooper, and in his marriage ten years later with Mr. Cooper's daughter. A rolling mill was started in Trenton, N. J., and in 1847 was incorporated the Trenton Iron Co., the first American concern to make iron beams and girders, and the first to introduce the Siemens-Martin process of making steel. He applied himself with wonderful energy to the iron and steel business, and during the Civil War furnished the government with cannon under rush orders and in a time far less than that estimated. As evidence of the broad gauge character of the concern it may be added that this work was done at a loss. For the five years ending 1878 the business, Mr. Hewitt publicly stated, was conducted at an annual loss of $100,000. It is a remarkable fact that there has never been a strike at the Trenton Iron Works. His public career began in 1867 when he was appointed one of the Commissioners to the Paris Exposition to report on iron and steel. From 1874 to 1886, with the exception of one term, he served continuously as congressman and in 1886 he was elected mayor of New York. He was president of the American Institute of Mining Engineers in 1876 and 1890, and in the latter year received the Bessemer gold medal of the Iron & Steel Institute. He was the head of Cooper Institute in New York since its foundation by Peter Cooper. Much of his last work was devoted to this institution, to the management of the funds of Barnard College, in New York, to the $10,000,000 Carnegie research institute and the Burke foundation of $4,000,000 for the relief of the sick poor. He was director of the American Bridge Co., the U. S. Steel Corporation, several railroads, a number of financial institutions and many other interests. Recently the New York Chamber of Commerce presented him with a gold medal commemorative of his long service in the cause of rapid transit for that city.

Trade Publications.

The General Power Co., 81-83 Fulton St., New York City, has recently issued an illustrated booklet on the Secor system of power, which describes the Secor oil engine with particular reference to its use in direct-connected generating sets. For these oil-electric units the makers claim low cost, through the use of ordinary commercial kerosene, and close and automatic regulation for varying loads without the assistance of a storage battery auxiliary.

Modern Hydro-Electric Power Stations is the subject of a pamphlet from Mr. J. W. Rickey, civil and hydraulic engineer, 508 S. First St., Minneapolis, Minn. The merits of his patented concrete-steel open penstocks are described together with the details of construction of the power station at Sault Ste. Marie, Mich., where 81 of these penstocks are in use.

Bulletin No. 29 issued last month by the Crocker-Wheeler Co., of Ampere, N. J., deals with semi and fully inclosed motors, form I, for driving machinery by direct connection. They are made in eight sizes with two speeds each and range from 3 to 45 horse-power. Many illustrations are given showing adaptations of the motor to the driving of different classes of machines.

The Allis-Chalmers Co., of Chicago, have lately brought out a tenth edition of catalogue No. 5, on rock crushing plants. Cuts aud descriptions are given of crushers, screens, conveyors and all apparatus for a complete plant's equipment, with drawings of several modern plants now in existence. From the same firm comes another booklet containing an extensive list of the users of the Riedler pumping, compressing and blowing engines, giving the type, capacity, power, speed and other data of each piece of apparatus installed.

From the General Electric Co., Schenectady, N. Y., the following bulletins have been received: No. 4,299 on a prepayment device for electric meters, 4,300 on direct-driven continuous-current generators for lighting and power; 4,301 on arc lighting, including direct and alternating enclosed arc lamps for various pressures, compensators and constant-current oil-cooled transformers; 4,302 on service cut-outs; and 4,303 on searchlight projectors, commercial and U. S. government types. Catalogues and price lists No. 7,564 of standard fuses, open, enclosed and plug types; 7,565, parts of R-27, R-27-D and R-32 controllers; 7,566, parts of R-11 and R-17 controllers; 7,567, parts of carbon feed enclosed arc lamps, form 5, for direct current multiple circuits; and 7,568, repair parts of GE-1,000 railway motor, have come to hand, together with flyer 2,107, listing an insulator for cables passing through I, or deck beams. With the foregoing there was also received an attractively illustrated catalogue on electrical apparatus and supplies for isolated plants.

A new descriptive price list of engineering and astronomical instruments has just been issued by George N. Saegmuller, Second St. and Maryland Ave., S. W., Washington, D. C., superseding all former publications of the firm of Fauth & Co., to whose business Mr. Saegmuller has succeeded. Nearly all the instruments, especially those for engineering purposes, have lately been remodeled in the endeavor to decrease their weights, increase their optical power, improve the accuracy of the graduations, and give thorough protection from dust and water. In the new coast and geodetic survey instruments, particular attention is called to the improvements in the pendulum apparatus, the iced-bar base apparatus, the precision level and the new tide gauge.

Catalogue A, or "Brass Products," as it is called on the cover, is an illustrated price list of a new line of brass gates and radiator valves manufactured by the Michigan Brass and Iron Works, of Detroit, Mich. The booklet has 40 pages, presenting the many patterns in which these two products are made.

The January issue of "Graphite," the monthly publication of the Joseph Dixon Crucible Co., Jersey City, N. J., contains the following leading articles: Phosphorizing Metals; How to Avoid the Cracking of Crucibles; Linotype Graphite; A New Graphite Force Feed Pump; and Graphite and Water for a Boiler Feed Pump.

"Sparks from the Anvil," published by the Crucible Steel Company of America, Pittsburg, Pa., presents the following articles this month: The Microscope and the Structure of Iron and Steel; Committee Report on Tool Steel; A Differential Fracture; Hardening Power and Magnetic Properties; New Departures in Scientific Research; Annealing Experiments; A Serviceable Cutter; and A Telescoped Punch.

A folder from the Buff & Buff Mfg. Co., Jamaica Plain, Boston, Mass., introduces a new line of precision transits, with a word about the equipment of its factory.

The following calendars have been received since the issue of Jan. 3. Among the more artistic may be mentioned two from the Christensen Engineering Co., of Milwaukee, Wis., each of which contains a colored reproduction of a moonlight water scene, from paintings by Neil Mitchell and Tyler; and one from the Lombard Governor Co., 36 Whittier St., Boston, Mass., with a similar picture, entitled "Moonlight at Sea," from the painting by W. Weber. "The Debutante" is the title on the calendar from the Springfield Gas Engine Co., Springfield, O., and it is as pretty as the name would imply. The one received from the New York-Continental-Jewell Filtration Co., 15 Broad St., New York City, contains an engraving of a more practical nature, representing a locomotive taking on water. Styles & Cash, 77 Eighth Ave., New York, are distributing a unique calendar. On the upper part there is a dial with a sheet for each month and a pointer at the center to indicate the date, and at the bottom an engagement block is attached with a sheet for each week. Useful, business-like calendars have been received from the Reading Cement Co., Baer Building, Reading, Pa.; Charles F. Bloom, 130 William St., New York; and the C. W. Trainer Mfg. Co., 89 Pearl St., Boston, Mass. The last has a page for each month, each 22x30 inches in size, with letters 2 inches high. Tippett & Wood, Phillipsburg, N. J., have attached a small thermometer to a neat little calendar showing an elevated water tank. The Meehan Boiler & Construction Co., Lowellville, O., makers of plate work of every description, send a diamond shaped calendar representing a mass of poppies in the center of which appears the head of a golden-haired girl; and the Means & Fulton Iron Works, Birmingham, Ala., a beautiful 8x10-inch reproduction of a painting of "Helene."

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 22 and 24.

WATER.

Boston, Mass.—The Metropolitan Water & Sewerage Bd. has reported to the House on the improvement of Spot Pond Brook. The plan reported provides for the laying of a 20-in. pipe from the present outlet in Stoneham to a point in Melrose, the building of a covered conduit to receive the water from the pipe and brook at this point, and the construction along the line of the brook to Winter St., Malden, of a wide channel with flat slopes to provide for freshet flows, and a narrower central channel to carry the ordinary flow; estimated cost of improvement is $275,000.

Falmouth, Mass.—H. F. Mitchell, Town Clk., writes that it is proposed to extend the water system to West Falmouth, at a cost of $30,000.

Oneida, N. Y.—City Engr. Vedder is stated to have been instructed by Council to report on the feasibility of constructing a reservoir, capable of holding about 75,000,000 gals.

Cazenovia, N. Y.—Bonds to the amount of $3,500 are to be sold for enlarging the water works.

Dunkirk, N. Y.—It is stated that a new main will be laid in Robin St. at a cost of $11,000.

Horseheads, N. Y.—The citizens will probably soon be asked to vote on the question of constructing water works, to cost from $90,000 to $100,000.

Jersey City, N. J.—The Street & Water Bd. is stated to have passed a resolution providing for an auxiliary pipe line under Passaic and Hackensack Rivers, if the corporation counsel decides that the city can contract for an extra pipe at these points and the Bd. of Finance and Mayor concur.

McKees Rocks, Pa.—An ordinance has been introduced in Council granting permission to the Fleming Park Water Co. to pipe the borough.

Greene, N. Y.—E. L. McKenzie writes that the question of constructing water works and an electric light plant, to cost about $40,000, is under consideration and will be voted upon in March. Engineers, Wise & Watson, of Passaic, N. J.

Plainfield, N. J.—The Plainfield Water Supply Co. is reported to be making arrangements to extend its pipes to Scotch Plains.

Pennsgrove, N. J.—John P. Leap, Chmn. Water Com., writes that the following bids were opened Jan. 13 for constructing water works: Geo. Pfeiffer, Camden, $32,500, and H. A. Miller, Wilmington, Del., $29,900. A press report states that the bids have been rejected and the matter postponed indefinitely.

Georgetown, S. C.—The Secy. of the Comrs. of Pub. Wks. writes that the Hughes Specialty Well Boring Co., of Charleston, has received the contract for boring an artesian well (bids opened Jan. 16) at $5 per ft. to 500 ft. and $6.20 for each additional foot to 750 ft.

Atlanta, Ga.—See "Sewerage and Sewage Disposal."

Evanston, Ill.—Bids are wanted Jan. 27 for laying a 6-in. cast iron water main and appurtenances in a portion of Madison St. Jas. A. Patten, Pres. Bd. Local Improv.

Rice Lake, Wis.—The Council is stated to have decided to purchase the plant of the Rice Lake Water Works Co. for $25,767.

Detroit, Mich.—Bids will be received Jan. 26 by the Bd. of Water Comrs. for $50,000 water bonds. Benj. F. Guiney, Secy.

St. Paul, Minn.—Local press reports state that the Water Bd. will expend $60,000 this year for betterments of its source of supply.
Bids are wanted Jan. 31 for furnishing the city with 28,500 ft. of 4 to 16 in. cast iron water pipe with privilege of 17,000 ft. additional. John Caulfield, Secy. Bd. of Water Comrs.

Primghar, Ia.—W. H. Downing, City Clk., writes that it was voted Jan. 13 to appropriate $4,600 for water works.

Cleveland, O.—The Neptune Water Co., of Long Island City, N. Y., is stated to have secured the contract for furnishing this city with 15,000 water meters.

Cincinnati, O.—Bids will be received Feb. 17 by the Bd. of Trus., "Comrs. of Water Wks.," for constructing buildings for the Western Pumping Station, advertised in The Engineering Record.

Algoma, Wis.—It is reported that John A. Cole & Son, of Chicago, Ill., have prepared plans for the proposed water works.

Bloomington, Ill.—It is stated that bids are wanted by the Water & Light Com. until Feb. 2 for boring not less than 5 or more than 20 wells, 4 in. or over in diameter.

Sioux City, Ia.—It is stated that bids are wanted Feb. 2 for $50,000 water works bonds. E. Q. Ledyard, City Aud.

Lakewood, O.—Bids will be received Feb. 14 by the Bd. of Trus. for laying water mains. John French, Hamlet Clk.

Owensboro, Ky.—Water bonds amounting to $200,000 are reported sold. B. L. Force, of Columbus, O., is stated to have submitted plans to Council for water works, which provide for a plant, to cost about $110,000.

Windsor, Mo.—Burns & McDonnell, Postal Telgh. Bldg., Kansas City, Mo., have been selected to prepare plans for water works. Bonds will be voted as soon as plans are completed.

Knoxville, Tenn.—See "Sewerage and Sewage Disposal."

Scranton, Miss.—Chas. T. Ballard, Saml. Culbertson, and associates are stated to have purchased the electric light plant, water works and ice plant at Scranton, and railroads extending from Scranton north to Moss Point and southwest to Pascagoula. It is reported that about $400,000 will be expended in improvements.

Sayre, Okla. Ter.—A press report states that at a town meeting Jan. 14, it was decided that the town shall have its own water works, supply to be obtained from Spring Lakes, on the opposite side of Red River. Electric lights and sewers are also contemplated.

Schulenburg, Tex.—F. F. Schaefer, City Clk., writes that it was voted Jan. 7 to issue $12,000 water works bonds.

Kansas City, Mo.—Local press reports state that the plan of building the masonry aqueduct between Quindaro and Turkey Creek pumping stations has been abandoned, and instead an additional 36-in. iron flow line will be laid between the two stations. Supt. of Water Wks. Goodwin is reported to have been directed to confer with Hiram Phillips, of St. Louis, the Consulting Engr., and prepare an estimate of the cost of the flow line, which will probably be about $150,000.
A press report that the Metropolitan St. Ry. Co. are about to let contracts for the construction of an intake to supply water from Missouri River for the cooling of condensers at its new power plant on Grand Ave. The intake will be carried 30 ft. into the river from the harbor line.

Jefferson Barracks, Mo.—Plans are being prepared for improvements to the water supply for fire pressure.

Ft. Morgan, Ala.—Bids will be received Mar. 1 by A. D. Raymond, Acting Q. M., for sinking an artesian well.

Boonville, Mo.—This city has employed Burns & McDonnell, of Kansas City, Mo., to make a valuation of the water works plant and submit plans and estimates.

Dyersburg, Tenn.—The House is stated to have passed a bill authorizing Dyershurg to issue $65,000 bonds for water works, electric light plant and sewers.

Biloxi, Miss.—Bonds amounting to $15,000, to complete water works, have been sold.

Lawton, Okla. Ter.—The Secy. of the Interior is reported to have declined to approve at this time the contract recently entered into by the City Council for the construction of water works, at a cost of $105,000, which was presented to Governor Ferguson a short time ago.

Lancaster, Tex.—The Municipal Construction Co., of Dallas, is stated to have secured the contract for constructing water works, for $9,000.

Denver, Colo.—The State Land Bd. is stated to have granted the Colorado Realty & Securities Co., 715 17th St., permission to construct an irrigation district 49 miles in length, at a probable cost of $201,500. Wm. C. Johnston, Pres.

Orangeville, Idaho.—S. A. Chamberlain, Pres. Central Idaho Water, Light & Power Co., writes that it is proposed to construct water works, electric light and power plant and an electric railway, to cost in all from $100,000 to $200,000.

Morgan, Utah.—The City Council is reported to be taking steps to secure a spring in North Morgan with a view to putting in a water system for domestic purposes.

Tulalip, Wash.—Indian Comr. Jones, of Washington, D. C., is reported to have ordered R. H. Pringle, Superv. Engr. of the Indian bureau, to go to Tulalip, for the purpose of locating water works, electric light plant and a sewer system.

Lagrande, Ore.—S. R. Haworth, of Lagrande, Pres. Lagrande Water Works Co., writes that it is proposed to construct water works, at a probable cost of $50,000. Will need an engineer in the spring.

Oakland, Cal.—The Citizens' Com. on Water Supply (R. H. Chamberlain) has completed its report on the municipal ownership of water and available sources of supply and recommends the construction of an adequate distributing system, the laying of pipe lines to Niles, construction of pumping plants, etc.; total cost of entire system including water rights, will be about $3,500,000.

Claremont, Cal.—See "Power Plants, Gas and Electricity."

San Francisco, Cal.—Mayor Schmitz, in his annual message to the Bd. of Superv., Jan. 12, is reported to have recommended the installation of a salt water system for fire purposes and for flushing streets and sewers, and also the use of bituminous macadam in place of smooth asphalt for paving.

SEWERAGE AND SEWAGE DISPOSAL.

Boston, Mass.—The Bd. of Aldermen on Jan. 12 on recommendation of Mayor Collins passed a loan order of $1,000,000, for the construction of sewerage works. This is the usual appropriation made annually.
Bids will be received Jan. 27 by the Street Dept. for furnishing iron castings, such as manhole and catch-basin frames and covers, lamp-hole frames and covers, catch-basin grates, tide-gate frames, iron inlets, traps, regulator castings, etc. James Donovan, Supt. of Streets.

Gloversville, N. Y.—Morrell Vrooman, City Engr., writes that it is proposed to construct a main intercepting sewer, mostly 30-in. pipe, at a cost of $80,000. Chas. Shafer, Chmn. Com.

Weehawken, N. J.—Bids will be received Jan. 27 by the Township Com. for constructing sewage disposal works and outlet sewer in this Township. Thos. Carroll, Township Clk.

Camden, N. J.—Project of filling meadows and sewering 150 acres drained now by small stagnant stream known as Line Ditch, is still being agitated. No definite action as yet by Council. L. E. Farnham, City Engr.

Jersey City, N. J.—Chas. O'Neill has secured the contract for the proposed sewers in Belmont, Gardner, Monticello, Fairview and Fairmount Aves. at 93 per cent. of standard price.

Asbury Park, N. J.—The citizens on Jan. 13 are stated to have voted to issue $50,000 bonds to buy Founder Jas. A. Bradley's sewerage system.

Edgemere, L. I., N. Y.—Press reports state that a survey for a trunk sewer is being made which will extend along the Jamaica Bay front, from Rockaway Park to Norton's Creek, at Edgemere; probable cost, $450,000, and work is expected to begin in the fall.

Paterson, N. J.—It is possible that an intercepting sewer will be built in the spring to drain the 4th, 5th and 9th Wards; length about 5,500 ft. Estimated cost about $75,000. H. J. Harder, City Engr.

Wilmington, Del.—The St. & Sewer Dept. intends applying for permission to issue bonds for constructing Prices Run sewer. The plans have been prepared and call for a brick and concrete sewer, varying in size from 7 ft. 9 in. diameter to 4 ft. diameter; estimated cost, $82,000. Leslie V. Christy, Secy.; T. Chalkley Hatton, Consulting Engr.

Washington, D. C.—A bill authorizing the District of Columbia to borrow $10,000,000 from the treasury of the United States for a period of 20 years has been ordered favorably reported to the House of Representatives by the House Com. on the Dist. of Columbia, for the carrying forward of the sewage disposal system, the filtration plant, the District building and for other improvements.

Atlanta, Ga.—Among the improvements on the apportionment sheet prepared by the Council Finance Com. is $27,000 for the extension of two sewers, probably Wells and Beckwith Sts. sewers to the city limits; $26,000 for the paving of Peachtree St., and $25,000 for buying and laying new water mains.

Toledo, O.—Bids are wanted Feb. 16 for furnishing material for constructing a circular brick and iron pipe sewer, 5 ft. inside diameter, in portions of Jefferson St. Chas. H. Nauts, City Clk.

Columbus, O.—The Council is reported to have passed the ordinance providing for the issue of $175,000 sewer bonds, to be divided as follows: North side, $30,000; central relief, $80,000; Kelton Ave. relief sewers and pumping station, $37,000, and the Beck St. relief sewer, $28,000.

Delphos, O.—J. W. Fisher, City Clk., writes that it was voted Jan. 12 to issue bonds to the amount of $60,000 for sanitary sewers and $40,000 for park improvements. He further states that plans will be received until Feb. 2 for sewers.

Tipton, Ind.—Bids are wanted Jan. 30 for constructing ditch No. 294; length, 15,142 ft. A. W. Gott, Co. Surveyor.

Evanston, Ill.—Bids are wanted Jan. 27 for laying a vitrified tile pipe sewer and appurtenances in a portion of Lake St. Jas. A. Patten, Pres. Bd. Local Improv.

Joliet, Ill.—Local press reports state that it is proposed to form a district, bounded by Jackson, Collins and Columbia Sts. and Spring Creek, and put down a main line sewer through the central portion of this district.

Slayton, Minn.—Bids will be received Feb. 2 by John Knutson, Village Recorder, for furnishing material and constructing sewers.

Burlington, Ia.—Local press reports state that the Council on Jan. 5 authorized Emmet Steece, City Engr., to secure new bids for the North Oak St. sewerage system.

Emmetsburg, Ia.—Engineer Tschirgi, of Dubuque, is stated to have been selected to prepare plans for a sewerage system, to cost about $20,000.

Collinwood, O.—The question of constructing a sewerage system is reported under consideration.

Columbus, O.—Contracts for sewer work (bids opened Jan. 6) are stated to have been awarded as follows: Richard Ave. sewer, Lee & Ceasey, of Pittsburg, Pa., $17,498; West Side main sewer system, Section A, John E. King, of Tiffin, $55,738; Walnut St. relief sewer, M. A. Talbot & Co., of Logansport, Ind., $23,334, and Central relief main sewer, Adams Bros., of Zanesville, $81,153.

Centralia, Ill.—Robt. Rohl, Mayor, writes that the city intends constructing a system of sanitary sewerage with filter beds and septic tanks. The plans and specifications are made to cover the whole city, but it is only intended to sewer 54 blocks at present time; it is also proposed to pave 7 or 8 blocks.

Aurora, Ill.—For the year 1903 this city has in contemplation about 17,400 lin. ft. of sewers and about 1 1/5 miles of asphalt paving. M. G. Stolp, City Engr.

Des Moines, Ia.—The Bd. of Pub. Wks. is reported to have recommended a 12-in. vitrified clay pipe sewer for North Des Moines.
The City Council is stated to have ordered the construction of a 15-in. sewer on W. 5th St.

Flora, Ill.—The City Council is reported to have authorized the employment of an engineer to make estimates for a system of sewers and other public improvements.

Lakewood, O.—Bids will be received Feb. 14 by the Bd. of Trus. for laying storm and sanitary sewer system in Lauderdale So. John French, Hamlet Clk.

St. Louis, Mo.—Local press reports state that the following are among the new sewers needed for this city: The Gin Grass Creek sewer, through Baden, cost $250,000; the Harlem Creek sewer, north of O'Fallon Park, cost $500,000; the Glazie Creek sewer, through Carondelet, cost $250,000, and the foul water intercepting sewer through Forest Park and Cheltenham, cost of about $220,000. In addition to these, there is great need of a sewer parallel to the Mill Creek sewer along Poplar St., to cost about $750,000, the enlargement of the Rock branch sewer along Ferry St. to the river, at a cost of about $600,000, and the Spring Ave. sewer near North Market St. at a cost of about $75,000.

Springfield, Mo.—About 10,000 ft. 8-in. district sewers will be built in the spring. Geo. W. Culler, City Engr.

Athens, Ala.—The Engineer appointed by the Chamber of Commerce to report on the construction of a sewerage system, estimates the cost of a system sufficient for 3,000 people at $10,000.

Sayre, Okla. Ter.—See "Water."

Knoxville, Tenn.—A bill has been introduced in Legislature to allow Knoxville to issue $400,000 improvement bonds, to be used to pave streets, build sewers, improve fire department and build schools. There is also a bill pending to allow the city to issue $700,000 bonds to build or buy water works. T. J. Moreland, City Engr.

Chattanooga, Tenn.—The Pub. Improv. Com. has decided to ask the Legislature for authority to issue bonds to the amount of $200,000 for street and sewers, $125,000 for a municipal lighting plant, $50,000 for public parks, $75,000 for public schools, and $100,000 for a new city hall.

Dyersburg, Tenn.—See "Water."

Tulalip, Wash.—See "Water."

Baker City, Ore.—The City Council is stated to have decided to begin at once the construction of a sewerage system.

BRIDGES.

Springfield, Mass.—Local press reports state that the building of a more substantial and wider bridge to replace the present narrow wooden structure over the tracks of the Highland division of the New York, New Haven & Hartford R. R. at St. James Ave., will probably be commenced early in the spring.

Woonsocket, R. I.—City Engr. Frank H. Mills reports many bridges to be unsafe, including the one across Blackstone River at Bernon St., which he states should be replaced with a steel structure; also that many others should be rebuilt.

Fall River, Mass.—The Co. Comrs. have submitted to the Legislature their report on the proposed Slade Ferry bridge, and recommend that said bridge be constructed south of the present structure. The cost of constructing at this location has been estimated at both $830,000 and $1,000,000, according to the type of structure built.

Syracuse, N. Y.—Local press reports state that John Newell, of Albany, has secured the contract for constructing the Butternut St. bridge at $17,829.

Tonawanda, N. Y.—Thos. W. Barrally, of Rochester, engineer for the State, is reported to be making a survey for a steel bridge across the Erie Canal between Seymour and Tonawanda Sts.

Northeast, Md.—The York Bridge Co., York, Pa., has secured the contract, according to reports, for constructing an iron bridge at Northeast, for $7,248.

Donora, Pa.—A bill has passed the House authorizing the construction of a bridge across Monongahela river near Donora.

Pulaski, Pa.—John E. Statt, Secy. Bd. Comrs. Pub. Bldg. & Grounds, Harrisburg, writes that the Nelson & Buchanan Co., of Chambersburg, has received the contract for constructing the bridge at Pulaski for $34,900.

Ridley Park, Pa.—The Pennsylvania R. R. Co. is reported to have under consideration the widening of the Crum Lynne bridge by extending the stone abutment on the south side of the structure, making a driveway of 19 ft. clear of the Chester Traction Company's roadbed. A 10-ft. sidewalk will also be constructed.

Scottsdale, Pa.—It is stated that a bridge will probably be built in the spring across Jacobs Creek, near Scottsdale.

Lodi, N. J.—The Bergen Co. Bd. of Freeholders, at Hackensack, are reported to be considering the strengthening of the present bridge across Saddle River in Lodi Borough, or the replacing of same with a $6,000 structure.

Griggstown, N. J.—It is reported that a $3,000 iron bridge is to replace present structure across Millstone River at Griggstown.

Wilmington, Del.—The building of a bridge across Christians River is said to be contemplated.

Beaver, Pa.—Press reports state that a bridge is to be built across Ohio River, at Smiths Ferry, below Beaver. It is stated that it will be, with approaches, 2,000 ft. long, and will have a channel span 1,000 ft. long. Its height above low water is to be 165 ft. Probable cost, $1,500,000.

Pittsburg, Pa.—Local press reports state that plans have been completed by the officials of the Bessemer & Lake Erie R. R. for a steel viaduct which is to replace present wooden structure in White Oak Level where the Hulton road crosses its main line tracks. H. T. Porter, Ch. Engr., Greenville, Pa.

Scranton, Pa.—A resolution has been passed by the Council directing the Ch. Engr. of the Bureau of Engineering to prepare an estimate of the cost of opening Hampton St., by constructing a bridge across the D., L. & W. R. R. tracks.

Brownsville, Pa.—The building of a county bridge between Brownsville and W. Brownsville is reported to be under consideration.

Centreville, Md.—The Co. Comrs. and Engr. Garey, of Baltimore, are considering the replacing of the recently destroyed Kent Narrows bridge with a steel structure.

Wilmington, Del.—Press reports state that the Engrs. of the Pennsylvania R. R. are making a survey preparatory to the building of a drawbridge across the Brandywine. W. H. Brown, Cb. Engr., Philadelphia, Pa.

Camden, N. J.—The joint meeting of the Bridge Committees of the East Side Improvement Assoc. and the Bd. of Freeholders have adopted the roller lift bridge as the one to be advocated to remedy the Federal St. nuisance.

Washington, D. C.—Local press reports state that Secy. Root has approved the plans and specifications for the highway bridge to be built across Potomac River, and has asked Congress to extend the time for completing said bridge to Feb. 12, 1905.

New York, N. Y.—The following bids were opened Jan. 20 by the Aqueduct Comrs. for building 14 steel highway bridges across Croton Lake and its tributaries:

Bridge.	F. R. Long, Hackensack, N. J.	King Bridge Co., 120 Liberty St., N. Y.	United Const. Co., Albany, N. Y.	Augustus Smith, 39 Cortlandt St., N. Y.
A.....	$89,500	$86,200	$85,950	$85,652
B.....	76,200	69,220	70,000	74,261
C.....	85,000	84,900	84,500	86,534
D.....	7,700	7,000	7,250	7,666
E.....	10,000	8,920	9,100	10,881
F.....	38,500	33,300	34,100	36,188
G.....	9,000	6,340	6,560	6,816
H.....	11,000	8,920	9,100	10,881
J.....	2,950	2,300	2,600	2,889
L.....	12,000	8,920	9,100	10,881
M.....	6,700	6,340	6,560	6,816
N.....	29,000	21,300	22,000	24,160
O.....	21,000	17,700	18,500	19,709
P.....	10,900	8,400	8,750	9,791
Totals...	$409,450	$369,760	$374,070	$393,125

Oneida, N. Y.—Press reports state that City Engr. Vedder approved plans and specifications for constructing a bridge 12 ft. in width across the canal feeder at the foot of Furnace Ave.; also to repair the roadway in North Lake St. by constructing a retaining crib and refilling the earthen embankment, and bids for said work will be received Jan. 27.

Camden, N. J.—Bids will be received by Jas. D. Wilkinson, Chmn. Bridge Com. Feb. 11 (readvertisement) for the construction of a steel bridge over Coopers Creek at Baird Ave.; appropriation, $20,000. John J. Albertson, Co. Engr.

New York, N. Y.—Bridge Comr. Lindenthal has approved the plans of Henry H. Hornbostel for the Blackwell's Island bridge, across the East River, and has forwarded said plans to the Municipal Art Com. for their consideration and approval.

Utica, N. Y.—The City Council has accepted the plan of City Engr. Schultz for a Howe truss bridge to be built at Genesee St., at a cost of $6,000; said bridge to replace present structure.

Scranton, Pa.—An appropriation of $6,000 has been made for constructing a bridge at Ash St.

Indianapolis, Ind.—Co. Engr. Klaussman is preparing plans for a bridge to be built at College Ave., for which $80,000 has been appropriated. Plans are to be prepared for stone, concrete and steel structures, but stone will, according to local press reports, receive the preference.

Kokomo, Ind.—The New Castle (Ind.) Bridge Co. is reported to have secured the contract to construct a bridge (not including abutments and piers) at Main St., this city, for $18,990.

New Castle, Ind.—Bids will be received by the Bd. of Co. Comrs. Feb. 9 for constructing 5 steel bridges and 1 steel arch bridge. John W. Whitworth, Chmn.

Columbus, O.—Local press reports state that a conference is to be held Jan. 28 by the members of the Bd. of Pub. Wks., the City Engr., the Council Com. on Streets, and representatives of the various railroads concerned, to devise means of removing the grade crossing difficulties at W. Broad, W. Mound and So. High Sts. by constructing viaducts.

Excelsior, Minn.—It is stated that engineers are making a survey for a bridge, to be built by the Minneapolis & St. Louis R. R., across the bay.

Winnebago City, Minn.—The building of a 110-ft. steel bridge across Blue Earth River in the town of Vermont is reported to be under consideration.

Muscatine, Ia.—Bids are wanted Feb. 3 for furnishing all metal for bridges needed by the county during the year 1903, delivered f. o. b. at any railroad station in Muscatine Co.; also bids for erecting same bridges, except flooring. A. C. Noble, Co. Aud.

Duluth, Minn.—Plans and specifications submitted by Ch. Engr. R. Angst, of the Duluth & Iron Range R. R. Co. have been accepted and the building of the bridge has been authorized. Probable cost, $6,000.

Cincinnati, O.—City Engr. Stanley has submitted to the Bd. of Pub. Service an estimate of the cost of constructing a steel viaduct to replace present wooden structure at Ida St., at $72,500. The specifications call for a viaduct having 6 spans, 4 girder and 2 truss, supported by braced steel columns on concrete or masonry foundations. It is to be 440 ft. long, to have an asphalt roadway 32 ft. wide, and cement sidewalks, 6 ft. wide.

Oak Harbor, O.—The Directors of the Toledo, Port Clinton & Lakeside El. Ry. are about to petition the Co. Comrs. to build a bridge across Portage River at Oak Harbor, which will accommodate said electric railway.

Cayuga, Ind.—The residents of Vermillion, Parke and Fountain Counties are reported to have under consideration the building of a bridge across Wabash River at Cayuga, at a cost of $36,000, and are about to petition the Comrs. of said counties to construct same.

Delaware, O.—An agreement has been reached between the officials of the Pennsylvania R. R. and the City Council whereby the R. R. Co. will build an 80 ft. stone and iron railroad bridge across North Sandusky St., at a probable cost of $10,000.

Spencer, Ind.—Bids will be received Feb. 3 by the Bd. of Co. Comrs. for constructing 3 small iron bridges. Holt Pickens, Chmn.

Tulsa, Ind. Ter.—Press reports state that the War Department has granted the Union Bridge Co. permission to erect a union railroad bridge across the Arkansas River here.

Shreveport, La.—W. Woodard, City Engr., writes that J. H. Sparks, of St. Joseph, Mo., has secured the contract for constructing the bridge over the bayou at Market St., for $16,660.

Kansas City, Mo.—Local press reports state that plans are to be prepared for a viaduct, 1,000 ft. long, to be built at Lydia Ave. by the Missouri Pacific, Alton and Metropolitan Ry. Companies.

St. Louis, Mo.—It is stated that the Terminal Association has had plans drawn for the widening of the east approach to Eads bridge. A steel structure is to be erected on each side of the roadway for the exclusive use of electric cars.

Kansas City, Kan.—See "Electric Railroads."

Houston, Tex.—The City Engr. has been instructed to prepare plans and specifications for a bridge at Main St.

The building of a bridge, connecting the 2d and 5th Wards, is under consideration.

St. Joseph, Mo.—The residents and merchants of Missouri Ave. have petitioned the Municipal Assembly to request the railroad companies to construct a viaduct in the vicinity of Illinois Ave.

Asher, Okla. Ter.—It is stated that the building of a bridge across Canadian River, in connection with a railroad, is contemplated.

Waverly, Tenn.—D. H. Goodrich, Co. Clk., writes that H. W. Hooper, of Bakerville, and J. T. Anderson, of Hurricane, have been appointed as a committee to secure estimates for a bridge across Duck River near Waverly, and report to the April term.

Encampment, Wyo.—The building of a steel wagon bridge across Platte River is contemplated.

Stockton, Cal.—Alfred W. Burrell, of Oakland, is reported to have submitted the lowest bid for constructing a bridge across Mokelumne River at Millers Ferry, at $13,948.

PAVING AND ROADMAKING.

Bridgeport, Conn.—The Council Com. on Streets & Sidewalks has decided to widen and pave portions of Main St. and Barnum Ave.

South Hadley, Mass.—The sum of $20,000 has been appropriated for new roads at South Hadley.

Boston, Mass.—A correspondent writes that bids will be received by Jas. Donovan, Supt. of Streets, until Feb. 27 for furnishing, as needed, during the year; beach gravel and granite, and North River flagging for cross walks.

Pittsburg, Pa.—The Road Drivers' Assoc. has asked the city to appropriate $100,000 to build a speedway through Highland park.

New York, N. Y.—The following bids were opened Jan. 16 by McDougall Hawkes, Comr. of Docks, for paving with asphalt (763 sq. yds.) the new-made land between 18th and 21st Sts., East River, and with granite (18,059 sq. yds.) between piers old 20 and new 16, East River: Continental Asphalt Paving Co., Class I, $2.83; Class II, $2.15 (awarded). Barber Asphalt Paving Co., I, $2.85; II, $2.20. Uvalde Asphalt Paving Co., II, $2.19.

Buffalo, N. Y.—Bids are wanted Jan. 30 for repaving portions of 3 streets. Francis G. Ward, Comr. Dept. of Pub. Works.

Williamsport, Pa.—About 15,000 sq. yds. brick or asphalt contemplated. Jas. F. Fisher, City Engr.

Morristown, N. J.—Local press reports state that bids will soon be asked by the Bd. of Co. Freeholders for constructing the following roads: Lincoln Park road, 4¼ miles, cost $17,527; Green Village road, 3¼ miles, cost $13,567; Sussex and Newton turnpike, 1 mile, cost $4,977, and Pompton road, ¾ mile, cost $3,634.

Baltimore, Md.—A resolution has been introduced in the City Council to pave with Belgian block on a portion of Columbia Ave., at a cost of $30,000.

Canonsburg, Pa.—The Town Council has passed a resolution to submit to the citizens a proposition to issue $35,000 bonds for street improvements.

Chester, Pa.—An ordinance has been adopted by the Select and Common Councils providing for the curbing and paving of 6th St.

Conshohocken, Pa.—The Council has appropriated $6,000 for street improvements during the coming year.

Reading, Pa.—The Select and Common Councils have approved an ordinance to pave most of the principal streets of the city.

Binghamton, N. Y.—The Mayor, in his annual message, recommends paving with brick portions of Front and Fayette Sts.

Haddonfield, N. J.—This Borough is reported to be considering the issue of $300,000 bonds for cement sidewalks, curb, brick gutters and macadam roads.

Brooklyn, N. Y.—Bids will be received Feb. 4 by J. Edward Swanstrom, Boro. Pres., for furnishing material and improving portions of numerous streets by grading, paving with granite about 43,557 sq. yds., with asphalt, about 5,075 sq. yds., laying 165,436 sq. ft. of cement sidewalks and 40,855 sq. ft. of cement concrete sidewalks, 3,300 sq. ft. of bluestone flagging and 42,517 cu. yds. of earth excavation.

Charlottesville, Va.—A committee has been appointed to have charge of the street improvements, which it is proposed to make, with the $80,000 recently appropriated. George Perkins is one of the committee.

Norfolk, Va.—The Select Council has passed an ordinance appropriating $5,525 for paving Clay St.

Atlanta, Ga.—See "Sewerage and Sewage Disposal."

Kenton, O.—Bids will be received Feb. 13 by the Co. Comrs. for grading, graveling, stoning and culverting roads in Marion, Washington, Liberty, Cessna, and McDonald Townships. James Bastable, Co. Aud.

St. Paul, Minn.—Local press reports state that the Barber Asphalt Paving Co. has secured the contract for paving Nina Ave. and Capitol Boulevard at $1.75 per sq. yd., totals $3,565 and $6,765 respectively, and the paving of 9th St. at $1.86 per sq. yd., total $26,398.

The paving of Mississippi St. with asphalt is under consideration.

The City Engineer contemplates laying considerable cement sidewalks during the coming season.

Albia, Ia.—A resolution has been adopted by the City Council to pave with 2 course brick on a portion of Washington St.

Kalamazoo, Mich.—The City Council has been petitioned to pave a portion of So. Park St. with asphalt block.

Menominee, Mich.—The St. Com. has reported to the City Council recommending the paving of Main St. with brick, the cost not to exceed $20,000.

Dayton, O.—The paving of Central Ave., probably with macadam, is under consideration.

Madison, Wis.—Bids will be received Feb. 9 by the Street Assessment Com. for furnishing material for grading, curbing, and paving with asphalt a portion of Main St. O. S. Norsman, City Clk.

Racine, Wis.—The Bd. of Pub. Wks. has submitted to the Bd. of Aldermen a report, including plans, specifications and cost of paving with brick and curbing with stone on Douglas Ave. as follows: 26,612 sq. yds. paving at $1.50, total $38,418, and curbing, 9,756 lin. ft., at 50 cts. per lin. ft., total $4,878.

Washington, Ill.—Henry Cassels, City Clk., writes that it is proposed to pave 6 blocks of Walnut St. with brick, on a gravel, concrete or crushed rock foundation; probable cost, $13,000. F. N. Rickman, Engr. in Charge.

Chicago, Ill.—Local press reports state that streets have been ordered paved with granite top macadam, at a cost of $136,000.

Pekin, Ill.—The paving of Capitol Boulevard, with brick or asphalt, is under consideration.

Rockford, Ill.—The Bd. of Local Improv. has been petitioned to pave with macadam on 14th Ave., a distance of about 1 mile.

Chippewa Falls, Wis.—Local press reports state that bids are about to be asked by the Bd. of Pub. Wks. for paving with vitrified shale brick.

Des Moines, Ia.—The City Council has adopted a resolution to pave with brick on a portion of W. 5th St.

Findlay, O.—The Bd. of Improv. is considering paving portions of W. Crawford St.

Battle Creek, Mich.—Local press reports state that bids will soon be asked by the City Recorder for paving with brick or asphalt block about 9,700 sq. yds. on Marshall St.

South Bend, Ind.—The City Engr. has been requested to prepare specifications for paving with brick on a portion of Franklin St.

Freeport, Ill.—The paving with brick on a concrete foundation several alleys in the business district and a portion of Stephenson St. is under consideration.

Centralia, Ill.—See "Sewerage and Sewage Disposal."

Aurora, Ill.—See "Sewerage and Sewage Disposal."

Des Moines, Ia.—The Bd. of Pub. Wks. is reported to be contemplating the purchase of a 15 ton steam road roller, at a probable cost of $3,000.

Toledo, O.—Bids will be received Feb. 13 by the Com. on Ways and Means of the Common Council for $59,966 street improvement bonds. J. H. Wylie, City Aud.

Cincinnati, O.—Bids will be received Feb. 2 by the Bd. of Pub. Service for furnishing material and improving by grading and paving with brick portions of Theis alley and Belvedere St. Robt. Allison, Pres.

Washington, Ia.—D. C. Kyle, City Engr., writes that the following bids were opened Jan. 15 for 32,000 sq. yds. brick paving—*a*, pavement; *b*, excav. per cu. yd.; *c*, curb per lin. ft.: Thomas W. Sennott, Chicago, *a*, $2.37; *b*, 23 cts.; *c*, 43 cts. Snoeffer & Ford, Cedar Rapids, Ia., *a*, $1.99½; *b*, 30 cts.; *c*, 42 cts. McCarthy Stone Co., Davenport, Ia., *a*, $1.88½; *b*, 30 cts.; *c*, 40 cts. Heintzelman & Korn, Davenport, Ia., cts.; *c*, 40 cts. Heintzelmar & Korn, Davenport, Ia., City, Ia., *a*, $2.09; *b*, 30 cts.; *c*, 41 cts.

Louisville, Ky.—The Bd. of Pub. Wks. has under consideration the paving with brick 7th and 18th Sts.

The Bd. of Pub. Wks. has ordered the paving of several short pieces of streets with brick.

Houston, Tex.—The City Council has adopted a motion authorizing the City Engineer to prepare plans and specifications for paving Girard and 3d Sts.

City Engr. F. L. Dormant, in his annual report, recommends the purchase of a 10-ton steam road roller.

McGregor, Tex.—At the recent election it was voted to issue $6,500 street improvement bonds.

Springfield, Mo.—About 2,700 yds. of brick paving with concrete base will be let on Feb. 3. Geo. W. Cuiler, City Engr.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Knoxville, Tenn.—See "Sewerage and Sewage Disposal."

Memphis, Tenn.—City Engr. J. A. Omberg, Jr., estimates that it will cost about $4,000,000 to pave the streets of the city.

Nashville, Tenn.—A bill has passed first reading in the City Council appropriating $4,000 to be used to purchase a road roller for the street department.

Topeka, Kan.—J. W. Squires, City Clk., writes about 30 blocks will be paved with brick, at a cost of about $90,000. Jas. McCabe, Engr. in charge.

New Orleans, La.—The City Engr. has been directed to prepare plans and specifications for repaving with asphalt on a portion of Canal St. and the Comptroller to let contracts for this paving in accordance with these specifications.

Luling, Tex.—The Co. Comrs. are reported to have under consideration the issuing of $50,000 road improvement bonds.

Seattle, Wash.—The Bway. Improvement Club has petitioned the City Council to pave, either with brick or asphalt, on Broadway, a distance of 25 blocks, at an estimated cost of $90,000.

The City Council has passed a resolution to pave with brick and asphalt on portions of First Ave., in all 19 blocks, at a cost of $103,000.

San Francisco, Cal.—The Bd. of Pub. Wks. has decided to repave 3d St. with basalt block.

Seattle, Wash.—The Bd. of Pub. Wks. has approved specifications for improvements in the Galer St. system, on Queen Anne Hill, which comprises the grading and curbing of numerous streets, at a cost of $102,000.

Tacoma, Wash.—The paving of a portion of North K St. is under consideration.

San Francisco, Cal.—See "Water."

Ontario.—Local press reports state that considerable road improvements are contemplated in the province of Ontario, including the establishment in Simcoe of a system of 250 miles at an expenditure of $150,000, toward which the Government is to appropriate $50,000; in Wentworth, a by-law has been adopted to purchase all the toll roads in the county at a cost of $98,000, the Government to appropriate $20,000 toward the cost, and the Co. of Lanark has adopted a by-law to build 100 miles of county roads, the Government to appropriate $35,000 toward the cost.

Toronto, Ont.—The City Engr. in a recent report recommends paving with asphalt on numerous streets, the cost being as follows: College St., from Yonge to Beverley, $30,725; Wilson Ave., King to Queen, $6,730; Spadina Ave., College St., to Spadina Crescent, $4,940; Duke St., Frederick to Jarvis, $9,222; a tar macadam pavement on a portion of Wickson Ave., to cost $6,045.

POWER PLANTS, GAS AND ELECTRICITY.

Pittsfield, Me.—The Sebasticook Power Co., of Pittsfield, has been incorporated, with a capital of $5,150,000, for the purpose of constructing and maintaining a dam across Sebatiscook River, and operating mills on said dam or nearby. Allen Hackett and J. W. Manson, both of Pittsfield, are among the incorporators.

Dunkirk, N. Y.—The Water Bd. is stated to have decided to purchase an 850-Kw. alternating generator and an engine.

Montgomery, N. Y.—The Central Valley & Highland Mills Electric Light & Power Co., Montgomery, has been incorporated; capital, $140,000. Directors: W. H. Cowan and W. L. Dickerson, Montgomery, and Chas. Riveuburg, Walden.

Atlantic City, N. J.—Mayor F. P. Stoy, in his message to Council under the new charter, recommends the widening of the boardwalk in the center of the city, and suggests that wires on the beach and throughout the city be placed underground.

Kane, Pa.—The Council has passed the ordinance granting the Kane Electric Light & Power Co. a franchise to construct and maintain an electric light plant.

Baltimore, Md.—The Continental Trust Co., acting for a syndicate, is stated to have made payment to the United Rys. & Electric Co. for the stock of the United Electric Light & Power Co. and the Mt. Washington Electric Light & Power Co., and the companies were turned over. This is the syndicate which is also reported to have a plan to utilize water power of Susquehanna River in generating electric current and transmitting it to Baltimore, Philadelphia and Wilmington, Del. This project will involve an expenditure of about $10,000,000.

Greene, N. Y.—See "Water."

Crewe, Va.—The Town Council is stated to have granted a franchise to C. M. Uber to build an electric plant.

Punta Gorda, Fla.—The City Council is stated to have granted an electric franchise to A. E. White and his associates. They are to put in the lights in 9 months.

Atlanta, Ga.—Judge Hillyer, Pres. Water Bd., in his annual report is stated to have recommended the establishment of an electric light plant at Hemphill Water Station, for the purpose of lighting the public buildings.

Piqua, O.—H. T. Bailey is stated to have secured a franchise for an electric light plant.

Freeport, Ill.—The Freeport Electric Co., of Freeport, has been incorporated, with a capital of $5,000, to operate an electric light, heat and power plant. Incorporators: Alpheus P. Goddard and Wm. N. Cronkrite.

Madison, Wis.—The Wisconsin Gas & Coke Co. has been formed to construct a plant in the 12th Ward for the manufacture of gas and coke, to cost about $3,000,000. The M. A. Hanna Co., of Cleveland, O., and Ferdinand Schlesinger, of Milwaukee, are among the incorporators.

Monticello, Wis.—The Village Trus. are stated to have under consideration the granting of a franchise to J. H. Staedtler, formerly of Milwaukee, for the establishment of an electric light plant here.

La Crosse, Wis.—The Council is reported to have under consideration the placing of all wires underground.

Manistee, Mich.—G. A. Hart, of Manistee, has petitioned the Council for a franchise for a gas, electric lighting and heating plant.

Lansing, Mich.—A. A. & F. B. Platt are stated to have petitioned the City Council for a franchise to lay mains for furnishing heat from a central plant.

Steubenville, O.—The plant of the Steubenville Traction & Light Co. is reported to have been destroyed by fire Jan. 13.

Galva, Ill.—The question of constructing an electric light plant is reported under consideration.

Twin Valley, Minn.—The Village Recorder writes that it was voted Jan. 6 to issue $5,750 bonds for the construction of an electric light plant.

Waukesha, Wis.—A press report states that the Gas Co. will lay about 5 miles of mains this summer.

Wabash, Ind.—F. McLees, City Clk., writes that the city is investigating the question of constructing an electric light plant.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Scranton, Miss.—See "Water."

Sayre, Okla. Ter.—See "Water."

Palestine, Tex.—The City Council on Jan. 12 is stated to have passed an ordinance granting J. S. Trittle, of St. Louis, Mo., and R. A. Gray, of Texarkana, a franchise for an electric light plant, gas plant and an electric railway.

Atlanta, Tex.—W. A. Boynton, of Shreveport, La., is stated to have secured a franchise for an electric light plant at Atlanta.

Nashville, Tenn.—The City Council has passed on second reading bills appropriating $6,000 for the purchase of a generator and engine, and $14,000 for the purchase of 2 boilers for the electric light plant.

Dyersburg, Tenn.—See "Water."

Sheridan, Wyo.—The Sheridan Electric & Power Co. is reported incorporated, to light the town. C. K. Durbin is one of the incorporators.

Boulder, Colo.—The South Boulder Power & Irrigation Co. has been incorporated, with a capital of $300,000, to operate in Boulder and Arapahoe Counties. Principal office to be in Denver. John A. Ebersole, W. E. Porter, and Henry V. Johnson are the incorporators.

Orangeville, Idaho.—See "Water."

Wallace, Idaho.—The Cascade Lumber & Power Co., operating at Cascade City, Idaho, is stated to have filed articles of incorporation with the County Auditor. This company is organized to manufacture lumber, but the articles also give the company power to erect an electric power plant. Incorporators: A. E. Holmberg, O. A. Anderson, C. C. Smith, and others. Capital, $200,000.

Olympia, Wash.—The Snoqualmie Falls Light & Power Co., which supplies the cities of Seattle and Tacoma with electric light and power, has applied for a franchise in Olympia.

Tulalip, Wash.—See "Water."

Claremont, Cal.—L. T. Gillett, Secy., writes in regard to the new Citizens' Light & Water Co. that electric or gas power and deep well pumps are to be installed.

Pomona, Cal.—The City Trus. are reported to be considering the construction of an electric light plant.

Ft. William, Ont.—The citizens are reported to have voted to issue $40,000 bonds for improvements to the electric light plant.

Mexico, Mex.—F. S. Pearson, and others, of Boston, Mass., with Jas. Ross, Sir William C. Van Horne, and others of the Dominion Iron & Steel and Dominion Coal Companies, of Montreal, Que., have organized the Mexican Light & Power Co., with a capital of $12,000,000. The company is organized to develop water power for Mexico City. It is expected that within two years it will develop 40,000 H-P. in Sierra Madre Mountains, 90 miles from Mexico City, and deliver it there in the form of electrical energy for running lighting plants, car lines and factories.

ELECTRIC RAILWAYS.

Chelmsford, Mass.—The Selectmen are stated to have granted a franchise to the Lowell & Fitchburg Electric Ry. Co.

Worcester, Mass.—The Mt. Wachusett State Reservation Comn. is stated to have decided to grant a franchise to the Worcester & Northern St. Ry. Co. for a cable and trolley road up Mt. Wachusett, subject to certain conditions.

Boston, Mass.—The State R. R. Comrs. are stated to have granted the Boston & Worcester St. Ry. Co. permission to issue $250,000 additional stock for construction and equipment. E. H. Bogers, Ch. Engr., Boston.

Millbury, Mass.—The Selectmen are stated to have granted a franchise to the Millbury, Singletary Lake & West Millbury St. Ry. Co.

Mineola, L. I., N. Y.—The Bd. of Superv. is stated to have granted the New York & Long Island Traction Co. a franchise to build a line on the Jericho turnpike from Mineola to the city line, near Queens, and also along the county highways from Freeport to Rockville Center.

Brooklyn, N. Y.—A charter has been granted to the Bush Terminal Co., of Brooklyn, with a capital of $15,000, to construct an electric railway about 1¼ miles on 41st St. and 1st Ave. from 2d Ave. to 65th St. Directors: Irving T. Bush, Fred. B. Studwell, Jos. Nash, and others of N. Y. City.

North Tonawanda, N. Y.—Engr. Frank Bardol, of Buffalo, is stated to have begun surveying two routes along the river front of the town of Tonawanda for the Niagara Transfer Ry. Co., recently incorporated with J. C. Conway, William Alport, and Henry Rosche, of Buffalo, as directors.

Cape May, N. J.—The Ocean St. Passenger Ry. Co. is stated to have petitioned the Council for a franchise on Washington St. from the Reading Depot to Schellinger's Landing. The road will be operated by the Philadelphia & Reading Ry.

Atlantic City, N. J.—The People's Traction Co. is stated to have petitioned the Council for a franchise.

Erie, Pa.—A charter has been granted to the People's Traction Co. of Erie. Incorporators: F. H. Schutte, J. D. Ilay, Chas. A. Mertens, and others.

Chambersburg, Pa.—The Dirs. of the Chambersburg, Greencastle & Waynesboro Trolley Co. are stated to have decided to build the road next summer from Greencastle to Pen Mar, a distance of 14 miles.

Collingswood, N. J.—It is stated that the Camden & Suburban Electric Ry. Co. is to build from Collingswood to Haddon Heights at once, and soon complete the Trenton-Camden line by building between Palmyra and Camden, 6 miles.

Chambersburg, Pa.—Local press reports state that bids are wanted by the Chambersburg, Greencastle & Waynesboro Electric Ity. Co. for the construction of a line from Greencastle to Pen Mar.

Union City, Pa.—The City Council is stated to have granted a franchise to the Erie, Cambridge, Union City & Corry Ity. Co.

Baltimore, Md.—Local press reports state that the Baltimore & Frederick Electric Ry. Co., which is planning to build a line from Baltimore to Frederick, will increase its capital from $1,500,000 to $2,000,000, and contemplates beginning the work of construction early in the spring. John W. Ellard, of Baltimore, and J. Roger McSherry, of Baltimore, are among the incorporators.

Feasterville, Pa.—The Philadelphia & Langhorne Ity. Co. is stated to have decided to extend its line from Somerton to Feasterville and Willow Grove.

Salem, W. Va.—Homer McKinley, of Salem, is reported interested in the construction of an electric railway between Salem and Clarksburg.

Port Clinton, O.—The Port Clinton Peninsular Electric R. R. Co. is reported organized by Chas. I. York, of Port Clinton, and Dr. W. M. Tuller and Chas. M. Draper, of Bowling Green, to build an electric line from Port Clinton to Marblehead and Lakeside via Oak Harbor and Elmore.

Shelbyville, Ind.—It is stated that the Indianapolis, Shelbyville & Southeastern Traction Co. will extend its line as far as Batesville, a distance of about 40 miles from this city.

Mt. Zion, Ind.—Isaac Roush and Alva Christman, of Mt. Zion, are reported interested in the construction of an electric railway to connect Warren and Montpeller, by way of Mt. Zion.

Wausau, Wis.—Miles J. Merrill and Chas. T. Noland, of St. Louis, Mo., are reported to have petitioned the Council for a franchise for an electric railway in Wausau.

Clinton, Ia.—Pepper & Registe, of Philadelphia, Pa., are stated to have secured the contract for constructing an electric railway between Clinton and Davenport, a distance of 42 miles, for the Illinois & Iowa Interurban Ry. Co.

Charlton, Ia.—The Charlton, Knoxville & Southern Ry. Co. has been incorporated, with a capital of $100,000, by S. H. Mallory, Eli Manning, and others, to construct an interurban line from some point on the southern boundary of Iowa via Charlton and Knoxville to a point on or near the Mississippi, northeast of Knoxville.

Cleveland, O.—The Cleveland, Richfield & Akron Transit Co., of Cleveland, has been incorporated, with a capital of $10,000, by D. Gundelsperger, S. P. Inman, and others, to construct or lease a railway, probably electric, between Barberton and Akron.

Crestline, O.—The Mansfield, Crestline & Galion Ry. Co., of Crestline, has been incorporated, with a capital of $10,000, by Frank N. and Owen N. Wilcox, and others, to build an electric railway from Galion to Mansfield, passing through Richland and Crawford Counties.

Moline, Ill.—It is stated that the Moline, East Moline & Watertown Ry. Co. is to construct a new power house, with a capacity of 500 H.-P. B. A. Mapledoran, Mgr., Moline.

Kansas City, Kan.—The Council has granted a franchise to the Kansas City Outer Belt & Electric Ry. Co. The company is reported to have consented to construct a bridge across Missouri River into Clay County, and also a $25,000 depot in Kansas City.

Louisville, Ky.—A press report states that the Louisville Ry. Co. will expend about $1,000,000 in improvements this year, including an addition to the power house. F. M. Miller, Ch. Engr., Louisville.

Clarksville, Tenn.—Right of way is stated to have been granted by the Comrs. of Davidson, Montgomery and Cheatham Counties to T. N. Watson, and others, of Clarksville, for the construction of an electric railway from this city to Nashville.

Montgomery, Ala.—The Co. Comrs. are stated to have granted a franchise to Wm. Berney to operate a railway in the vicinity of Red Bridge Road.

Palestine, Tex.—See "Power Plants, Gas and Electricity."

Wildman, Okla. Ter.—A charter has been granted to the Mountain Park Electric Ry. Co., of Mountain Park, with a capital of $50,000, to build an electric line from Wildman to Mountain Park, 15 miles. R. D. Simpson and G. J. Galent are among the incorporators.

St. Joseph, Mo.—Gen. Mgr. J. H. Van Brunt is stated to have filed with City Clerk Beach his acceptance of the terms of the franchise recently granted to the St. Joseph St. Ry. Co. for a double track electric line over Lake Ave. and Alabama St., in South St. Joseph. Work of construction will soon commence.

Beaumont, Tex.—Bids are wanted about Mar. 1 for grading 19 miles of electric railroad running from Beaumont to Sour Lake. Address Ed. Kennedy, Beaumont Trust Co. Bldg.

Grangeville, Idaho.—See "Water."

Oroville, Cal.—The Superv. are stated to have granted a franchise to T. M. Clough.

Roswell, N. M.—The Town Council is stated to have granted a franchise to Karl A. Snyder.

Santa Cruz, Cal.—The East Santa Cruz St. car line, which runs to Twin Lakes, is stated to have been purchased by the Santa Cruz, Capitola & Watsonville Ry. Co., which will change it to an electric line. All the rights of way for a road to Capitola have been obtained, and the work of construction will soon begin.

RAILROADS.

Providence, R. I.—Local press reports state that the New York, New Haven & Hartford R. R. Co. has entered into an agreement for the abolishment of the grade crossings remaining on the main line within the city limits. Colon M. Ingersoll, Jr., Ch. Engr., New Haven, Conn.

Rochester, N. Y.—The Council is stated to have granted the N. Y. Central & Hudson River R. R. Co. (W. J. Wilgus, Ch. Engr., N. Y. City,) permission to construct an underground crossing at Union St. crossing. The subway, with its approaches, will be about 150 ft. long and will cost $75,000. The R. R. Co. will pay 50 per cent. of the expense, while the city and State will each pay 25 per cent. Permission must be obtained from the State R. R. Comn. before the work can be started. E. A. Fisher, City Engr.

Ossian, N. Y.—The Northern Shawmut R. R. Co. has been incorporated, with a capital of $30,000, to operate a steam road 2½ miles in length from a point on the line of the Pittsburg, Shawmut & Northern R. R., in Grove, to Michael's Mills, Ossian. Directors: C. W. Artz, N. Y. City; A. M. Wellman, of Friendship; S. K. Ayers, of Jersey City, N. J., and others.

Denton, Md.—A press report states that the plan to extend the Queen Anne's R. R. to Franklin City contemplates a line from Denton, via Salisbury to Franklin City. I. W. Troxel, Ch. Engr., Queenstown.

Uniontown, Pa.—The Big Sandy & Bruceton R. R. Co., of Uniontown, has been incorporated to construct and operate a railroad from the month of Big Sandy Creek to Bruceton Mills; capital, $10,000. Incorporators: Fred C. Keighley and Isaac W. Semons, Uniontown, Pa.; Herbert C. Graer, New Castle, Pa., and others.

New York, N. Y.—It is stated that agreement has been reached between the city and the New York Central & Hudson River R. R. concerning terminal improvements and the substitution of electricity for steam, and work will soon commence. W. J. Wilgus, Ch. Engr., N. Y. City.

Enon Valley, Pa.—A charter has been granted to the Pennsylvania Western R. R. Co. to construct a line 60 miles in length from Redbank Juaction to Enon Valley; capital, $600,000. Edw. B. Taylor, of Sewickley, and A. P. Burgwin, of Pittsburg, are among the incorporators.

Mapleton, Pa.—The Hares Valley R. R. Co. has been incorporated to built a line 12 miles in length between Mapleton and Saltillo, Pa. H. Shoemaker, Pres., Harrisburg.

Indianapolis, Ind.—Mayor Bookwalter has appointed a commission of 7, with Dr. Henry Jameson as Chma., to investigate the question of track elevation.

Peoria, Ill.—The Illinois Black Diamond R. R. Co. has been incorporated, with a capital of $100,000, to construct a line to start at Peoria and run to Springfield, Hillsboro, Greenville, Carlyle, Nashville and then southeast to Marion and Harrisburg as the terminus. Central office to be in Springfield, Ill. Incorporators: Henry Davis, Springfield; John Ramsay, Litchfield, and others.

Rock Island, Ill.—The Rock Island & Southeastern R. R. Co. has been incorporated, with a capital of $100,000, to construct a line from Rock Island, Ill., to a point at or near Peoria. Wm. P. Kopf and Emory Stanford Hall, of Chicago, are among the incorporators.

Union, Mo.—A certificate authorizing the St. Louis, Kansas City & Colorado Ry., owned by the Rock Island, to extend its line from Union to Kansas City, Mo., is stated to have been granted by the Secy. of State. W. H. Given, Supt. Mo. Div., Trenton, Mo.

Natchez, Miss.—It is stated that final surveys are being made for the Natchez & Gulf R. R. The route is through south Mississippi, crossing the Illinois Central at McComb City, and then on a direct line to Gulfport; it will tap the northern parish of Louisiana.

Scranton, Miss.—See "Water."

Gadsden, Ala.—The Chattanooga Southern R. R. Co. is reported to have decided to extend its line from Gadsden to Duke's, a distance of about 19 miles. W. W. Kent, Gen. Mgr., Chattanooga, Tenn.

Seattle, Wash.—The City Council has passed four ordinances which make it possible for the Great Northern, Northern Pacific and Columbia & Puget Sound Railroads to begin the construction of terminal improvements in this city. These improvements include the construction of a new union depot, the building of freight yards in the south part of the city and the boring of a tunnel to run from Virginia St. on the water front to 3d Ave. S. and Jackson St.

San Pedro, Cal.—It is reported that the San Pedro, Los Angeles & Salt Lake R. R. Co. will shortly begin work on extensive improvements at the terminus of the road here, at a cost of about $100,000.

Los Angeles, Cal.—The Southern Pacific R. R. Co. is stated to have decided to expend about $150,000 in terminal improvements in Los Angeles, including a passenger station, freight depot and new trackage. Wm. Hood, Ch. Engr., San Francisco.

Tacoma, Wash.—A company is reported to have been formed here by Andrew J. McCabe, E. C. McDonald, and others, of Tacoma, to build a railroad from a point near Olympia, through Thurston and Mason Counties, to Shelton, and into Kitsap County to Bremerton.

Woonsocket, S. D.—B. H. Eldridge, an engineer for the Chicago, Milwaukee & St. Paul R. R. Co., is reported to be making a survey for an extension from Woonsocket to Wessington Springs. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Napanee, Ont.—The Public Works Dept. is stated to have received plans for a proposed extension of the Bay of Quinte Ry. from Napanee to Deseronto. R. C. Carter, Gen. Mgr., Deseronto, Ont.

PUBLIC BUILDINGS.

Leominster, Mass.—The Unitarian Church is reported destroyed by fire Jan. 13.

Holyoke, Mass.—The Episcopal Society is stated to have accepted plans for the erection of a $50,000 church at Appleton and Linden Sts.

Astoria, L. I., N. Y.—The plans of Tuthill-Higgins, of Jamaica, are stated to have been selected for the Carnegie Library to be erected on Fulton St., to cost about $25,000. Contracts for the construction will soon be let.

Brooklyn, N. Y.—Plans are stated to have been prepared by Lord & Hewlett, 16 E. 23d St., New York City, for the Carnegie Library to be erected at Bedford Ave. and Hancock St.; the building will be a 2-story brick and stone structure.

Clearfield, Pa.—W. O. Weaver & Sons, of Harrisburg, are stated to have been selected to prepare plans for an edifice for the First M. E. Congregation, to cost about $50,000.

Brooklyn, N. Y.—Plans have been filed for the erection of a 3-story brick engine house at Hicks and Joralemon Sts., to cost $30,000. Archts., Adams & Warren, 20 W. 34th St., N. Y. City.

New Paltz, N. Y.—It is stated that John Arbuckle, of New York City, will erect a sanitarium here for the women and girls employed by the Arbuckle Co.

Weehawken, N. J.—It is stated that the St. Joseph's R. C. Church will erect an edifice at Palisade Ave. and 20th St., in West New York. The building will be a 166x54-ft. brick and stone structure, and cost about $40,000.

Pittsburg, Pa.—It is stated that the Second Presbyterian Society will erect a church on the Duquesne way, to cost $200,000. Rev. Dr. S. E. Young, Pastor.

Iroquois, N. Y.—Dean & Havens, of Olean, N. Y., are reported to have secured the contract for the Thomas Idian Orphan Asylum, at Iroquois, for $35,000.

Sonyea, N. Y.—The lowest bids opened Jan. 13 by the Bd. of Mgrs. of Craig Colony for improvements are stated to have been submitted as follows: Construction, Thos. Whalen, of Niagara Falls, $60,834; heating, Russell, Culley & Miller, Mt. Vernon, $5,943; and plumbing, Mr. Barr, $3,365.

Newark, N. J.—Plans are stated to have been approved for the armory for the First (Essex) Troop, as submitted to the State Military Bd. by Capt. Wm. A. Bryant. The Legislature will be asked to make an appropriation for the building which is estimated to cost $125,000.

Pikesville, Md.—Wyatt & Nolting, 4 E. Lexington St., are stated to be revising plans for an Armory for Troop A, to be erected on Reisterstown Road near Pikesville. It is not proposed to erect the 100x200 ft. stone riding hall at present. The structure will cost about $30,000.

Greensboro, N. C.—The Sisters of Charity are reported to be considering the erection of a hospital here, to cost $60,000. Rev. Father Lammon is reported interested.

Cambridge, O.—F. L. Packard, Archt., Columbus, writes that contracts for remodeling Guernsey Co. Court House have been awarded as follows: To C. E. Chapman, New York, N. Y., for decorating, and the Sackett Mine & Supply Co., of Columbus, for electrical work.

Madison, Wis.—The Dirs. of the Madison Hospital Assoc. are reported to have decided to erect a hospital, to cost $24,000, on the Greenbush site, within the coming year. W. A. Henry, Pres.

Boone, Ia.—Bids are wanted Feb. 6 for erecting a poor-house and insane asylum to cost about $15,000. Archie Patterson, Co. Aud.

Columbus, O.—Stribling & Lum, of Cleveland, are reported to have been selected to prepare plans for the B'nai Israel Temple, to be erected at Bryden Road and 18th St., for the B'nai Israel Hebrew Congregation.

Newport, Ind.—It is stated that bids are wanted Feb. 20 for erecting an addition and remodeling court house. Wm. P. Bell, Co. Aud.

Lawrence, Kan.—Bids will be received Feb. 18 by the Bd. of Co. Comrs. for erecting a court house, including heating, plumbing, and gas fitting; probable cost about $80,000. Geo. A. Flory, Co. Clk.

Springfield, Mo.—F. M. Gathwait, of Chicago, Ill., has secured the contract for the exterior work on the Carnegie Library for $35,334. Interior work to be let later; total cost, $50,000.

Russellville, Ky.—It is stated that the Fiscal Court has appropriated $30,000 toward the erection of a court house for Logan County.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Galveston, Tex.—It is stated that the Sacred Heart Catholic Society will erect a $50,000 edifice. Father Murphy, Pastor.

Hickman, Ky.—Pierce, Cequin & Co., of Fulton, are reported to have received the contract for the erection of a court house, for $70,700.

New Orleans, La.—The Louisiana Field Armory is reported destroyed by fire Jan. 13.

Knoxville, Tenn.—It is stated that the First Cumberland Church will erect a $20,000 edifice. Rev. W. T. Rodgers, Pastor.

Galveston, Tex.—The Jesuit Fathers are reported as having plans prepared for a church, to cost about $50,000.

Hamburg, Ark.—It is stated that bids are wanted Feb. 2 for erecting the Ashley Co. Court House. E. T. Johnson, Co. Comr.

Yankton, S. D.—Parsons & Sons, of Des Moines, Ia., are reported to have been selected to prepare plans for the Yankton County Court House, to cost $40,000.

Baker City, Ore.—It is stated that plans are being prepared for the erection of a city hall, to cost about $30,000.

Santa Rosa, Cal.—The Bd. of Superv. are reported to have in contemplation the erection of a new hospital, to cost about $40,000.

Libraries.—Andrew Carnegie is stated to have made the following cities offers for libraries: Council Bluffs, Ia., $70,000; Everett, Wash., $25,000; Wilmington, N. C., $25,000, and Ann Arbor, Mich., $20,000.

BUSINESS BUILDINGS.

Springfield, Mass.—The Itescue Mission has purchased a site on Court St., 50x150 ft. No plans have yet been made for the building.

Providence, R. I.—Wm. R. Walker & Son, 17 Custom House St., are reported to be preparing plans for a 7-story, 40x180 ft. brick business building, to be erected at 398 Westminster St., for Caesar Misch.

Bangor, Pa.—It is stated that the Lackawanna R. R. Co. (Riley Williams, Div. Supt.) will erect a depot at Bangor, to cost $20,000.

Philadelphia, Pa.—The Bell Telephone Co. is reported as having plans prepared for a 64x160 ft. office building to be erected at 1633 to 1637 Arch St.

Pittsburg, Pa.—Plans are reported to have been prepared for the erection of a warehouse and store building at Ross St. and 3d Ave. for the Bailey-Farrell Mfg. Co.; probable cost, $175,000.

It is stated that at the Convention of the Miners of the Pittsburg Dist. it was decided to erect a labor temple to cost $75,000. P. Dolan, of McDonald, Pres., and Wm. Dodds, of Banksville, Secy.

Dr. Henry M. Hall is reported interested in the erection of a 100x54 ft. office building at 4th Ave. and Market St.

Baltimore, Md.—E. H. Glidden is reported to be preparing plans for a 4-story brick warehouse for E. L. Kaufmann & Co., to be erected at Liberty and Fayette Sts., for which contracts will soon be let. He is also reported to be preparing plans for the new 5-story Hotel Baltimore to be erected at Courtland and Saratoga Sts.

Ireeree, N. Y.—Edw. Waldman is reported interested in the erection of a 6-story frame hotel, to be erected on Amsterdam Ave.; estimated cost, $60,000.

Long Island City, N. Y.—Plans are stated to have been filed for a 2-story depot for the Long Island R. R. Co., to cost $50,000. Wm. H. Baldwin, Pres.

Newark, N. J.—The car barns of the North Jersey St. Ry. Co. (J. G. Elliott, Ch. Engr., Jersey City) are reported destroyed by fire Jan. 15.

Allegheny, Pa.—The Heinz Preserving Co. is reported interested in the erection of a building at Main and Chestnut Sts., to cost about $150,000.

Centreville, Md.—It is stated that the Centreville Natl. Bank will erect a $20,000 business building.

Syracuse, N. Y.—Plans are stated to have been prepared for a business building to be erected at 432 S. Salina St. for Chas. M. Warner and Arthur R. Peck; probable cost, $50,000.

Philadelphia, Pa.—It is stated that plans are being prepared for a theater to be erected at 8th and Vine Sts. for Jeremiah G. Donoghue, to cost about $1,000,000.

Richmond, Va.—C. E. Borden will have charge of erecting the new buildings to replace the buildings of the Va.-Carolina Chemical Co., recently destroyed by fire.

Raleigh, N. C.—The North Carolina Home Fire Insurance Co.'s Bldg. is reported destroyed by fire Jan. 15.

Wilmington, N. C.—The Odd Fellows of Wilmington are reported to be considering the erection of a building to cost about $50,000.

Bartow, Fla.—W. B. Talley, of Lakeland, is reported to be preparing plans for a 3-story hotel, 128x129 ft., to be erected by the Bartow Hotel Co.

Cleveland, O.—The warehouse at 131 Ontario St. is reported destroyed by fire Jan. 14. Owner, The May Co.

The warehouse of the General Cartage & Storage Co., 171 Prospect St., is reported destroyed by fire Jan. 10.

Columbus, O.—It is stated that E. M. Parker will erect a 4-story business building, to cost $20,000, at Long and Mulberry Sts.

Clement T. Hoy is reported to be considering the erection of a business building at E. Gay and 4th Sts., to cost about $20,000.

Indianapolis, Ind.—It is stated that A. G. Arrasmith will erect a 3-story office building at Washington and High Sts., to cost $25,000.

It is stated that the Union Traction Co. will erect a depot on McClure St. and Railroad Ave. The structure will be 191x285 ft. in dimensions.

Alton, Ill.—The State Banking & Trust Co. want architects to submit plans for its new building, which is to cost about $20,000. S. H. Wyss, Pres.

Joliet, Ill.—J. P. Stevens is to erect a $20,000 business building on Osgood and Chicago Sts.

Crookston, Minn.—Chas. Westerberg is reported interested in the erection of a hotel at Main and Fletcher Sts.; cost, $20,000.

Colfax, Ia.—The A. A. Renquite Hardware Co. is reported to be preparing to erect a 3-atory brick business building to measure 50x150 ft.

Council Bluffs, Ia.—A 4-story brick warehouse is to be erected for Construction Co. No. 2. Architects, Cox & Schoentgen, Council Bluffs.

Davenport, Ia.—It is stated that John Mahan will erect a brick building on Front and Perry Sts. for C. A. Ficke, to cost $17,000.

Sioux City, Ia.—It is stated that G. O. Swasey will erect a business building here, to cost $40,000.

Holland, Mich.—The Masonic Society is reported to be planning to erect a $50,000 lodge hall and opera house.

Duluth, Minn.—M. S. & B. J. Cook are reported as having plans prepared for a brick building to be erected at Superior and Michigan Sts., to cost from $25,000 to $30,000.

St. Charles, Ill.—John Wheeler, of Geneva, is stated to have received the contract for erecting the buildings for the Home for Boys at St. Charles, for $50,000.

Kansas City, Kan.—See "Electric Railways."

St. Louis, Mo.—The Hoffman Contracting Co. is reported to have received the contract for the erection of the Buckingham Hotel at Kings Highway and West Pine Boule. It will be a 10-story structure, and cost $1,500,000.

Louisville, Ky.—Plans are being prepared for a 6-story warehouse to be erected here by Lyttleton Cooke.

Ft. Worth, Tex.—It is stated that Ft. Worth Lodge, No. 251, I. O. O. F., will erect a hall at 1st and Throckmorton Sts., to cost $30,000. The structure will be brick and measure 100x75 ft. W. R. Francis, Secy.

Owensboro, Ky.—Plans are stated to have been prepared for an apartment house for the Kenyon Realty Co.; probable cost, $30,000.

The Daviess County Title Co. and the Owensboro Undertakers' Asso. are reported interested in the erection of an office building on St. Ann St., to cost about $40,000.

Nashville, Tenn.—The Lyles Black Co.'s building is reported destroyed by fire Jan. 10.

Pine Bluff, Ark.—R. H. Hunt, of Chattanooga, is stated to have been selected to prepare plans for an opera house for the Elks of Pine Bluff, at a cost of $40,000.

Knoxville, Tenn.—It is stated that the building of Col. C. M. McGhee, recently destroyed by fire, will be replaced with a 4-story, 74x127 ft. brick structure. Archts., Baumann & Baumann, 612½ Gay St.

Mandan, N. D.—Hancock Bros., of Fargo, are stated to have completed plans for the 2-story building to be erected at Main St. and Stark Ave. for the First Nat. Bank, of Mandan; probable cost, $15,000 to $20,000.

Denver, Colo.—The Orpheum Circuit Co. will erect a $45,000 brick and stone theater at 1507 to 1515 Welton St.

A 6-story building will be erected at 17th St. and Bway. for D. C. Dodge, to cost $275,000. Architects, Marean & Norton, 206 Equitable Bldg.

Los Angeles, Cal.—John Parkinson, of Los Angeles, is reported to be preparing plans for a 4-story business building for R. A. Rowan, to be erected on Bwsy., west of 6th St.

Carl Leonhardt is reported to have received the contract for the erection of the 8-story brick building at 4th and Spring Sts., to cost $550,000. Archt., A. F. Rosenheim.

Los Angeles, Cal.—See "Railroads."

Tekoa, Wash.—Russell & Vincent, of Spokane, are reported to have prepared plans for a brick hotel for Frank H. Quinn, at a cost of $20,000.

Seattle, Wash.—See "Railroads."

Los Angeles, Cal.—See "Railroads."

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

61 and 63 Columbia St, 6-story br tenemt and stores, c, $45,000; o, Hillman & Golding; a, Sass & Smallheiser.

Hester and Eldridge Sts, 6-story br tenemt and stores, c, $25,000; o, Kleinfeld & Hamburger; a, Horenburger & Straub.

Spring and Sullivan Sts, 6-story br tenemt and store, c, $35,000; o, Morris Fine; a, Horenburger & Straub.

Waverly Pl and Charles St, 6-story flat and stores, c, $45,000; o, Malbin & Kammermann; a, Geo F Pelham.

19th St and 6th Ave, 6-story br and stone loft bldg, c, $29,000; o, Bella Warnstadt; a, Jos C Cocker.

Bwny and 50th St, 3-story br automobile house, c, $33,000; o, Fred Dietz; a, John W Ingle; m, John Laimbeer, Jr.

5th Ave and 21st St, 11-story br and stone loft and store bldg, c, $450,000; o, Hudson Realty Co; a, Buchman & Fox.

7th Ave and 49th St, 5-story br and stone theater and office bldg, c, $180,000; o, Chas Schmidt, Jr; a, J B McElpatrick & Son.

Bleecker and Thompson Sts, 7-story extension to 7-story br loft bldg, c, $30,000; o & m, J C Lyons Bldg and Operating Co; a, Lawrence L Barnard.

528 to 532 E 18th St, 3-story addition on 7-story br factory, c, $30,000; o, John S Huyler; a, Schickel & Ditmars.

DWELLINGS.

New London, Conn.—Morton F. Plant is reported to be considering the erection of a residence at Eastern Point. The building will be of granite, 150x50 ft., and cost $250,000.

Washington, D. C.—W. E. Speir, 1417 F St., N. W., is stated to have submitted the lowest bid for erecting a residence for Dr. Geo. Barrie, at 22d St. and Massachusetts Ave., N. W. The building will be a 4-story structure, 63x63x89 ft., and cost $35,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

29 Cornelia St, 6-story br tenemt, c, $65,000; o, Jacob Finelite; a, Wm H Boylan; b, Israel Feldman.

192 to 202 Elizabeth St, 2 6-story br tenemts, c, total, $74,000; o, Jacob Weinstein; a, Bernstein & Bernstein.

259 and 261 W 12th St, 6-story br tenemt, c, $35,000; o, Jacob Margovitz; a, Horenburger & Straub.

16th St and 1st Ave, 2 6-story br tenemts, c, total, $100,000; o & a, Michael Larkin; a, Geo F Pelham.

SCHOOLS.

Olneyville, R. I.—Murphy & Hindle, 146 Westminster St., Providence, are reported to be preparing plans for a 3-story brick school to be erected at Barton St. and Bainbridge Ave. for the Congregation of St. Mary's Church; probable cost, $70,000.

Boston, Mass.—Bids will be received Jan. 26 by the Schoolhouse Comrs. for ventilating and heating the primary school, Emerson Dist., Horace & Byron Sts. R. Clipston Sturgis, Chmn.

The following bids were opened Jan. 21 by the Schoolhouse Comn. for the erection of a primary school on School St., West Roxbury, from plans of Andrews, Jaques & Rantoul: Wheston Bldg. & Lumber Co., $104,500; Mack & Moore, $106,900; Conners Bros., $108,300; Morrill & Whiton Const. Co., $109,845; A. Fales & Sons Co., $109,944; Henry McGshey, $111,560; C. H. Dodge Const. Co., $111,059; Wm. Crane, $113,000; J. J. Flynn, $113,807; H. P. Cummings & Co., $120,103; W. L. Morrison Co., $121,000; Connery & Wentworth, $121,393; Geo. W. Harvey, $127,950; Holmes Bros., $134,310.

Jamestown, N. Y.—It is stated that plans are being prepared for a 3-story parochial school to be erected at W. 5th and Washington Sts., to cost about $30,000.

New York, N. Y.—Contracts for school work (bids opened Jan. 19) by C. B. J. Snyder, Supt. of School Bldgs., have been awarded as follows: For ventilating and heating addition to and alterations in School No. 92, Boro. of Manhattan, Wm. N. Tobin, 109 W. 42d St., $14,735; for sanitary work of annex to School No. 18, Boro. of Manhattan, I. Hoffman, $4,350, and for electric wiring the following schools: School No. 89, Boro. of Manhattan, to Commercial Construction Co., 1 Madison Ave., $7,832; Schools Nos. 31 and 142, Boro. of Manhattan, Fredk. Pearce, 18 Rose St., $7,280 and $5,979 respectively, and School No. 130, Boro. of Brooklyn, to Peet, McAnerney & Powers, $4,405.

Schenectady, N. Y.—The Bd. of Educ. is stated to have awarded the contract for plumbing the High School to Ridgway & Tyler, of Albany, for $7,519.

York, Pa.—Bids will be received Jan. 29 by the Bd. of School Control, for erecting a 12-room school on Richland Ave. and W. Princess St., according to the plans of Hamme & Leber. Luther A. Small, Chmn. Bldg. Com.

Washington, D. C.—Bids are wanted Jan. 26 for erecting an 8-room school on 27th St. Henry B. F. MacFarland, Comr., D. C.

Greensburg, Pa.—It is stated that the Bd. of School Dirs. has ordered plans for a high school, to cost about $35,000.

New York, N. Y.—Bids will be received Feb. 2 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary work at school No. 188, Boro. of Manhattan.

Syracuse, N. Y.—Bids will be received until Feb. 2 by the Bd. of Contract & Supply for erecting an addition to Lincoln School. Wm. H. Jones, Clk.

Scranton, Pa.—It is stated that contracts will soon be let for the High School Annex to be erected on Adams Ave. Archt., G. M. Edson.

Jonesboro, Ind.—It is stated that a school will be erected here to replace the one destroyed by fire, at a cost of $22,000.

Sheldon, Ia.—The High School is reported destroyed by fire Jan. 12.

Milwaukee, Wis.—The contract for heating the 9th Ward School is reported to have been awarded to John S. Brennan for $9,718.

Rockford, Ill.—It is stated that Duke M. Farson, of Chicago, will erect a Metropolitan Holiness Seminary here, to cost $50,000. Rev. C. B. Wetherell, pastor of a local church, is reported to have been authorized to select the site.

Chicago, Ill.—It is stated that bids are wanted by the Bd. of Educ. until Jan. 30 for erecting a boiler house at Normal School.

Huntington, W. Va.—It is stated that bids are wanted Feb. 10 for erecting 2 schools. Address J. R. Stewart, Bd. of Educ.

Knoxville, Tenn.—See "Sewerage and Sewage Disposal."

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Clinton, La.—Bids will be received Feb. 3 by the Mayor, C. W. Ball, for erecting a 2-story brick school.

Newport, Ky.—The contract for heating the Corpus Christi School and hall is stated to have been awarded to McGowan & Co., of Cincinnati, O., for $4,680.

Pasadena, Cal.—The plans of Stone & Smith, San Francisco, are stated to have been accepted for the high school to be erected at Walnut and Los Robles Aves. The building will be a 2-story brick structure and cost about $75,000.

San Francisco, Cal.—Newsome & McNeil are stated to have submitted the lowest bid for the erection of the Noe Valley School, for $34,114.

Hoquiam, Wash.—It is stated that bids are wanted Jan. 31 for erecting a school in Dist. 45. Alfred Nelson, Clk. of said Dist.

STREET CLEANING AND GARBAGE DISPOSAL.

Wilmington, Del.—The City Council is stated to have awarded contracts as follows, for the collection and removal of garbage for 3 years, beginning Feb. 3: 1st Dist., Geo. C. Slaughter, $6,000; 2d Dist., Martin F. Keough, $8,850; 3d Dist., Henry Witsil, $9,600, and 4th Dist., Danl. McCormick, $17,100.

Brooklyn, N. Y.—Bids will be received Feb. 2 by John McG. Woodbury, Comr. of Street Cleaning, for furnishing and delivering 250 steel ash carts, 1,000 iron ash cans and 200 combination can and bag carriers.

Syracuse, N. Y.—The plant of the Syracuse Reduction Co., on Hiawatha St., was burned Jan. 19. It will be rebuilt at once.

GOVERNMENT WORK.

Boston, Mass.—Bids are wanted Feb. 18 for delivering 30,000 tons of rubble stone in jetties at Newburyport Harbor. Capt. Harry Taylor, Corps Engrs.

Capt. A. M. Palmer, Depot Q. M., writes that Chas. King & Co., of Boston, have received the contract for erecting the buildings at Ft. Strong, Boston Harbor (bids opened Jan. 2) for $18,560.

Bids will be received Feb. 21 for constructing roads and walks at Ft. Revere, Nantasket Head, Boston Harbor, Mass. Address A. M. Palmer, Depot Q. M.

Bids are wanted Feb. 20 for delivering 25,000 tons of rubble stone in breakwater at Isles of Shoals, Me. Capt. Harry Taylor, Corps Engrs., U. S. A., Boston.

Burlington, Vt.—Bids will be received at the office of Constructing Q. M., Burlington, Vt., until Feb. 20 for constructing buildings at Ft. Ethan Allen, Vt., as advertised in The Engineering Record.

Newport, R. I.—The only bid received Jan. 15 by Major Geo. W. Goethals, Corps Engrs., U. S. A., at Newport, for jetty construction at Nantucket, Mass., was that of E. S. Belden & Son, of Hartford, Conn., at $2.97 per short ton of stone in place. No bids were received for dredging.

Bids will be received at U. S. Engr. Office, Newport, Feb. 11, for dredging and removing bowlders in Newport Harbor, R. I., as advertised in The Engineering Record.

Philadelphia, Pa.—The following bids were opened at Washington, D. C., Jan. 17, for constructing the brick and steel extension of Bldg. No. 14, Navy Yard, League Island: American Paving & Construction Co., Philadelphia, $12,323, and E. F. Fonder, Philadelphia, for $11,592 and $13,963 respectively.

Washington, D. C.—The following bids were opened Jan. 20 at the office of Superv. Archt., Treas. Dept., for the construction (except plumbing and mechanical equipment) of the Physical Laboratory, National Bureau of Standards, Washington, D. C.: A. B. Stannard, New York, N. Y., $189,745 and $182,745; Cramp & Co., Philadelphia, Pa., $171,593 and $159,176; Doyle & Doak, Philadelphia, Pa., $237,879 and $228,322; Henderson & Co., Philadelphia, Pa., $193,000; Meade & Reynolds, Washington, $238,000 and $221,251; Pavarini & Greer, Washington, $179,000 and $163,000; Richardson & Burgess, Washington, $201,281 and $186,061; W. E. Spier, Washington, $185,700 and $171,737.

New York, N. Y.—Bids are wanted Feb. 20 for dredging in Canarsie Bay, N. Y. Col.. S. M. Mansfield, Corps Engrs., U. S. A.

Charleston, S. C.—The following bids were opened in Washington, D. C., Jan. 17, for constructing a pile and timber wharf at Navy Yard, Charleston: Grant Wilkins, Atlanta, Ga., $36,000; Simons & Mayrent, Charleston, $32,897; Penn Bridge Co., Beaver Falls, Pa., $32,839; Snare & Trieste, New York, N. Y., $36,315; N. York Const. & Jewell Filtration Co., New York, N. Y., $37,800.

Norfolk, Va.—Bids will be received at U. S. Engr. Office, Norfolk, on Feb. 13 for dredging harbor at Cape Charles City, Va., as advertised in The Engineering Record.

Superior, Wis.—Hugo & Tims, of Duluth, Minn., have secured the contract for furnishing and driving 819 piles, at Superior Entry, for $4,931.

Grand Rapids, Mich.—Bids will be received at U. S. Engr. Office, Grand Rapids, Feb. 19, for repair of pier at St. Joseph and Black Lake, Mich., as advertised in The Engineering Record.

Chicago, Ill.—Bids are wanted Feb. 24 for the engine plant of the Post Office, Court House, etc., in Chicago; also at the same time for the electrical generators of the said building. Plans and specifications may be obtained upon request, accompanied by a certified check of $100 (each branch), payable to the Treas. of the U. S., or order. Henry Ives Cobb, Archt., Chicago Bldg., Washington, D. C.

Grand Marais, Mich.—The following bids were opened Jan. 15 by Capt. D. D. Gaillard, Corps of Engrs., U. S. A., for pier extensions—*a*, 512 lin. ft. pier extension complete; *b*, 201 lin. ft. additional superstructure east pier, including rock fill; *c*, riprap, 2,316 short tons at base of extension; *d*, total: Powell & Mitchell, Marquette, Mich., *a*, $91.26; *b*, $9.67; *c*, $1.75; *d*, $52,722. Butler Bros., St. Paul, Minn., *a*, $135.00; *b*, $12.00; *c*, $2.60; *d*, $77,554. Adolph Green, Green Bay, Wis., *a*, $92.42; *b*, $10.85; *c*, $2.15; *d*, $54,479.

Duluth, Minn.—Bids will be received at U. S. Engr. Office, Duluth, Feb. 19, for pier work and dredging at Port Wing, Wis., as advertised in The Engineering Record.

Janesville, Wis.—Bids will be received until Mar. 5 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for installing a conduit and electric wiring system for the U. S. Post Office at Janesville.

Ft. Thomas, Ky.—The U. S. Government is stated to have appropriated $20,000 for a gymnasium for Ft. Thomas.

Memphis, Tenn.—Bids are wanted Feb. 10 for levee work in Upper and Lower St. Francis, White River, Upper Yazoo and Reel Foot Levee Dists. Capt. F. W. Van C. Lucas, Corps Engrs.

Chilocco, Okla. Ter.—Bids are wanted Feb. 19 for furnishing material for constructing a stone dormitory and an addition to a stone dormitory at the Chilocco School. Address W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

Dallas, Tex.—Bids are wanted until Feb. 18 for the construction (including heating apparatus, electric wiring and conduits) of the U. S. Court House, Post Office, etc., extension, at Dallas. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Norfolk, Neb.—The following bids were opened Jan. 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for construction of U. S. Post Office: Congress Const. Co., Chicago, Ill., $83,550; J. H. Welsse, South Omaha, Neb., $88,570, and J. B. Herman, Norfolk, Neb., $94,695.

Helena, Mont.—The following bids were opened Jan. 14 by the Superv. Archt., Treas. Dept., Washington, D. C., for the installation of a conduit and electric wiring for U. S. Building, at Helena: Crowley Electric Co., Denver, Colo., $3,149; Arthur Frantzen, Chicago, Ill., $3,962; Gilbert Wilkes Co., Denver, Colo., $3,838; Cuthbert & Black, Chicago, Ill., $3,230; W. J. Bonwell, St. Paul, Minn., $2,754; Liddle & Lamden, St. Paul, Minn., $4,674.

Bids will be received by Superv. Archt., Treas. Dept., Washington, D. C., Mar. 3, for the low pressure, steam heating and mechanical ventilating apparatus of the U. S. Public Building, Helena, as advertised in The Engineering Record.

Los Angeles, Cal.—The following bids for completing jetty work at San Diego Harbor, Cal., were received by Capt. Edgar Jadwin, Corps Engrs., U. S. A., on Jan. 15, amount to be expended $200,000: *a*, total number of short tons; *b*, price per ton: City Street Improv. Co., San Francisco, *a*, 101,523; *b*, $1.97. Fairchild, Gilmore, Wilton Co., Los Angeles, *a*, 101,266; *b*, $1.975. Wm. H. Healy, San Francisco, *a*, 101,368; *b*, $1.973. Waldo S. Waterman, San Diego, *a*, 108,108; *b*, $1.85.

Phoenix, Ariz.—Bids are wanted Feb. 17 for furnishing material for constructing a brick hospital, brick addition to dining hall, and a brick addition to boys' dormitory, including plumbing and electric light, at the Phoenix Indian School. Address W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

Ft. D. A. Russell, Wyo.—Bids will be received until Feb. 19 by Capt. W. S. Scott, Constructing Q. M., Cheyenne, Wyo., for constructing a bakery at Ft. D. A. Russell.

Haines, Alaska.—Capt. W. P. Richardson, of Skagway, Alaska, 8th Infty., Constructing Q. M., writes that no award has been made for constructing a wharf at Army Post on Portage Cove, Haines (bids opened Dec. 31) as bids were considered excessive.

Bids are wanted Mar. 5 for constructing, including heating, plumbing, and gas piping, several buildings, at new Army Post, on Portage Cove. Address Capt. W. P. Richardson, Constructing Q. M., Skagway, Alaska.

MISCELLANEOUS.

Boston, Mass.—The Massachusetts Dry Dock Co. is stated to have purchased water front property from the Simpson Dry Dock Co., and will erect a large dry dock.

Local press reports state that Henry S. Pritchett, S. N. Mansfield and Richard H. Dana, a special committee on the Charles River dam, submitted a report to the Legislature on Jan. 14 recommending that a dam be built sufficiently high to keep out all tides, and that a fresh water basin be maintained at a permanent level; they recommend Craigie bridge as the site for the dam. The total cost is estimated at $1,236,000, and they apportion the cost as follows: Boston, $721,000; Cambridge, $309,500; Newton, $103,000, and Watertown, $103,000.

Asbury Park, N. J.—The citizens are stated to have voted to issue $250,000 bonds to buy the beach and build a new boardwalk.

Atlantic City, N. J.—See "Power Plants, Gas and Electricity."

Buffalo, N. Y.—Bonds amounting to $100,000 for the Hamburg Canal nuisance abatement and $17,669 for grade crossings have been sold.

New York, N. Y.—Bids will be received Jan. 29 by the Park Bd. for furnishing and delivering broken stone and screenings of trap rock, also vitrified stoneware drain pipe where required in parks, Boro. Bronx. Wm. R. Willcox, Chmn.

The following bids were opened Jan. 16 by Comr. of Docks Hawkes for dredging the North River, between W. 18th and 20th Sts., Boro. of Manhattan: International Contracting Co., 95 Broad St., 38¾ cts. per cu. yd.; Morris & Cummings Dredging Co., 40 cts.; W. H. Beard Dredging Co., 42 cts.

Bids were also opened Jan. 16 for furnishing 3,397,112 ft. of sawed yellow pine timber, the lowest being that of Chas. S. Hirsch & Co., 29 Bway., at $21.43 per 1,000 ft.

Bids were opened at the same time for building a pier at the foot of Albany St., North River, as follows:

Bidders.	Building pier.	Riprap, 17,200 cu. yds.
A. Walsh	$79,000	$0.52
W. H. Jenka	79,993	.50
Bernard Rolf	83,333	.40
G. R. Spearin, 11 Bway.*	78,900	.50

*Awarded contract.

Delphos, O.—See "Sewerage and Sewage Disposal."

Chicago, Ill.—The Chicago Edison Co. and the Commonwealth Electric Co. are stated to have petitioned the city for permission to construct tunnels under the river, one at Washington St., the other at Indiana St.

St. Paul, Minn.—The Water Bd. is reported to be considering plans for a general park system, to cost about $100,000.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

New Orleans, La.—A press report states that the Bd. of State Engrs. on Jan. 15 opened the following bids for levee work—*a*, Lakeland Levee, 50,000 cu. yds.; *b*, Bordelonville Levee, 40,000 cu. yds.; price given per cu. yd.: Menzies & Co., *a*, 14.95 cts. I. R. Bobbitt, *a*, 19.90 cts.; *b*, 14.90 cts. R. T. Clark, *a*, 17.90 cts.; *b*, 17.25 cts. M. L. Linnan, *a*, 17.74 cts.; *b*, 17.40 cts. Dameron & White, *a*, 16 cts. Eppel & Hayes, *b*, 16.9 cts.

Shreveport, La.—A press report states that new bids will be received Jan. 28 for the Thompson Levee, on Red River, Caddo Parish. S. N. Kerley, State Engr.

Asher, Okla. Ter.—There is reported to be a movement on foot here by which it is proposed to straighten the channels of Little and Salt Rivers, two streams which traverse Cleveland and Pottawatomie Counties and the Seminole nation by an east and west course. Geo. G. Boggs and Chas. T. Reichert, of Asher, and C. H. Austin, of Hamilton, Mo., are reported interested.

Pocatello, Idaho.—J. H. Brady, of Pocatello, representing the Idaho Canal & Improvement Co., is stated to have purchased canal properties in Idaho, and will thoroughly overhaul and also extend the canal to Pocatello.

Kaysville, Utah.—T. H. Phillips is reported to have begun surveying for a canal to be constructed from Weber River to the southern end of the county.

NEW INDUSTRIAL PLANTS.

The Manitoba Iron Works, Ltd., Winnipeg, Man., are being organized and will erect as soon as possible large shops covering several acres for making boilers, engines, pumps, elevator machinery and all kinds of castings, machine work and repairs. About $50,000 will be spent for plant, etc., and it is hoped to have it in operation in June. T. R. Deacon, Mgr.

The Lord & Burnham Co., Irvington-on-Hudson and New York City, is making extensive additions to the plant at Irvington. These additional buildings will comprise a large wood-working mill equipped with the most modern machinery for the preparation of cypress wood capping, bars, etc., for their standard iron construction greenhouses, also for the manufacture of cypress greenhouse material for the trade for the "all sash bar" construction (the demand having outgrown the capacity of the present mill); a power house on their new dock for the installation of new steam boilers and engine; also additions to their foundry and shops for making the Burnham heating boilers. The enlargements referred to, taken in connection with its present works, including the extensive iron working shop built three years since, will nearly double this firm's present facilities, making it possible not only to fill all orders promptly, but also to handle its rapidly growing business in completed greenhouses and all kinds of greenhouse material.

James E. Mitchell, Millville, N. J., is interested in the erection of a 10-pot flint glass furnace. The buildings will cover about 300 ft. of ground. The size of the power plant has not been fully decided.

BUSINESS NOTES.

In consequence of the great and constantly increasing demand for the instruments of precision manufactured by C. L. Berger & Son, their old quarters, where the business was founded 31 years ago by the senior member, C. L. Berger, could no longer be made to fit the purpose, and they have been compelled to build a new factory with enlarged facilities. After Jan. 20 they will be located at their factory, main office and showrooms, 37 William St., Boston, Mass., where personal interviews may be had and where all communications should be addressed. Customers and friends will find it of great interest to visit the new factory, as it is fitted with the most modern machinery and auxiliary apparatus for the manufacture of precise engineering, surveying and astronomical instruments, and it is their aim to keep a large stock of engineering instruments of all kinds, leveling rods, tapes, etc., always on hand.

Pawling & Harnischfeger, Milwaukee, Wis., crane and hoist builders, report that the condition of business during 1902 was better than during any year of their partnership of 18 years' standing. The crane sales during 1902 averaged one crane for each working day and required the use of day and night gangs during the entire year, and this condition still prevails. Through additions to their plant last fall they now have better facilities to reduce the time required to turn out a crane. This is clearly shown by their statement that in December they shipped 26 cranes. The outlook for 1903 is very encouraging; orders are coming freely from all parts of the country. Recent sales are partly represented by the following: Lake Shore Engine Works, Marquette, Mich.; St. Paul, Minn., Foundry Co.; Commissioners of the District of Columbia, Washington, D. C.; Bettendorf Axle Co., Davenport, Ia.; Allis-Chalmers Co., West Allis, Wis.; American Bridge Co., Pencoyd, Pa.; Southwark Fdy. & Mch. Co., Philadelphia; Jos. T. Ryerson & Sons, Chicago; Standard Steel Works, Burnham, Pa.; W. F. & John Barnes Co., Rockford, Ill.; The Vilter Mfg. Co., Milwaukee; Southern Creosoting Co., Slidell, La.; National Malleable Castings Co., Indianapolis, Ind.; Chicago & Eastern Illinois R. R. Co., Danville, Ill.; Western Tube Co., Kewanee, Ill.; Westinghouse Machine Co., East Pittsburg, Pa.; C. H. Bradley, Jr., & Co., Pittsburg; Pittsburg Plate Glass Co., Ford City, Pa.; Ansonia, Conn., Brass & Copper Co., and Fairbanks, Morse & Co., Beloit, Wis.

The C. O. Bartlett & Snow Co., Cleveland O., has recently received orders for grill four-compartment dryers from the following firms: Bronson, Mich., Portland Cement Co.; Illinois Central R. R. Co., Chicago; Colonial Construction Co., Hudson, N. Y., and is also erecting a large dryer for the St. Louis, Mo., Portland Cement Co., and the Egyptian Portland Cement Co., Detroit, Mich.

The Philadelphia Pneumatic Tool Co. reports that its sales for December exceeded those of any other month but one in its history. The business outlook for the current year is very bright and a number of large orders for pneumatic tools that had been held over until after the first of the year have already been received and executed by the company. A very gratifying feature of the company's business is the large increase in railroad trade during the last six months of 1902, not only in the United States, but in Canada and Mexico. With its recently greatly increased facilities the company expects to double its last year's business during the current year. The Philadelphia Pneumatic Tool Co. is an independent company.

The Pittsburgh, Pa., Gage & Supply Co., is equipping two 3,000-H.-P. Allis engines of the Pittsburg Steel Co. Monessen, Pa., with the White Star continuous oiling systems. Other contracts are the equipping of three 400-H.-P. engines for the Clairton, Pa., Steel Co., and six 500-H.-P. engines in the electric light and power plant of Union Depot, Pittsburg, for the Pennsylvania Railroad Co. The company is also furnishing systems for Swift & Co., Ft. Worth, Tex.; Seere & Co., Moline, Ill., and Amherst, Mass., Gas Co.

The Interborough Rapid Transit Co. has awarded the Power Specialty Co., 126 Liberty St., New York, a contract for installing Foster superheaters in four 600-H.-P. Babcock & Wilcox boilers in the new power house of the underground road at 59th St. and Hudson River, and the New York City Water Department has awarded the same company a contract for two 500-H.-P. separately fired Foster superheaters—one to be installed at the 98th St. pumping station, and the other at the 179th St. pumping station.

The Pedrick & Ayer Co., which for many years has been located in Philadelphia, has removed to Plainfield, N. J., and is occupying the new works which it has just completed, the main building of which is 400x100 ft., with independent power house, blacksmith shop, pattern shop and pattern storage. This new shop has been equipped with electric traveling cranes and modern tools so as to enable the company to meet the largely increased demand for the standard goods which it makes, consisting of air compressors, air hoists, pneumatic riveters and special railroad tools. The selling office is at 85-89 Liberty St., New York.

The Allis-Chalmers Co., Chicago, reports the following among its sales of Reynolds-Corliss engines during December: Hall Bros., San Francisco, 16x42-in.; H. Mueller Mfg. Co., Decatur, Ill., 18x42-in.; Pettibone-Mulliken & Co., Chicago, 24 and 40x48-in.; Hocking Valley Ry. Co., Columbus, O., 18x36-in.; Geo. A. Fuller Co., Philadelphia, for Bellevue Stratford Hotel, three 22x42-in.; Adams & Kelly Co., Omaha, Neb., 18x36-in.; Virginia-Carolina Chemical Co., Richmond, Va., 16x42-in.; Lincoln Cotton Mills Co., Evansville, Ind., 30x72-in.; American Locomotive Co., Schenectady, N. Y., 16 and 32x42, and 16 and 32x36-in.; Southern Cotton Oil Co., New York, 14 and 28x36-in.; Transit Development Co., Brooklyn, N. Y., two 42 and 86x60-in.; Dow Chemical Co., Midland, Mich., 10 and 24x40-in.; Sterling, Dixon & Eastern Ry. Co., Sterling, Ill., 20x42-in.; Barrett Mfg. Co., Beloit, Wis., 30 and 64x60-in. The company also reports the sale of a 66-in.x18 ft. horizontal boiler to Henkel Bros. Milling Co., Molucca, Mex.; 16x48-in. left hand Corliss steam cylinder to Fraser & Chalmers, Ltd., England; a Fraser & Chalmers standard single drum portable hoisting engine to Aktiebola et Prospector, Finland; Fraybold & McDonald, Alaska, a duplex double-acting Riedler pump with 7x30-in. plungers, driven by a cross compound condensing Corliss engine with 12x24-in. steam cylinders and 30-in. stroke; Green Consolidated Copper Co., Mexico, duplex differential Riedler pump with 5 and 7x42-in. plungers and driven by a horizontal cross-compound condensing Corliss engine. At a meeting of the Board of Directors of the Allis-Chalmers Co. on Jan. 15 the regular quarterly dividend on preferred stock was declared.

The Wm. E. Caldwell Co., Louisville, Ky., reports that it is furnishing the Wilkesbarre Lace Mfg. Co., Scranton, Pa., with a 100,000-gal. water tank which will be 87 ft. above ground.

The Thomson Meter Co., 79 Washington St., Brooklyn, N. Y., reports that on Jan. 1 it stamped water meter No. 224,478. In 1902 there were sold 24,635 meters, an increase of 1509 over the number sold in 1901. The company stamps its meters as they are sold.

The Ball Engine Co., Erie, Pa., reports the following among recent sales: La Junta, Colo., Electric Co., a 250-H.-P. tandem compound engine; National Transit Co., Oil City, Pa., a 350-H.-P. direct-connected unit; the Lewis Block, Pittsburg, Pa., three 350-H.-P. vertical cross compound engines direct-connected to Westinghouse generators.

The Montello Brick Works, Reading, Pa., has let a contract to Geo. W. Beard & Co., Reading, Pa., for a building and sewer brick plant at Perkiomen, Pa., to have a daily capacity of 250,000 brick. Contracts have been also let for the machinery, which includes two 600-H.-P. engines, two steam shovels, twelve dry pans, four brick machines having a daily capacity of 60,000 each, four boilers, etc.

Wellesley College is to have, through the generosity of John D. Rockefeller, an entirely new and up-to-date power plant. Apparatus will be installed for heating all the buildings on the college grounds, which extend over several acres, and the grounds will be lighted by electricity throughout. Electric motors will be used for operating elevators and blowers for ventilation purposes. The Westinghouse Electric & Mfg. Co. will furnish for this plant two alternating-current, engine-type, two-phase alternators, separately excited, one of 150-Kw. and one of 75-Kw., also a five panel switchboard.

The Sheet Metal Mfg. Co., of Niles, O., has been awarded the contract for the metal ceilings throughout the 14 stories of the new Benton block in New York City. It will take one year to complete the contract.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Jan. 27.	Evanston, Ill.	Jan. 24
Jan. 28.	Filters, reserv'r, etc., Washington, D.C. Adv., Eng. Record, Jan. 3 to 24.	Jan. 3
Jan. 30.	Havre, Mont.	Dec. 27
Jan. 31.	St. Paul, Minn.	Jan. 24
Feb. 1.	Brinkley, Ark.	Jan. 10
Feb. 2.	Bloomington, Ill.	Jan. 24
Feb. 2.	Wessington Springs, S. D.	Jan. 17
Feb. 2.	Pumping Engine, Winnipeg, Man. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 2.	Rayne, La.	Jan. 17
Feb. 2.	Winnipeg, Man.	Jan. 10
Feb. 2.	Gillett, Wis.	Jan. 10
Feb. 6.	Wellsville, O. Adv., Eng. Record, Jan. 10.	Jan. 10
Feb. 14.	Lakewood, O.	Jan. 14
Feb. 17.	Cincinnati, O. Adv., Eng. Record, Jan. 24.	Jan. 24
Mar. 1.	Ft. Morgan, Ala.	Jan. 24
Mar. 14.	Dillon, Mont.	Jan. 10
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Jan. 27.	Weehawken, N. J.	Jan. 24
Jan. 27.	Evanston, Ill.	Jan. 24
Jan. 27.	Boston, Mass.	Jan. 24
Jan. 27.	New Haven, Conn.	Jan. 17
Jan. 27.	Newark, O.	Jan. 10
Jan. 29.	Ft. Duchesne, Utah.	Jan. 10
Jan. 30.	Tipton, Ind.	Jan. 24
Jan. 31.	Rock Island, Ill.	Jan. 17
Jan. —	Walnut, Ill.	Dec. 13
Feb. 2.	Plans, Delphos, O.	Jan. 24
Feb. 2.	Slayton, Minn.	Jan. 24
Feb. 2.	New Orleans, La. Adv., Eng. Record, Nov. 29 to Jan. 24.	Nov. 29
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 7.	Philadelphia, Pa.	Jan. 10
Feb. 9.	Cincinnati, O.	Jan. 17
Feb. 14.	Lakewood, O.	Jan. 24
Feb. 14.	Washington, D. C. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 16.	Toledo, O.	Jan. 24
Mar. 1.	Peoria, Ill.	Jan. 17
	BRIDGES.	
Jan. 27.	Oneida, N. Y.	Jan. 24
Jan. 27.	East Peoria, Ill.	Jan. 10
Jan. 28.	Springfield, O.	Jan. 10
Jan. —	Peoria, Ill.	Dec. 13
Feb. 1.	Jacksonville, Fla.	Jan. 10
Feb. 3.	Muscatine, Ia.	Jan. 24
Feb. 3.	Spencer, Ind.	Jan. 24
Feb. 9.	New Castle, Ind.	Jan. 24
Feb. 9.	Fredericton, N. B.	Jan. 17
Feb. 10.	Arkadelphia, Ark.	Jan. 10
Feb. 10.	Castroville, Tex.	Jan. 3
Feb. 11.	Camden, N. J.	Jan. 24
Feb. 14.	Bay City, Mich. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
	PAVING AND ROADMAKING.	
Jan. 27.	Boston, Mass.	Jan. 24
Jan. 27.	Seattle, Wash.	Jan. 17
Jan. 27.	Cleveland, O.	Jan. 10
Jan. 28.	Chicago, Ill.	Jan. 24
Jan. 29.	Cleveland, O.	Jan. 3
Jan. 30.	Buffalo, N. Y.	Jan. 24
Jan. 30.	Owosso, Mich. Adv., Eng. Record, Jan. 10.	Jan. 10
Jan. 31.	Akron, O.	Jan. 17
Feb. 1.	Burlington, Ia.	Jan. 3
Feb. 2.	Cincinnati, O.	Jan. 24
Feb. 3.	Springfield, Mo.	Jan. 24
Feb. 3.	Cleveland, O.	Jan. 10
Feb. 4.	Brooklyn, N. Y.	Jan. 24
Feb. 4.	Portland, Ind.	Jan. 17
Feb. 4.	Sandusky, O.	Jan. 10
Feb. 4.	Cincinnati, O.	Jan. 10
Feb. 9.	Madison, Wis.	Jan. 24
Feb. 9.	Toledo, O.	Jan. 17
Feb. 10.	Newark, O.	Jan. 17
Feb. 13.	Kenton, O.	Jan. 24
Feb. 13.	Toledo, O.	Jan. 24
Feb. 14.	Lafayette, Ind.	Dec. 27
Feb. 17.	Three Rivers, Mich. Adv., Eng. Record, Jan. 10.	Jan. 10
Feb. 23.	Fond du Lac, Wis. Adv., Eng. Record, Jan. 3 to 17.	Jan. 3
	POWER, GAS AND ELECTRICITY.	
Jan. 30.	Havre, Mont.	Dec. 27
Jan. —	South Norwalk, Conn.	Dec. 13
Feb. 1.	Brinkley, Ark.	Jan. 10
Feb. 2.	Rayne, La.	Jan. 17
Feb. 10.	Granbury, Tex.	Jan. 17
Feb. 12.	Guayaquil, Ecuador	Dec. 20
———	Franchise, Vicksburg, Miss.	Jan. 17
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Jan. 26.	St. Augustine, Fla. Adv., Eng. Record, Jan. 3 to 24.	Jan. 3
Jan. 27.	Creston, Ia.	Jan. 3
Jan. 28.	Ft. Caswell, N. C.	Jan. 10
Jan. 29.	Ft. Duchesne, Utah.	Jan. 10
Jan. 29.	Philadelphia, Pa. Adv., Eng. Record, Jan. 3 to 24.	Jan. 3
Jan. 30.	Newport, R. I. Adv., Eng. Record, Jan. 3 to 24.	Jan. 3
Jan. 31.	Ft. Caswell, N. C.	Jan. 10
Feb. 2.	Ft. Wadsworth, N. Y.	Jan. 10
Feb. 3.	New York, N. Y. Adv., Eng. Record, Jan. 10, 17.	Jan. 10
Feb. 3.	San Francisco, Cal.	Jan. 3
Feb. 4.	Algiers, La.	Jan. 17
Feb. 4.	Boston, Mass.	Jan. 10
Feb. 5.	Grand Rapids, Mich. Adv., Eng. Record, Jan. 10 to 24.	Jan. 10
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 6.	Ft. Logan, Colo.	Jan. 10
Feb. 7.	Sewer, Philadelphia, Pa.	Jan. 10
Feb. 7.	Dry dock, Philadelphia, Pa.	Dec. 20
Feb. 9.	San Diego, Cal.	Jan. 17
Feb. 9.	Superior, Wis.	Jan. 17
Feb. 9.	Little Rock, Ark. Adv., Eng. Record, Jan. 10 to 24.	Jan. 10
Feb. 10.	Chicago, Ill. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 10.	Memphis, Tenn.	Jan. 17
Feb. 10.	Boston, Mass.	Jan. 10
Feb. 11.	Newport, R. I. Adv., Eng. Record, Jan. 24.	Jan. 24
Feb. 12.	Memphis, Tenn. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 12.	St. Augustine, Fla. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 12.	Boston, Mass.	Jan. 17
Feb. 12.	Newport, R. I. Adv., Eng. Record, Jan. 10 to 24.	Jan. 10
Feb. 13.	Norfolk, Va. Adv., Eng. Record, Jan. 24.	Jan. 17
Feb. 16.	Ft. Illey, Kan. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 16.	New York, N. Y. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 16.	Boston, Mass.	Jan. 17
Feb. 17.	Phoenix, Ariz.	Jan. 24
Feb. 18.	Boston, Mass.	Jan. 24
Feb. 18.	Dallas, Tex.	Jan. 24
Feb. 18.	San Francisco, Cal.	Jan. 17
Feb. 19.	Duluth, Minn. Adv., Eng. Record, Jan. 24.	Jan. 24
Feb. 19.	Grand Rapids, Mich. Adv., Eng. Record, Jan. 24.	Jan. 24
Feb. 19.	Chilocco, Okla. Ter.	Jan. 24
Feb. 19.	Ft. D. A. Russell, Wyo.	Jan. 24
Feb. 19.	Burlington, Ia. Adv., Eng. Record, Jan. 17, 24.	Feb. 17
Feb. 20.	Burlington, Vt. Adv., Eng. Record, Jan. 24.	Jan. 24
Feb. 20.	New York, N. Y.	Jan. 24
Feb. 20.	Boston, Mass.	Jan. 24
Feb. 21.	Boston, Mass.	Jan. 24
Feb. 21.	Bldg., Philadelphia, Pa.	Jan. 17
Feb. 24.	Chicago, Ill.	Jan. 24
Feb. 25.	Creston, Ia. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Mar. 3.	Helena, Mont. Adv., Eng. Record, Jan. 24.	Jan. 24
Mar. 5.	Haines, Alaska	Jan. 24
Mar. 5.	Janesville, Wis.	Jan. 24
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
	BUILDINGS.	
Jan. 26.	School, Washington, D. C.	Jan. 24
Jan. 26.	School, Boston, Mass.	Jan. 24
Jan. 27.	Library, Jackson, Mich.	Jan. 17
Jan. 27.	School, Abercrombie, N. D.	Jan. 10
Jan. 28.	Hospital, Kings Park, L. I., N. Y. Adv., Eng. Record, Jan. 24.	Jan. 17
Jan. 28.	Court house, Centerville, Ia.	Jan. 10
Jan. 28.	Library, San Bernardino, Cal.	Jan. 10
Jan. 29.	School, York, Pa.	Jan. 24
Jan. 30.	School, Chicago, Ill.	Jan. 24
Jan. 30.	Masonic Temple, Washington, D. C.	Jan. 10
Jan. 30.	School, Geneseo, N. Y.	Dec. 13
Jan. 31.	School, Hoquiam, Wash.	Jan. 24
Jan. 31.	Church, Scotchbridge, O.	Nov. 29
Jan. —	Church, Marine City, Mich.	Dec. 27
Feb. 1.	Church, Springfield, O.	Jan. 10
Feb. 1.	School, Clarksville, Ia.	Jan. 3
Feb. 1.	Hospital, Springfield, O.	Jan. 3
Feb. 1.	Office Bldg., Flint, Mich.	Dec. 27
Feb. 1.	Pub. Bldg. Plans, Louisville, Ky.	Dec. 27
Feb. 1.	School, Dickinson, N. Y.	Dec. 6
Feb. 2.	School, New York, N. Y.	Jan. 24
Feb. 2.	Court House, Hamburg, Ark.	Jan. 24
Feb. 2.	School, Syracuse, N. Y.	Jan. 24
Feb. 2.	School, Darien, Wis.	Jan. 17
Feb. 2.	Hotel, Beaumont, Tex.	Jan. 10
Feb. 2.	Warehouse, Aberdeen, S. D.	Jan. 10
Feb. 2.	City Hall, Houston, Tex.	Dec. 13
Feb. 3.	School, Clinton, La.	Jan. 24
Feb. 3.	School, Columbus, O.	Jan. 10
Feb. 6.	Pub. Bldg., Boone, Ia.	Jan. 24
Feb. 7.	School, Toledo, O.	Jan. 17
Feb. 10.	School, Huntington, W. Va.	Jan. 24
Feb. 10.	Court house, Lawrence, Kan.	Jan. 17
Feb. 14.	Library, Norfolk, Va.	Jan. 10
Feb. 17.	Church, Carrollton, Ky.	Jan. 17
Feb. 18.	Court house, Lawrence, Kan.	Jan. 24
Feb. 18.	Church, Selma, Ala.	Jan. 17
Feb. 20.	Court House, Newport, Ind.	Jan. 24
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
	MISCELLANEOUS.	
Jan. 24.	Breakwater, Halifax, N. S.	Jan. 3
Jan. 26.	Supplies, Brooklyn, N. Y.	Jan. 17
Jan. 27.	Pier, New York, N. Y.	Jan. 17
Jan. 28.	Levee Work, Shreveport, La.	Jan. 24
Jan. 29.	Supplies, New York, N. Y.	Jan. 24
Feb. 2.	Ash carts, etc., Brooklyn, N. Y.	Jan. 24
Feb. 3.	E. Ry. franchise, Pasadena, Cal.	Jan. 17
Feb. 4.	Levee Work, Shreveport, La.	Jan. 17
Feb. 5.	Levee Work, Bossier City, La.	Jan. 10
Feb. 17.	Cement, Winnipeg, Man. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Mar. 1.	Grading, Beaumont, Tex.	Jan. 24
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	R. R. work, Cincinnati, O.	Dec. 20

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Broader Applications of Engineering Talent.

Although even among the intelligent there is still much misapprehension as to what an engineer is, it is encouraging to observe that the public estimation of the work of the profession is steadily advancing. The more enlightened and progressive are even now beginning to comprehend that the engineer can do something more than "adapt the great sources of power in nature for the use and convenience of man." In other words, the services which the engineer is called to render to the community are passing onward from the material into moral and ethical fields. Men of large capacity and thorough engineering training are coming to be recognized as among those best equipped for managing great enterprises and solving large problems intimately affecting the social welfare. In an address recently delivered at a dinner of the Lehigh Alumni Association in New York, President Alex. C. Humphreys, of the Stevens Institute of Technology, emphasized particularly some elements of engineering education especially valuable in assisting to develop this broader type of engineering talent.

Discussing the question now so prominent in industrial fields, President Humphreys said: "As an engineer and a manager of properties, it seems to me that in no other line is there a better opportunity for such good work in connection with the solution of the labor problem than in the technical schools. The graduates of our technical schools are becoming more and more the administrative officers of our industrial concerns, the connecting link between Capital and Labor. Frequently the decision between strike and no strike rests with the manager and his staff. Many a strike has been finally occasioned by the lack on the part of the manager of the ability to see both sides of a question. The strength of purpose to protect the property of Capital should be coupled with tactfulness and human sympathy. The engineer should appreciate that the highest efficiency in the operation of his works can only be obtained by looking upon his workmen as fellow-men, entitled to share, beyond the daily wage, in the prosperity of the undertaking. And if his directors insist that the management must eliminate all features except those that pay, with his broader training he can probably succeed in demonstrating that in the long run the Golden Rule does pay in the management of industrial properties.

"It is then most important that these engineers should be educated not only to be thoroughly efficient technically, but to be finally and practically efficient as leaders of men. If good results are to be obtained workmen must respect those in authority over them. The manager who is simply one of themselves fails to command their entire respect; still less is the theorist, who constantly exhibits his insufficiency in practical affairs, able to secure their confidence. The intelligent workman is quick to acknowledge the supremacy of the man who has a complete command of his business in detail and as a whole. Such a command only comes to the man trained in theory *and* practice. I do not claim that this training must be obtained in a technical school, but somehow it must be obtained, and it can be best and most easily obtained in a good school of technology."

The achievement of the technical schools during the past generation in showing that there is no opposition between theory and practice in the scientific fields has come to be pretty well recognized. The importance of the laboratory method of technical instruction is now universally accepted, but President Humphreys well remarks "that it must never be forgotten that the engineer is not primarily a scientist. Better for the engineer to know well only the science of his specialty and be able to efficiently apply that little than to know much of science and be unable to bring it into efficient practice." He contended also "that the exclusive study of pure science is less narrowing than the exclusive study of dead languages, that the study of applied science is decidedly broadening, and that the curriculum for the engineer students should be broadened to include such studies as English literature, logic, history, economics and modern languages. The engineer actually needs to have a working command of his own language." Of the necessity for emphasizing this latter point the editor of a technical journal is perhaps more fully cognizant than anyone else. The frequent clumsiness, redundancy and tautology, not to mention other faults in grammar and rhetoric, of an engineer's report or description of work certainly does not tend to enhance the public appreciation of engineering as a learned profession. Indeed, most unfortunately, such shabby clothing not infrequently causes an unduly low estimate of the worth and dignity of truly able reports of investigations and descriptions of engineering achievement which should command admiration. The habit of using good language accurately tends also to help the habit of thinking accurately and clearly, and the man who can think well will have added much to his power if he can with facility gracefully express the product of his mind.

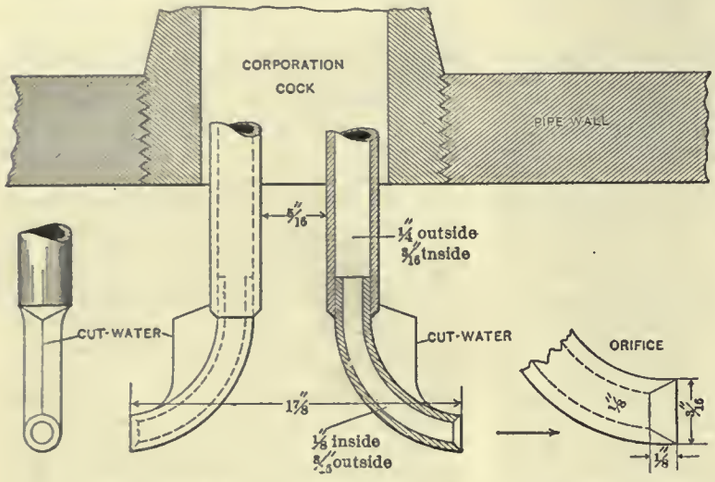
Another line of instruction seldom if ever emphasized as a part of an engineer's education was strongly urged by President Humphreys when he said: "I claim that the engineer student should have some training in business methods. He should be at least shown that when he goes out into the world he will be called upon to follow his profession within certain limits set by commercial requirements and conditions. We cannot expect to train the students to be expert book-keepers, nor is it necessary or desirable to do so; but we can expect to give them what is of far more value and what many book-keepers do not possess—a sound knowledge of the principles of double entry book-keeping. This knowledge engineers and works managers need to enable them to exercise a close, intelligent and independent supervision of manufacturing cost. They should be shown the dangers of confusing capital and revenue entries and the necessity of providing for depreciation through some scheme based upon an exhaustive examination of local conditions. They should be shown that books of account can unfortunately be so kept, either through ignorance or design, as to hide the facts and to so present a warrant for the payment of dividends unearned. They should be shown that this and more they will need to know if they are to be competent as managers or reliable as advisers in connection with the purchase of properties." Too many of our young engineers who have a fair ability to use calculus have not learned the simplest business arithmetic and frequently forget or seem to forget the relative as well as the absolute commercial value of materials, time and services. "If nothing more can be done in the Department of Economics," President Humphreys recommends that at least "there should be given enough instruction in the science of statistics to warn the students against the danger of drawing conclusions from insufficient or inconsistent data."

The question has sometimes been raised, and is again brought forcibly to mind, Is sufficient differentiation made in our engineering colleges between the training for the practice of the art and the practice of the profession of engineering? We fear that in most of these colleges but one curriculum is open alike to the young man who can best serve the community as a draftsman, a good instrument man or a conscientious inspector and to him who has capacity to become a master of men and resources and to direct alike human and physical forces. While four or even five years of technical training, following a more or less complete academic course, may be requisite for the latter student, would not three years in a technical school after a thorough English education be sufficient to fit the former man for efficient services? If it be not feasible, especially in the smaller colleges, to completely separate the two classes of students, might not something in this direction be accomplished by a proper use of the elective power in the choice of studies and by giving diplomas of different grades for courses of different length and scope, in the various departments of engineering, civil, mechanical, electrical and the others?

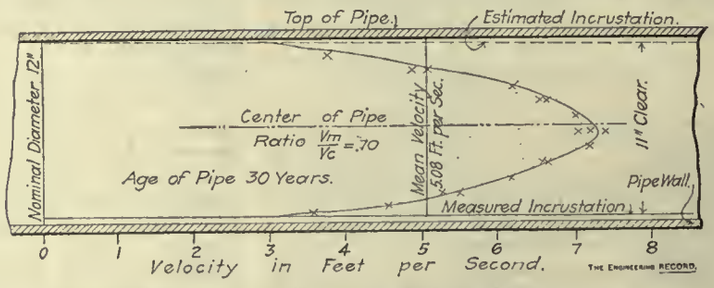
State Civil Service Examinations for civil engineering draftsmen at $4 to $5 per day will be held throughout the State of New York on Saturday, February 28, as announced among the proposals published in another column. The examinations will be open to non-residents. Persons wishing to take the examinations should file applications in due form before noon of February 23, and may obtain blanks and further information by writing to Chief Examiner, State Civil Service Commission, Albany, N. Y.

Water Waste Detection in New York City.

The Department of Water Supply, Gas and Electricity of the City of New York is taking energetic measures, under the able administration of Commissioner Robert G. Monroe and Chief Engineer Nicholas S. Hill, Jr., to get definite information as to the exact condition of the water distribution system in several typical districts of the Borough of Manhattan. If the steps taken prove as successful as is hoped and as the work already accomplished seems to indicate, the plan will probably be extended. This work on the part of the department comes at a particularly opportune time, as it will greatly facilitate the investigations of Messrs. Burr, Freeman and Hering, who were recently appointed to make a thorough report on the water supply of the city and all possible means of increasing it. The amount of water supplied to the Boroughs of Manhattan and the Bronx at the present time is approximately 115 gallons per inhabitant daily, which is unquestionably more than is actually utilized. How much more is what the department is now proceeding to find out by the only practical method —actual measurement. It is probable, however, that the preventable waste is not nearly so great as is popularly supposed.



Details of Pitometer Orifices.



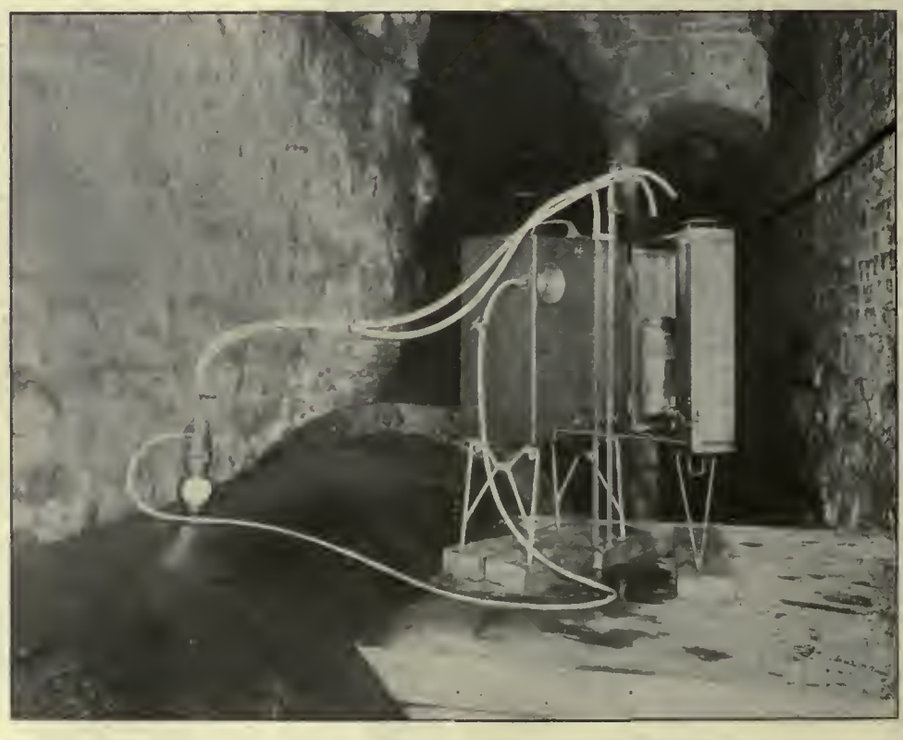
Vertical Pipe Traverse, 12-Inch Main.

What is known as the Cole-Flad Pitometer is being used in these investigations. The essential features of this instrument were independently devised about six years ago by the late Henry Flad, of St. Louis, and Mr. Edward S. Cole, of Chicago. The instrument has been brought to its present improved condition through the efforts of Mr. Cole, who is a member of the firm of John A. Cole & Son, of Chicago. Mr. Cole's methods and instruments have been used for the detection of water waste in several cities, notably Columbus, O., and Terre Haute, Ind., with excellent results, but the method has never received any great publicity.

The system as applied in New York is as follows: The city is divided into large districts, the boundaries of which are so selected that the entire water supply for each can be made to pass through one or two large mains. These mains are tapped under pressure and a 1-inch corporation cock attached, through which the tubes of the Pitometer are inserted when it is desired to obtain a record of the quantity of water flowing into that district. The instrument gives a continuous record of this quantity. At the same time inspectors are sent around to obtain the figures for the quantity of water supplied to the district through meters. The population of the district is also obtained, either from the city census records or by the inspectors, who also obtain as accurately as possible the figures for the non-resident population and any other significant data.

The total metered consumption of the district being deducted from the total amount supplied to the district as measured by the Pitometers, the difference shows the amount of unmetered consumption plus the waste. Under ordinary conditions, this difference for the hours of 2 to 4 a. m. measures the amount of waste in the district. Local conditions may modify this conclusion, however, as in the case of one of the districts considered in New York where the pressure is not great enough to supply the upper floors of the buildings during the day, and especially in the large apartment houses tanks have been provided on the top floors, which are filled during the night for use the next day. Special conditions like this may affect very appreciably the night consumption of water, and it requires considerable experience to be able to interpret correctly the results of such investigations. If the amount of waste and leakage is found to be enough to warrant further investigation, the large district is subdivided into smaller ones and a similar process is followed until the trouble is located.

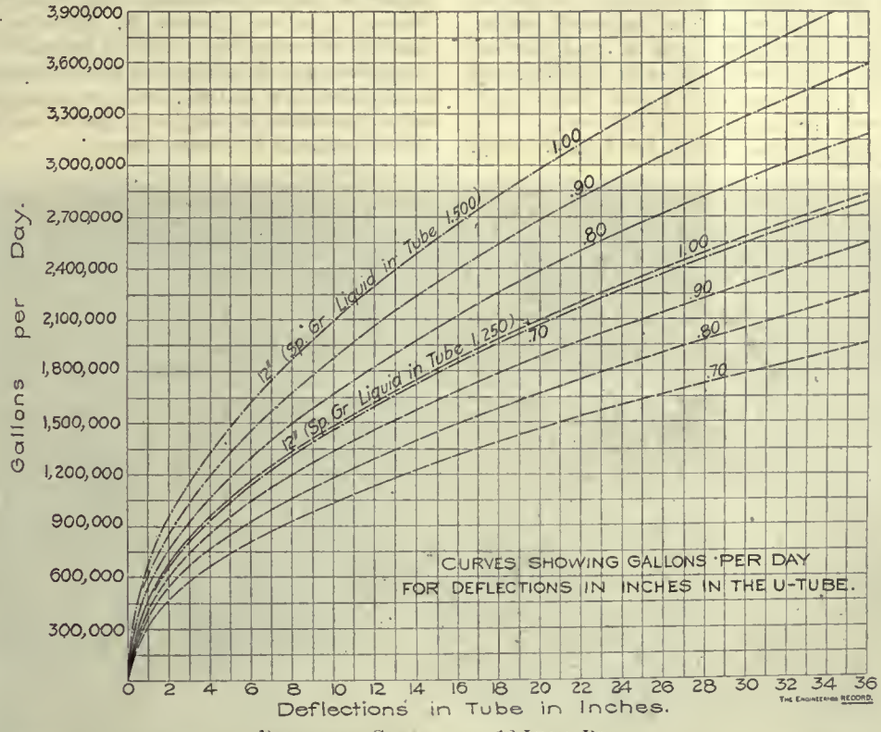
The only essential feature of this system of waste detection that distinguishes it from any other is in the use of the Pitometer, by which a continuous and accurate record of the flow in the main is obtained at a minimum expense and without shutting off the supply for the insertion of valves and meters. All that is necessary is to tap the main under pressure and insert through a 1-inch corporation cock the two orifice tubes of the Pitometer, details of which are given in an accompanying cut. A special cap fitting on to the cock simplifies the insertion of the tubes. The ends of the tubes projecting into the main are placed so that one orifice points against the current and the other with it. They are provided with cutwaters so as to cause as little eddying as possible. The other ends of the orifice tubes are connected by cloth-insertion rubber tubing to the ends of a glass U-tube or manometer, each arm of which is about 2 feet long and 5/16 inch in internal diameter. The bottom of this U-tube is filled with a mixture of carbon tetrachloride and gasoline having a specific gravity of 1.25 at ordinary temperatures. In some cases, however, where a very high velocity is to be measured, Mr. Cole has used a mixture having a specific gravity of 1.5, as otherwise the deflections would be beyond the limits of the U-tube. A blow-off for the removal of air from the apparatus is located at the top of each arm of the U-tube, stopped with an ordinary pinch-cock, as shown in the photograph of the instrument. The special liquid in the U-tube was chosen with the object of uniformly maintaining at a specific gravity of 1.25, a differential effect between the two arms of the tube equivalent to four times the simple water head, thus making the instrument sensitive to very slight variations in the velocity. It is stated that the instrument, if carefully used, can be depended on to measure velocities as low as 4 inches per second. At ordinary pipe velocities the deflections may run up to 24 inches and need not then be read very closely.



The Pitometer Recording Flow through 36-Inch Main.

The velocity of the water in the main affects the deflection in the U-tube according to the law of the parabola, $V = c\sqrt{2gh}$, in which h is one-quarter of the total deflection. For the ⅛-inch orifices the coefficient c has been found by experiment to be .80. For 1/16-inch orifices it is slightly greater. The curve of the ⅛-inch orifices has been adopted as the standard, and the various pipe calibrations have been made on this basis. The accuracy of the Pitometer has been established by many weir and pump tests and by calibration in open channels where the velocities indicated by the instrument were compared with float measurements. In the latter cases the orifice tubes were inserted upward through the bottoms of the troughs, with the orifices about ½ inch below the surface. Substituting the values $c = .80$, $g = 32.2$, and $h = \frac{1}{4}\ d$, the preceding formula becomes $V = 3.212\sqrt{d}$, in which d is the U-tube deflection in feet.

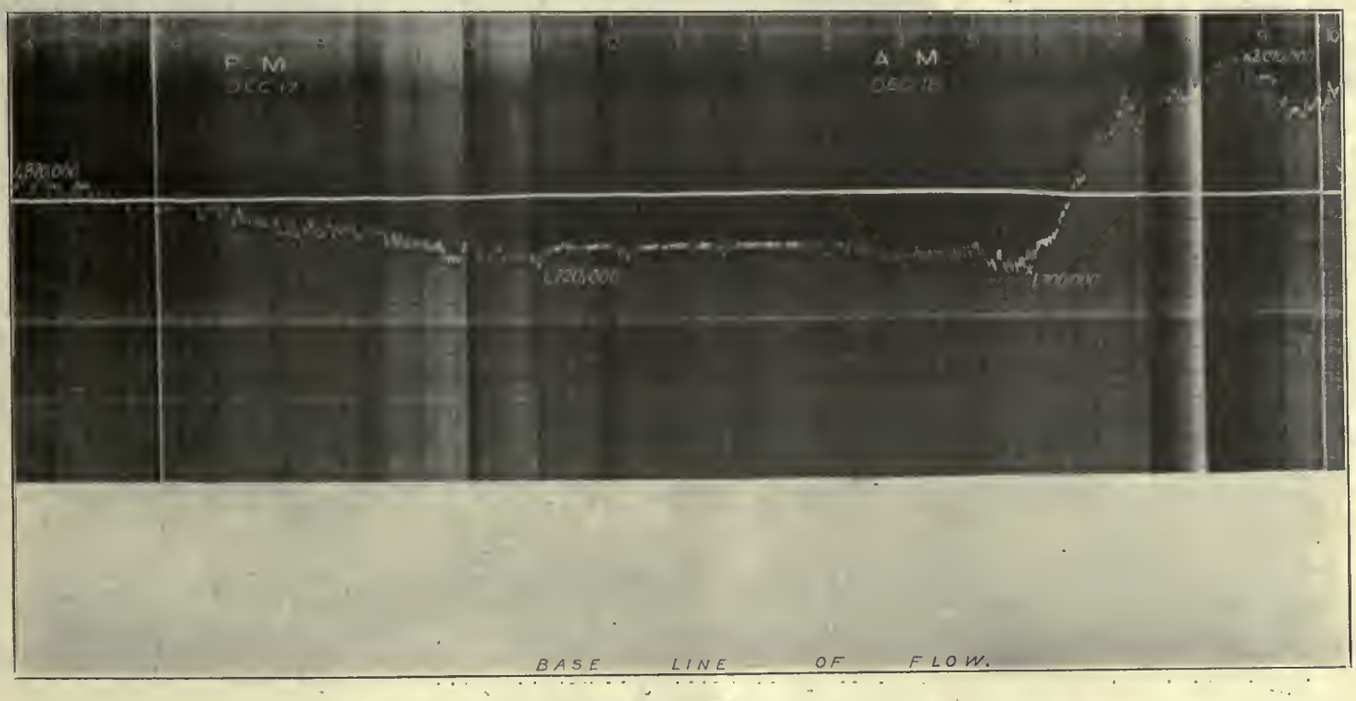
The velocity of the water at whatever point the orifices are placed can be determined by this formula or scaled directly from the plotted calibration curves. What is called a traverse of the main can thus be obtained, showing the velocity at each point along a diameter of the pipe. From this traverse the point of maximum velocity is noted and when a permanent record of the flow is to be obtained, the orifices are placed at this point. From this traverse the mean velocity, V_m, is also computed, by considering rings a certain distance apart, say 1 inch, in the pipe section and averaging the velocities according to the relative areas of the rings. The relation between the mean velocity, V_m and the center or maximum velocity, V_c, is then found. If it is desired to be especially accurate, or if it is thought that the velocities in the pipe may vary irregularly on account of incrustations, etc., a second traverse may be made along the diameter 90 degrees from the first. Two diagrams can thus be made showing the range of velocities in a vertical plane and also in a horizontal plane. It has been found that the ratio between the mean and the center velocities holds good for a given pipe at all velocities, although it is not the same for pipes of different sizes or conditions. The ratio of mean to maximum velocity varies from .70 to .90.



DISCHARGE CURVES FOR 12-INCH PIPE.

A remarkably interesting pipe traverse of a 12-inch high service main at Fortieth Street and Sixth Avenue is shown in an accompanying illustration. The pipe is thirty years old and the first thing that was discovered in connection with the main was an incrustation which reduced the diameter by a full inch. The velocity of the water in this main was far beyond any reasonable amount, the maximum being about 7.3 feet per second, and the average 5.08 feet per second. The very close agreement with the curve of the several points from which the traverse was plotted is characteristic of the records obtained by the Pitometer. In this case the ratio of mean to center velocity was .70.

To determine the velocities in the pipes for any given deflection in the U-tube a diagram has been prepared (not reproduced here) giving a scale of deflections along the horizontal axis and the corresponding velocities along the vertical axis. This diagram facilitates the preparation of the traverses; and when the mean velocity has been found the discharge through the pipe can be computed by means of any of the standard pipe formulas. Ordinarily, however, the quantity of water flowing through the pipe is determined directly from the U-tube deflections, by means of another set of diagrams, one for each size of pipe used. That for 12-inch pipes accompanies this description. The deflections are laid off horizontally and the discharge in gallons per day along the vertical scale. Of the different curves shown, four give the discharge corresponding to a certain deflection when the specific gravity of the liquid in the U-tube is 1.50, and four give it when a specific gravity of 1.25 is used. Each set of four is marked .70, .80, .90, and 1.00, the different curves of the set being used according as the ratio of mean to center velocities is one or another of these values. If it is not exactly



PITOMETER RECORD OF 12-INCH PIPE AT FORTIETH STREET AND SIXTH AVENUE.

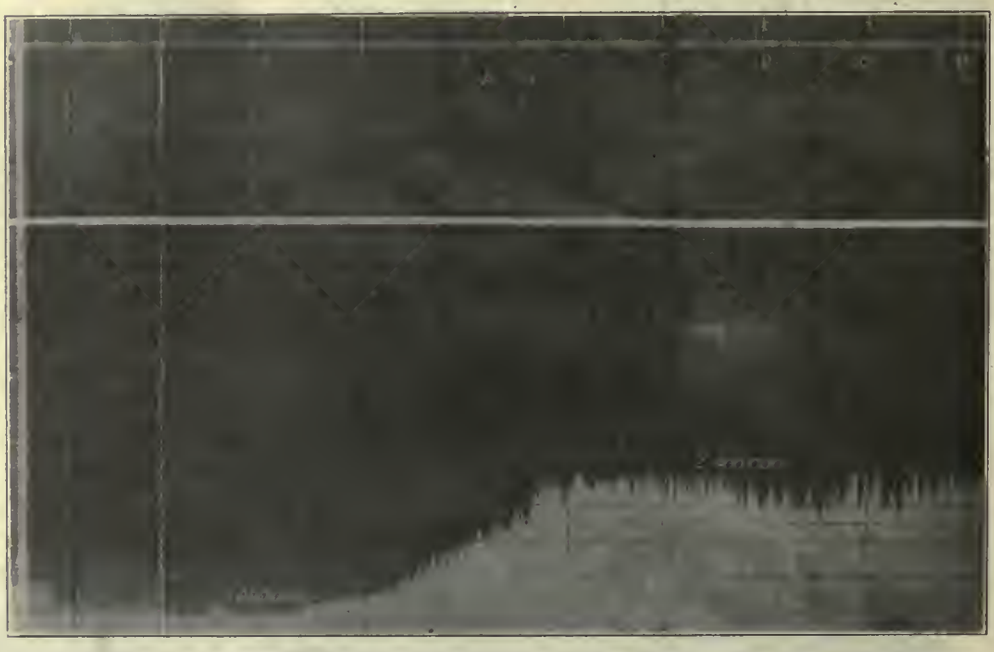
one of these values the correct value can be easily interpolated.

To illustrate the use of this diagram, suppose the ratio of mean to center velocities had been found from the pipe traverse to be .70, and a given deflection was 20 inches. If the specific gravity of the liquid in the tube was 1.25 the discharge through the pipe is found to be 1,470,000 gallons per day. If the specific gravity of the liquid had been 1.50 the corresponding discharge would have been 2,070,000 gallons. For convenience in obtaining the discharge directly from the record without referring to the diagram, Mr. Cole has prepared slips of cardboard, one for each of the conditions most encountered, on which the discharge in gallons per day is laid off vertically according to the law of the particular parabola under consideration. That is, an inch near the bottom of the scale represents a much greater difference in the quantity discharged than one near the top of the scale, because at the bottom the parabola is more nearly vertical. By simply placing the correct slip with its zero point on the zero line of the record, the corresponding discharge can be read directly from the slip at the point where the scale crosses the line that records the deflections in the U-tube.

It was found that photography was the only practical method of obtaining a continuous record of the U-tube deflections, and much time was spent in perfecting this part of the instrument, which has been called a photo-recorder. The record is made of the surface of the liquid in the rising end of the U-tube, or that end connected to the orifice which points downstream. When there is no current flowing, the liquid in the two arms of the U-tube is at the same height, which is the zero point for the recording instrument. When the water begins to flow through the main which is being inspected, the liquid in the recording arm rises. This recording arm is clamped into a slot in the box-like recorder, so that no light can pass into the interior of the latter except through that arm of the U-tube. Directly behind the tube is a very narrow slit, in which are cut slight notches so spaced as to correct for the angularity of the light and record horizontal lines spaced equal distances apart on the recording drum, for convenience in reading the deflections. Just behind the narrow slit is the recording drum, about 6 inches in diameter, which revolves on a vertical axis, the motive power being a special form of clock-work, so geared that the perimeter of the drum travels at the rate of 1½ inches per hour, making an 18-inch record in 12 hours. By a special device the record is interrupted for a short interval every two hours, thus leaving a vertical base line on the record for identifying the time of any event.

When a record is to be made, a sheet of ordinary velox paper 10x18 inches in size is attached to the drum and the clock-work started. The liquid in the lower part of the U-tube, on account of its brown color, due to iodine, cuts out the greater part of the light which would otherwise pass through the tube and the slit and affect the velox paper, while in the upper portion of the tube containing the clear water, the light is transmitted clearly through the slit. When the record sheet is developed, a distinct line of demarkation shows on the paper, indicating exactly the height at which the liquid stood in the tube at any time within the 12-hour limit of that sheet.

In addition to recording the flow in this way, a continuous record is made on the same sheet of the pressure during the same time, this being done by a narrow pointer which moves up and down with the pressure across the slit. This pointer being perfectly opaque, a clearcut line is therefore left on the record sheet, which is used not so much to determine the exact pressure as to facilitate the interpretation of the results of the flow record. For example, when the pressure and the flow increase and decrease together at night, it is evident that the change in flow is due mainly to the change in pressure, and it is probable that there are a number of places where water is flowing continuously from the system. If, however, the pressure increases when the flow decreases, it is probable that the change in pressure is due to a decrease in actual use, which, in connection with a low minimum night flow, shows that the district contains no serious leaks.



Pitometer Record of 20-Inch Main at Eighty-third Street.

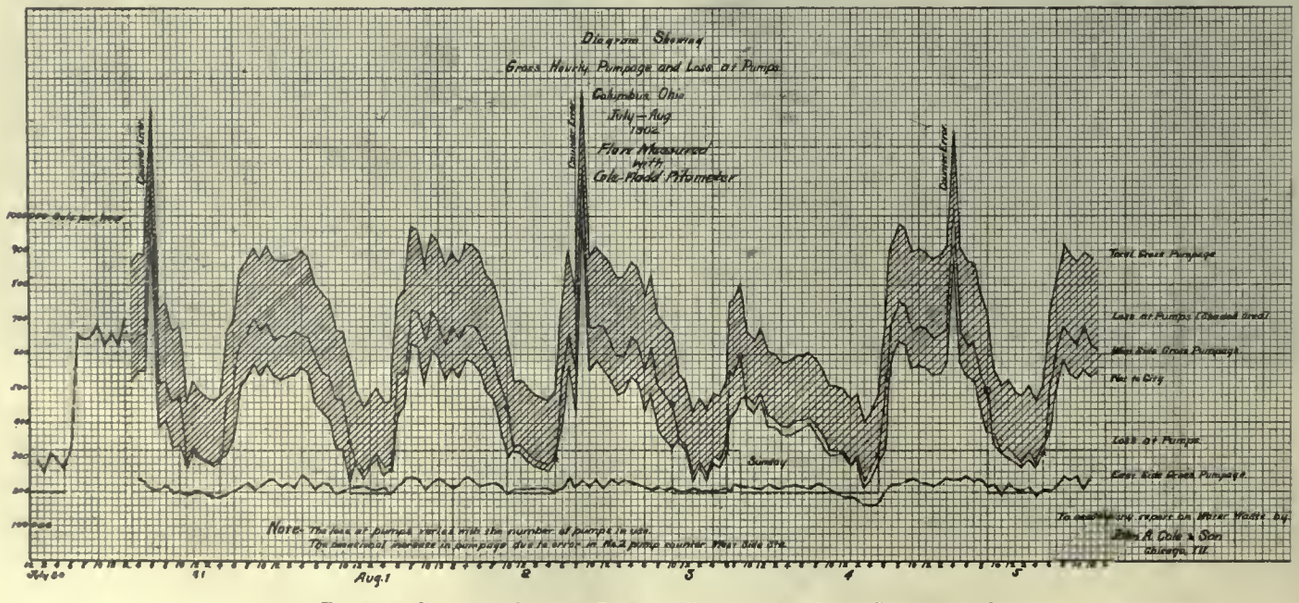


Diagram Showing Slip of Pumps (Shaded Area) at Columbus, O.

A reproduction of an 18-hour record obtained from the 12-inch main at Fortieth Street and Sixth Avenue, of which a traverse has also been shown, accompanies this description. There was not sufficient coloring matter in the liquid when this record was taken, so that the difference in shade between the parts of the record above and below the record line is not very marked. Nevertheless it will be noticed that the record line itself is very distinct. This record shows that all night long the rate of flow through the pipe did not fall below 1,700,000 gallons per 24 hours, while the maximum day flow was only 2,070,000 gallons. The nearly

horizontal white line across the record is the pressure line, which shows that the pressure gradually rose during the night till about 4.30 a. m., when it began to fall again as the consumption began to increase. In explanation of the large night consumption it may be said that much of it was due to the filling of large tanks in hotels and apartment houses during the night for use the next day.

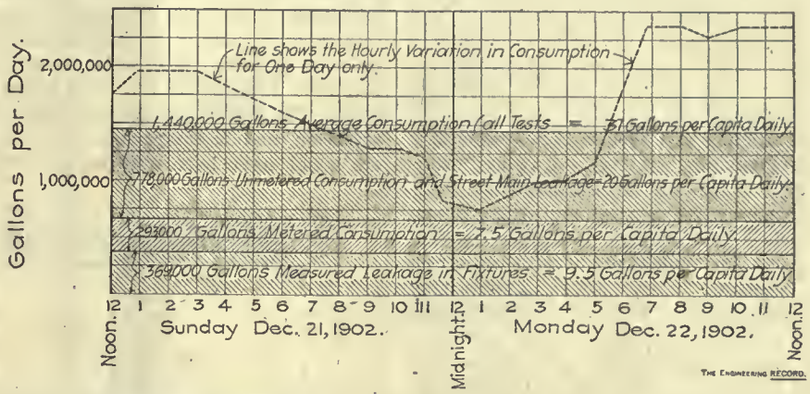
The other record, a portion of which is reproduced, was taken from a 20-inch pipe in Eighty-third Street. In this case the coloring matter in the liquid was in better condition, giving a more distinct line of demarkation. The velocities, and therefore the deflections, were not so extreme in this case as in the previous one.

The accompanying photograph of the Pitometer, which shows it in use recording a flow of 15,000,000 gallons per day in a 36-inch discharge main, gives a very good idea of the various parts and connections. The legs of the photo-recorder are arranged so as to fold up underneath the box when the instrument is being carried from place to place. The oil well of the kerosene lamp—similar to a student lamp—which furnishes the light is clearly shown in that portion of the instrument at the right of the picture.

In addition to discovering and locating water waste, the Pitometer may also be used to determine the slip of pumps, as the measurement made by the Pitometer when placed on the mains from the pumps should agree with the measurement of flow as determined by the nominal displacement of the pumps. A diagram accompanies this article showing the excessive slip that occurred at a pumping station in Columbus, O. The shaded area of the diagram represents the loss at the pumps. This, of course, was an exceptional case, and it accounted for a large amount of water that was supposed to have been going to waste in the distribution system.

The results of this investigation for two large districts have just been made public, and the accompanying table gives the details in condensed form. It should be noted that at the time of the third measurement of district No. 1, which is bounded by 42nd and 34th Streets, Lexington and Sixth Avenues, and has been called a typical "brownstone" district, the per capita consumption was reduced considerably, this being due largely to the inspectors sent around, who reported all cases of leakage or waste coming under their observation. District No. 2 is a tenement district, from 80th to 86th Streets, and from Second Avenue to the East River. The results given in the table for that district are also shown graphically on the accompanying diagram. Both the table and the diagram speak for themselves.

In concluding its report on the investigations, the officials of the water department state that the flow in the third district has also been measured. This district is bounded by Grand Street on the north, East River on the east, Market Street on the south, and Division Street on the west, and has a population of 90,000, but full data concerning this district has not been compiled. The gross per capita consumption is about 60 gallons, but the plumbing leakage is very great and has not yet been fully measured. This data is given out rather with the idea of showing what work is being carried on and not with the thought that sufficient information has yet been obtained for correct generalization. A district on the west side downtown is being arranged for, and also one in the apartment house section west of Central Park. By the time half of the area of Manhattan has been divided into districts and these measurements taken and computations made, the public will have a very fair idea of what becomes of the Croton water and just what condition the distribution system is in. Effective remedies can only be applied after the facts are fully obtained.



RESULTS OF WATER WASTE INVESTIGATION FOR DISTRICT NO. 2.

RESULTS OF WATER WASTE INVESTIGATION WITH THE COLE-FLAD PITOMETER.

Number of Test. Date of Test.	District No. 1. 1. Dec. 17-19, 1902.	2. Dec. 21-22, 1902.	3. Jan. 9-12, 1903.	District No. 2. 1. Dec. 20-22, 1902.
Population Statistics:				
(1) Total Resident Population—U. S. Census (1900)	8,396	8,396	8,396	38,906
(2) Non-Resident Population estimated by canvass	3,760	3,760	3,760	.....
(3) Total Population—Resident and Non-Resident	12,156	12,156	12,156	.....
(4) Number of families supplied on frontage rates	1,104	1,104	1,104	7,771
(5) Estimated population on frontage rates	7,172	7,172	7,172	32,638
(6) Population metered—Resident (1)—(5)	1,224	1,224	1,224	6,268
(7) Total Population Metered—Resident and Non-Res. (Est.)	4,984	4,984	4,984	.....
Statistics of Supply:				
(8) Total flow measured into district	1,871,000	1,700,000	1,470,000	1,440,000
(9) Total flow measured out of district	.....	.....	.....	.....
(10) Total daily supply in gallons (8)—(9)	1,871,000	1,700,000	1,470,000	1,440,000
Statistics of Consumption:				
Number of houses unmetered	1,019	1,019	1,019	971
(11) Number of metered houses	389	389	389	174
(12) Gallons metered—Average daily from Dept. records	638,000	638,000	638,000	293,000
(13) Gallons supplied pop. paying frontage rates (10)—(12)	1,233,000	1,062,000	832,000	1,147,000
(14) Total (12) + (13)	1,871,000	1,700,000	1,470,000	1,440,000
(15) Total plumbing leakage reported from inspection	42,429	42,429	42,429	369,000
(16) Net consumption and street main leakage (14)—(15)	1,828,571	1,657,571	1,427,571	1,071,000
(17) Street main leakage found	.....	.....	.....	.....
(18) Net consumption (16)—(17)	1,828,571	1,657,571	1,427,571	1,071,000
(19) Gross per capita con. based on resident pop. (10)÷(1)	223	203	175	37
(20) Gross per capita con. based on total pop. (10)÷(3)	154	140	121	.....
(21) Net per capita con. based on resident pop. (18)÷(1)	218	197.7	170.2	27.6
(22) Net per capita con. based on total pop. (18)÷(3)	150.4	136.5	117.5	.....
(23) Metered per capita con. based on res. pop. (12)÷(6)	522.	522.	522.	46.8
(24) Metered per capita con.—Res. and Non-res. (12)÷(7)	128	128	128	.....
(25) Ratio-minimum night consumption to aver. for 24 hrs.	.90	.90	.90	.50
Leakage Inspection (House to House):				
(26) Number of buildings inspected	599	599	599	1,047
(27) Number of buildings with leaky fixtures	161	161	161	713
(28) Number of fixtures reported leaking	.....	.....	.....	.....
(29) Number of ball-cocks reported leaking	.....	.....	.....	.....
(30) Sewer inspection—date made	Dec. 17-18, 1902.		Jan. 11-12, 1903.	Dec. 19-20, 1902.
(31) General results	Small flow.		Small flow.	Small flow.
Financial Statistics:				
(32) Yearly revenue from frontage rates	$18,115.00	$18,115.00	$18,115.00	$37,315.00
(33) Yearly revenue from meter rates	31,000.00	31,000.00	31,000.00	14,550.00
(34) Total yearly revenue (32) + (33)	49,115.00	49,115.00	49,115.00	51,865.00
(35) Yearly revenue per capita based on res. pop. (34)÷(1)	5.85	5.85	5.85	1.33
(36) Yearly revenue per capita based on total pop. (34)÷(3)	4.03	4.03	4.03	.....
(37) Revenue per 1,000 gallons based on total consumption.	0.072	0.072	0.072	0.0988
(38) City meter rate per 1,000 gallons	0.133	0.133	0.133	0.133
Incidental Information:				
Night Rate of Supply.				
(39) Minimum night rate in gallons per 24 hours	1,740,000	1,600,000	1,300,000	720,000
Total number of metered houses in district	389	389	389	174
(40) Number of large meters read at night	20	20	20	7
(41) Total night rate of large meters read—Gal., 24 hrs.	157,000	157,000	157,000	5,299
(42) Estimated total night rate for all meters—Gal., 24 hrs.	574,000	574,000	574,000	150,000
(43) Night rate of net unmetered consumption	1,123,571	983,571	683,571	201,000
(44) Night rate of net unmetered cons. per cap. (43)÷(5)	157	137	95.3	6.1
(45) Approximate area of district, acres	127	127	127	70

The Physiological Effects of Compressed Air have been observed by the doctors in charge of the Danube regulation works at Vienna, where 675 men have been employed at different times upon the Nussdorf lock on an average of 553 hours each. The working shifts, including time spent in the air locks, were 4 hours and the men were off duty between shifts 8 hours. When beginning work each man was required to spend 8 minutes in the air lock for each atmosphere of pressure, but on leaving the works the time in the lock was 5 minutes for a working pressure less than 1 atmosphere, 10 minutes if the pressure was between 1 and 1½ atmospheres, 20 minutes if between 1½ and 2 atmospheres, 30 minutes for pressures between 2 and 2½ atmospheres and 35 minutes for higher pressures. The hospital was equipped with an air chamber in which patients could be put under pressure and in which the pressure could be very slowly decreased. In the three years' duration of the operations nearly 49 per cent. of the men employed required medical attendance; 2 died and 6 received permanent damage to their health. The doctors reached the conclusion that carefully selected men can work under pressures up to 5 atmospheres without serious risk. Nasal catarrh and diseases of the ear and digestive organs particularly unfit men for this work. They recommend that at least 5 minutes should be spent in the air lock for a pressure of ½ atmosphere, 10 minutes for 1½ atmospheres, 20 minutes for 3½ atmospheres and at least 30 minutes for 5 atmospheres; and that longer periods should be spent in the locks when leaving the space under pressure, or as much as 20 minutes for each atmosphere of pressure. The importance of renewing the air in the locks especially when the men are required to spend a considerable time in them, is emphasized, but the temperature of the air supply should not exceed 65 degrees Fahrenheit, and the quantity should not be less than 1,000 cubic feet per man per hour.

Civil Engineers in the United States Navy.

Competitive examinations for positions in the Corps of Civil Engineers, United States Navy, will be held on February 23 at the Civil Service Commission rooms, Post Office Building, Chicago, and at the Navy Yard, New York. Candidates should obtain permits from the Navy Department. No person will be appointed who is less than 27 or more than 35 years of age. The professional examination will be preceded by a physical examination conducted by a board of medical officers of the navy and candidates found unfit for service physically will not be further examined. The technical examination by a board of officers appointed by the Secretary of the Navy will comprise English grammar and composition, elementary physics, elementary geology, drawing, arithmetic, algebra, geometry, trigonometry, analytical geometry, differential and integral calculus, applied mathematics, including mechanics of solids and fluids and strains in structures; construction materials; engineering constructions, such as heating and ventilation, workshops, chimneys, steam and electrical machinery, quay walls, wharves, dry docks, sewers, yard railways, pavements, water distribution, foundations, etc.; surveying (topographical, trigonometrical, and hydrographical) and mapping; instruments, their use and adjustment.

In order to pass, candidates must obtain a general average of 75 per cent. and an average of at least 80 per cent. in applied mathematics, constructional materials, and engineering construction. Successful candidates will be listed in the order of their relative merit as determined by the examination. Each applicant must present testimonials as to character, evidence of American citizenship, evidence of having received a degree in the civil engineering course of some professional institution of good repute, and a record of at least five years' practical experience as a civil engineer and three years' responsible charge of work. No person will be admitted who has been examined at any time within the six months prior to the date of this examination.

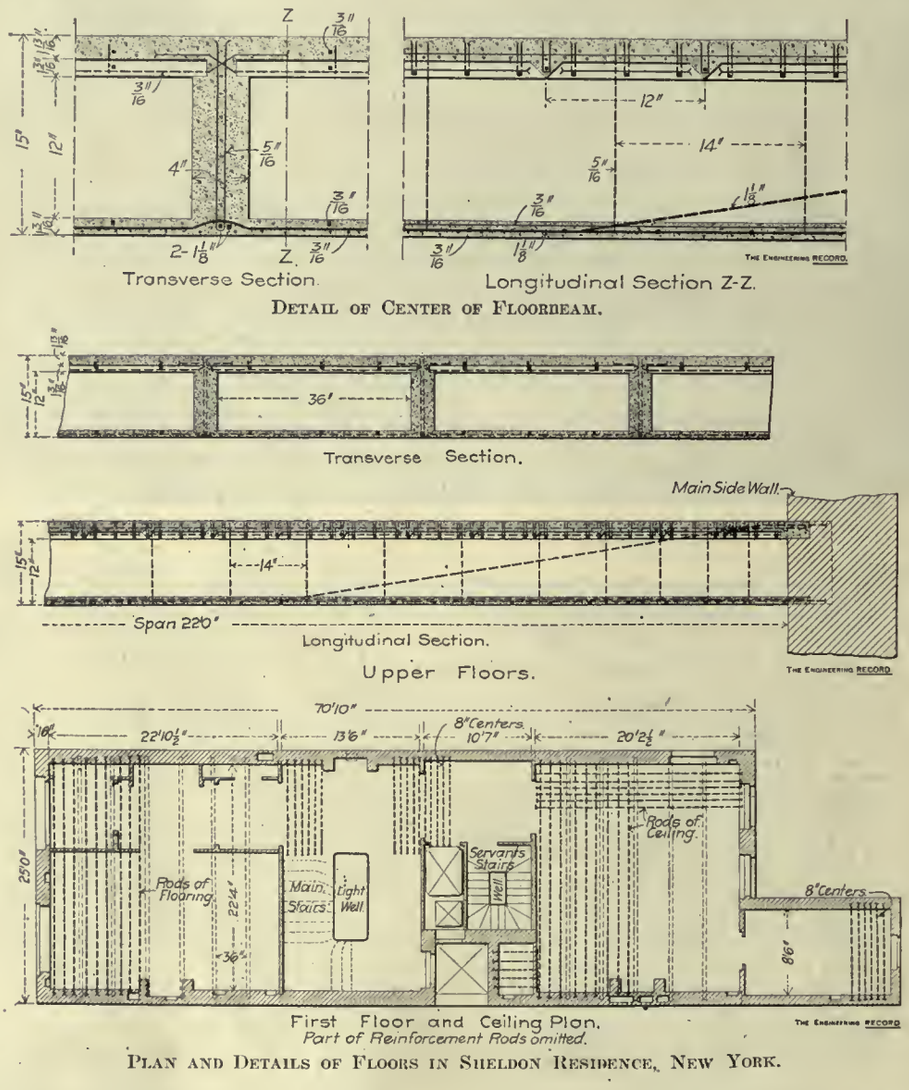
Commander Robert E. Peary, Civil Engineer, U. S. N., has sent some information in this connection which will be of especial interest to young engineers seeking to better their condition. From among the men passing the examination two, and perhaps three, will be appointed to the Corps of Civil Engineers of the navy and will enter the corps with the rank of junior lieutenant with a salary of $2,700 per annum. At the end of five years the pay will be increased to $3,000, and at the end of ten years to $3,500. The senior civil engineer at the principal yards is furnished with quarters by the government. Rank in the corps ascends from junior lieutenant to captain and the chief of the Bureau of Yards and Docks is at the head, having the rank of rear-admiral with pay and allowance varying from $6,200 to $6,500 per annum. At the age of sixty-two or if disabled in the course of duty, members of the corps are retired on three-fourths pay. The corps now has twenty-five members and it is hoped and expected that the present Congress will make it possible to increase the number to forty. The requirements outlined above in connection with the examination seem very high but only the best men are sought for this service, and the opportunities and responsibilities are large. The corps has charge of all improvements, including large dry docks at all the yards and stations of the Navy Department, including ten large yards in the United States and twelve stations scattered over the world, and is charged with the expenditure of $7,000,000 or $8,000,000 annually.

Hennebique Fireproof Construction in New York and Cleveland.

A large amount of reinforced concrete construction for walls, floors, columns, roofs, foundations, tanks, pipes, piers, abutments, bridges, etc., has been built in Europe on the Hennebique system. Care has been taken in the analysis of stresses and investigation of conditions to arrange and proportion the reinforcement according to the computed service so as to produce a scientific design and make the steel develop the full strength of the concrete. The system is applied to monolithic construction, and is comparable with various others which have been used in this country, the principal differences being in the character and arrangement of the reinforcement bars. It has considerable resemblance to the Ransome system which has been used for important buildings and heavy floors as illustrated in The Engineering Record in the descriptions of the monolithic four-story borax factory, at Bayonne, the St. James church, Brooklyn; the Mineola court house, and various floors, chimneys, etc.

The Ransome system secures great adhesion between the steel and concrete by using the former in the shape of twisted square bars, while the Hennebique system uses plain round bars, for which it is computed that the adhesion is equal to the ultimate tensile strength in a bar which is bedded in concrete for a length of twenty-five diameters. A characteristic feature of girder construction is the use of two sets of rods, horizontal ones in the lower edge, and bent ones which are close to the horizontal lower edge of the girder in its middle third, and are bent up to the upper edges of the girder at its supports, like the outline of the bottom chord in an inverted queen-post truss, which, in fact, the girder corresponds to. Another feature which is considered important is the use of vertical U-shaped bars which engage the lower chords in their loops and extend to the tops of the beams; these are relied on to take up horizontal shear, and are shown by tests to increase the strength considerably.

The specifications do not define the exact proportions of the concrete, but provide for all interstices in the aggregate to be completely filled with cement mortar, and that one barrel of cement be used for each cubic yard of concrete. The gravel or broken stone is not more than ¾-inch, and "the steel or iron is preferably covered with rust, to facilitate the formation of an extra hard coat of ferro-concrete, which prevents the penetration of moisture and air to the metal." Wooden floors are laid on 2x2-inch nailing strips set on the concrete and filled between with cinder concrete. Roofs are generally covered with tar paper and gravel. Standard column footings are calculated for loads of 3 tons per square foot. Partitions are 4 inches thick and when used to support upper floors are claimed to be cheaper than 4-inch tile partitions. For outer walls 8-inch brick work is stiffened by ¼-inch steel rods 2 or 3 feet apart which are anchored to the concrete columns. The girders are guaranteed to deflect not more than 1/800 of the span under a test load 50 per cent. greater than the calculated load.



Detail of Center of Floorbeam.

Plan and Details of Floors in Sheldon Residence, New York.

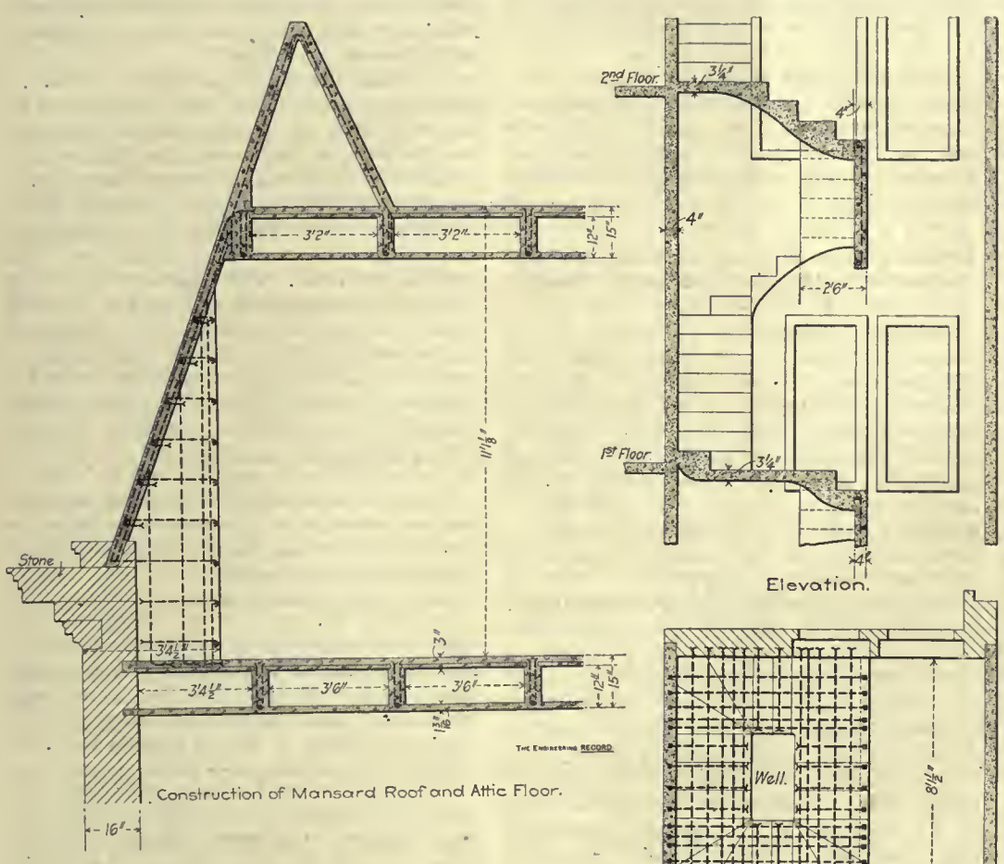
The five-story and basement residence of Mr. W. C. Sheldon, on Fortieth Street, New York, is about 70x25 feet in plan, and has all the floors and the roof made of reinforced concrete of the Hennebique system. The main walls are of brick and carry the floors except for two single story concrete columns in the basement. The second and third floors correspond substantially with the first floor which is shown in plan. Adjacent to the light and stair shafts there are no floorbeams, elsewhere there are transverse beams about 36 inches apart in the clear, which are supported by the side walls. Parallel to the beams 3/16-inch rods are bedded 12 inches apart in the floor slab which is 1 13/16 inches thick with triangular V-shaped ribs, 1 3/16 inches deep and about 12 inches apart on the under side. These ribs are not indicated in the plan, but are shown in the transverse and longitudinal views which give the sections and elevation of the floorbeams.

The ceilings are thin concrete slabs covering the lower edges of the floorbeams and enclosing inaccessibly the spaces between them. They are 1 3/16 inches thick and are strengthened by 3/16-inch longitudinal and transverse rods, the former 12 inches, and the latter 7 inches apart. These rods are spaced uniformly over all the floor and ceiling areas, but only a few are shown on the plan, the remainder being omitted to avoid confusion. The floorbeams are reinforced by pairs of 1⅛-inch rods, one horizontal and one bent, as shown in the longitudinal section. The floor slab ribs are reinforced by single 3/16-inch rods parallel with and close to the lower edges, but bent up at the ends to engage the concrete above the ribs in adjacent panels, as shown in the transverse section. All of these rods are split and separated to make V-shaped anchors at the ends, and all are engaged between the vertical sides of 5/16-inch suspender rods 12 inches apart as shown in the longitudinal section.

The roof is made like the floors, and is covered with asphalt bricks, welded together. At the front it is built into the mansard face which extends about 4 feet above it to form a parapet, braced with an inner sloping surface and reinforced in the attic with vertical concrete webs, like the sides of dormers, which form buttresses. Both the main and rear stairs are made entirely of concrete which forms solid masses with inclined plane surfaces on the lower sides and notched on the upper sides, to form treads and risers. The rear stairs turn, with mitered steps, around three sides of a narrow well, and have reinforcement in the walls of the latter and under the steps. The main stairs are in half flights with intermediate landings, and are seated at top and bottom on double or extra heavy floor girders. They are reinforced on the same principle as the floorbeams, with the ends of the rods anchored to the girders at the top and bottom and with stirrups perpendicular to them in every step.

On November 4th official tests were made on a section of the first floor, and were witnessed by several civil and consulting engineers. The floor was designed for live load of 60 pounds per square foot, thus giving 3,600 pounds on each floorbeam panel 3 feet wide and 20 feet long. The estimated weight of the beam, ceiling and floor increased this to a total of 4,300 pounds. The beam was loaded with 14,400 pounds of sand, in a rectangular box 6 feet wide inside and 3 feet long in a direction parallel to the axis of the beam. This box was placed symmetrically on the center of the beam so that its short sides reached to the edges of the adjacent beams, and on each side of it, on the center line of the beam were piled ten cement barrels in a double tier, filling up all the space to the end of the beam and weighing 4,000 pounds. A total load, partly distributed and partly concentrated, of 22,400 pounds, or more than six times the required live load, was thus imposed, and produced a total center deflection of 1 millimeter which disappeared the next day after the load had been removed, leaving no permanent set and causing no injury or cracks. While the beam was loaded in the middle with 14,400 pounds of sand a 50-pound wooden block was dropped on it from a height of 8 feet without injuring the floor and produced a vibration 1/20 millimeter.

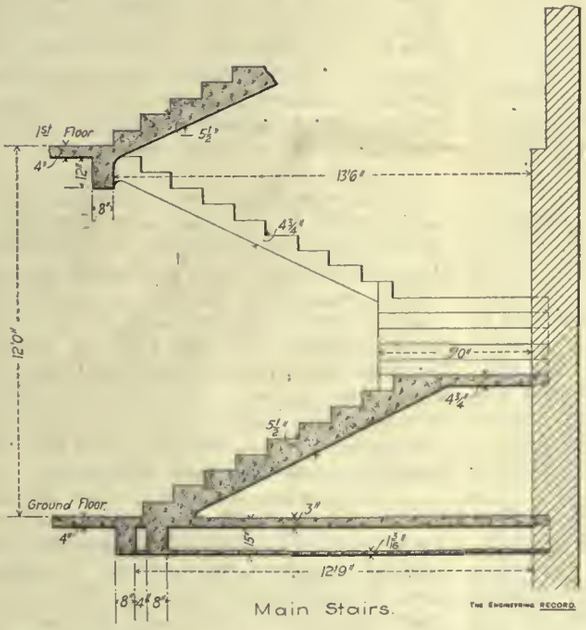
Measurements were taken at the center and both ends of the beam, but no deflection was observed except in the center. Each of the three deflection gauges had a vertical brass plate a few inches wide and high with a horizontal flange and leveling screws on the lower



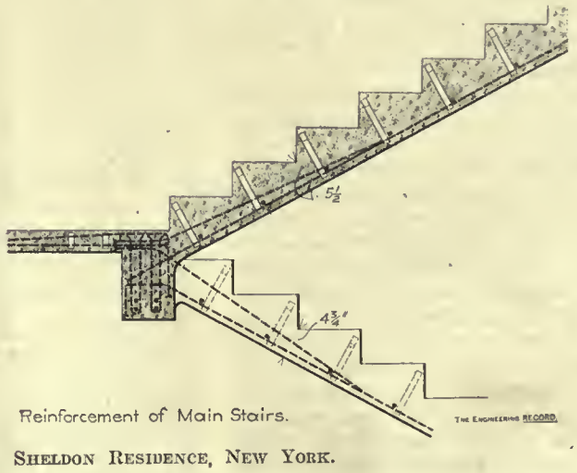
Construction of Mansard Roof and Attic Floor.

Elevation.

Second Floor. Servants Stairs.



Main Stairs.



Reinforcement of Main Stairs.

DETAILS OF STAIRS AND ROOF IN SHELDON RESIDENCE, NEW YORK.

edge. An index needle was pivoted at one end of the horizontal center line of the plate and the point traversed a circular scale with divisions representing 1/5 millimeter deflections. Near the pivot, the needle, which was set horizontal for no deflection, had a slot engaging a spur on a vertical bar which slid in guides and had a spiral spring forcing it up against the lower end of a wooden rod set against the under side of the floorbeam. If the beam moved up or down there was an equal displacement of the spur, and the movement was multiplied at the point of the needle.

Mr. Ernest Flagg is the architect of the building, Mr. O. F. Semsch is the architect's engineer, and Mr. F. A. Burdett is the consulting engineer. The work was built under direction of Mr. H. Baffery, who is the manager for the Hennebique patents and the contractor for this work. A report of the test was signed by Mr. Rudolph P. Miller, engineer, and Mr. F. H. Dewey, assistant engineer, of the building department, New York City; Mr. Eugene A. Richard, superintendent of construction; Mr. George A. Post, Jr., C. E.; Mr. F. A. Burdett, consulting engineer; Mr. H. L. Malmros, and Mr. O. F. Semsch, architects' engineer.

The new Salvation Army Citadel, corner Erie and Eagle Streets, Cleveland, O., a five-story building with basement, is about 50 feet wide and 135 feet long. The first floor on Erie Street will be used for stores, the second floor as offices for the Salvation Army and for Sunday-school rooms. In the rear, the first and second stories have an auditorium and galleries for one thousand people. The upper stories are to be partitioned for small sleeping rooms, and the roof will be used as a roof garden. The building is fireproof and all the footings, columns, beams, lintels, girders, floors, roofs, galleries and staircases are built on the Hennebique system. The floors are proportioned to carry a load of 150 pounds per square foot in the first and second stories and 125 pounds on the remaining floors and roof.

On December 16, 1902, the first floor was tested in the presence of the architect, Mr. Fred. Baird; Colonel Holtz, of the Salvation Army; Prof. C. W. Marx, of the University of Cincinnati; Prof. Eno, of the Ohio State University, Columbus; Prof. F. H. Neff, of the Case School of Applied Science, Cleveland; Mr. C. A. Tooker, Inspector of Buildings, of Cincinnati; Mr. H. J. Harks, Inspector of Buildings, of Cleveland, and about one hundred guests from Ohio and Pennsylvania.

The floorbeams were 8 inches wide and 20 inches deep, including the 4-inch continuous floor slab, and were reinforced with vertical and horizontal rods similar to those shown in the Sheldon residence. One beam 24½ feet long on centers, was supported at one end by a concrete column 14 inches square, and at the other end by a transverse beam 11 feet long. Symmetrical with the center line of this beam there was built a box, 7 feet wide, 23 feet long and 6 feet high, which was filled in with gravel weighing 110 pounds per cubic foot. When the load reached 75,000 pounds, or 460 pounds per square foot, the deflection at the center was only 3/16 inch. At 90,000 pounds, or 555 pounds per square foot, the deflection was 5/16 inch. After twenty-four hours this load was increased to 100,000 pounds, or over 600 pounds per square foot, and the maximum deflection registered 13/32 inch.

A steel beam of the same depth, and strong enough not to be strained over the elastic limit would have a computed deflection of 1¾ inches. After unloading, the permanent deflection resulting from a load four times as great as the beam was designed for was 1/16 inch.

Another panel of the floor was supported on similar floorbeams on the center lines of four concrete columns, 10½ feet apart transversely and 12⅓ feet apart longitudinally. The upper surface of the 4-inch floor slab was covered, inside the column lines, by a box filled with gravel up to a weight of 300 pounds per square foot, which produced a maximum deflection at center of 3/32 inch. The next day the load was increased to 450 pounds per square foot without any perceptible injury to the floor, but no more deflection readings were taken. The floor and girder had been built seven weeks, but were not considered quite seasoned.

The building was erected by Mr. E. P. Faragher, engineer and contractor, and acknowledgment for the data from which this description has been prepared is made to Mr. L. J. Mensch, civil and contracting engineer, Cleveland, O.

Additional Experiments on the Compressive Resistance of Concrete-Steel and Hooped-Concrete.

Since the publication of the treatise on the compressive resistance of concrete-steel and hooped-concrete, a translation of which was printed in The Engineering Record of December 20 and 27, 1902, and January 10, 17 and 24, 1903, M. Considère has made some additional experiments on hooped-concrete prisms. These experiments, as reported in "Le Génie Civil," have all confirmed the previously obtained results, and some of the numerical values of these additional tests are given.

1. A prism 19.7 inches long of octagonal section, 4.3 inches in diameter, was made of concrete containing 840 pounds of Portland cement per cubic yard of gravel and sand mixed in the proportion of 1 to 3. The gravel had a greatest diameter of 1 inch and the sand of 0.2 inch. The spirals were made of iron wire 0.17 inch in diameter wound around a cylinder of 3¾ inches diameter with a maximum pitch of 0.7 inch. Eight longitudinal reinforcing rods of the same wire were added. The total sectional area of the prism was 15.5 square inches. The sectional area of the core enclosed by the spirals was 11.16 square inches. The prism failed by bending as a column, without rupture, under a load of 142,000 pounds, corresponding to a pressure of 9,150 pounds per square inch of initial section and 12,700 pounds per square inch of the section of the core, which alone remained intact under the high pressures. The first cracks in the external layer of concrete surrounding the spirals appeared under a pressure of 3,420 pounds per square inch. The shortening of the prism was not measured at this stage, but was 0.12 per cent. under a pressure 286 pounds and increased to 2.4 per cent. of its length when the last measurement was taken before failure. An identical prism made of the same concrete, but without reinforcing, gave a resistance of 2,240 pounds per square inch.

2. A prism of the same length, 19.7 inches, of octagonal section, 12.6 inches in diameter, was made of the same concrete as No. 1. The spirals were of iron wire 0.39 inch in diameter and wound around a cylinder of 10.6 inches diameter with a maximum pitch of 1.46 inches. Eight longitudinal rods of rolled iron 0.59 inch in diameter were added. The total section of the prism was 131 square inches. The sectional area of the core enclosed by the spirals was 88.5 square inches. The prism crushed under a total load of 820,600 pounds by the rupture of one of the spirals. This load corresponds to a pressure of 6,260 pounds per square inch of initial section and 9,280 pounds per square inch of core section. The first cracks appeared under a pressure of 285 pounds per square inch. The shortening of the prism before rupture amounted to 4.2 per cent. of its length. No comparative identical concrete prism was made with this one. Examination of the concrete of this prism showed that it was not of as good a quality as prism No. 1. The iron wire of 0.39 inch diameter which formed the spirals had, of course, a less resistance per square inch of section than the wire of 0.17 inch diameter. It may be stated that the least results obtained exceeded the values as computed according to the rules given in the main paper, previously published.

3. Though the fact that hollow prisms of hooped concrete will not resist pressures well and will crush on the inner side could have been foretold, it was found to be necessary to verify it by experiment. Two cylinders of 23.6 inches length and an external diameter of 7.1 inches were made. The diameter of the hollow space was 0.49 inch for one cylinder and 0.45 inch for the other. The resistance was found to be 2,580 pounds per square inch of concrete section for the first cylinder and 2,290 pounds for the second. The resistance of an identical concrete prism without reinforcing was 2,490 pounds per square inch. It was thus proved that hooped members must be of solid cross-section or have small openings only.

The First Automobile Speedway in America for the exclusive use of automobilists was recently completed at Lakewood, N. J. It is 1¼ miles long and 80 feet wide.

Irrigation in Siam is to be undertaken on a large scale, according to an Italian contemporary. The king is reported to be negotiating with Signor G. Grassi in relation to the construction of about 750 miles of canals and feeders for the benefit of 600,000 acres of land.

The Water Intake of Niagara Falls, Ont., was completely blocked by ice recently, according to press reports. Aid being solicited from Niagara Falls, N. Y., Superintendent of Water Works Swan connected about 1,300 feet of fire hose to a hydrant near the lower steel arch bridge and fed the pipes of the Canadian town through a hydrant near the other end of the bridge under 60 pounds pressure. Of course the supply was much restricted.

A Lumbering Flume, said to be the longest in the world, has recently been completed at Madera, Cal., 185 miles from San Francisco. It is over 53 miles long, and has 18 miles of feeders, and extends through the heart of the redwood forests. It can carry 400,000 board feet of logs daily and cost $270,000. The water, after its use for transporting timbers, is applied to irrigation. The flume is V-shaped, 46 inches wide at top, with 36-inch sides, of 2-inch planks doubled, and with its trestles contains about 5,700,000 feet of lumber.

Municipal Ownership and Public Franchises are to be publicly discussed in New York at a national convention, to be held under the auspices of the Committee on City Affairs, of the New York Reform Club, at 233 Fifth Avenue, February 25, 26 and 27. Papers are to be presented on the history of municipal ownership in the United States, on British and German experiences, and on the comparison of European and American methods and results. Three sessions are to be devoted to transportation, gas and electric lighting and water and telephones. General subjects, such as the control and regulation of public service corporations, and labor clauses in franchise grants, will be considered. Mr. John Martin, 50 Pine Street, New York, is secretary of the Advisory Board.

The Preservation of Structural Steel in Tall Buildings.

The Pabst building at Broadway and Forty-second Street is a 12-story steel cage structure built in the early part of 1899, and is just being removed to make way for improvements in connection with the Rapid Transit Subway. Its demolition has afforded opportunity to study the state of the steel work after exposure to the conditions obtaining in a finished structure of modern office building type. The design, quality of materials, and workmanship in the building were excellent and the comparatively short time since the building was erected does not permit any conclusive deductions, although the evidences noted are satisfactory and reassuring in their indications.

The framework had interior and wall columns made with four Z bars and a web plate and the walls and floors were supported on rolled I-beams with riveted web connections. Some of the interior columns were encased with porous brick shells laid in cement mortar and not packed in between the flanges. The others were enclosed with red brick and terra-cotta and had the spaces between flanges and webs on all sides filled with bricks flushed with cement mortar so as to thoroughly seal all parts of the columns. The floors were of the Roebling arch construction enclosing the webs and upper flanges of the beams with concrete made of one part Atlas Portland cement, 2 parts sand and 5 parts steam boiler ashes and estimated to have two-thirds the compressive strength of stone concrete. The arches were built on a centering of painted steel rods and bars and galvanized wire netting. Metal furring similar to the centering was attached to the lower flanges of the floor beams to receive the cement plaster of the flat ceilings, and the floor system was thus entirely enclosed.

The steel framework had a total weight of about 250 tons and had received two coats of Nobrac paint, one at the shops and one after erection, 100 gallons in all being used. This paint is represented to be composed of pure carbon and triple boiled linseed oil. The first coat was black and the second was olive so as to insure thorough covering. When the brick work and masonry was removed the appearance of the steel framework throughout was excellent, and it appeared to have suffered no deterioration. In a few places there was slight discoloration from the rust; but there was no thick oxidation or apparent injury to the metal, some of the rust apparently having existed in the first place. The outside columns were in as good a condition as the interior ones, and the floor beams and girders showed even less signs of rust than the columns. Quantities of cement and concrete adhered to their surface in many places, and where it was removed the paint was found bright and fresh underneath. In some places where pieces of steel like splice plates or connection angles which had been in contact were removed and where rivets were cut out slight coatings of rust were observed; but in no case was the rust thick. The paint throughout was hard and well preserved, the steel was thoroughly covered with it, and did not need repainting. It was removed by a penknife with difficulty, and thin strips would curl up like a shaving and demonstrate its elasticity. Underneath it the steel was clean and bright without traces of rust. The painted rods in the arch centering were rusted, but the galvanized netting was not. Some special partitions were made with metallic lathing plastered with lime mortar, and here the lath was found badly rusted, although the partitions were otherwise in good condition.

Mr. H. F. Kilburn was the architect of the building; Mr. H. W. Hodge was the consulting engineer, and Messrs. Lewinson & Just were the contractors for the structural steel which was built by the Pencoyd Bridge Works. Messrs. Robinson & Wallace were the general contractors.

Bituminous Macadam Pavement.

A paper read by Mr. C. A. Kenyon before the convention of the Indiana Engineering Society, at Indianapolis, January 15, 1903, somewhat condensed.

The name Bituminous Macadam was selected by the inventor for a pavement of broken stone mixed with bituminous cement. It combines the good qualities of macadam with the best qualities of the asphalt pavement. It eliminates the bad qualities of the asphalt as well as the bad features of macadam, and yet it is a stone pavement. Every engineer knows that a very good pavement can be built of broken stone without any cementing material. The coarse angular pieces of stone, when submitted to heavy pressure, fit and wedge themselves together in such a way that the resultant mass will bear great loads. The mass thus laid, will have with 3-inch stone, from 40 to 45 per cent. of voids. These voids while not uniform in size, will be large compared with the voids in ½-inch stone.

Rains and water ravel and wash macadam badly, so that tons of the road metal go into the sewers or are washed away by each storm Water goes through it and softens the foundation, and it loses its grade. The fine metal on the surface mixes into a pasty mud. In dry weather that mud becomes dust, high winds blow it off the road, and it must be replaced at great cost. Such a pavement must be sprinkled. It is costly to clean because the economical sweeping machine cannot be used and so it must be cleaned by hand. It is costly to maintain.

Mr. Frederick J. Warren sought experimentally to discover a pavement which would combine the best qualities of macadam and sheet asphalt. He took a cubic foot of solid stone, fitted a box over it, weighed the stone, and then broke it into pieces about 2 inches in diameter, attempted to replace all the stone in the box, and but little more than ½ in volume or weight would go back into the box. He undertook the task of so breaking and arranging the sizes of that remaining out of the box, that he could place it all back into the box. While he did not put all of it back in the box, he did put 90 per cent. of it back, and discovered and formulated the principle whereby, with predetermined proportions, he can accomplish practically the same results every time. After discovering a way to reduce the voids in a mixture of stone to 10 per cent., the work was not finished. In order to accomplish a useful result, it was necessary to find a way to get that compact mass of stone into a pavement surface, and keep it there. It was finally decided that a bituminous cement of great uniformity and durability in all temperatures, one that should be absolutely unaffected by water, and one with great cementing strength, was necessary. The result was the Puritan brands of bituminous cements. Of course this had to be followed by the devising of appropriate bins, screens, mixers, heaters and machinery for the manufacture and laying of the pavement.

The pavement is constructed with from 4 to 6 inches of 2½ inch to 3 inch crushed hard stone foundation, laid on a thoroughly compacted subgrade. This foundation is thoroughly compacted by a 15-ton road roller and brought to a true surface. Hot bituminous cement is then poured over the surface so that it will run into the interstices, thus binding it together and making it waterproof. Many engineers favor this form of foundation in preference to hydraulic cement concrete, which is pervious to water, and has not the advantage of having been wedged into place by the use of a heavy roller. The concrete foundation for any pavement is of recent origin; the first one used in London was in 1872. On top of this foundation is placed the wearing surface. The broken stone is heated in revolving drums, to about 200 degrees Fahrenheit, and then, by carefully arranged screens, sorted into sizes and deposited into separate bins. From each of these bins, can be drawn the exact amount of the particular size required, the aggregate of which corresponds to the result of the experiments, and when compressed into a mass, approaches to 90 per cent. of a solid stone. This aggregate is then put into a revolving mechanical mixer and the heated bituminous cement, by exact weight, poured in and the mixing continued until every piece of stone from the largest to the finest powder is covered with a thin waterproof coating of the bituminous cement. It is then dumped into a wagon, hauled to, and deposited in a layer on, the foundation prepared as above described, and then rolled with a 15-ton road roller.

The result is practically a solid. It is rigid because the large, angular stones in the mass are wedged together. These large stones thus wedged would bear the weight of any load likely to be hauled over them, without the use of cementing material. It is therefore not necessary, as it is in the construction of an asphalt pavement, which is sand mixed with bituminous cement, to have the cement so stiff or hard that under all atmospheric conditions the cement is strong enough to hold the grains of sand in a column. The sand without the cement, no matter how arranged, will not bear any load.

The advantages claimed for this kind of pavement may be summed up as follows: The smaller materials fill the voids in the larger materials, thus giving great density; the bituminous cement makes the pavement absolutely waterproof; the bituminous cement holds the fine material in the interstices, preventing it from shifting or going to the bottom as in the ordinary macadam, and also preventing the pavement from rolling into waves; the cement forms a cushion between the stones and prevents them from rubbing against one another, thus making the pavement elastic and quiet; in such a dense and rigid mixture, the exposure of the cementing material is reduced to a minimum, permitting the use of a softer bituminous cement, which will retain its cementing property much longer in this form of pavement, than cements will in the asphalt or sand mixtures, giving great durability to the pavement; being waterproof, homogeneous, and dense, rain and water cannot wash, or wind blow, any part of it away; it can be flushed with water for cleaning, or swept with a sweeping machine; since the surface is slightly indented by the laying of the stones, a flush coat of quick drying cement is poured on or squeezed into these indentations, and fine sand and screenings are spread over the surface and rolled in with the heavy roller, by which means, while the pavement has a surface for the wheels equal to asphalt, it provides a foothold for horses equal to macadam.

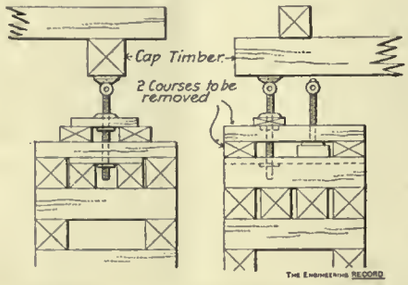
The question of cost is difficult to answer without knowing the conditions, cost of stone, labor, size of contract, etc. It is not advocated as a cheap pavement, but on account of its great excellence. Last year there was laid and contracted for, in over forty cities from Boston to Seattle, over 640,000 square yards of Bituminous Macadam pavement.

A Difficult Feat in House-Moving.

An unusual and rather complicated job of house-moving was recently accomplished safely and satisfactorily by the John Eichleay, Jr. Co., Pittsburg, who make a specialty of this class of work. The residence of Mr. R. B. Ward, Grant Boulevard, Pittsburg, is a 40x48-foot two-story and attic brick and frame building. The owner wished to erect a new residence on its site, and in order to move it to the new location it was carried 50 feet in one direction, 100 feet in another direction over a steep embankment and then lowered 35 feet to a new foundation. Holes were cut through the walls of two opposite sides just below the first floor and through them were placed fifteen horizontal 12x12-inch needle timbers, on which the walls, partitions and floors were wedged up. The needle timbers were supported on double tiers of cross timbers, and these were carried on four equidistant lines of continuous longitudinal timbers parallel to the needle beams. The longitudinal timbers were simultaneously lifted by jack screws, and groups of transverse wooden rollers were inserted under them on the upper faces of pairs of longitudinal sills. The lower part of the brick work was cut free from the foundation, and the house was readily moved forward by means of a horsepower capstan and double and triple blocks and 2-inch manila rope, and on descending the grade another set of double and triple blocks and a capstan were used in the rear to keep the building from moving faster than was intended through the working of the blocks and capstan in front.

The sills were supported and kept level by ordinary blocking, which was built up in some places to a height of 40 feet. The cribbing was made, as shown by the illustration, in cob-house towers about 4 feet square, built principally with 6x8-inch timbers. The towers were about 2 feet apart in the clear and were braced transversely and longitudinally by building in occasional courses of long timbers, which bound several towers together and served, where necessary, as supports for working platforms. In order to change the direction of movement, the building was lifted on jack screws until the rollers were released. New lower sills were laid in the required direction on a descending incline of ½-inch per foot. The rollers were reinserted between the upper and lower sills and the building moved forward in the new direction. In this manner a lower level of 6 feet was obtained. The building was then lowered 29 feet more by taking the weight through the sills on jack screws and then removing two courses of the cribbing. The screws were slacked off until they were run in and then they were released one in each pair and reset lower in the blocking, and then the other was released and reset, always using two screws to each blocking.

The estimated weight of the building and contents was about 300 tons, and the moving was accomplished by fourteen men in about sixteen days, without even cracking the plaster.



Releasing Jacks to Lower Roller Ways.



Moving a Brick House over Low Ground.

The Panama Canal Treaty.

The Panama Canal treaty was signed January 22 by Secretary Hay for the United States and Dr. Thomas Herran for Colombia. Active work upon the canal cannot be undertaken, however, before the ratification of the treaty which, it is provided, shall take place within eight months from the date of signature. By the terms of the treaty Colombia authorizes the New Panama Canal Company to transfer to the United States its rights and properties as well as the Panama Railroad, but public lands outside of a specified zone and the shares of the railroad owned by Colombia are to be the property of that government. The United States is given a 100 years' lease with privilege of renewal perpetually and the grant of a zone of territory about six miles wide. Colombia, however, does not relinquish its sovereignty over this territory, and it agrees that it will not sell or lease to any foreign government any of its islands or harbors within or adjacent to the Bay of Panama or on the Atlantic Coast between the Atrato River and the western boundary of Panama.

The United States is given control over the water of the Chagres River and other streams and lakes within or without the leased zone to such extent as may be necessary or desirable for the construction, maintenance and operation of the canal and its auxiliary works. Private rights and property are duly regarded and all damages are to be settled by a joint commission appointed by the two governments. Panama and Colon are declared to be free ports for vessels destined for transmission through the canal. Immigrants of all nationalities are to be permitted to work on the canal and no charges are to be imposed upon persons or equipment in connection with the construction and operation of the canal. The canal is to remain forever neutral. Provisions are made for policing and for the establishment of tribunals of justice. The United States Government agrees to complete the preliminary works in the shortest time possible, to begin the construction of the main canal within two years from the date of ratification of the treaty and to open the canal within fourteen years. Provision is made for the extension of this time by twelve years in case great and unforeseeable difficulties should arise, if the United States is proceeding in good faith with the construction. In case the United States should at any time determine to make the canal practically a sea level canal, then the period shall be extended for ten years further. The treaty provides for the payment of $250,000 gold annually for the lease beginning nine years after the date of ratification, and $10,000,000 in gold on the exchange of ratifications; but it is stipulated that no delay or difference of opinion on this matter of payment shall affect or interrupt the full operation and effect of the treaty in other respects.

Over Two Hundred Miles of improved roads were built in New Jersey during 1902.

The Indiana Engineering Society filed articles of incorporation with the Secretary of State January 10. The purposes set out are the encouragement of professional intercourse between the engineers and surveyors of the State, and the advancement of its members in scientific research in the various branches of engineering and for the discussion of scientific papers and other matters of interest to the members. The principal office will be in the Commercial Club Building, Indianapolis. Mr. R. L. Sackett is president, and Mr. Charles C. Brown, secretary.

Directory of National Engineering Societies.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st Street, New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, R. W. Pope, 95 Liberty Street, New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Convention at Albany, N. Y., February 17th, 18th and 19th. Secretary, R. W. Raymond, 99 John Street, New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, Elmira, N. Y.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 235 Water Street, New York.

Annual Meetings of Engineering Societies.

The Ohio Society of Surveyors and Civil Engineers held its twenty-fourth annual meeting at Columbus on January 20 and 21 with an attendance of about twenty-five.

The Illinois Society of Civil Engineers and Surveyors held its eighteenth annual convention at Aurora, beginning January 21. Among the papers read were: "The Real Estate Records of a Great Railway System," by H. I. Orwig; "The Proposed Co-operative Survey of Illinois," W. H. Herron; "Farm Drainage," L. Z. Jones; "Open Ditch Drains," P. C. Knight. The board of new officers elected is given among the personal notes in another column.

The Iowa Engineering Society held its fifteenth annual session in the new Engineering Hall of the Iowa State College, at Ames, Iowa, January 21-23. The attendance was the largest in the history of the Society. Among the personal notes in another column the new board of officers is given. A reception on the evening of the twenty-second celebrated the informal opening of Engineering Hall which, besides increasing the equipment of the State College, is to serve as the Engineers' club house of the State. Many interesting technical papers were presented at the various sessions.

The Engineers' Club of St. Louis held its annual meeting and dinner on December 17 with an attendance of 42. The board of officers elected is given among the personal notes. At the meeting on January 7 there was a discussion on "The Use of Electric Power in Factories." Mr. Layman stated that the efficiency of the best methods of electric drive was 70 per cent. as compared with 20 or 25 per cent. in belt drive and that individual tools could be operated at a greater saving of power. Other members emphasized the advantages due to the great speed variations possible, thus increasing the output of individual tools.

The twenty-third annual convention of the Indiana Engineering Society was held January 16 and 17. This is the first meeting since the Society's incorporation. The Secretary's report shows the Society in an excellent condition with nearly one hundred members in good standing. The convention was presided over by Prof. W. D. Pence, of Purdue University, Lafayette. Mr. Pence took the subject of "Engineering Education" for his annual address theme, and among other things said: "The engineer does things. In the march of civilization he has a place of command and is a real 'captain of industry.' The engineer promotes, designs and builds. With the growth of population, when the village becomes a town, the town a city, he constructs the system of improvements, of lights and of transportation. He designs power development whether electric, hydraulic or steam; in short, the engineer has a part in a thousand phases of advancing civilization. As time goes on his duties become more and more exacting, and he must ever rise to a higher level of efficiency. As an organization we are especially interested in any influence which tends to elevate the standard of the engineering profession. Among the most potent of such influences is the system of technical education which is now making such steady progress in this country." He said there had been evolved in the course of a few years a group of engineering schools which have assumed a place of the most importance when we measure their influences upon the industrial progress of the country and in upbuilding the status of engineering as a learned profession. In speaking of the growth of attendance upon engineering schools he said: "We naturally judge of the value of a commodity by the demand for it. Considering engineering education in this light, and noting the very striking increase in attendance of students within the past few years, we must conclude that there is a growing appreciation of technical education. Statistics show that during 1902 there were more than 15,000 engineering students in attendance at the 114 institutions in this country which have courses in engineering." In his reference to the correspondence schools, he said: "The popular movement is further illustrated by the enormous growth of the correspondence school patronage. One of these institutions alone had an enrollment of upward of 500,000, an almost incredible enrollment. While the correspondence course is not of the best it certainly can be commended for arousing the ambition of thousands of young men who are now attending the more exacting and formal technical schools because of their having first taken the correspondence course. No school pretends to graduate engineers. It would be absurd to attempt such a feat. This training is but little more than the corner-stone laying, after which the professional superstructure is to be built by the man himself."

Mr. James B. Nelson, city engineer, Indianapolis, read an interesting paper on the construction and machinery of the Richmond, Ind., electric lighting plant, of which he was consulting engineer. "Street Dust and Disease" was discussed by Prof. Severance Burrage, of Lafayette; "Sewerage Systems," by Mr. J. W. Fulwider, city engineer of Lebanon; "Bituminous Macadam Pavements," by Mr. C. A. Kenyon, Indianapolis; "Sand Filtration, Indianapolis Water Works," by Mr. F. A. W. Davis, Indianapolis; "The Manual Training School and Its Benefits as a Training for Engineers," by Mr. P. W. Covert, Indianapolis; "Stream Pollution," by Mr. M. O. Leighton, hydrographer U. S. Geological Survey, and "Bridges," by Mr. H. C. Brubaker. Mr. Frank O. Wolfel, assistant engineer of the American Bridge Company, of Pittsburg, advocated a State department of competent engineers who should prepare the plans of all the bridges. Such a system, he said, would save the State money, give it better bridges both as to appearance and safety, and would do away with unfair contract letting. The Society refused to indorse this plan, insisting that bridge building was a matter of county supervision. The convention was a great success, and the secretary anticipates doubling the enrollment during the present year.

The New Orleans Drainage Commission recently transferred its work and obligations to the Sewerage and Water Board. This board is composed of sixteen members and is charged with the duties of providing the city with adequate systems of sewerage, drainage and water supply. According to press reports, these works are to cost about $14,000,000.

Yale Sheffield Scientific School is to have several new buildings. Byers Hall will contain quarters for the Y. M. C. A. and have some dormitory accommodations. Kirtland Hall will be a laboratory, and two dormitories are to be built, as a gift from Mr. Frederick W. Vanderbilt, class of '76. There are now nearly 800 students in the scientific school, and the faculty numbers 78.

The Engineers' Club of Philadelphia has arranged an excursion to New York on February 7 to visit the plant of the Barber Asphalt Company and the New York subway. One of the principal objects of the excursion is to give the members an ocular demonstration of the manufacture and uses of asphalt as a sequel to a paper and discussion on the subject presented at the meeting of January 31.

The Water Supply of San Francisco, Cal., is supplying a topic for lively discussion in the region of the Golden Gate. The present supply is furnished by the Spring Valley Water Works Company largely from storage reservoirs on Alameda Creek, at an average cost to the city of 21 cents per 100 cubic feet, or a flat rate of $20 to $25 per year. The citizens have come to the conclusion that the price is too high and that the company is turning too much water into its capitalization and too little into the city, and they threaten to throw over the company entirely and secure a municipal supply on their own account. The company replies to the charges by saying that the supply is all that can be desired and that they are about to extend the plant so as to provide for future demands. At this point the city of Oakland, just across the bay, steps in and declares her intention to appropriate, on what is claimed to be a prior right, the greater part of the available supply of the Spring Valley Company, this supply to be obtained by a system of wells at Niles, on property not controlled by the company. Meanwhile a fourth party to this interesting complication has been quietly but steadily "sawing wood." This is the Bay Cities Water Company, of San Francisco, incorporated on October 21 last, with a capital stock of $10,000,000, of which $1,000,000 is to be issued at once. This company, which has no connection whatever with the Spring Valley Company, has already acquired control of about 300 square miles of watersheds in Santa Clara county, and expects to begin early in the spring the construction of a system of dams, ditches, flumes, pipelines, pumping stations and reservoirs, capable of dealing with a minimum of 50,000,000 gallons of water per day, and a possibility of 100,000,000 gallons per day when needed. The supply will be collected at a point 12 miles southeast of San Jose, near Coyote station on the Southern Pacific Coast Line. It is in the upper part of the Santa Clara valley, at an elevation of 260 feet above sea level. The solidity of the engineering part of this project is assured by the engagement of Mr. Edwin Duryea, Jr., M. Am. Soc. C. E., as chief engineer, and Mr. Frank S. Washburn, M. Am. Soc. C. E., as consulting engineer.

Progress Report of Special Committee of American Society of Civil Engineers on Uniform Tests of Cement.

At the recent annual meeting of the American Society of Civil Engineers the committee on uniform tests of cement stated that its investigations were still in progress but made a preliminary report, from which the most prominent features are reprinted in abstract.

It is recommended that, where conditions permit, one barrel in every ten should be sampled. All samples should be passed through a sieve having twenty meshes per linear inch. For determining the characteristics of a shipment of cement, the individual samples may be mixed and the average tested; where time will permit, however, it is recommended that they be tested separately. Cement in barrels should be sampled through a hole made in the center of one of the staves, midway between the heads, or in the head, by means of an auger or a sampling iron similar to that used by sugar inspectors. If in bags, it should be taken from surface to center.

Chemical analysis may render valuable service in the detection of adulteration with considerable amounts of inert material, such as slag or ground limestone, and in determining whether certain constituents are present in inadmissible proportions. The Committee would suggest that the most recent and reliable evidence appears to indicate that magnesia to the amount of 5 per cent., and sulphuric anhydride to the amount of 1.75 per cent., may safely be considered harmless. The method proposed by the Committee on Uniformity in the Analysis of Materials for the Portland Cement Industry, of the New York Section of the Society for Chemical Industry, and published in the "Journal" of the Society for January 15, 1902, is recommended.

The specific gravity of cement is lowered by underburning, adulteration and hydration, but the adulteration must be in considerable quantity to affect the results appreciably. When properly made this test affords a quick check for underburning or adulteration. The determination is most conveniently made with Le Chatelier's apparatus [fully described and illustrated in the report].

It is generally accepted that the coarser particles in cement are practically inert, and it is only the extremely fine powder that possesses adhesive or cementing qualities. The more finely cement is pulverized, all other conditions being the same, the more sand it will carry and produce a mortar of a given strength. Sieves known as the No. 100 and No. 200 sieves are recommended for determining fineness. They should be circular, about 20 centimeters (7.87 inches) in diameter, 6 centimeters (2.36 inches) high, and provided with a pan, 5 centimeters (1.97 inches) deep, and a cover. The wire cloth should be woven (not twilled) from brass wire having the following diameters: No. 100, 0.0045 inches; No. 200, 0.0024 inches, and should be mounted on the frames without distortion; the mesh should be regular in spacing and within the following limits: No. 100, 96 to 100 meshes to the linear inch; No. 200, 188 to 200 meshes to the linear inch. Fifty grams (1.76 ounces) or 100 grams (3.52 ounces) should be used for the test, and dried at a temperature of 100 degrees Cent. (212 degrees Fahr.) prior to sieving. The Committee has reached the conclusion that mechanical sieving is not as practicable or efficient as hand work, and, therefore, recommends the following method: The thoroughly dried and coarsely screened sample is weighed and placed on the No. 200 sieve which, with pan and cover attached, is held in one hand in a slightly inclined position, and moved forward and backward, at the same time striking the side gently with the palm of the other hand, at the rate of about 200 strokes per minute. The operation is continued until not more than one-tenth of 1 per cent. passes through after one minute of continuous sieving. The residue is weighed, then placed on the No. 100 sieve and the operation repeated. The work may be expedited by placing in the sieve a small quantity of large shot. The results should be reported to the nearest tenth of 1 per cent.

The use of a proper percentage of water in making the pastes (neat cement and water) from which pats, tests of setting and briquettes are made, is exceedingly important, and affects vitally the results obtained. The determination consists in measuring the amount of water required to reduce the cement to a given state of plasticity, or to what is usually designated the normal consistency. Various methods have been proposed for making this determination, none of which has been found entirely satisfactory. The Committee recommends a method employing the Vicat needle apparatus, which is described at length. The trial pastes are made with varying percentages of water until the correct consistency is obtained. The normal consistency should produce a rather wet paste, since this consistency tends to greater uniformity in the mixing, and since there is less liability of compressing the briquettes during the moulding. Having determined the proper percentage of water required to produce a neat paste of normal consistency, the proper percentage required for the sand mortars is obtained from an empirical formula.

The time of setting is the time which elapses from the moment water is added until the paste ceases to be fluid and plastic (called the "initial set"), and also the time required for it to acquire a certain degree of hardness (called the "final," or "hard set"). The former of these is the more important, since, with the commencement of setting, the process of crystallization or hardening is said to begin. As a disturbance of this process may produce a loss of strength, it is desirable to complete the operation of mixing and moulding or incorporating the mortar into the work before the cement begins to set. For this determination the Vicat needle should be used. The setting is said to have commenced when the needle ceases to pass a point 5 millimeters (0.20 inches) above the upper surface of the glass plate, and is said to have terminated the moment the needle does not sink visibly into the mass.

The Committee recognizes the grave objections to the standard quartz and for the present recommends the natural sand from Ottawa, Ill., screened to pass a sieve having 20 meshes per linear inch and retained on a sieve having 30 meshes per linear inch; the wires to have diameters of 0.0165 and 0.0112 inches. The Sandusky Portland Cement Company, of Sandusky, Ohio, has agreed to undertake the preparation of this sand, and to furnish it at a price only sufficient to cover the actual cost of preparation.

While the form of the briquette recommended by a former Committee of the Society is not wholly satisfactory, this Committee is not prepared to suggest any change, other than rounding off the corners by curves of ½-inch radius. Gang moulds are preferred by many to single moulds; since the greater quantity of mortar that can be mixed tends to produce greater uniformity in the results. The moulds should be wiped with an oily cloth before using.

For mixing all proportions should be stated by weight; the quantity of water to be used should be stated as a percentage of the dry material. The temperature of the room and the mixing water should be as near 21 degrees Cent. (70 degrees Fahr.) as it is practicable to maintain it. The Committee has decided not to recommend any machine that has thus far been devised. A method for hand mixing is described in detail. The moulds should be filled at once, the material pressed in firmly with the fingers and smoothed off with a trowel without ramming; the material should be heaped up on the upper surface of the mould, and, in smoothing off, the trowel should be drawn over the mould in such a manner as to exert a moderate pressure on the excess material. The mould should be turned over and the operation repeated. A check upon the uniformity of the mixing and moulding is afforded by weighing the briquettes just prior to immersion, or upon removal from the moist closet. Briquettes which vary in weight more than 3 per cent. from the average should not be tested.

During the first 24 hours the test pieces should be kept in moist air. A moist closet is so easily devised that the use of the damp cloth should be abandoned if possible. Covering the test pieces with a damp cloth is objectionable, because the cloth may dry out unequally, and, in consequence, all the test pieces are not maintained under the same condition. After 24 hours in moist air, the test pieces for longer periods of time should be immersed in water maintained as near 21 degrees Cent. (70 degrees Fahr.) as practicable.

The tensile strength tests may be made on any standard machine. A solid metal clip is to be used without cushioning at the points of contact, the bearing at each of which should be ¼ inch wide, and the distance between the centers of contact on the same clip should be 1¼ inches. Test pieces should be broken as soon as removed from the water. The load should be applied at the rate of 600 pounds per minute. The average of the briquettes of each sample tested should be taken as the test, excluding any results which are manifestly faulty.

The object of tests of constancy of volume is to develop those qualities which tend to destroy the strength and durability of a cement. As it is highly essential to determine such qualities at once, tests of this character are for the most part made in a very short time, and are known as accelerated tests. Tests are divided into two classes: (1) normal tests, or those made in either air or water maintained at about 21 degrees Cent. (70 degrees Fahr.), and (2) accelerated tests, or those made in air, steam or water at a temperature of 45 degrees Cent. (115 degrees Fahr.) and upward. The test pieces should be allowed to remain 24 hours in moist air before immersion in water or steam. For these tests, a pat, about 7½ centimeters (2.95 inches) in diameter, 1¼ centimeters (0.49 inches) thick at the center, and tapering to a thin edge, should be made, upon a clean glass plate about 10 centimeters (3.94 inches square) from cement paste of normal consistency. [Directions for both tests follow.]

In the present state of our knowledge it cannot be said that cement should necessarily be condemned simply for failure to pass the accelerated tests; nor can a cement be considered entirely satisfactory, simply because it has passed these tests.

The complete report contains much of interest to those having occasion to test cements and may be obtained from the secretary of the American Society of Civil Engineers.

Railroad Track Laying in the U. S. during 1902 amounted to about 6,000 miles, exclusive of second track, sidings and electric lines.

Furnace Heating in the Public Library, Ilion, N. Y.

Abstract of a paper presented by W. H. Switzer at the recent meeting of the American Society of Heating and Ventilating Engineers.

A furnace system of heating and ventilating has been in use ten successive winters in the Public Library building at Ilion, N. Y., having been installed in the fall of 1892, satisfactorily maintaining a comfortable temperature throughout, with an average consumption of about 20 tons of coal per winter. The building, which is exposed on all sides, is constructed of brick and stone, the walls being about 16 inches thick, stripped, forming an air space, and then lathed and plastered. Cathedral glass is used in the upper sash of the front and rear windows of the main building with a 9x10-foot circular top window above the book cases on the north side. Ordinary windows are used in the other rooms which open into the main library room.

The first-floor plan given in an accompanying illustration will show the arrangement of the part of the building that is heated and also the location of the fireplaces, which have a 6x32-inch throat tapering to a 12x16-inch flue. These fireplaces are never fired and only serve as an outlet flue to aid the ventilation of the building, and under an anemometer test have shown the air movement to be 250 feet per minute. The main room is 25x70 feet with a ceiling averaging 25 feet in height. The ceiling is an oval arch finished with lath and plaster on the rafters, which support a tile roof. The main room has a capacity of 43,750 cubic feet, with a wall surface of 3,045 square feet and a glass surface which amounts to 355 square feet. The reading room, vestibule and office have a capacity of 16,350 cubic feet, with a wall surface of 1,976 square feet and 174 square feet of glass surface. This makes a total air space of 60,100 cubic feet, a wall surface of 5,031 square feet and a glass surface of 529 square feet, exerting a cooling effect which must be counteracted by the heating apparatus to maintain a temperature of 70 degrees in the building, located at a point where the mercury at times sinks 18 degrees below zero. The important fact is that the furnaces have fulfilled the requirements under these conditions.

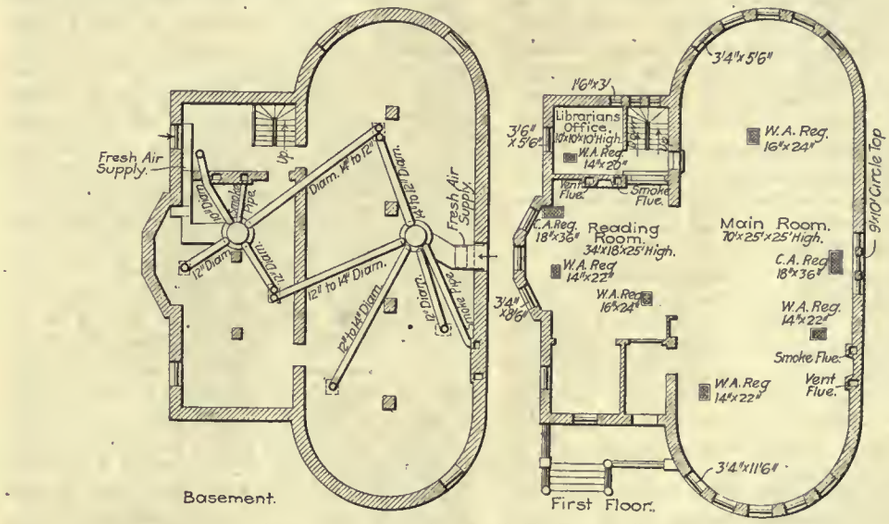
Two furnaces are used of the portable type, having 52-inch galvanized iron casings. The casings are double lined with asbestos paper and heavily corrugated bright tin to prevent loss of heat by radiation into the cellar and to prevent the heat from causing the zinc coating to peel from the casing. The interior construction provides a deep ashpit supporting a heavy triangular bar grate of open construction to allow a free entrance of air to support combustion, and having an effective diameter of 22 inches and an area of 2.62 square feet and a total of 5.24 square feet. The ashpit supports a substantial two-part cast-iron fire-pot, the lower section being 7 inches deep and having anti-clinker fingers cast on the lower edge, affording a further entrance for air to the combustion chamber. The upper section is 11 inches deep, having vertical flanges or radial ribs ½-inch thick and extending 4 inches cast on its outer circumference at intervals of 5 inches, largely increasing the heating surface at an effective point. The fire-pot is 18 inches deep and 26 inches in diameter at the top. Immediately above the fire-pot is a central steel combustion dome, having an opening at the front for supplying fuel. This central dome is made of 10-gauge steel plate and is 28 inches in diameter and 30 inches high. This dome is surrounded by a circular radiator 46 inches in diameter, having inner and outer walls of steel plate 15 inches high and cast-iron heads. The products of combustion enter this radiator from the combustion dome at the front and pass each way, making a complete circuit, then passing down a reverse draft pipe to the smoke outlet. This reverse draft pipe also connects with the ash-pit to serve as a dust flue when the fire is stoked and to allow any dust collected to drop to the ashpit when opened. The radiator is so located as to allow air to pass between it and the combustion dome, and also up along its outer side. The fire-pot, combustion dome, and radiator of each furnace expose 88 square feet of effective air-heating surface, or a total of 176 square feet.

The air-supply ducts are connected so that air can be kept in circulation when few people are in the library or in extremely cold weather, and that the supply, by means of dampers, can be taken conjointly or entirely from out of doors to freshen the atmosphere at will as may be necessary. This method of supplying air is widely practiced in furnace heating, as its advantages outweigh its disadvantages. It saves fuel, allows quick heating and insures successful heating in extremely cold weather. When all the air is taken from outside there is a certainty of frequent changes of air in the building, as the heated air cannot enter to keep up the temperature without a corresponding volume of air passing out. In this building the fireplaces continually remove a considerable quantity of air to make room for fresh air. The basement plan shows that the north furnace supplies one 12-inch and three 14-inch hot-air pipes, having a combined area of 575 square inches. The south furnace supplies one 10-inch, two 12-inch, and one 14-inch pipes, having a combined area of 458 square inches; the 14-inch pipes in every instance being tapered to 12 inches to connect with the register boxes; and all the pipes are covered with asbestos paper. As the air in transit contracts in bulk with loss of temperature, the pipes are tapered to avoid a decrease in the velocity of the flow. Two of the registers are connected with each furnace to secure a distribution of the heat when but one furnace is used in the milder seasons.

The registers are of the open Persian pattern. The air ducts leading from the outside are 16x40 inches with an area of 640 square inches, and run across above the basement floor, connecting with the bottom of the furnace casing, with an opening 16x36 inches, having an area of 576 square inches. The return air registers are 18x36 inches in size. Each furnace is connected with a smoke flue 12x12 inches in size by means of an 8-inch smoke pipe. With the mercury at 18 degrees below zero no difficulty has been experienced in keeping up a temperature from 68 to 74 degrees, and nothing has been expended for repairs. A recent examination showed the entire apparatus to be in excellent condition, capable of many years of further service.

Figuring 6 square feet of wall as having a cooling effect equal to one square foot of glass shows, by dividing 5,031 by 6, an equivalent glass surface of 838 square feet in the walls, which, added to the 529 square feet of glass surface, gives a total equivalent glass surface of 1,367 square feet. The furnaces have a grate surface of 5.24 square feet, and a heating surface of 176 square feet. The cold air supplies have an area of 1,152 square inches, and the hot air pipes of 1,033 square inches. The grate bears a proportion of 1 square foot to 33.8 square feet of heating surface, to 11,278 cubic feet of space and of 1 square inch to 1.8 square feet of equivalent glass surface. The heating surface bears a proportion of 1 square foot to 341 cubic feet of space, and to 7.76 square feet of equivalent glass surface. The hot-air pipe area bears a proportion of 1 square inch to 58.1 cubic feet of space, and 1.33 square feet of equivalent glass surface. The coal consumed bears a proportion of one ton to 3,005 cubic feet of space, and to 68.8 square feet of equivalent glass surface per season. There being an equivalent glass surface of 1,367 square feet and the heat units lost at zero by one square foot being practically one heat unit per hour for each degree difference between inside and outside temperatures, that is, 70, by multiplying by 1,367 it is found that there are 95,690 heat units lost per hour, and for 24 hours, 2,296,560. Figuring that one pound of anthracite coal gives off 14,000 heat units, it will be found by division that 164 pounds of coal will be required per day. By figuring the season that heat will be required at 180 days and multiplying by 164 and dividing by 2,000, it will be found that 14.75 tons of coal will be required. But this would consider no loss by imperfect combustion, no waste in the chimney, by radiation from furnace and piping, and by the vent flues, and it is a matter of record that 20 tons of coal have been the average yearly consumption. Figuring that the season contains 180 days, a consumption of 222.2 pounds of coal each day is necessary to consume 20 tons of coal in a season; so divide 222.2 by 24 and then by 5.24; it will be found that 1.76 pounds of coal per square foot of grate surface must be burned per hour on the average, or more in cold and less in mild weather.

As uncertain as are the records of an ane-



HEATING IN THE ILION, N. Y., PUBLIC LIBRARY.

mometer test, the following are given, having been taken when the mercury stood at zero: Flow of air at outside cold air supply inlet, 350 feet per minute; at point of connection with furnace, 120 feet per minute; at the two 16x24-inch registers with two 12-inch hot-air pipes to each register, flow of air 380 feet per minute; at the three 14x22-inch registers connected with one 12-inch hot-air pipe to each register, flow of air 300 feet per minute; at 14x20-inch register connected with one 10-inch hot-air pipe, flow of air 210 feet per minute. Temperature of warm air at register, 140 degrees.

Meeting of the American Society of Heating and Ventilating Engineers.

The ninth annual meeting of the American Society of Heating and Ventilating Engineers was held in New York City, January 20 to 22. The reports of officers and committees showed that there had been a substantial increase in membership and that the finances were in better condition than they had been for some years. The result of the election of officers was announced in last week's issue, among the personal notes. A committee appointed to determine rules by which the several component parts of a house-heating boiler may be definitely prescribed in order to arrive at the relation between its area of grate and the quantity of radiating surface it is to carry presented its report. The formula $G = R \div (1.1x144)$ was deduced for cast-iron steam boilers of the upright sectional type for standard cast-iron direct radiation, G being the grate area and R the radiating surface, both in square feet. It is understood that this formula is based on the use of anthracite nut coal and that if pea coal is used, a coefficient of 3 should be introduced before R. For water heaters, the coefficient should be multiplied by 0.585.

Prof. J. H. Kinealy discussed in a general way the subject of temperature regulation. One method described consisted in filling a part of each radiator with air to render that part inactive. The air valve and a diaphragm valve on the steam supply were connected through a thermostat to an air vacuum system, so that when the room temperature exceeded the desired limit the thermostat shut off the vacuum line, closed the steam valve by the atmospheric pressure and allowed air to enter the radiator through the air valve. Where a two-pipe system was used, the return connection was provided with a check valve closing against a return of water into the radiator. A number of topical discussions were taken up. On one of these, relating to radiator nipples, it was the general opinion that malleable iron nipples were the most durable, steel and wrought iron becoming pitted and weakened by the water remaining in a radiator and cast-iron not having sufficient ductility.

Prof. R. C. Carpenter read a paper on a test of a fan blower with cast-iron radiating surface, in which he described about 100 tests made on a blower and heater, the latter being of cast iron instead of wrought iron as commonly used. The runs were made under various conditions of speed, number of sections used, etc. On account of the resistance of the restricted air paths the full delivery of the fan was not secured, and he believes better results would be obtained with a heater having larger air spaces. Mr. S. A. Jellett, chairman of the committee on uniform contracts, next read the form recommended for adoption universally for heating and ventilating work. By vote it was decided to have a printed copy of the form sent to all members for comment. In the report of the committee on the next annual meeting, which will be the 10th anniversary, special plans are to be presented for making it a memorable one. It will be held in New York, as usual. One suggestion made was that each member should prepare a paper on an installation of his own for that meeting.

The next paper described a hot-air furnace system of heating and ventilating as installed in the Public Library, at Ilion, N. Y., read by Mr. W. H. Switzer. The succeeding paper, presented by Mr. B. H. Carpenter, was along the same line, being a test of a hot-air gravity system of heating and ventilating in a school building.

Mr. R. P. Bolton's paper, "The Smoke and Gas Flue System in the Ansonia Apartment Hotel, New York City," explained the manner in which by combining the flues of the fireplaces and ranges with the ventilating system, thus securing a positive draft in all, it was possible to use one flue for a single line of fireplaces throughout the seventeen floors, instead of a flue in each individual case, which would have meant not less than 268 flues. In the course of topical discussions, the point was brought out that it should be the manufacturer's place to determine and publish an accurate and honest rating of his boiler, which would furnish the engineer something besides the price, upon which to base his selection.

Mr. C. D. Thompson laid before the society the results of some house-heating boiler trials obtained in his own experience and gave comparisons between different boilers with different ratios of grate to heating surface. This was followed by the reading of Mr. J. J. Blackmore's paper on "The Capacity of Cast-Iron Sectional Steam Boilers," printed in last week's issue. Mr. William Kent offered a scheme for carrying the computations further than the author, which was recommended for consideration to the committee on standards. In brief it is as follows: Let A equal the number of square feet of steam radiating surface to be supplied, or if hot water radiation is used let it be represented by B, and since the same boiler is able to supply about 1.6 more surface of radiation with hot water than with steam, B equals 1.6A. Let D be the number of British thermal units to be furnished per hour; the pounds of steam per hour, from and at 212 degrees, E; and the boiler horse-power, F. In a boiler having a ratio of grate to heating surface of 1 to 25, and evaporating about 2 pounds of steam per square foot of heating surface, we should have:

$$H = 0.15\ A = 0.15\ B \div 1.6 = 0.0005\ D = 0\ 483$$
$$E = 16\tfrac{2}{3}\ F$$

and,

$$G = 0.04\ H = 0.2\ E = 0.7\ F = D \div 48{,}300,$$

from which, by substituting the values of grate or heating surface, the other quantities may be obtained. If the ratio of grate to heating surface is other than the one assumed, or if the pounds of steam per square foot of heating surface should be more, or less, the numerical factors given may be altered to suit. For example, for 3 pounds evaporated per square foot of heating surface all of the factors in the H equations will be ⅔ of the foregoing values, or for 4 pounds per square foot, ½, etc. Similarly for a ratio of 20 to 1 for heating to grate surface, the factors in the G equations must be multiplied by 5/4, or for a ratio of 30 to 1, by 5/6. A heater now on the market was shown to agree very closely with the conditions as here assumed.

The paper by Mr. H. J. Barron described a water-tube boiler designed by the author, and constructed of standard wrought-iron pipe and fittings. An interesting account of the use of ice to cool the auditorium of the Scranton High School, during the commencement exercises of the last two years, was presented by Mr. J. J. Harris. A rack holding about 8 tons of ice was placed in the fan inlet and disposed to afford the greatest amount of contact of the air to the surface of the ice. The room was occupied by about 1,400 persons and with an outside temperature of 90 degrees the inside temperature was maintained at about 76 degrees. The fans were designed to deliver about 3,000,000 cubic feet of air per hour, the plenum fan running at 100, and the exhaust fan at 120 revolutions per minute. The humidity of the air was kept normal by the use of calcium chloride distributed at various points throughout the ducts. The auditorium was 80x80x20 feet and during the three nights that the apparatus was running 38,400 pounds of ice were melted. It would have been interesting to know, but the data did not give it, just how many hours the apparatus was running, and what the rate of the evaporation of the ice was.

The remainder of the meeting was devoted to topics for discussion. On the first, "Are there any advantages in the use of vacuum systems of steam heating for residences?" there seemed to be a difference of opinion. Mr. Andrew G. Paul cited an instance in his own experience in which the replacing of an ordinary system of steam heating by one under a vacuum resulted in the consumption of 8⅝ tons of coal in one winter, as against 15 tons in previous years. As to what is the largest size of pipe which it is well to make up with screwed joints, one opinion was that 6 inches should be the limit; others declared that for reasonably low pressures no flanges should be used, except where necessary to allow for making repairs.

The Buffalo Harbor Improvement Project to obtain a waterway for deep-draught vessels around the shoals and rapids at the head of the Niagara River has reached the stage where surveys are being made to prepare for an appropriation in the annual river and harbor bill providing for the actual work of construction. The river from Lake Erie to Grand Island is a more or less engorged channel where in perhaps three miles or more of its length there is a drop of 5 feet and a flow through the greater part of this distance of 4 to 7 miles an hour. At Grand Island, where the river takes two channels, there is greater depth and lower current velocity, and it is felt that the improvement will allow for a development of that island, as well as both sides of the river, and generally is of much commercial importance in a rapidly expanding region. In 1888 a project was adopted for deepening the Niagara from Lake Erie to Tonawanda to pass vessels of 16 ft. draught at mean river stage, but of late years the river and lake levels have been so low that the actual draft in the completed channel is limited to 14 ft. A very early scheme to get around the rapids of this upper gorge of the Niagara resulted in the construction of the so-called Black Rock harbor, which is, in reality, a canal running between the river on one side and the beginning of the Erie Canal on the other, being practically one with the Erie. This harbor is in communication with the river at its downstream end by means of a 36.5x200-foot lock of 9½ ft. depth on the sills. It is proposed to remove the wall that separates at different places the Erie Canal from the Black Rock harbor, making the waterway 250 to 500 ft. wide, to deepen it sufficiently to accommodate the largest vessels of the lakes, and to build a lock, perhaps 60x700 ft., with a lift of 5 ft., for transferring to and from the river. The work is in charge of Major T. W. Symons, M. Am. Soc. C. E., Corps of Engineers, U. S. A.

Smoke and Gas Flue System in the Ansonia Apartment Hotel, New York.

The Ansonia Apartment Hotel, New York City, and its mechanical plant, were described in some detail in The Engineering Record for November 15, 1902, but comparatively little was said at that time concerning the problem encountered in the designing of the smoke and gas flue system. The engineer of the work, Mr. Reginald Pelham Bolton, of New York, has described it very fully in a paper, read this week before the American Society of Heating and Ventilating Engineers, of which the following is an abstract:

The building contains 63 fireplaces in each apartment floor, and 12 kitchen gas ranges, making 1,133 in all, inclusive of those in the ground floor. The difficulty in providing flues for the large number of superimposed fireplaces, necessitating, under usual methods, not less than 268 separate flues, was complicated by the fact that most of the rooms were so designed that the respective fireplaces were situated on interior partitions, others were placed back to back, and in general they were planned to occupy a corner of a room. In almost every case, therefore, a line of flue in wall or partition cut the lines of steel framing, and, if placed to one side of the latter, required separate framing to carry its load, and in addition as the flues were added on upper stories, seriously encroached on room space. The flues had been planned in detail, and were so proportioned that four fires were served by each flue. In order to avoid the framing, and especially that due to the change of outline by the mansard roof, they were required to be offset and twisted in a most complicated and undesirable manner.

The entire system as proposed seemed to present so much special work as to be very costly, particularly in the special framing and offsets rendered necessary. A study of the conditions led the author to propose a radical departure from ordinary methods, which has been successfully installed. It consisted in the abandonment of outside chimney stacks as a means of disposal of the gases and the connection of the smoke flues and vent fans on the roof, whereby a definite draft would be maintained in any fireplace. By combining the gas-range flues with their vents, similar results could be effected in the kitchens. The arrangement obviates the necessity of separate flues for limited numbers of outlets, and enables a long line of fireplaces to be connected to one flue. The adjustment of draft could be readily set by a fixed damper at each smoke inlet.

The apartments are ventilated by a supply of tempered air, delivered inside the private corridor of each apartment suite. The escape for the air there introduced is provided by vent registers in flues passing through each toilet room, bath room and kitchen. In addition, in each parlor or bed room, a vent was provided over the chimney-breast, these being connected into the space behind the breast, with connecting holes through the floors. Each line of chimney-breasts therefore forms a vent shaft. Every bath room has a vent shaft or flue formed in one of the outside corners, by furring out around the stacks of pipes which are arranged to be grouped at those points. The horizontal connections and the traps of bath tubs are arranged in a space between the under side of the floor beams and a false or hanging ceiling, this space being open to the vent flue. Thus any leakage of sewer gas at the joints or traps is drawn off by the vent system.

These various flues pierce the building from the second floor level to the floor of seventeenth, where they connect into galvanized steel ducts, by which they are grouped to five centers, at each of which is a 48-inch Seymour fan, electrically operated by a direct-connected Lundell motor. The connection of the smoke discharge was made in the manner illustrated as follows: Under the curved portion of the seventeenth floor outer walls, due to the mansard roof, a system of ducts was extended, planned to run as nearly as possible over the line of all smoke flues. Where interior fireplaces twisted there was provided a separate extension rising to the ceiling of the seventeenth. In the southwest quarter of the building, a large dining room occupies the sixteenth and seventeenth floors, and here the rising flues of all kinds are connected together by charcoal-iron horizontal ducts covered with air-cell asbestos extended over the ceiling of the fifteenth floor, to one of the vent shafts connecting to a fan.

Vitrified earthenware drain pipes were proposed and adopted for the vertical flues and are arranged to stand within the interior spaces occupied by chimney breasts, and passing up alongside the iron fire hearths occupy no space in the partitions or walls of the rooms. One line of 8-inch pipe is provided for a tier of fireplaces, and where two back on each other, a line for each is provided and alternately connected. Some of the outside flues, where an outside chimney stack occurs, have been provided with a by-pass and cut-off, connecting them to the outside stack. This was done simply as a concession to non-technical prejudice and from no feeling that it was necessary or desirable. In most cases, however, no such connection suits, nor can it be made. The earthenware pipes are connected by 4-inch bends to the fireplaces, by a spigot specially made the reverse direction to ordinary sanitary patterns. The bend is set into a spigot formed on the top of the iron fire-hearth, which was designed specially with a tapered top, contracted to a throat in which a butterfly damper is set at a fixed point by a set screw.

The support of these lines of smoke pipe, each of which is about 186 feet in height, was very simply effected by arranging as a bed for each fireplace a mass of cement concrete with wire rods imbedded therein, forming the floor thickness above the floor arch-top up to the finished hearth level. This was extended in any convenient direction so as to reach over the nearest floor beams and obtain a thorough support. In this bed, the socket of the vertical drain pipe was set and bedded, and connected to the corresponding pipe rising from the floor below. The weight on any floor is, therefore, only that of the length of pipe corresponding to its height. On the unoccupied side of the interior of the chimney-breast, a hole was opened through the bed and the arch below. This was simply cemented in any convenient shape, in corner fireplaces being trianguiar. Around the whole the chimney-breast was built, the iron fire-hearth having been set, and its front arch being made of sufficient strength to carry the center of the breast. Most of the fireplaces have been provided with gas-logs, but the system was planned for dealing with the products of combustion from a certain amount of coal or wood fires, and the opening can at any point be set to suit.

The net reduction in cost by this departure from ordinary methods of flue construction was fully $26,000, and had the outside chimney been dispensed with as much more might have been saved. One considerable advantage appears to result, namely, that on starting a fire or a gas-log a draft is immediately obtainable. In tall buildings, annoyance is frequently experienced from smoke and gas, due to the cold chimney failing to draw off the products of combustion. For large buildings it may be expected that this system will eventually displace the use of outside chimney stacks.

New Books Received.

A TREATISE ON ROADS AND PAVEMENTS. By Ira Osborn Baker, Professor of Civil Engineering, University of Illinois. New York: John Wiley & Sons. 655 pages, illustrated. Price $5.

SURVEYING AS PRACTISED BY CIVIL ENGINEERS AND SURVEYORS. By John Whitelaw, Jr., Assoc. M. Inst. C. E. New York: D. Van Nostrand Company. 516 pages, illustrated. Price $4.

AN ELEMENTARY TREATISE ON THE MECHANICS OF MACHINERY, WITH SPECIAL REFERENCE TO THE MECHANICS OF THE STEAM ENGINE. By Joseph LeConte, Instructor in Mechanical Engineering, University of California. New York: The Macmillan Company. 311 pages, illustrated. Price, $2.25.

THE THERMODYNAMICS OF HEAT ENGINES, INCLUDING STEAM TABLES. By Sidney A. Reeve, Professor of Steam Engineering at the Worcester Polytechnic Institute. New York: The Macmillan Company. 358 pages, illustrated. Price, $2.60.

MANUAL FOR RESIDENT ENGINEERS. Containing general information on construction. By F. A. Molitor, Chief Engineer Choctaw, Oklahoma & Gulf Railroad, and E. J. Beard, Principal Assistant Engineer Choctaw, Oklahoma & Gulf Railroad. New York: John Wiley & Sons. 118 pages. Price, $1.

IRRIGATION INSTITUTIONS. A discussion of the economic and legal questions created by the growth of irrigated agriculture in the West. By Elwood Mead, C. E., M. S., Chief of Irrigation Investigations, United States Department of Agriculture; Professor of Institutions and Practice of Irrigation in the University of California, and Special Lecturer on Irrigation Engineering in Harvard University. New York: The Macmillan Company. 392 pages, illustrated. Price, $1.25.

Book Notes.

A NEW SYSTEM OF HEAVY GOODS TRANSPORT ON COMMON ROADS. By Bramah Joseph Diplock. New York: Longmans, Green & Co. 116 pages, illustrated. Price, $2 net.

The book outlines a scheme for the transportation of heavy merchandise over common roads by means of wagons, in trains, hauled by traction engines, which is applicable to agricultural communities and manufacturing towns more or less remote from railroads. In England, the country of the author, the traction engine is used to a considerable extent for hauling heavy goods on the highways, and 8,000 of them are now working in the United Kingdom. These are for the most part owned and operated by small jobbing men "who work 'from hand to mouth' with insufficient capital and little or no commercial training."

Mr. Diplock's plan includes the establishment of branches in a number of localities, with many "depots" along the routes, each taking care of the haulage work of its territory. Each branch is to be controlled by a "District Center," which in turn is to be managed by one "Chief or Head Center," it being the intention that the system shall be ultimately national in character. It is, however, wisely advocated that the system begin on a small basis. The author, who had for many years the superintendence of a large amount of traction engine haulage, has invented a new type of engine called the "Pedrail," which he describes fully. The book is well illustrated by line drawings

and photographic reproductions. The word "Pedrail," according to the author, implies "a railway on feet." The most striking feature of the invention is in the wheels. Around the periphery of each are fourteen feet, spaced equidistantly, circular on the bottom, and 11 inches in diameter. These feet are operated by ingenious and somewhat intricate mechanical devices, in such a manner that three of the feet are always in contact with the ground. As the wheels go forward, the rear foot of the trio is lifted and another falls in front. The power is imparted to all the wheels by a system of gears connected with the engine. The weight of the machine is so distributed that all the wheels are equally loaded. The inventor claims that with wheels constructed as in the "Pedrail" the maximum of road-adherence is given to the propelling power with the minimum of road-resistance, and that the damage to roads, due to the heavy loads, is reduced to the minimum, if not entirely obviated. By means of the "Pedrail" and a train of eight wagons of peculiar design, each with two "Pedrail" wheels, Mr. Diplock estimates that 100 net tons may be hauled not only on level roads, but also on roads with moderate grades. If such a train were operated to the best advantage for 208 days out of the year, and run 35 miles in each day of 10 hours, he says that freight might be transported at the surprisingly low cost of 3/5 of a penny (1.20 cents) per ton mile.

Personal and Obituary Notes.

Mr. Ezra Barkhuff has been appointed city engineer of Tacoma, Wash.

Mr. Allen Hazen has been engaged to prepare plans for water filtration for Yonkers, N. Y.

Mr.. Eugene A. McMurray has been re-appointed engineer of the sewer system of Newark, N. J.

Mr. Robert E. Mitchell has been appointed superintendent of sewer construction in Willimantic, Conn.

Mr. L. D. Carlisle has been elected superintendent of the City Water Works Co., of Bowling Green, O.

Mr. John H. Decker has been appointed superintendent of the Atlantic City (N. J.) Sewerage Co.

Mr. J. W. Maxcy has been appointed superintendent of road and bridge construction of Houston, Tex.

Mr. William Wheeler has been elected consulting engineer of the Mystic Valley Water Co., of Middletown, Conn.

Mr. F. A. Hoffman has been re-elected superintendent of the Board of Water Commissioners of New Brunswick, N. J.

Mr. W. B. Howe has been re-elected city engineer, and Mr. Alfred Clark, commissioner of highways of Concord, N. H.

Mr. George A. Mayland has been engaged by Messrs. M. W. Kellogg & Co., engineers and contractors, No. 37 Dey Street, New York, as chief engineer.

Mr. Charles F. Lacombe has been appointed engineer of surface construction for the Department of Water Supply, Gas and Electricity of New York City.

Mr. James B. Barber has been elected superintendent of bridges of Bay City, Mich., succeeding Mr. Robert McFarlane who held the office for some six years.

Mr. L. Fred Patstone, an assistant in the city engineer's office of Providence, R. I., has received an appointment in the city engineering department at Manila, P. I.

Mr. Boyd Ehle, Assoc. M. Am. Soc. C. E., principal assistant engineer of the Isthmian Canal Commission, has been appointed engineer in charge of sewer work in Summit, N. J.

Mr. D. W. Cole, assistant to City Engineer R. A. Cairns, of Waterbury, Conn., has joined the staff of the New York water supply commission, which has opened offices in the Park Row Building, New York.

Mr. John B. Ansley has resigned his position as city engineer of Americus, Ga., to become superintendent of the construction of the sewerage system of New Orleans, La., and he will be succeeded by Mr. David W. Speer.

Mr. John Fuller, superintendent of bridges on the New York division of the New York, New Haven & Hartford Railroad, died January 22 at Bridgeport, Conn. He was 79 years old, and had worked for the company for 45 years.

The Illinois Society of Civil Engineers and Surveyors, at its meeting at Aurora, elected officers as follows: President, J. W. Alvord, Chicago; vice-president, J. C. Quade, Kewanee; trustees, J. G. Mellnish, Bloomington; D. W. Mead, Chicago.

Civil Engineer H. H. Rosseau, U. S. N., has been transferred from the Bureau of Yards & Docks, in Washington, to the Mare Island yard, San Francisco, and Civil Engineer F. R. Harris, U. S. N., has been detailed to the Charleston, (S. C.) navy yard.

Mr. Julian C. Smith, a graduate of Sibley College, Cornell University, in the class of 1900, has been appointed general superintendent of the hydro-electric power plant at Shawinigan Falls, Que., for which Mr. Wallace C. Johnson is consulting engineer.

Mr. Frederick S. Chapman, a graduate of Yale University in the class of 1894, and at present connected with the New London, Conn., office of the Corps of Engineers, has received an appointment as supervisor of one of the provincial boards of the Philippine Islands.

Mr. F. L. Chase, M. Am. Soc. C. E., has resigned his position as engineer of bridges of the New York Central & Hudson River Railroad to become president of the Jamestown, Chautauqua & Lake Erie Railroad Co., and the Chautauqua Steamboat Co., with headquarters at Jamestown, N. Y.

The Engineers' Club of St. Louis has elected the following officers: President, J. L. Van Ornum; vice-president, J. A. Ockerson; secretary, H. J. Pfeifer; treasurer, E. E. Wall; librarian, E. B. Fay; directors, W. G. Brenneke and S. H. Freeman; members of board of managers, E. R. Fish and F. F. Bausch.

The Ohio Society of Civil Engineers has elected the following officers: President, Robert E. Kline, Dayton; vice-president, Frank A. Bone, Lebanon; secretary-treasurer, B. H. Flynn, Columbus; trustees, F. L. Niederheiser, Ashland; A. W. Jones, Chillicothe; S. T. Stinebaugh, Port Clinton; William Evers, Cleveland.

The Iowa Engineering Society has elected the following officers: president, Prof. S. N. Williams, Mt. Vernon, Ia.; vice-president, B. Marsh, Des Moines; secretary-treasurer, W. H. Jackson, vice-president of the Des Moines Bridge & Iron Works, Des Moines; directors, Prof. A. V. Sims, Iowa City, Ia., and C. R. Allen, Ottumwa, Ia.

The Engineers' Club of Philadelphia has elected the following officers: President, Edwin F. Smith; first vice-president, Silas G. Comfort; second vice-president, Horatio A. Foster; secretary, J. O. Clarke; treasurer, George T. Gwilliam; directors, W. B. Riegner, Thos. C. McBride, H. K. Myers, James B. Bonner, D. A. Hegarty, Geo. Neville Leiper.

Mr. S. W. Hodgen and Mr. V. M. Murdock have been appointed assistant engineers of the Marietta and the Indianapolis & Vincennes divisions, respectively, of the Pittsburg, Cincinnati, Chicago & St. Louis Railway, the Southwest System of the Pennsylvania Lines West of Pittsburg. Mr. Guy F. Scott has been appointed division engineer of the eastern division of the Pittsburg, Fort Wayne & Chicago Railway. Mr. F. K. Huger has been appointed general superintendent of the Seaboard Air Line Railway, at Portsmouth, Va., succeeding Mr. N. D. Maher. Mr. William Coughlin has been appointed general superintendent of the Denver & Rio Grande and of the Rio Grande Southern railways, with headquarters at Denver.

The transfer of the Second Battalion of Engineers to the Philippine Islands, scheduled to occur in April, will result in a number of important changes in the Corps of Engineers. Major James L. Lusk is to assume the duties of Major C. McD. Townsend at Rock Island, Ill., and the latter will relieve Major Clinton B. Sears at Manila, who is to proceed to San Francisco. Capt. Herbert Deakyne is to go to Fort Leavenworth, Kan.; Capt. George A. Zinn is to go to Wheeling, W. Va.; Capt. W. E. Craighill is transferred to Mobile, Ala.; Capt. Spencer Cosby is to take up duties with the Third Battalion at Washington as is also Capt. Charles Keller; and Capt. William W. Harts is to take station at Portland, Ore. Capt. J. J. Morrow is to return from the Philippines to Washington.

Elnathan Sweet, for two terms engineer and surveyor of New York State, died suddenly of heart disease in Albany, January 26. He was born in Cheshire, Mass., in 1837, and was graduated from Union College in 1859. He began engineering in the year of his graduation, receiving an appointment as deputy to the surveyor-general of Kansas and Nebraska. Until 1872 he remained for the most part in the Western States, serving for the last three years of that period as chief engineer and part of that time as general superintendent of the Rock Island & St. Louis Railroad. In 1875 he was appointed by Gov. Tilden engineering expert of the State canal investigating commission, and for the five years succeeding was engineer of the Eastern Division of the State canals. For many years he was the head of the Hilton Bridge Construction Co., and was a member of the New York State Water Storage Commission which has just reported to the Legislature. He was a member of the American Society of Civil Engineers since 1878.

At a meeting of the Fritz Memorial Committee, the announcement was made that the four national engineering societies have appointed the following representatives on the Board of Trustees of the Fritz Medal: American Society of Civil Engineers—J. James R. Croes, New York, one year; Robert Moore, St. Louis, two years; Alfred Noble, New York, three years; Charles Warren Hunt, New York, four years. American Institute of Mining Engineers—E. E. Olcott, New York, one year; E. G. Spilsbury, New York, two years; James Douglas, New York, three years; Charles Kirchhoff, New York, four years. American Society of Mechanical Engineers—Gaetano Lanza, Boston, one year; John E. Sweet, Syracuse, N. Y., two years; Robert W. Hunt, Chicago, three years; S. T. Wellman, Cleveland, Ohio, four years. American Institute of Electrical Engineers—Arthur E. Kennelly, Cambridge, Mass., one year; Carl Hering, Philadelphia, two years; Charles P. Steinmetz, Schenectady, three years; Charles F. Scott, Pittsburg, four years.

Malaria is to be fought in New York City by filling marshes and pools where mosquitoes breed.

Detection of Alum in Water.

With the increasing use of mechanical filters, a means for detecting the presence of alum in water has come to have considerable importance. A method of testing which has a high degree of delicacy is described by Mrs. Ellen H. Richards, of the Massachusetts Institute of Technology, in "Technology Quarterly" for December, 1902. In 1891 a method was described for detecting alum in water by the use of a freshly prepared solution of logwood.

As early as 1898, Mr. A. H. Low, of Von Schulz & Low, Denver, Colorado, having occasion to test the effluent from the mechanical filters of the Denver Union Water Company, began experimenting with the logwood test with especial reference to the interfering substances. At that time one part in 4,000,000 was his claim for the test. Mr. Low has continued his experiments and his method appears to be a distinct contribution to the accuracy and delicacy of the determination, since one part in 8,000,000 may be detected. The exclusion of carbon dioxide up to a certain stage in the process, when it is required, and the prevention of access of alkali from glass vessels by the use of platinum are essential points.

Directions for the Alum Test.—The logwood solution is made as follows: Take two grams of logwood chips and boil one minute in a platinum dish with 50 cubic centimeters of distilled water. Decant the solution and boil again for one minute with 50 cubic centimeters of water. Decant this and similarly boil a third time with 50 cubic centimeters of water. Decant this into a platinum receptacle for use. Take three drops for each test. Kept in platinum, the solution will last for several days at least.

Test the water as follows: Boil 50 cubic centimeters of the water in a platinum dish for a short time to expel carbon dioxide. Add three drops of the logwood solution and continue boiling for a few seconds to develop the color. Decant into a glass flask and cool quickly under the tap (so as not to keep the hot solution too long in the glass). Transfer to a No. 2 beaker and blow in carbon dioxide from the breath by means of a glass tube until there is no further decolorization. Pour the water into a Nessler tube for comparison with standards similarly prepared. Allow them to stand several hours before taking the final reading. No wash water is used at any of the decantations. The test shows one part of aluminum sulphate in 8,000,000 parts of water.

A blank made with distilled water, if not completely decolorized by the CO_2, will show a tint perceptibly fainter than that produced by one part in 8,000,000 of aluminum sulphate. It should be noted that carbon dioxide must be kept absent until the point prescribed. The solution is therefore transferred to a beaker in order to keep the flask free from carbon dioxide for the next test.

The main points are:—

(1). Any kind of logwood appears to answer. (2). The solution is good for several days, at least, if kept in platinum. (3). The use of platinum instead of glass for boiling the test. (4). The use of carbon dioxide instead of acetic acid.

Aluminum hydrate, as pointed out by the late Professor A. R. Leeds in 1893, will produce a tint almost as strong as if it were in solution. The removal of the hydrate is a difficult matter.

Mr. Low's method of procedure is as follows: First, test the water as above described. If no tint, or none exceeding that of the blank, remains after standing several hours, or over night, that is sufficient. If, however, a tint persists, or a colored precipitate settles out, it is necessary to determine if this is due to aluminum hydrate. Pour a sample of the water several times through a double Swedish filter and finally test the filtrate. If the tint produced is weaker than that given by the unfiltered water, repeat the operation on a fresh portion of the water, using the same filter, and continue repeating with new portions of the water and always using the same filter, until it is apparent that no further diminution of the tint can be effected. The tint finally remaining may be assumed to be due to a salt of aluminum in solution.

An alternative method is to clog a filter with a little aluminum hydrate, wash until no test is given, and then filter the sample of water. Mrs. Richards does not agree with Mr. Low's suggestion to allow the filtered water to stand several hours and then refilter. The filtrate from a mechanical filter which uses alum should be tested at once. A slow decomposition appears to take place by which aluminum hydrate separates out. While it may be said that consumers do not use the water until after the lapse of some hours, the chemist should be able to say whether any undecomposed alum comes through the filter.

Letter to the Editor.

CONCRETE-STEEL.

Sir: In your issue of January 3 in speaking of the experiments of M. Considére you say: "Various applications of steel in planes transverse to the stress, in the forms of radial and intersecting rods and netting likewise did not give as high results as were desirable." I have been experimenting on this line for some time, and my results would seem to disprove this conclusion most positively. M. Considére's ratio of "before and after" strengths ranges a little under 10, whereas mine have gone up into the hundreds. So absolutely astounding have been my results that I have employed an assistant to devote his entire time to this investigation. A study of the forces in granular substances has led me into this field, and the results all along the line have been most astonishing.

Yours truly,

A. V. SIMS.

Iowa City, Ia., Jan. 6, 1903.

A Bridge on Sleds is an unusual sight. But a bridge of 78 feet span and 18 feet width of roadway was moved a distance of 1,000 feet on January 20, at Bradford, Pa., in 2 hours and 30 minutes, by being mounted on four pairs of sleds and drawn over the snow. Most of the time was consumed in turning a corner. For this information we are indebted to the City Engineer, Mr. A. F. Bannon, Jr.

Window Sashes in Long Lines, as in the side walls of factory buildings, can be opened and closed simultaneously from one point by the Lovell window and shutter operating device, manufactured by the G. Drouvé Company, Bridgeport, Conn. It is claimed for the device that it can be successfully attached to sash pivoted, hinged or hung from the top and will operate lines of sash 500 feet in length.

Iowa State College, at Ames, has recently occupied a new fireproof building for purposes of instruction. Engineering Hall, as it is called, is 208x100 feet in plan, four stories high, cost $275,000 with its equipment and contains electrical, ceramic and cement laboratories, recitation rooms and large drafting rooms. The engineering departments occupy also five other buildings, and have 554 students, 21 members of faculty and 24 instructors.

A Compensating Turnbuckle has recently been patented by J. P. and T. J. Hains, 41 West Twenty-fourth Street, New York, which is designed to absorb sudden stress and prevent shock to steel ropes and rigging to which it may be attached. At each end of the turnbuckle there is an eye with a screw end engaging a cross head. The cross heads slide on connecting rods and between them are inserted compression springs which consist of pairs of thin spherical segments with their concave sides together. They have a hole through the center through which one of the screw rods passes and they are enclosed between the two pairs of connecting rods. They are made of different thicknesses and can be combined so as to vary the rigidity of the connection.

A Turbo-Generator Outfit has recently been contracted for by the Rockland Light and Power Company, of Nyack, N. Y., to supplant a two-phase 3,300-volt, alternating-current belted system. The station supplies light and power to a number of small towns, the principal load being incandescent lights, although the service includes a number of motors of considerable size. The turbine is of the standard single-cylinder, multiple-expansion type using superheated steam at 125 pounds pressure, and the generator will furnish two-phase, 60-cycle current at 3,300 volts. The equipment is being furnished by the Westinghouse companies, of Pittsburg, and will include a Snow condenser and an Alberger cooling tower. After the installation of the turbo-generator, the other machinery will be held in reserve for special requirements.

Bituminous Macadam has been subjected to a practical test recently in several New England cities, among them Lowell, Worcester, Holyoke and Cambridge. In the report of Mr. Charles A. Brown, superintendent of streets of Cambridge, there is a statement about the pavement placed in the fall of 1901 on Temple Street. This piece of bituminous macadam has been carefully watched and at the end of 1902 is reported to show no signs whatever of wear or disintegration. As the result of this experience Mr. Brown, who was formerly president of the Massachusetts Highway Association, recommends the further use of this pavement in his city, especially in residential regions, but also suggests that it be laid on a portion of Massachusetts Avenue subjected to heavy traffic. This pavement is called "Bithulic" pavement by the contractors, Warren Brothers & Co., of Boston.

A Trunk Sewer for the Passaic Valley has been recommended in a report recently made to the New Jersey Legislature by a special commission, for which Hering & Fuller, of 170 Broadway, New York, were the engineers. The sewer is to begin near Great Falls in Paterson, and extend to a submerged outlet in New York Bay opposite Bayonne, N. J., a distance of about 26 miles; is to have diameters varying from 5 to 13 feet; and is estimated to cost, with appurtenances, about $8,800,000, exclusive of expenditures for right of way. A main pumping station will be required in Newark to elevate the sewage to a high point in Bayonne, whence it will flow by gravity to the outlet. Two secondary pumping stations are provided to lift the sewage from the branches draining Hudson and Bergen counties, into the main sewer. The report suggests that the cost of construction be apportioned among the twenty communities benefited according to assessed valuations.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 22 and 24.

WATER.

Dexter, Me.—A petition is being circulated, providing for the construction of water works.

Conway, Mass.—A petition has been filed with the State Water Supply Com. for the incorporation of the Conway Water Co. by Dr. Laidley and Arthur P. Delabarre for the purpose of supplying water for fire and domestic purposes.

Pawtucket, R. I.—Wm. H. Barclay, Comr. of Pub. Wks., in his annual report recommends that the City Council take immediate steps toward the installation of a 12,000,000 gal. pumping plant, and that the roadway of Cottage St. be improved by a bituminous macadam pavement.

South Manchester, Conn.—The Selectmen are stated to have sold a portion of the town farm to Cheney Bros. as a site for their proposed reservoir, which will have a capacity of 85,000,000 gals., and cost about $1,000,000. J. Davenport Cheney will be Supt. in Charge.

Waterbury, Conn.—The Bd. of Pub. Wks. has voted to ask the Bd. of Aldermen to petition the General Assembly, for a bond issue of $100,000 to increase the pressure of the water supply.

Norwalk, Conn.—Fred Buckley, Secy. Water Comrs., writes that contracts will be let in the spring for from 4 to 5 miles of 16-in. iron pipe, at a probable cost of $80,000. C. N. Wood, of Norwalk, Engr. in Charge.

Norwalk, Conn.—The City Council is reported to have voted to ask the General Assembly for permission to issue $100,000 bonds for water works improvements.

Yonkers, N. Y.—Allen Hazen, of N. Y. City, is stated to have been selected to prepare plans for the proposed filter bed system, which is to cost about $35,000.

New Rochelle, N. Y.—The capital of the New Rochelle Water Co., of New Rochelle, is reported to have been increased from $80,000 to $2,450,000. Adrian Iselin is one of the directors.

Buffalo, N. Y.—Dr. Green, Health Comr., in his annual report is stated to have called attention to the need of a filtration plant.

Rochester, N. Y.—Mayor Rodenbeck is reported to be in favor of building a conduit system from Lake Ontario for a water supply, instead of constructing the Cobbs Hill reservoir.

Schenectady, N. Y.—A correspondent writes that there is a proposition now before Council providing for laying 14 miles of pipe, and for a 12,000,000 gal. pump; approximate cost, $320,000.

Allentown, Pa.—The Council has passed ordinances providing for the laying of a 30-in. main from Schantz Spring to Crystal Spring, and also for an 8-in. water main on Lehigh St.

Stewartstown, Pa.—The question of granting a franchise or constructing municipal water works, is under consideration by the Boro. Council. W. H. Fulton, Pres.

Camden, N. J.—F. Walter Toms, Supt. of Water Works, in his report to the Water Com. of City Council has recommended the following improvements at Morris Station: Additional pumping and boiler facilities, the installation of a dynamo for operating an electric light plant and the laying of a 36-in. pipe line from the station to the city.

Finleyville, Pa.—The Finleyville Water & Power Co. is reported formed, to supply water to Finleyville and Union, Nottingham and Peters Townships. Incorporators: Geo. C. Boggs, C. Fritchman, and others.

Hawkinsville, Ga.—A press report states that the city authorities are considering the issue of bonds for a complete system of water works and for a better service of electric lights.

Findlay, O.—Bids will be received on Feb. 12 by the Water Works Trus. for furnishing labor and material to construct a conduit way, to deliver water at the pumping station, as advertised in The Engineering Record.

Lorain, O.—The Bd. of Water Wks. Trus. are stated to have authorized O. H. Jewell, of Chicago, Ill., to prepare plans for water works improvements, which will cost about $10,000.

Maumee, O.—W. Richardson, City Clk., writes in regard to water works that bids were opened Nov. 17, 1902, and the ordinance to contract with E. H. Young, of Maumee, for the work has passed two readings in Council; probable cost, $40,000.

Cincinnati, O.—Water bonds amounting to $1,000,000 are reported sold.

Chicago Heights, Ill.—Bids are wanted Feb. 2 for furnishing, delivering and installing 1 vertical high duty compound crank and fly wheel pumping engine, having a capacity of 5,000,000 gals. of water in 24 hours against a domestic pressure of 60 lbs. and a fire pressure of 110 lbs., for said city. P. F. Jirtle, City Clk.

Kenosha, Wis.—A press report states that the Kenosha Municipal Water Co. has ordered specifications for a standpipe, to cost between $15,000 and $20,000.

Twin Valley, Minn.—It is reported that O. Claussen, of St. Paul, will prepare plans for a system of water works and electric lights.

Bids are wanted Feb. 9 for $5,750 water and light bonds. J. A. Salomanson, Village Recorder.

Thief River Falls, Minn.—The Council is reported to be considering the question of water works.

Sioux City, Ia.—The Water Wks. Trus. are stated to have employed F. W. Cappelen, of Minneapolis, Minn., to prepare plans for improving and enlarging the water works. City Engr. Lewis will be Engr. in Charge.

Elizabeth, Ill.—It is stated that plans have been prepared for water works, to cost about $10,000.

Sheboygan, Wis.—A committee is reported to have been appointed to consider the advisability of constructing water works and an electric light plant.

Marinette, Wis.—It is reported that the Marinette Water Co. will let contracts shortly for lowering the intake pipe, at a cost of about $20,000.

North Milwaukee, Wis.—Bids are wanted Feb. 6 for furnishing and installing 2 6-in. water meters; also for furnishing 320 tons 8-in., 124 tons 6-in., 30½ tons 4-in. cast iron water pipe; 26 single nozzle fire hydrants, 5 to be 4-in. and 21 to be 5-in. diameter, fitted with brass waste valves of the "Single Valve Mathews" or improved Stowell pattern; also furnishing and delivering 4, 6 and 8-in. gates including box and covers; bids will also be received Feb. 16 for furnishing material and laying 4, 6, and 8-in. pipe water mains, and for unloading, hauling and delivering water pipe, hydrants, gates and special castings. W. E. Chase, Village Clk.

Milwaukee, Wis.—Bids are wanted Feb. 6 for furnishing to the city 135½ tons cast iron water pipe and 30 3/10 tons of special castings. Chas. J. Poetsch, Chmn. Comrs. of Pub. Wks.

Louisville, Ky.—The following bids were opened Jan. 15 for pumping machinery for the Louisville Water Co. First the bids are given for machinery, including 30,000,000-gal. engines; second, the bids for machinery, including 24,000,000-gal. engines. There were also tenders for alternate types of boilers, furnaces and economizers with accompanying methods of stoking. The items are *a*, traveling crane; *b*, engines; *c*, boilers; *d*, total: R. D. Wood & Co., Camden, N. J., *a* (30-ton), $8,800; *b*, $321,600; *c*, $49,038 (economizers); *d*, $379,438. Kilby Mfg. Co., Cleveland, O., *b*, $287,200 and $258,400. Holly Mfg. Co., Buffalo, N. Y., *a* (25-ton), $8,525; *b*, $327,000, $331,000, $311,000; *c*, $47,775; *d*, $383,300, $387,300, $367,300. Allis Chalmers Co., Chicago, *a* (20 tons), $6,400; *b*, $324,000, $330,000; *c*, $44,600 (economizers); *d*, $375,000, $381,000. Allis-Chalmers Co., Milwaukee, *a* (25 tons), $8,000; *b*, $344,000; *c*, $44,800; *d*, $396,800. R. D. Wood & Co., *a*, $8,800; *b*, $275,200; *c*, $44,074 (economizers); *d*, $328,074. Kilby Mfg. Co., *b*, $253,200, $263,760. Holly Mfg. Co., *a*, $8,525; *b*, $269,000, $272,000, $256,000; *c*, $40,320; *d*, $317,845, $320,845, $304,845. Allis-Chalmers Co., Chicago *a* (17 tons), $5,200; *b*, $280,000, $286,000; *c*, $39,800 (economizers); *d*, $325,000, $331,000. Allis-Chalmers Co., Milwaukee, *a* (20 tons), $6,600; *b*, $299,000; *c*, $38,800; *d*, $344,400.

Meridian, Miss.—A press report states that the Water Works Co. has rejected the offer of the city for the purchase of its plant and the Council has decided to construct municipal water works, at a probable cost of $150,000.

Ardmore, Ind. Ter.—The American Light & Water Co., of Indianapolis, Ind., is reported to have secured the contract for constructing the water works (bids opened Jan. 14) for $150,000.

South McAlester, Ind. Ter.—A press report states that the Secy. of State has approved the issue of $150,000 bonds for water works and sewers, and contracts for pipe, hydrants and machinery will be let about Feb. 14.

Austin, Tex.—The Dixie Irrigation Co., which was organized under the laws of Arizona, with a capital of $1,000,000, is reported to have secured a permit to do business in Texas.

Port Arthur, Tex.—Bids are wanted Feb. 7 for furnishing material and constructing water works, ice and electric light plants, as advertised in The Engineering Record.

Kansas City, Mo.—The Bd. of Pub. Wks. has granted permission to the Stock Yards Co. to construct a 2,500,000 gals. capacity water storage reservoir at 19th and Wyoming Sts., to be fed from the city's flow line between Quindaro and Turkey Creek pumping stations; probable cost of construction, $30,000.

Cleveland, Tenn.—The House has passed the bill amending the charter of Cleveland so as to allow the town to contract for electric lights and water works.

Pocahontas, Ark.—N. T. Collier, of Paragould, writes that it is proposed to construct water works and an electric light plant at Pocahontas, to cost about $50,000. Laufketter-Bendit Co., of St. Louis, Mo., are the Engineers.

St. Francisville, La.—Bids will be received by the Bd. of Mayor and Aldermen until Feb. 18 for constructing a system of water works. C. H. Jenks, Engr., Fayette, Miss.

Augusta, Ark.—Bids will be received by the Water Wks. Comrs. until Feb. 12 for furnishing material and doing the following work: An 80 H.-P. engine, 60x16 ft. boiler, 60 Kw. generator, exciter and switchboard, arc lamps, transformers and pole line complete; power station, 38x41 ft., 2 6-in. wells, 100 ft. deep, and deep well pumps. Weatherford & Hildebrand, Engrs., Memphis, Tenn.

Colorado Springs, Colo.—Local press reports state that the Northfield Land & Water Co. will construct a reservoir at Austin Bluffs, with a capacity of from 3,000,000 to 5,000,000 gals.; probable cost, $10,000.

Hood River, Ore.—The Mt. Defiance Water, Power & Light Co., of Hood River, has been incorporated; capital, $35,000. Incorporators: Frank Davenport, C. T. Early and G. W. Stapleton.

Woodville, Ore.—The Old Mill Ditch & Irrigation Co. of Woodville has been incorporated; capital, $3,000. Incorporators: J. E. Estell, Joel Milton, and others.

Granite, Ore.—The Granite Electric Light & Water Co. of Granite has been incorporated; capital, $7,000. Incorporators: J. N. Ditmars, J. W. Tabor, and others.

Portland, Ore.—The Columbia Land & Irrigation Co. of Portland has been incorporated; capital, $25,000. Incorporators: John E. Atchison, John W. Cook, and Wm. A. Munly.

In the report of the Water Com. just submitted the following are reported to be the estimates of cost of improvements under consideration: Distributing and reinforcing mains already planned, $100,000; additional distributing mains during 1903 petitioned for, $40,000; drainage tunnels, permanent structure, $12,000, and repairs of one reservoir, $31,000. H. W. Corbett, Chmn. Com.

Pendelton, Ore.—The Inland Irrigation Co., of Umatilla County, has been incorporated, with a capital of $50,000, by C. A. Macomber, J. B. McDill and J. B. Despain, to build and operate irrigation ditches in this State.

Los Angeles, Cal.—The following bids are reported to have been opened on Jan. 12 by the Water Bd. for pumping machinery for the Buena Vista St. pumping station: Risdon Iron Works, San Francisco, $25,081 (awarded contract); Allis-Chalmers Co., San Francisco, $26,000; Tracy Eng. Co., San Francisco, $28,275; Machinery & Electrical Co., Los Angeles, $32,950; Baker Iron Works, Los Angeles, $37,500.

Oceanside, Cal.—The City Trus. are stated to have adopted plans for improvements to the water works, at a cost of $15,000.

Visalia, Cal.—The West Side Ditch Co. is reported incorporated, to construct and maintain irrigation ditches in and about the town of Visalia.

Mt. Pleasant, Utah.—The question of constructing water works is reported under consideration.

Lewiston, Idaho.—Chas. S. McDonald, City Clk., writes that the citizens voted Jan. 17 to issue $60,000 bonds for improving the water works.

Winnipeg, Man.—The time for receiving bids for a pumping engine, having a capacity of 5,000,000 imperial gals. per day, has been extended to Mar. 2, as advertised in The Engineering Record.

Ottawa East, Ont.—The leading ratepayers at a public meeting Jan. 21 voted in favor of establishing a water works and a sewerage system; probable cost, $40,000. R. M. Saunders is Reeve.

Dawson City, B. C.—A press report states that City Engr. Rendell, in his annual report, recommends that the city build and operate its own water works.

SEWERAGE AND SEWAGE DISPOSAL.

Easthampton, Mass.—The Sewer Comrs. have presented a petition to Legislature for changing the original plans for its sewer system and for authority to expend a sum not to exceed $75,000 for the extension of the system. It is the intention to extend the trunk line from a point near the gas house to a point below Hampton Mills and to discharge the sewage into Manhan River.

Pawtucket, R. I.—City Engr. Geo A. Carpenter, in his annual report, is stated to have recommended the construction of a sewer on Middle St. and also the replacing of the iron bridges over Blackstone River at Cross and N. Main Sts. with modern structures.

New Haven, Conn.—The Com. of Sewers has voted to recommend the construction of sewers in Woodland, Fillmore, Pine and Lombard Sts.

New York, N. Y.—Bids will be received Feb. 3 by Geo. Livingston, Comr. of Pub. Wks., for furnishing material and making improvements to several brick and pine sewers in portions of Nicholas Ave. and Waverley Pl.; altering and improving outlet sewer in portion of Broad St.; also for furnishing material for receiving basins on Park and Mulberry Sts.

Bids will be received Feb. 9 by Louis F. Haffen, Pres. Boro. Bronx, for furnishing material and constructing 20,546 lin. ft. 8, 12, 15 and 18-in. pipe sewer and 960 lin. ft. 2-ft. 9-in. brick sewer in portions of several streets.

Brooklyn, N. Y.—A. M. Fragner, 350 Fulton St., has been awarded the contract for building a sewer in Narrows Ave. (bids opened Jan. 14), for $22,790. The work includes 710 ft. of 30-in. brick sewer, 1,060 ft. 24-in. vit. pipe, 1,420 ft. 18-in. vit. pipe, 810 ft. 15-in. vit. pipe, 2,320 ft. 12-in. vit. pipe, 58 manholes and 8 receiving basins.

Syracuse, N. Y.—The following bids are reported received on Jan. 19 for an extension of the Midland Ave. trunk sewer to the city line: Thos. Marnell, $19,210, and John W. Bustin, $23,022.

Binghamton, N. Y.—City Engr. S. E. Monroe, in his annual report calls attention to the need of a trunk sewer west of Beethoven St.

Babylon, L. I., N. Y.—There is reported to be a movement on foot for the construction of a sewerage system, to cost about $50,000.

Paterson, N. J.—Press reports state that the Passaic Valley Sewerage Commission's report, which is about to be submitted to Legislature, recommends a trunk sewer 35 miles in length. According to the new plan, the sewer is to begin at the foot of Passaic Falls in Paterson, and extend to Robin's Reef, below Bayonne. The cost of construction is placed at $8,690,000. Newark's share of expense under the new plan is $4,866,400; Paterson's, $1,577,300; Passaic's, $260,700. The remainder is divided among other municipalities which will make use of the sewer. Lateral sewers are to connect the trunk sewer with municipalities on the east side of the river.

Vailsburg, N. J.—The Council is reported to have appointed Eugene A. McMurray as engineer for the local sewerage system.

Atlantic City, N. J.—Local press reports state that the Atlantic City Sewerage Co. will expend about $50,000 to complete the improvements to the system. A. M. Jordan, Pres., Atlantic City.

Summit, N. J.—The Council is stated to have selected Boyd Ehle, of New York, N. Y., as engineer in charge of the joint sewer work within the limits of Summit.

Media, Pa.—Pres. S. A. Field, of the Boro. Council, is stated to have appointed Edw. H. Hall, Dr. E. Marshall Harvey and Geo. T. Butler a committee to investigate the cost of a sewage system.

Harrisburg, Pa.—Mayor McCormick has signed an ordinance providing for the construction of the South Ave. and 14th St. sewers.

Doylestown, Pa.—The Boro. Council has passed on first reading the ordinance granting a franchise to the Doylestown Sewerage Co.

Fernandina, Fla.—Contracts for constructing the sewerage system (bids opened Jan. 7) have been awarded as follows: For laying pipe and constructing the system, Talbutt & Co., Jackson, Miss., $18,303; for terra cotta pipe, Montague & Co., Chattanooga, Tenn., $4,391, and for iron pipe manhole covers and siphons, H. H. Richardson & Co., Jacksonville, $1,405.

Girard, O.—An ordinance is stated to have been passed in Council providing for the appointment of Snow & Barber, of Columbus, as engineers to prepare plans for system of sewerage and sewage disposal.

Chicago, Ill.—Plans for a sewerage system to drain the entire southwest portion of the city from Chicago Lawn north, and to cost $700,000, as drawn up by Ch. Engr. Hill, of the Bd. of Local Improv., were submitted to Commissioner Block1 Jan. 22 and approved. The plans will be laid before the Illinois and Michigan Canal Comrs. for further approval.

Evanston, Ill.—The Council has passed an ordinance providing for the construction of a 12-in. sewer on a portion of Florence Ave.

Milwaukee, Wis.—R. J. Hickey, 253 14th St., is stated to have secured the contract for lowering the sewers in North and Oakland Aves., at $14.47 per ft. for 1,835 ft.

St. Paul, Minn.—Local press reports state that sewers, which will cost approximately $100,000, have been proposed by the Bd. of Pub. Wks.

New Comerstown, O.—Edwin R. Davis, of the firm of Davis & Humphrey, 6 Beacon St., Boston, Mass., has been engaged by this city to prepare plans for sanitary and street drainage and street paving for entire city; estimated cost of work, $75,000.

Toledo, O.—Bids are wanted Feb. 9 for furnishing material for constructing circular pipe sewers 8 and 10-in. inside diameter in portions of 3 streets; also a circular brick sewer 24-in. inside diameter and 4-in. shell in portions of Grand Ave. Chas. H. Nauts, City Clk.

Wabash, Ind.—Bids will be received for construction of sanitary sewers in Miami and Stilt Sts. on Feb. 23. John Hlity, City Engr.

Indianapolis, Ind.—It is reported that bids are wanted by the Bd. of Works for constructing the Valley Ave. sewer, to cost about $33,500, and the Bloyd Ave. sewer, to cost $18,900.

Cincinnati, O.—The following bids for sewer construction were opened Jan. 26 by the Bd. of Pub. Service—A, Wm. Heffron, 257 Ludlow Ave.; B, Van Sandt & Meeds, 518 Walnut St.; C, A. J. Henkel & Bro., 621 Main St.:

	A	B	C
85 ft. 6½ ft. (tunnel)	$25.00	$22.00	$24.00
632 ft. 6½ ft. (open cut)	15.50	12.60	12.00
513 ft. 6 ft. sewer	10.00	10.60	10.00
400 ft. 5½ ft. sewer	9.00	9.60	9.00
940 ft. 5 ft. sewer	8.00	8.60	8.00
25 ft. 4½ ft. sewer	6.00	6.00	6.00
25 ft. 2½ ft. sewer	4.00	3.80	3.00
400 12 in. pipe	1.00	1.50	1.50
4 24 in. pipe	3.00	3.50	3.50
180 6 in. slants	.30	.30	.30
15 12 in. slants	1.00	1.00	1.00
15 Palmer inlets	45.00	45.00	45.00
75 cu. yds. rubble mas	4.00	4.00	4.00
60 cu. yds. concrete	5.00	5.00	5.00
29 M ft. timber	30.00	30.00	30.00
850 lin. ft. piling	.35	.35	.35
65 cu. yds. brick mas	10.00	.01	8.00
360 cu. yds. broken stone	1.50	.01	1.25
180 cu. yds. gravel	.50	.01	1.00

Cleveland, O.—Bids are wanted Feb. 5 for constructing sewers in numerous streets; also Feb. 19 for constructing sewers in several streets. Chas. P. Salen, Dir. of Pub. Wks.

Cicero, Ill.—It is stated that bids are wanted Feb. 5 for constructing pipe sewers in portions of 3 streets. David T. Brennan, Secy. Bd. of Local Improv., Chicago.

Morton Park, Ill.—It is stated that bids are wanted Feb. 5 for constructing a 12, 15 and 20-in. pipe sewer system in 25th St. David T. Brennan, Secy. Bd. Local Improv., Chicago.

Knoxville, Tenn.—The House and Senate are stated to have passed the bill authorizing the city to issue $407,000 bonds for sewers, paving, schools and an improved fire department.

Laurel, Miss.—There is reported to be a movement on foot for the construction of a sewerage system.

Independence, Mo.—It is stated that bids are wanted Feb. 7 for constructing sewers. H. H. Pendleton, City Engr.

Salida, Colo.—The City Council is stated to have granted J. E. Condon a franchise for a sewerage system.

BRIDGES.

New Haven, Conn.—Local press reports state that the Secretary of War has signed a permit to construct a raised stationary bridge across West River, at Kimberly Ave., between New Haven and Orange.

Salem, Mass.—The Co. Comrs. have decided to build a bridge, having a 60 ft. span, to be 30 ft. wide, at Jefferson Ave.

Portsmouth, N. H.—The building of a suspension bridge across Piscataqua River is, according to local reports, being agitated, and it is estimated by Engr. W. H. Keepers that it could be built for $230,000.

Washburn, Me.—The building of a steel bridge across Aroostook River is being considered.

Lawrence, Mass.—Local press reports state that plans are being prepared by the Boston & Maine R. R. Co. for a bridge to be built at Union St., this city. H. Bissell, Ch. Engr., Boston, Mass.

Pawtucket, R. I.—See "Sewerage and Sewage Disposal."

Brooklyn, N. Y.—The local boards of the Prospect Heights and Red Hook Dists. have approved the proposition to change the grade of the approaches to Hamilton Ave. bridge across Gowanus Canal. It is proposed to replace the present structure at Hamilton Ave. with a bridge of sufficient height to permit all but masted vessels to pass through the canal without opening the draw. The estimated cost of the improvement is reported to be $140,000.

Canajoharie, N. Y.—Press reports state that no bids were received Jan. 20 by State Supt. of Pub. Wks. Boyd, at Albany, for constructing a canal lift bridge at Church St., this city.

Le Roy, N. Y.—See "Electric Railways."

Tonawanda, N. Y.—Ch. Bridge Inspector Carr, of the Western N. Y. Division of the N. Y. C. & H. R. R., is said to be making preparations for constructing a double track bridge across Erie Canal and Tonawanda Creek, between Young St., Tonawanda, and Sweeney St., North Tonawanda.

Jersey City, N. J.—The building of a bridge across Passaic River, between Hudson and Essex Counties, is reported to be under consideration.

Lockhaven, Pa.—The Co. Comrs. have decided to erect an iron bridge, 80 ft. long, in Lamar Township.

Newcastle, Pa.—The residents of Mahoning Township are reported to be agitating the building of a bridge across Mahoning River, about 1 mile south of present Edenburg bridge.

McKees Rocks, Pa.—Plans have been submitted by the Western Bridge Co. to Capt. W. L. Sibert, Corps Engrs., U. S. A., Pittsburg, for the proposed bridge which is to be built across Ohio River, from Allegheny to McKees Rocks. The plans provide for a bridge having a main channel span, 900 ft. long, and to be 90 ft. above low water.

Chicago, Ill.—Press reports state that the Atchison, Topeka & Santa Fe Ry. Co. will build 167 bridges on its system during the present year, including the trans-Mississippi bridge. The majority are to be concrete and iron structures. J. Dun, Ch. Engr., Chicago, Ill.

Paris, Ill.—The proposition to construct a bridge at Campbell's Ford, and the issuing of bonds to the amount of $4,500 for said purpose, is reported to have carried at the recent election.

Freeport, Ill.—Local press reports state that 7 bridges, or a trestle the entire distance, will be built across Pecatonica River, from Freeport to Rockport, in connection with the new electric line. Weston & Bro., Merchants' Loan & Trust Bldg., Chicago, Ill., are said to be the engineers for this work.

Mason City, Ia.—The building of a stone arch bridge, 88 ft. long and 48 ft. wide, across Willow Creek, at East State St., is reported to be contemplated.

Plainwell, Mich.—A bill has passed the House, granting Gun Plains Township the right to issue $25,000 bonds, provided the people sanction it, for construction of a bridge across Kalamazoo River at Main St.

St. Paul, Minn.—Newman & Hoy, Chamber of Commerce Bldg., are reported to have secured the contract for constructing abutments for Arcade St. bridge, at $23,369.

Milwaukee, Wis.—Mayor Rose has signed the $100,000 bonds ordinance for constructing the 27th St. viaduct.

Dayton, O.—The Bd. of City Affairs and the officials of the City Ry. Co. are reported to be contemplating the building of a bridge at 3d St.

Akron, O.—The Osborne Engineering Co., of Cleveland, has submitted to the City Comrs. plans for a viaduct to be built at Mill St. The plans provide for a structure of concrete and steel, 765 ft. long, and to be 21 ft. above the present grade of Mill St.

Mt. Carmel, Ind.—The building of a $100,000 bridge across Wabash River is contemplated. Subscriptions amounting to about $70,000 have been received for this project.

Bridgeport, O.—It is stated that bids are wanted Feb. 18 for $12,000 bridge bonds.

Shreveport, La.—The directors of the Shreveport Bridge & Terminal Co. have authorized the issue of $1,000,000 bonds, the proceeds to be used to construct a bridge across Red River, said bridge to be used by the Cotton Belt and the Shreveport & Red River Valley Railroads.

Jellico, Tenn.—C. H. Ackert, Gen. Mgr. of the Southern Ry., is reported to have stated that all bridges between Jellico and Asheville, via Knoxville, are to be replaced with steel structures. D. W. Lum, Engr. Bdgs & Bridges, Washington, D. C.

Wichita, Kan.—The building of a stone structure across Arkansas River, at Douglas Ave., is reported to be under consideration.

Oklahoma City, Okla. Ter.—The City Council is reported to have under consideration the building of a $7,000 viaduct across Choctaw tracks.

City Engr. Wadsworth and the officials of the Chicago, Rock Island & Pacific R. R. are reported to be contemplating the building of a viaduct in this city.

Knoxville, Tenn.—T. J. Moreland, City Engr., writes that it is proposed to construct a 600-ft. viaduct, at a probable cost of $80,000.

St. Charles, Mo.—The Senate has passed a bill authorizing the Iowa & Missouri Ry. Co. to construct a bridge across Missouri River at St. Charles.

Louisville, Ky.—Local press reports state that the 14th St. bridge may be rebuilt in the near future, and that plans for an additional track on the bridge are under consideration, by the Pennsylvania R. R. Co. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Clarksville, Tenn.—Press reports state that the officials of the Louisville & Nashville R. R. intend making improvements to the drawbridge across Cumberland River, this city, at an estimated cost of between $50,000 and $75,000. R. Montfort, Ch. Engr., Louisville, Ky.

Los Angeles, Cal.—The Pacific Electric Ry. Co. is stated to be contemplating the building of a viaduct across Alhambra Ave. at Daly St.

Tacoma, Wash.—Local press reports state that all bids recently received for constructing an iron bridge for the purpose of carrying all water and sewer pipes across the gulch at De Lin St. have been rejected, the lowest being above the Engineer's estimate, which was $4,600. A new ordinance has been introduced in the City Council authorizing the Comr. of Pub. Wks. to again receive bids for an iron bridge and appropriating $7,500 for constructing same.

Toronto, Ont.—The Bd. of Control has confirmed the recommendation of the Wks. Com. to build the Yonge St. bridge.

PAVING AND ROADMAKING.

Marion, Mass.—Col. H. E. Converse has petitioned the Trustees to macadamize a portion of Charles Neck road, a distance of about 1 mile.

Pawtucket, R. I.—See "Water."

South Hadley, Mass.—At the special town meeting on Jan. 24 it was voted to appropriate an additional $5,000 bonds for road improvements.

Albany, N. Y.—The Good Roads Convention on Jan. 21 adopted resolutions favoring the appointment of a county engineer for road construction and favoring the bill in Congress appropriating $20,000,000 for good roads, of which New York would receive about $2,000,000.

Greenville, N. Y.—Asst. State Engr. Flanigan is reported to be surveying for a State road to be constructed between Greenville and Port Jervis.

Lake Pleasant, N. Y.—It is stated that surveys are being made for a 4-mile macadamized road to be built in Lake Pleasant, at an estimated cost of $32,000.

Hazleton, Pa.—City Engr. Ceilax has submitted to the City Council the following estimates for paving, approximately 17,302 sq. yds., on Wyoming St.: With brick, at $2.10; with bituminous macadam, $2.25, and with sheet asphalt, $2.40 per sq. yd.; 1,290 lin. ft. of stone headers, at 60 cts. each, will also be needed.

Buffalo, N. Y.—The following are the lowest bids received by the Bd. of Pub. Wks., Jan. 22, for paving and repaving: For macadamizing Orchard Pl. and Fairfield St., 1,699 sq. yds., Henry P. Burgard, at $2,475; repaving Spring St., 2,730 sq. yds., with asphalt, Henry P. Burgard, $5,177; with brick, Louis Gipp, $6,564, and with stone, H. P. Burgard, $7,995; for repaving Superior St., 1,724 sq. yds., Barber Asphalt Paving Co., with asphalt, at $2,241; with brick, at $3,310, and with stone, $5,172.

Plainfield, N. J.—Major Newton B. Smalley, of North Plainfield, has petitioned the local Bd. of Trade to open another street in the business section of the city. Probable cost, $30,000.

Trenton, N. J.—The following resolutions have passed third reading in the City Council: For paving with sheet asphaltum on a portion of Barnes St. and with brick on Kersey alley.

Johnstown, N. Y.—The paving of Williams St. with bituminous macadam is being considered.

Chester, Pa.—Ordinances have been passed by the Councils for paving on portions of Graham and Kerlin Sts. with sheet asphaltum and setting granite curb.

Morristown, N. J.—Bids are wanted Feb. 23 for macadamizing portion of Morristown and Green Village road, Boonton and Beavertown road and Sussex Turnpike, in all a distance of about 8½ miles. G. A. Becker, Dir. Co. Bd. Chosen Freeholders.

Harrisburg, Pa.—Mayor V. C. McCormick has signed the ordinance providing for the paving of about 57 streets and alleys, in all about 395,500 sq. yds. M. B. Cowden, City Engr.

Frederick, Md.—The Bd. of Aldermen estimates the cost of paving with vitrified brick on a portion of E. Church St., at $8,767.

Buffalo, N. Y.—Bids are wanted Feb. 10 for paving on portions of 2 streets. Francis G. Ward, Comr. of Pub. Wks.

Newburgh, N. Y.—Bids are wanted Mar. 2 for paving Bway. with brick and telford macadam; probable cost, $40,000. Everett Garrison, City Engr.

New York, N. Y.—Bids will be received Feb. 9 by Louis F. Haffen, Pres. Boro. Bronx, for furnishing material and laying 40,000 sq. yds. asphalt pavement, including binder course, 3,620 sq. yds. asphalt block pavement; also 9,940 lin. ft. curbstone furnished and set, and 39,325 sq. ft. flagging furnished and laid.

Portsmouth, Va.—The Virginia-Carolina Construction Co. is reported to have secured the contract to construct about 7,500 sq. yds. of granolithic aldewalks, at $1.47 per sq. yd. for walkways and $1.75 per sq. yd. for driveways, across walks.

Ft. Myer, Va.—Capt. W. F. Clark, Q. M., writes that F. S. Corbett, of Arlington, Va., has received the contract for constructing a macadam road at this post (bids opened Jan. 10), for $7,500.

Houghton, Mich.—The Village Council has decided to pave Shelden Ave., the material to be used to be probably asphalt or asphalt blocks.

Kalamazoo, Mich.—Press reports state that the Comrs. have decided to pave Water and Portage Sts., in the business section, with brick.

Superior, Wis.—The special Paving Com. had decided to recommend paving with macadam in the East End.

Cleveland, O.—Fred. C. Williams, Ch. Engr. of the Division of Parks, has prepared plans for a boulevard system to connect the East End park system with the Edgewater park and boulevard, of the West Side.

Findlay, O.—The City Council has been petitioned to pave a portion of W. Sandusky St. with vitrified brick, asphalt block or bituminous macadam.

Toledo, O.—Bids will be received Feb. 27 by the Com. on Ways and Means of the Common Council for $121,000 street improvement bonds. J. H. Wylie, City Aud.

A petition is being circulated asking for the paving of Millard Ave., from Jessie St. to the easterly city limits.

St. Paul, Minn.—Local press reports state that the contract for paving with Kettle River sandstone on a portion of Eagle St. has been awarded to Peter Berkey, at $2.75 per sq. yd.; total, $9,950.

Chicago, Ill.—Local press reports state that the construction of a subway under the Chicago River, connecting the North and South Side park and boulevard systems, is being considered. Estimated cost, $3,000,000.

Elgin, Ill.—The residents of Grove Ave. are petitioning for asphalt pavement.

Evanston, Ill.—It is proposed to pave a portion of Dempster St. with granite top macadam.

Sioux City, Ia.—Bids are wanted Feb. 10 for furnishing material and paving a portion of Jackson St. with sheet asphaltum on a 4-in. Portland concrete foundation except a strip 9 ft. wide, which shall be paved with vitrified brick on a similar foundation, in all approximately 59,300 sq. yds., and for resetting curb. L. L. Cathcart, Chmn. Paving Com.

Chas. Kloster, City Clk., writes that about 4 miles of brick paving is now under consideration.

Local press reports state that the following bids were received Jan. 20 for paving with brick on a natural cement concrete foundation on the following streets—*a*, Hanson Bros.; *b*, M. L. Flinn; *c*, C. F. Lytle: W. 3d St., 17,932 sq. yds.—*a*, $1.96; *b*, $1.93; *c*, $2.30; 6th St., 5,500 sq. yds., and 7th St., 1,400 sq. yds.—*a*, $1.95; *b*, $1.93, and *c*, $2.30, on both streets.

Lafayette, Ind.—The contract for paving with asphalt on a portion of State St. is reported to have been awarded to the Western Paving Co. at $5.98 per lin. ft.

Ft. Wayne, Ind.—The City Engr. is reported to be preparing plans for paving, estimated to cost about $20,000.

Tiffin, O.—The City Council has accepted plans and specifications for paving Washington St.

New Comerstown, O.—See "Sewerage and Sewage Disposal."

Cincinnati, O.—Bids are wanted Feb. 16 for furnishing material and improving portions of Fuller St. by paving the roadway with boulders, redressing and resetting old curb, furnishing and setting new 5-in. granite curbs and laying limestone gutter flagging. Robt. Allison Pres. Bd. of Pub. Service.

Cleveland, O.—Bids are wanted Feb. 18 for paving portions of the lower boulevard in Rockefeller and Gordon Parks with telford macadam. Chas. P. Salen, Dir. of Pub. Wks.

Hancock, Mich.—It is stated that the Council has decided to pave several blocks on Sheldon St.

Celina, O.—Press reports state that the Village Council has passed an ordinance to issue $12,359 bonds for street improvements.

North Manchester, Ind.—Jos. Cowgill, Town Clk., writes that bids are wanted Feb. 23 for 20,000 sq. yds. of sheet asphalt, rock asphalt, Warren's bituminous macadam or brick.

Galesburg, Ill.—The Bd. of Pub. Improv. has been petitioned to pave a portion of Grand Ave.

Rockford, Ill.—Press reports state that the City Council has decided to pave about 5 miles of streets.

Menominee, Mich.—Press reports state that the City Council has adopted plans for paving with brick on portions of Ogden Ave. and Main St. and has authorized the City Engr. to prepare specifications for same.

Burlington, Ia.—Bids are wanted Feb. 16 for improving several streets. Emmet Steece, City Engr.

Iowa City, Ia.—Local press reports state that bids will be received by the City Council until Feb. 20 for paving with brick on a macadam foundation on a portion of Linn St. Chas. S. Magowan, City Engr.

Akron, O.—Bids will be received by the Bd. of City Comrs. until Feb. 7 for the purchase of a steam road roller, either 10 or 15-ton. Chas. H. Isbell, Clk.

Tipton, Ind.—It is stated that bids are wanted Feb. 3 for constructing 6 miles of gravel roads. A. W. Gott, Engr.

Morton Park, Ill.—It is stated that bids are wanted by the Bd. of Local Improv., Chicago (David T. Brennan, Secy.,) for paving with 10-in. macadam on Linden Ave., Morton Park.

Chippewa Falls, Wis.—It is stated that bids are wanted by the Bd. of Pub. Wks. until Feb. 14 for about 26,625 sq. yds. of brick paving.

Springfield, Tenn.—The Co. Court has passed a resolution asking the Legislature to authorize Robertson Co. to issue $150,000 bonds for building macadam roads.

Louisville, Ky.—The Bd. of Pub. Wks. has submitted to the General Council an ordinance providing for the construction of 3 blocks at the end of 7th St. and is preparing a similar ordinance for constructing 5 squares at the end of 18th St. The citizens petitioned for these improvements some time ago, and the Bd. of Pub. Wks. acted upon the petitions favorably. The pavement is to be vitrified brick and the cost, which is estimated at about $40,000, is to be paid by the property owners.

The Bd. of Pub. Wks. is preparing to pave with asphalt on portions of E. Jefferson, E. Main, 10th and 2d Sts., and 4th Ave.

Dallas, Tex.—Bids are wanted Feb. 14 for repaving with brick, asphalt or other material on portions of 4 streets. Hugh Raines, City Engr.

Port Arthur, Tex.—Press reports state that bids are about to be asked for approximately 30,000 sq. ft. of cement sidewalks.

Louisville, Ky.—The Bd. of Pub. Wks. has under consideration the paving of W. Broadway with asphalt. Estimated cost, $75,000.

St. Louis, Mo.—Bids will be received Feb. 10 by the Bd. of Pub. Improv. for furnishing material and improving portions of numerous streets by grading, curbing with granite and with asphalt, rock asphalt, brick and granite blocks. Walter Edwards, Secy.

Atchison, Kan.—It is proposed to pave N. 6th St. with brick. About 10,700 sq. yds. paving and 6,000 lin. ft. curbing will be required. Fred Giddings, City Engr.

Knoxville, Tenn.—See "Sewerage and Sewage Disposal."

Boulder Creek, Cal.—The Supervisors of Santa Cruz and San Mateo Counties are considering the building of a road between Boulder Creek and Pescadero.

Riverside, Cal.—The City Trus. are reported to be contemplating the improving of Cypress Ave., at a cost of $4,250.

The City Engr. has been directed to prepare a map for paving a portion of Main St.

Tacoma, Wash.—The Comr. of Pub. Wks. has been authorized to receive bids for constructing cement sidewalks in Dist. No. 51.

Warren, Idaho.—Press reports state that the building of a road from Warren to Battle Creek, at a cost of about $8,000, is under consideration.

Denver, Colo.—See "Miscellaneous."

Los Angeles, Cal.—The City Engr. is preparing plans for paving with asphalt on a portion of North Fair Oaks Ave.

Seattle, Wash.—The following estimates have been submitted for street improvements: Grading and curbing Norman St., $15,800; grading and curbing Mercer St. Dist., $25,700; similar work in E. Marion St., $10,300.

The Green Lake Improv. Club is about to petition the City Council to construct 25 miles of sidewalks in Green Lake.

Spokane, Wash.—Local press reports state that bids were received by the Bd. of Pub. Wks. for grading and curbing on a portion of Sinto St., as follows: Mitchell Bros., $5,200; A. Ilse, $7,756; Peter Costello, $8,249. For sidewalking same, with cement: A. Ilse, $4,200; R. E. Lee, $4,350; Peter Costello, $4,374; J. C. Kennedy, $4,550; Sorenson & Stone, $4,995.

Oakland, Cal.—Press reports state that the City Council has decided to pave a portion of 10th St.

San Diego, Cal.—Geo. D. Goldman, City Clk., writes that contracts will probably be let in March for paving a portion of 5th St.; probable cost, $60,000.

Ogden, Utah.—Bids are wanted for 7,500 lin. ft. sandstone curbing, 7,000 sq. yds. sandstone block paving and 9,000 sq. yds. asphaltum on concrete base. To be let under separate contracts. A. F. Parker, City Engr.

Denver, Colo.—R. W. Speer, Pres. Bd. Pub. Wks., writes that the Western Realty & Paving Co., Opera House Blk., has received the contract for sidewalks in So. Bway., Dist. No. 2, for $17,777. Price per sq. ft., 16½ cts.

Toronto, Ont.—The Bd. of Control has authorized the paving with asphalt on portions of Wilson, Spadina and Barton Aves, with brick on Harrison St., with cement concrete on France St. and Marion Ave., cedar block on Van Horne St. and tar macadam on Wickson Ave.; also cement sidewalks on Smith, Murray, Ontario and Clifford Sts.

Winnipeg, Man.—Bids are wanted Feb. 3 for furnishing 1,000 to 1,500 cords of cedar paving wood. H. N. Rattan, City Engr.; C. J. Brown, City Clk.

POWER PLANTS, GAS AND ELECTRICITY.

Rochester, N. Y.—The Trus. of the City Hospital are reported to be considering the question of installing an electric light plant.

Geneva, N. Y.—The Interurban Gas Co. is reported incorporated. It proposes combining the gas companies in Ontario, Seneca and Cayuga Counties and supplying gas from a central plant, to be located at East Geneva. Directors: Herbert K. Seybolt, Edw. H. Palmer and L. G. Hoskins, all of Geneva.

Binghamton, N. Y.—The Council has adopted a resolution authorizing the appointment of a committee of three to report on or before the first regular meeting in Dec., 1903, upon the advisability of the city acquiring an electric light plant.

Watervliet, N. Y.—The Watervliet Illuminating & Power Co., of Green Island, has been incorporated, with a capital of $10,000, to manufacture electricity for light, heat and power. Directors: Eugene L. Ashley and C. H. Peddrick, Jr., of Glens Falls, and B. E. Morrow, of Schenectady.

Syracuse, N. Y.—The Bd. of Trus. of Syracuse Univ., are stated to have appointed a committee to investigate the advisability of erecting a central heating and lighting plant to provide heat and light for all buildings on the campus; probable cost, $35,000.

Central Valley, N. Y.—The Central Valley & Highland Mill Electric Light & Power Co. has been incorporated to furnish light, heat and power in Highland Mills, Central Valley, Monroe and Turners; capital, $140,000. Directors: W. H. Cowan, of Montgomery; C. Rivenburg, of Walden, and W. B. Royce, of Middletown.

Elmira, N. Y.—Local press reports state that the Potter Gas & Power Co., with offices in the Realty Bldg., will construct an immense electrical power plant in Elmira. Mr. Siebert, Pres.

Hyattsville, Md.—Bids will be received by the Washington, Baltimore & Annapolis El. Ry. Co., 405 Bond Bldg., Washington, D. C., for erecting a power house.

Hawkinsville, Ga.—See "Water."

Cameron, W. Va.—The Council is reported to have granted a franchise to the Cameron Pottery Co., for an electric light plant. It is the intention of the company to furnish light for its own use and also for the town.

Anderson, Ind.—Frank A. Sharp, City Clk., writes that it is proposed to procure entire new equipment for the electric light plant, at a cost of $75,000.

The Anderson Steam Htg. & Lighting Co. is reported incorporated, with a capital of $60,000.

Jacksonville, Ill.—It is proposed to increase the capacity of the street lighting plant by the addition of a 40-Kw. generator and engine and a 66x16-H.-P. boiler. C. W. Brown, Public Engr.

Quincy, Ill.—Local press reports state that the Quincy Gas & Electric Co. will erect a new gas retort building, to cost about $30,000, extend gas mains between 5 and 10 miles, mostly 4-in. mains, at a cost of about $25,000 and make other improvements at the electric plant.

Otsego, Mich.—The Otsego Power Co., Ltd., has been incorporated, with a capital of $200,000, to build a dam across Kalamazoo River at Otsego and furnish water and electrical power in southwestern Michigan. Incorporators: Glenn D. Smith, Jackson; Edw. H. Marrinane, of Grass Lake, and others.

Breckenridge, Minn.—Vernon A. Wright, of Fergus Falls, owner of an extensive water power near Fergus Falls, purposes to utilize it by furnishing electric lights and power to Fergus Falls, Wahpeton, Breckenridge, Foxhome, Campbell, and several smaller towns.

Minneapolis, Minn.—The Minneapolis Gas Light Co. is reported to have decided to build a gas storage plant of 1,500,000 cu. ft. capacity at Lyndale Ave. N. and the St. Louis tracks. A 12-in. main will connect the holder with the company's plant at 14th Ave. S. and the river.

St. Paul, Minn.—Chas. Kiewert, of Milwaukee, Wis.; Robt. L. Ware, of St. Paul, and C. S. McKune, of New York, N. Y., are stated to have petitioned the Assembly for a 25-year franchise for furnishing light, power and heat to the residences of the St. Anthony District.

Winona, Minn.—G. P. Coleman, City Engr., writes that the contract for constructing the municipal electric light plant was awarded, on Jan. 19, to W. I. Gray & Co., of Minneapolis, for $44,890.

Ft. Dodge, Ia.—It is reported that the Ft. Dodge Light & Power Co. will probably expend about $275,000 in improvements.

Cedar Falls, Ia.—The Cedar Falls & Janesville Power Co. has been incorporated, with a capital of $100,000, to develop the water power of the Cedar River at Janesville. Frank Adams, Pres.; Roger S. Clay, Secy.

Galion, O.—It is reported that about $25,000 will be expended by the Galion Gas Light Co. in improvements.

Portsmouth, O.—The City Council has granted a franchise for heat, light and power plants to Wm. B. Anderson, Felix Haas, and others. The new company has not yet been organized.

Wabash, Ind.—The Eclipse Gas & Oil Co. has asked the Common Council for a franchise to pipe gas from Lafontaine field to supply gas for factory purposes.

The Common Council has ordered the Fin. Com. to employ an Electrical Engr. to prepare plans for a municipal lighting plant to do city and commercial lighting. John Hilty, City Engr.

Ashley, Ill.—The question of constructing an electric light plant is reported under consideration. It is stated that the Jenney Electric Co., of Indianapolis, Ind., will petition the Council for a franchise.

Watertown, Wis.—The Council is reported to have granted the Watertown Electric Co. a franchise for 20 years, with a 10-year contract for street lighting.

Sandusky, O.—The Central Htg. & Lighting Co. is stated to have petitioned the Council for a franchise. The company proposes establishing a heating system, and also proposes to engage in commercial electric lighting.

Twin Valley, Minn.—See "Water."

Bluffton, Ind.—It is stated that bids will be received about Feb. 11 for constructing a municipal light plant, to cost about $15,000. John Mack, Mayor.

Cleveland, Tenn.—See "Water."

Huntsville, Ala.—The citizens are stated to have voted on Jan. 19 to ask Legislature for authority to issue $20,000 bonds for an electric light plant.

Ft. Worth, Tex.—The Council is considering the granting of an electric light franchise to Geo. W. Armstrong, and other local capitalists.

Port Arthur, Tex.—See "Water."

New Orleans, La.—The New Orleans Rys. Co. is reported to have under consideration a proposition for the installation of a steam heating plant. The heating system would take in all the business section of the city and would represent an expenditure of from $250,000 to $500,000.

Pocahontas, Ark.—See "Water."

Augusta, Ark.—See "Water."

St. Francisville, La.—Bids will be received by the Bd. of Mayor and Aldermen until Feb. 18 for constructing an electric light plant. C. H. Jenks, Engr., Fayette, Miss.

Spring City, Utah.—The question of constructing an electric light plant is reported under consideration.

Hood River, Ore.—See "Water."

Granite, Ore.—See "Water."

North Bend, Neb.—The citizens are stated to have voted Jan. 20 to establish a lighting system. A gas plant will probably be installed.

Grand Island, Neb.—W. H. Thompson and H. J. Palmer are stated to have petitioned the Council for a franchise for a heating plant.

Toronto, Ont.—Wm. Mackenzie and Frederic Nicholls are stated to have petitioned the Queen Victoria Niagara Falls Park Comn. for a franchise for power development. They propose developing 125,000 H.-P. with a special view to the needs of Toronto and other portions of Ontario.

The Comn. also has under consideration plans for a pipe line for the Ontario Power Co.

Nelson, B. C.—J. K. Strachan, City Clk., writes it is proposed to expend about $150,000 to construct a power plant and improve the electric light system. Bids will not be called for until grant of power site is received from the Provincial Government.

ELECTRIC RAILWAYS.

Concord, N. H.—The House has passed two bills, one to extend the charter for building the Claremont St. Ry., and the other to authorize the Concord & Montreal R. R. to acquire the Concord St. Ry. and other property, to issue stock and bonds to pay therefor and authorizing a physical connection of the Manchester St. Ry. with the electric branches of the Concord & Montreal R. R.

Nashua, N. H.—It is stated that the Boston & Maine R. R. Co. will construct an electric railway this spring from Manchester to Nashua, and 6 miles further to the State line. H. Bissell, Ch. Engr., Boston, Mass.

Sutton, Mass.—The Uxbridge, Whitinsville & Douglas St. Ry. Co. is stated to have petitioned the Council for a franchise.

Adams, Mass.—The Selectmen are stated to have granted a franchise to the Hoosac Valley St. Ry. Co. through Center, Summer and North Summer Sts. to the North Adams line. P. C. Dolan, Supt., North Adams.

Middletown, Conn.—The Selectmen are stated to have granted the Middletown St. Ry. Co. permission to extend its line. C. H. Chapman, Mgr., Middletown.

Rockville, Conn.—Perkins & Perkins, of Hartford, Attorneys for the Stafford Springs St. Ry. Co., are stated to have petitioned the Mayor for a franchise in this city.

Spencerport, N. Y.—The Albion Electric Ry. Co. is stated to have secured a right of way through Spencerport.

Leroy, N. Y.—The Buffalo & Depew Trolley Co. is stated to have petitioned the Bd. of Aldermen for a franchise to extend its line through the village. The company proposes rebuilding the bridge on Main St. over Oatka Creek. E. Melvin, Ch. Engr., Depew.

Hamburg, N. Y.—The Hamburg Ry. Co. has petitioned Highway Comr. Gould for a franchise to build a line along the Hamburg turnpike from the north line of the township to the southern boundary of Big Tree Road. Thos. F. Kelley, Supt., Buffalo.

Glen Cove, L. I., N. Y.—The Supervisors at Mineola are stated to have granted a franchise to the Glen Cove Ry. Co.

New York, N. Y.—It is reported that the Metropolitan R. R. Co. will expend about $5,000,000 for the betterments of its system, mainly in the way of equipping old lines with electric underground system. Milton G. Starrett, Ch. Engr.

Clayton, N. J.—It is stated that the South Jersey Gas, Electric & Traction Co. in the spring will extend its trolley line from Mantua to Clayton. F. D. Moses, Ch. Engr., Trenton.

Pleasantville, N. J.—Richard F. Loper, representing the Delaware Valley Traction Co., is stated to have petitioned the Council for a franchise.

Trenton, N. J.—L. D. Mathis, formerly Supt. of the Trenton & New Brunswick R. R. Co. is reported interested in a company about to be formed for the purpose of building a trolley line from Trenton to Lakewood. The road is to be 42 miles long, passing through Allentown, Centerville and other towns.

The Stockholders of the Camden & Trenton Traction Co. are stated to have decided to push the extension of the road into Trenton as soon as the weather permits. M. B. Perkins, Mgr., Beverly.

Vailsburg, N. J.—The Essex Cross St. Ry. Co. is stated to have petitioned the City Council for a franchise.

York, Pa.—The York & Gettysburg St. Ry. Co. has been incorporated by C. J. Basehore, E. J. Wilkes, and others, of Carlisle, to construct a street railway from York to Gettysburg via East Berlin.

Oakgrove, Pa.—The Lock Haven & Oakgrove Trolley Co. is stated to have secured a right of way through the town.

Baltimore, Md.—Articles of incorporation of the Baltimore & Belair Electric Ry. are reported to have been filed with the Secretary of State; capital, $500,000. The route will be either on the Baltimore & Harford or Baltimore & Jerusalem turnpike.

Ellicottville, N. Y.—Engr. Chas. Locke, of Randolph, is reported to have made a survey for an electric railway proposed from Ellicottville to Mansfield and East Otto, a distance of 13 miles.

East Orange, N. J.—The Essex Cross R. R. Co. is stated to have petitioned the Council for a franchise for a crosstown trolley line.

Newark, N. J.—The North Jersey St. Ry. Co. is stated to have petitioned the Bd. of Wks. for a franchise in Bergen St. J. G. Elliott, Ch. Engr., Jersey City.

Johnstown, Pa.—A corporation to be called the Johnstown & Geistown Passenger Ry. Co., with a capital of $42,000, will shortly be chartered to build a line between the two places. Joseph Ruth and Jacob Grosch are reported to be interested.

Harrisburg, Pa.—A charter has been granted to the West Fairview & Harrisburg St. Car Co., with a capital of $12,000, to construct a railway between Harrisburg and Enola, a distance of abont 2 miles. Incorporators: John W. Weitzel, Frank Martin, and others.

Baltimore, Md.—Crook, Horner & Co. are stated to have secured the contract for an addition to the steam power plant of the United Rys. & Electric Co. at Pratt St.; contract price, $24,500.

Latrobe, Pa.—A charter has been granted to the Latrobe, Pleasant Unity & Greensburg St. Ry. Co. to connect the towns named. Directors: Capt. John B. Kenna, Greensburg; Chas. Saxman, and J. L. Freeble, of Latrobe, and others.

Belair, Md.—Engr. B. E. Cutler is reported to be in Belair engaged in making surveys for an electric railway between Belair and Baltimore. The construction of the road from the tracks of the United Rys. & Electric Co. on the Hartford Road to Belair would require the laying of about 16 miles of track, which would cost about $200,000.

Columbia, S. C.—The City Council is stated to have granted a franchise to the Lexington & Columbia Electric R. R. Co.

Atlanta, Ga.—The Chattahoochee Terminal R. R. Co. is stated to have filed a petition with the Secy. of State for a charter for an electric railway to be constructed from a point near Atlanta through Fulton and Cobb Counties to Marietta.

Toledo, O.—The Maumee River & Eastern Ry. Co. is reported incorporated, with a capital of $10,000, to construct an electric or steam line from Toledo to Presque Isle, a distance of about 5 miles. Incorporators: Webb C. Hayes, Lloyd T. Williams, and others.

Loctonia, O.—The Village Council is stated to have granted a franchise to Max Goodman.

Salem, O.—The Stark Electric Co. is securing right-of-way between Sebring and Salem, O., and expects to extend its street railway between these places during the coming season.

Mt. Vernon, Ind.—The City Council is stated to have granted a franchise to the Evansville, Mt. Vernon & Uniontown Traction Co. The power house and machine shops will be located here.

Swayzee, Ind.—The Town Bd. is stated to have decided to grant a right of way to T. C. McReynolds and L. J. Kirkpatrick, representing one of the Marion-Kokomo electric lines.

Vincennes, Ind.—The Western Indiana Traction Co. is reported to have petitioned the Council for a franchise.

S. W. Williams, of Vincennes, is reported interested in the construction of an electric railway from Vincennes to Sullivan.

Muskegon, Mich.—The Muskegon Traction & Lighting Co. is reported to have decided to expend $100,000 this spring in further improvements to its property here. F. S. Richmond, Mgr., Muskegon.

Lansing, Mich.—The Michigan Central Traction Co., which was organized to build an electric line between Lansing and Battle Creek, is reported to have secured all right of way between Lansing and Grand Ledge.

Moorehead, Minn.—H. E. Roberts, City Clk., writes that it was voted Jan. 21 to grant M. E. McDonald a franchise for a railway.

Keokuk, Ia.—A press report states that J. R. Robertson, of Keokuk, is about to begin a preliminary survey for a trolley line from Ft. Madison to Keokuk.

Chariton, Ia.—S. H. Mallory, of Chariton; J. S. Bellamy, of Knoxville, and others, are reported interested in the construction of an electric railway from Knoxville to Corydon via Chariton.

Cincinnati, O.—It is stated that work will probably begin in March on the construction of the Cincinnati, Milford & Eastern Ry.; probable cost of construction and equipment, $290,000. Sumner B. Day, of Elyria, is reported interested.

Indianapolis, Ind.—The Shareholders of the Indianapolis, Greenwood & Franklin Ry. Co. are stated to have decided to change the name of the company to the Indianapolis, Columbus & Southern Traction Co., and increase the capital from $150,000 to $285,000. This increase is for the extension of the road to Franklin and the additional expenses of running the line through to Columbus.

Jefferson, O.—The Ashtabula Co. Comrs. are stated to have granted Frank P. Hood a franchise for an electric railway between Geneva and the Lake Erie resorts, 4 miles north.

Cleveland, O.—Local press reports state that the Eastern Ohio Traction Co. will expend about $500,000 in improvements.

St. Joseph, Mo.—The Co. Comrs. are stated to have granted a renewal of franchise to the Kansas City, Parkville & St. Joseph Electric Ry. Co. Work of construction will soon commence.

Mosspoint, Miss.—A press report states that the Mosspoint & Pascagoula R. R. Co. has passed into the hands of Chas. T. Ballard and associates, of Louisville, Ky., and is to be converted into a trolley line.

Nashville, Tenn.—The McMinnville, Woodbury & Nashville Ry. Co. is stated to have petitioned the Co. Comrs. for a franchise. The road will run through Warren, Cannon and Rutherford Counties.

Dallas, Tex.—The Dallas Consolidated Electric St. Ry. Co. has petitioned the City Council for permission to make improvements to its system which, it is estimated, will cost between $60,000 and $70,000. Edw. T. Moore, Secy.

Oakcliff, Tex.—The City Council is stated to have granted a franchise to the Dallas & Oakcliff Ry. Co. D. H. Lavenberg, Supt., Dallas.

Omaha, Neb.—The Omaha, Decatur & Northern Ry. Co. is reported incorporated, with a capital of $1,000,000, to build a line through Douglas, Washington, Burt, Thurston and Dakota Counties. Incorporators: C. E. Burlow, A. M. Anderson, and others.

Sonora, Cal.—Hersch F. Lamotte, representing an Indiana company, is stated to have petitioned the Tuolumne County Bd. of Superv. for a franchise to construct and operate an electric railway between Chinese Station on the Sierra Ry. line in this County and the western boundary line of the Yosemite Natl. Park.

Louisville, Ky.—The Louisville, Anchorage & Pewee Valley Electric Ry. Co. is stated to have filed articles of incorporation changing the name of the road to the Louisville & Eastern, and increasing the capital stock from $350,000 to $1,250,000. According to the amended articles the company shall have the right to extend, construct and operate its line from Shelbyville to Frankfort, Ky.; to build a division from Shelbyville to Eminence and New Castle, and, if desirable, to a point on Kentucky River, in Henry County, Ky.; and also a division from Shelbyville to Mt. Eden, together with necessary switches, turn-outs and sidetracks. Percival Moore, Pres.

Brockville, Ont.—A syndicate of New York capitalists, represented by John Gerken, Clarence P. King, and others, are reported to have purchased the Brockville, Westport & Sault Ste. Marie Ry. They propose changing the name to the Brockville & Northwestern Ry., and will take steps at once to extend the line to the "Soo."

Dawson City, B. C.—An ordinance is reported to have been introduced in Council, granting a franchise to the Klondike Mines Ry. Co. to lay its tracks on 1st Ave. to Queen St.

RAILROADS.

Akron, Pa.—The Engineers of the Pennsylvania R. R. Co. are reported to have located the route of the new line across Southern Lancaster County, which will connect the main line at Akron, and the branch on the Susquehanna River, near York Furnace; it will be 27 miles in length. W. H. Brown, Ch. Engr., Philadelphia.

Richmond, Va.—It is proposed to run a railroad (the Central of Virginia) via Harrisonburg, Va., and Richmond to the coast. A. A. Chapman, Oxford, N. C., is reported interested.

Elnora, Ind.—The stockholders of the Southern Indiana R. R. Co. are stated to have authorized its officers to build an extension from Elnora to Evansville, a distance of 75 miles. J. W. Thompson, Gen. Supt., Terre Haute.

Minneapolis, Minn.—It is stated that the Red Lake Transportation Co. will issue about $100,000 bonds, to be used in extending its railroad to Whitefish Lake and for making other improvements.

Morgantown, W. Va.—A charter has been granted to the Union Utility Co. of Morgantown, to construct and operate a railway in that city; capital, $1,000,000. Incorporators: E. M. Frant, D. H. Courtney, Frank Cox, and others, all of Morgantown.

Chicago, Ill.—A charter has been granted to the Eastern Illinois & St. Louis R. R. Co., with a capital of $100,000, to construct a line from a point on the Indiana State line in Iroquois County through the counties of Iroquois, Vermilion, Champaign, Douglas, Moultrie, Shelby, Christian, Montgomery, Bond, Macoupin, Madison, and St. Clair to East St. Louis. Incorporators: Edw. H. Seneff, Jonathan P. Reeves, and others, all of Chicago.

East St. Louis, Ill.—Articles of incorporation have been filed by the East Side Terminal Co. of East St. Louis, with a capital of $2,500, to construct a line from East St. Louis to its suburbs. Incorporators: Jas. J. Hafter, Fred W. Kraft, and others, of East St. Louis.

Mattoon, Ill.—The Chicago, Indianspolis & St. Louis Ry. Co. of Mattoon has been incorporated, with a capital of $55,000 to construct a line connecting with the Cairo, Vincennes & Chicago Ry. near Hillsboro, southwesterly through the counties of Montgomery, Macoupin, and Madison to a point on the line of the same railway near Mitchell. Incorporators: Melville E. Ingalls, Cincinnati, O.; Hadley Baldwin and W. M. Duane, of Mattoon, and others.

St. Louis, Mo.—The American Bridge Co., of New York, N. Y., is reported to have received a contract from the Union Depot Terminal Assoc. of St. Louis, for all of the structural steel necessary to build an entirely new line into the city for the World's Fair next year. The contract will involve an expenditure of over $1,600,000.

Vicksburg, Miss.—A charter has been granted to the Vicksburg & Gulfport R. R. Co. for a railroad which is to run from Vicksburg to Gulfport through the following counties: Warren, Hinds, Copiah, Lincoln, Lawrence, Pike, Pearl River, Hancock and Harrison. Incorporators: B. W. Griffith, C. J. Searls, and others.

Muscogee, Ind. Ter.—The Stockholders of the Ozark & Cherokee Central R. R. Co. are stated to have decided to amend the charter so as to construct a railroad from Muscogee to Shawnee and Oklahoma City from Gibson to Joplin, Mo.; from Muscogee to Fort Smith, and Fayetteville (Ark.) to Jasper, Ark.

Amarillo, Tex.—The Chicago, Rock Island & Choctaw R. R. Co. has filed incorporation papers and will build a railroad from Amarillo to Tucumcari, connecting the Choctaw & Rock Island system and giving a short line from Memphis and Little Rock to El Paso; capital, $1,500,000. Headquarters of the company will be Chicago, Ill., and Alamo Gordo, N. M.

Buna, Tex.—Surveys are now being made for an extension of the Orange & Northwestern R. R. from Buna to Shreveport, La., or Waskom, Tex., a distance of about 135 miles. L. Miller, Pres., and M. L. Montandon, Ch. Engr., both of Orange, Tex.

Arlington, Ore.—The Arlington & Pacific Coast R. R. Co. has been incorporated, with a capital of $1,500,000, by J. P. Finley, J. R. Smalles and J. E. Simmons, to construct and operate a railroad from Arlington to the Pacific Ocean, a total distance of about 300 miles.

Albuquerque, N. M.—B. Lantry & Sons, of Strong, Kan., are reported to have secured the contract for building 75 miles of the 290-mile cut-off, the Santa Fe R. R. is to make on its overland line to California. The cut-off will cost $10,000,000 and will run from Beten, a station on the main line near Albuquerque, to Texico, a point on its Pecos Valley & Northwestern Ry. in Texas.

San Francisco, Cal.—The Midland Pacific Ry. Co. has been incorporated, to build from a point on San Luis Bay easterly through San Luis Obispo, Santa Barbara and Kern Counties to Bakersfield. Side lines will be built into all the neighboring oil districts. Capital, $500,000. Incorporators: A. L. Weill, M. A. Lippitt, and others.

Dawson City, B. C.—The White Pass R. R. Co. is reported to have applied at Ottawa, Ont., for a franchise permitting railroad construction from Dawson City to American territory.

Santiago, Chile.—A press report states that the Chilean Congress has approved the bill authorizing the Government to invite bids for the construction of a transandine railroad, on the basis of a guarantee of 5 per cent. interest on the cost of the work.

PUBLIC BUILDINGS.

Manchester, N. H.—A bill has been introduced in Council appropriating $48,000 for the erection of an armory in Manchester.

West Springfield, Mass.—The Church of the Immaculate Conception, West Springfield, is considering the erection of an edifice. Address Rev. R. S. J. Burke, pastor.

New York, N. Y.—The lowest bids opened Jan. 21 for erecting the 3 comfort stations in the Boro. of Brooklyn are stated to have been submitted as follows: N. W. Ryan, for the stations at Greenpoint and Hamilton Aves., at $18,879 and $19,500, respectively, and W. R. Watts, for the Liberty Ave. station, at $14,700.

Bids will be received Feb. 6 by Francis V. Greene, Police Comr., for furnishing material necessary to install low pressure steam heating apparatus and heating system through the 5th Precinct Police Station.

The Armory Bd. at a meeting Jan. 21 is stated to have approved plans for the erection of the 71st Regiment Armory at 4th Ave. and 31st St., to cost $650,000.

It is stated that a 4-story brick nurses' home will be erected on North Brother Island. The structure will be 70x34-ft. and cost about $40,000. Architect, W. Wheeler Smith, 45 Exchange Pl.

Bids will be received Feb. 11 (readvertisement) by J. Edw. Swanstrom, Boro. Pres., for furnishing material and erecting 2 underground public comfort stations at Manhattan and Greenpoint Aves., and at the junction of Hamilton Ave. and Richards St., Boro. of Brooklyn, including hot water heating equipment and stack or coil heating equipment.

Albany, N. Y.—The Council has passed an ordinance providing for the appropriation of $25,000 for the erection of a building for the 1st Precinct Station.

Brooklyn, N. Y.—The Armory Bd. is stated to have adopted the plans of Lord & Hewlett, 16 E. 23d St., for an armory for the 2d Naval Battalion, to be erected at 1st Ave. and 52d St., at a cost of $250,000.

New York, N. Y.—Bids will be received Feb. 9 by Thos. Sturgis, Fire Comr., for furnishing material for erecting a building for Engine Co. No. 7 and Hook & Ladder Co No. 1.

Allegheny, Pa.—The Congregation of the R. C. Church of Anunciation, Charles St., is reported as having plans prepared for a stone and brick edifice, to cost $45,000.

Athens, Ga.—J. W. Barrett, City Engr., writes that bids are wanted for the purchase of $50,000 city hall bonds.

Marion, Ind.—The Co. Comrs. are stated to have awarded the contract for the erection of the county jail to the Champion Iron Co., of Kenton, O., for $92,559.

Marquette, Mich.—It is stated that the Catholic diocese of Marquette and Sault Ste. Marie will erect an orphan asylum here, to cost $50,000.

Des Moines, Ia.—Bids are wanted Feb. 25 for erecting the Iowa building on the Louisiana Purchase Exposition Grounds, St. Louis, Mo. Proudfoot & Bird, Archts., 712 Crocker Bldg., Des Moines. F. R. Conaway, Secy., Iowa Comn.

Guttenberg, Ia.—Bids are wanted Feb. 4 for cut stone and stone mason work on the new Catholic church. Address Rev. J. H. Brinkmann.

Portsmouth, O.—Press reports state that bids will be received Feb. 15 by Richards, McCarthy & Bulford, Archts., "The Ruggery," Columbus, O., for erecting a library.

Springfield, O.—R. C. Gotwald, Archt., Gotwald Bldg., writes that the date for receiving bids for erecting the 4-story brick and stone city hospital, including steam heating, laundry, machinery and elevators, has been extended to Mar. 5; probable cost, $60,000.

Oshkosh, Wis.—It is reported that bids will be received Feb. 16 by the Com. of the Co. Bd. for installing 150 H.-P. Scotch marine boilers at the Co. Asylum for the Chronic Insane. A. W. Kellogg, Chmn.

Ishpeming, Mich.—Plans for the Carnegie Library will be ready in about a month; probable cost, $15,000. Dr. T. A. Felch, Mayor.

Trenton, Mo.—The plans of G. A. Berlinghof, of Beatrice, Neb., are stated to have been adopted for the court house and jail, to cost $60,000.

Danville, Ky.—The contract for erecting 2 dormitories, power building and steam plant, including plumbing, gas-piping, etc., at Ky. Institute for Deaf (bids opened Jan. 20) has been awarded to A. J. Craig, of Covington, Ky., for $58,480. Augustus Rogers, Supt.

Warren, Ark.—E. D. Krouse, of Warren, is stated to have secured the contract for erecting the Bradley County Court House, for $37,645.

Franklin, La.—Press reports state that plans will be received Feb. 16 by the Police Jury for erecting a court house, to cost not less than $110,000.

Spokane, Wash.—The First Baptist Society is reported considering the erection of a $50,000 church.

Havana, Cuba.—The House of Representatives is reported to have appropriated $300,000 for the construction of a capitol.

BUSINESS BUILDINGS.

Braddock, Pa.—It is stated that the Braddock Trust Co. will erect a business building at Braddock Ave. and Liberty Pl., to cost between $40,000 and $50,000.

Latrobe, Pa.—The Pennsylvania R. R. Co. is reported to have awarded the contract for the erection of the passenger station here to Roydhouse, Arey & Co., 24 S. 7th St., Philadelphia; the structure will be brick 120x41 ft. and cost $50,000.

Philadelphia, Pa.—Plans are stated to have been filed by Stacy Reeves & Sons for the 5-story addition to the department store of Strawbridge & Clothier, at 825 Market St., to cost $266,000. Archt., Addison Hutton, 400 Chestnut St.

The Pennsylvania R. R. Co. is stated to have awarded the contract to Millard & McGraw, Arcade Bldg., for the erection of the $20,000 2-story, 58x229 ft. brick office and freight depot at Germantown Junction.

Salisbury, Md.—It is stated that R. E. Powell & Co. will erect a 3-story, 75x200 ft. department store. The building will be heated with steam and contain an electric plant.

Albany, N. Y.—It is stated that contracts will soon be let for a 9-story addition to the Hotel Ten Eyck on Maiden Lane. Architect, H. N. Wilson, of Pittsfield, Mass. H. J. Rockwell, Proprietor.

Allentown, Pa.—Jacoby & Weishampel, Commonwealth Bldg., are reported to be preparing plans for a 5-story stone building for John W. Eckert, to be erected at 812 Hamilton St. and measure 40x150 ft.

Reading, Pa.—A $30,000 extension will be erected at the Widows' Home in Reading. Architect, A. Smith, 531 Court St. John D. Mishler, Mgr., Reading.

Cordele, Ga.—It is stated that a union depot will be erected here, to cost $30,000. The Seaboard Air Line Ry. (E. Berkeley, Div. Supt., Atlanta,) is reported interested.

Richmond, Va.—Noland & Baskerville, Chamber of Commerce Bldg., has prepared plans for a $30,000 office building and bachelor apartments, to be erected by the State Insurance Co. Robt. Lecky, Jr., Vice-Pres.

Chicago, Ill.—The Otis Estates and the Chicago Savings Bank Co. are reported interested in the erection of an 18-story office building at State and Madison Sts. The structure will be 18 story, 48x120 ft., and cost from $500,000 to $750,000.

Ft. Sheridan, Ill.—P. J. Weber, 1142 Rookery Bldg., Chicago, is reported to be preparing plans for theater to be erected here, to cost $25,000. The structure will be 80x135 ft. in dimensions.

Mankato, Minn.—Lamm & Landkammer are reported interested in the erection of a 4-story brick, 44x120 ft. business building on Walnut St. Archt., Albert Schippel, First Natl. Bank Bldg.

Ottumwa, Ia.—H. H. Richards, 269 Dearborn St., Chicago, Ill., is stated to have submitted plans for the 7-story stone and brick hotel to be erected here. The Commercial Exchange is reported interested. J. H. Mitchell, Secy.

East Liverpool, O.—The Union Bldg., Loan & Trust Co. and Geo. H. Owen & Co. are reported interested in the erection of a 2-story, 80x130 ft. brick office building.

Flint, Mich.—Bids are wanted Feb. 16 for erecting a 5-story brick store and office building, 110x80 ft., for the supreme division of the Knights of the Loyal Guard, including electric elevator. Clark & Munger, Archts., Shearer Bldg., Bay City.

Muskogee, Ind. Ter.—It is stated that an opera house and hotel will be erected, to cost $75,000. C. T. Haskell is reported interested.

Ft. Smith, Ark.—Anderson Constr. Co., of St. Louis, Mo., is reported to have secured the contract for the erection of a depot here, at $32,000.

Helena, Ark.—The Helena Hotel Co. recently incorporated is stated to have decided to erect a hotel at Cherry and Poplar Sts., to cost $50,000.

St. Louis, Mo.—The Texas World's Fair Comn. is stated to have accepted the plans of C. H. Page, of Austin, Tex., for the Texas Building, to cost $200,000.

San Bernardino, Cal.—It is stated that plans are being prepared for a 85x150 ft. theater to be erected at 3d and C Sts. for the San Bernardino Theater Co., recently incorporated, with a capital of $75,000. A. C. Denman, of the San Bernardino Valley Traction Co., is reported interested.

Athena, Ore.—It is stated that bids are wanted Mar. 20 for erecting a 2-story brick business block for N. A. Miller. Probable cost, $45,000. C. E. Troutman, Archt., Pendleton.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Cannon and Rivington Sts, 6-story br tenemt and stores; c, $45,000; o, Louis Lipmann; a, Sass & Smallheiser.

Chrystie and Hester Sts, 6-story br tenemt and store; c, $45,000; o, Isaac Grossman; a, Horenburger & Straub.

14 and 16 Wooster St, 7-story br loft and stores; c, $75,000; o, Geo H Pigneron; a, W G Pigneron.

2d St and Ave A, 6-story br tenemt and stores; c, $45,000; o, Mandel & Maran; a, Horenburger & Straub.

36 W 22d St, 7-story loft and office bldg; c, $40,000; o, Standard Constr Co; a, Geo F Pelham.

Park Ave and Ittner Pl, 4-story br stk mill; c, $40,000; o, Saml K Jacobs; a, Buchman & Fox.

737 Bway, 2-story addition to 7-story br loft bldg; c, $30,000; o, Henry E Jones; a, Chas Volz.

BROOKLYN, N. Y.

Driggs Ave and N 10th St, 6-story br factory; c, $120,000; o, W H Robinson; a, F J Ashfield.

DWELLINGS.

Syracuse, N. Y.—It is stated that P. S. Callahan & Son propose erecting an apartment house at Irving Ave. and Croton St., to measure 132x395 ft., and cost from $40,000 to $50,000.

Philadelphia, Pa.—Chas. J. Brooke, 14 S. Broad St., is stated to be preparing plans for 80 3-story and 40 2-story brick and stone dwellings, to be erected in West Philadelphia; probable cost, $300,000.

East St. Louis, Ill.—It is stated that E. G. Helm, Arcade Bldg., will erect a $75,000 apartment house here. Architects, Bartlow & Kennedy, East St. Louis.

Portland, Ore.—Davis C. Lewis, Chambers Bldg., is stated to have prepared plans for a residence for Joseph N. Teal, to be erected on St. Clair St.; probable cost, $25,000.

Toronto, Ont.—Plans are stated to have been filed for the erection of an apartment house on Sussex Ave. and Huron St., to cost $35,000. A. Hawes is reported interested.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Sullivan and Bleecker Sts, 5 6-story br tenemts; c total, $150,000; o, Estate N Low; a, McIlvaine & Tucker.

196 to 200 Waverley Pl, 6-story br flat; c, $50,000; o, Malbin & Kammermann; a, Geo F Pelham.

206 to 210 W 106th St, 6-story br flat; c, $85,000; o, Miller & Mofsenson; a, Bernstein & Bernstein.

Morningside Ave and 116th St, 6-story br tenemt; c, $50,000; o, Geo Doctor; a, John Hauser.

158th St and St Ann's Ave, 3 6-story br tenemts; c total, $80,000; o, Lorenz Weiher; a, Moore & Landsiedel.

Robbins Ave and Kelly St, 5-story br tenemt; c, $35,000; o, Patrick J. Owens; a, Bronx Architectural Co.

SCHOOLS.

Brockton, Mass.—It is stated that a high school, to cost about $200,000, will be erected this year.

Fitchburg, Mass.—The Com. on City Property of City Council (C. H. Greene, Chmn.,) has been authorized to erect a brick school house on Lunenburg and East Sts., at a cost of $20,000.

Boston, Mass.—The lowest bid opened Jan. 26 by the School House Comrs. for a 20-room grammar school on Heath St., Roxbury, was submitted by Mack & Moore, 22 Chapman Pl., for $187,600.

A. A. Sanborn, 18 Post Office Sq., submitted the lowest bid for ventilating and heating the school to be erected on Horace St., East Boston (bids opened Jan. 26) for $9,600.

Willimantic, Conn.—Bids will be received Feb. 2 by the State Bd. of Educ., Hartford, for erecting, including plumbing, the State Normal School. Hartwell, Richardson & Driver, Archts., 62 Devonshire St., Boston, Mass. Wm. H. Palmer, Jr., Chmn. Com.

Albion, N. Y.—The Bd. of Educ. is stated to have accepted the plans of E. E. Joralemon, of Niagara Falls, for the high school to be erected here, to cost $70,000.

Schenectady, N. Y.—The Bd. of Educ. is stated to have adopted the plans of Benn Varney, of Lynn, Mass., for the 2 ward schools—one to be erected at Brandywine Ave. and Becker St. and the other at E. Liberty and Niskayuna Sts.: total cost, $100,000.

Brooklyn, N. Y.—Jas. Harley, 288 Flatbush Ave., has secured the contract for the sanitary work in School No. 130, Boro. of Brooklyn, for $6,868.

Buffalo, N. Y.—Bids are wanted Feb. 5 for erecting a 6-room brick addition to school in Dist. No. 58, including ventilating, heating, plumbing, gas-fitting, masonry, etc. Francis G. Ward, Comr., Dept. of Pub. Wks.

Georgetown, D. C.—Plans are stated to have been prepared for the erection of an addition to the Georgetown Univ.; probable cost, $65,000.

Philadelphia, Pa.—J. W. Cuff & Co. are reported to have received the contract for installing the steam heating apparatus in the school of St. Elizabeth's R. C. Church, 23d and Berks Sts., for $10,500.

New York, N. Y.—Bids will be received Feb. 9 by C. B. J. Snyder, Supt. of School Bldgs., for installing electric light wiring, fixtures and electric bell system in school No. 145.

Augusta, Ga.—A correspondent writes that 2 new schools will probably be erected.

Athens, Ga.—The plans of Haralson Beckley, of Atlanta, are stated to have been accepted for the Library of the State Univ. at Athens, to cost $50,000.

Decatur, Ill.—It is stated that the Bd. of Educ. has decided to erect a 2-story structure to replace the present Church St. School, at a cost of about $45,000.

Kankakee, Ill.—Jorgensen & Larsen, of Kenosha, Wis., are reported to have received the contract for erecting a high school, for about $60,000.

St. Charles, Ill.—It is reported that the contract for the erection of the $50,000 school for the St. Charles Home for Boys will soon be let.

South Milwaukee, Wis.—It is stated that $25,000 bonds will be issued to erect a 9-room brick school in the 2d Ward.

Royaloak, Mich.—The Senate is stated to have authorized the issue of $30,000 school bonds.

Sac City, Ia.—The plans of Murphy & Ralston, of Waterloo, are reported to have been accepted for a high school, to cost $40,000.

Sheldon, Ia.—It is stated that the high school recently destroyed by fire will be rebuilt at a cost of $50,000.

Columbus, O.—Bids are wanted Feb. 16 for erecting 2 gymnasiums for the Ohio State School for the Blind. Stribling & Lunis, Archts. Alfred Robinson, Secy.

Marion, Ind.—It is stated that the contract will soon be let for the rebuilding of the Marion High School recently destroyed by fire; probable cost, $40,000.

Chicago, Ill.—Bids will be received Feb. 6 by the Business Mgr. of Bd. of Educ. for erecting a school on W. Ohio St. and N. Sawyer Ave., including masonry, cut stone, terra cotta, steel ceilings, etc.; also for electric work, plumbing and gas fitting for the physiographical laboratory in R. A. Waller High School. W. B. Mundie, Archt.

Caledonia, Minn.—P. M. Fuos, Village Recorder, writes that the citizens have voted to issue $20,000 bonds for the erection of a school.

St. Louis, Mo.—Gerber Bros. are stated to have received the contract for erecting the Blow School, at Virginia Ave., for $128,546. The plumbing and heating contracts are stated to have been awarded to Geo. T. Meyer & Bro., 2603 Chouteau Ave., and J. J. Cullen Htg. Co., for $6,900 and $12,939, respectively.

Orange, Tex.—The City Secy. writes that it was voted Jan. 19 to issue $22,000 bonds for the erection of a school in the 2d Ward.

Knoxville, Tenn.—See "Sewerage and Sewage Disposal."

Norman, Okla. Ter.—The Bd. of Regents of the Oklahoma Univ. is stated to have decided to rebuild the Science Hall recently destroyed by fire, at a cost of $35,000.

Weatherford, Okla. Ter.—Bids are wanted Feb. 14 for furnishing material for erecting the Southwestern Normal School. J. H. Bennett, Archt., Guthrie. L. W. Baxter, Territorial Supt. of Pub. Instruction, Guthrie.

Whatcom, Wash.—W. H. Hildebrand, City Clk., writes that it was voted Jan. 17 to issue $65,000 bonds for the erection of a school.

Lewiston, Idaho.—It is stated that the School Trus. have decided to erect a 2-story school on Normal Hill, to cost $25,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Toledo, O.—The Council has passed a resolution providing for the appointment of a committee to confer with the City Solicitor and prepare a plan for the collection and disposal of the city garbage and that the City Clerk procure information relative to the collection of garbage in other cities. Councilmen Vogel and Barfield were appointed on the committee.

Kansas City, Mo.—Edwin W. Davis, Secy. Bd. of Health, writes that the date of receiving bids for the collection and disposal of garbage and dead animals has been extended to Feb. 20.

GOVERNMENT WORK.

New Bedford, Mass.—Bids will be received on Feb. 16 by Capt. Thos. H. Slavens, Q. M., at Newport, R. I., for installing electric light fixtures in the buildings at Ft. Rodman, New Bedford, Mass., as advertised in The Engineering Record.

Ft. Mansfield, R. I.—Bids are wanted Feb. 11 for constructing roads and sidewalks at this post. Address Constructing Q. M., New London, Conn.

Boston, Mass.—The following bids for dredging in Boston Harbor were opened Jan. 22 by Lieut. Col. W. S. Stanton, Corps of Engrs., U. S. A.: International Contg. Co., N. Y. City, Divisions (1) and (2), 27.5 and 42.9 cts. per cu. yd.; Geo. H. Breymann, Toledo, O., Division (1), 20.5 and 39 cts.; (2), 24 and 39 cts.; (3), 23.5 and 39 cts. Breymann Bros., Toledo (1), 20 and 39 cts.; (2), 24 and 39 cts.; (3), 24.5 and 39 cts. Morris & Cummings Dredging Co., N. Y. City, (1), 26 and 40 cts.; (2), 23.4 and 40 cts.; (3), 24.5 and 40 cts.; (4), 25.75 and 40 cts.. Eastern Dredging Co. & New England Dredging Co., Boston, (1), 25.9 and 39.7 cts.; (2), 25.7 and 39.7 cts.; (3), 25.7 and 39.7 cts.; (4) 23.9 and 39.7 cts.

Jamestown, N. Y.—Bids will be received by the Supervy. Archt., Treas. Dept., Washington, D. C., on Mar. 2 for the steam heating apparatus, etc., at the U. S. Post Office, Jamestown, as advertised in The Engineering Record.

Ft. Terry, N. Y.—Bids will be received by S. Y. Britt, Q. M., on Feb. 28 for constructing, plumbing, heating and electric wiring frame barrack building and for a gun shed and machine shop, as advertised in The Engineering Record.

West Point, N. Y.—Bids are wanted Feb. 6 for road to southern end of the military post with retaining wall. Address J. B. Bellinger, Maj. & Q. M., U. S. M. A.

Buffalo, N. Y.—Local press reports state that the following bids were opened on Jan. 22 by Major Thos. W. Symons, U. S. A., for improving the entrance to Black Rock Harbor and Erie Basin, appropriation $800,000: Jas. B. Donnelly, Buffalo, $1,848,000; Daly & Hannon Dredging Co., Ogdensburg, $1,071,500; Lake Erie Dredging Co., Buffalo, $1,020,500; L. P. & J. A. Smith, Cleveland, O., $1,179,500; Buffalo Dredging Co., $802,250.

Washington, D. C.—Cramp & Co., of Philadelphia, Pa., have secured the contract from the Supervy. Archt. of the Treas. Dept., for erecting the main building for the Bureau of Standards, at $159,176.

Wilkesbarre, Pa.—Bids will be received by the Supervy. Archt., Treas. Dept., Washington, D. C., on Mar. 11 for the steam heating apparatus, etc., U. S. Post Office, at Wilkesbarre, as advertised in The Engineering Record.

Ft. Dade, Fla.—Bids will be received by Robt. S. Welsh, Q. M., on Feb. 19 for constructing a wharf, as advertised in The Engineering Record.

St. Augustine, Fla.—The following bids for dredging in St. John's River, Fla., were received by Capt. Francis R. Shunk, Corps Engrs., U. S. A., Jan. 26, price given per cu. yd.: Sanford & Brooks Co., Baltimore, Md., 24.5 cts.; Geo. W. Catt, New York, N. Y., 25 cts.; Coastwise Dredging Co., Baltimore, Md., 21.5 cts. The Maryland Dredging & Contracting Co., of Baltimore, Md., bid $15 for dredging plant, per hour.

Warren, O.—Bids are wanted Feb. 7 for installing electric elevator in court house. Address Co. Clk.

Chicago, Ill.—The following bids were opened Jan. 8 for pneumatic-tube service over four routes, the bids being tendered first per annum; second, per mile: Chicago Postal Pneumatic Tube Co., (1), $118,250, $13,750; (2), $84,562.50, $13,750; (3), $118,250, $13,750; (4), $119,625, $13,750. Batcheller Pneumatic Tube Co., (1), $150,813.60, $16,450; (2), $101,332, $16,450; (3), $153,116.60, $16,450; (4), $157,327.80, $16,450. Chicago Pneumatic Service Co., (1), $142,104, $15,500; (2), $100,749, $16,500; (3), $144,150, $15,500; (4), $144,274, $14,500.

Chicago, Ill.—The following bids were opened at the office of the Supervy. Archt., Treas. Dept., Washington, D. C., on Jan. 26 for installing the ventilating system of the Post Office, Court House, etc., Chicago: Andrew & Johnson Co., Chicago, $173,537, 250 days; L. H. Prentice & Co., Chicago, $190,497, 180 days; Matthew Bros., Chicago, $137,500, 220 days; C. B. Kruse Htg. Co., Milwaukee, Wis., $132,584, 365 days; Buffalo Forge Co., Buffalo, N. Y., $188,075, 270 days.

Bids were opened at the same time and place for installing the elevator system in said building: *a*, hydraulic; *b*, electric: Winslow Elevator Co., Chicago, *a*, $114,000; *b*, $94,400. Marine Engine & Machine Co., New York, N. Y., *a*, $127,500; *b*, $95,000. Otis Elevator Co., New York, N. Y., *a*, $112,800; *b*, $92,780.

Creston, Ia.—The lowest bid opened on Jan. 27 at the office of the Supervy. Archt., Treas. Dept., Washington, D. C., for installing the heating apparatus in Post Office Building at Creston, is stated to have been submitted by H. Sandmeyer, of Peoria, Ill., for $3,975.

Ashland, Wis.—Bids are wanted Feb. 24 for furnishing and placing about 26,000 tons of riprap at Ashland. D. D. Gaillard, Corps Engrs., U. S. A., Duluth, Minn.

Nashville, Tenn.—Bids will be received at the U. S. Engr. office, Feb. 28, for 4 pairs of steel lock gates, filling valves, etc., for Locks A and No. 1, Cumberland River, as advertised in The Engineering Record.

Chattanooga, Tenn.—The lowest bids opened Jan. 22 by Capt. H. J. Slocum, Q. M., for erecting a brick hospital at Chickamauga Park, Ga., are as follows: Construction, Hunt, Armstrong & Trimby, Chattanooga, $55,334; plumbing, Fred Fox, Jr., Chattanooga, $3,868; heating, Harris & Algoe, Camden, N. J., $6,635, and gas piping, F. S. Wilcox, Chattanooga, $155.

Mobile, Ala.—Bids will be received at the U. S. Engr. Office, Mobile, on Feb. 28 for building Locks and Dams Nos. 1, 2 and 3, Warrior and Tombigbee Rivers, Ala., as advertised in The Engineering Record.

New Orleans, La.—Bids are wanted Feb. 12 for constructing about 455,000 cu. yds. of earthwork in the Pontchartrain Levee Dist. Capt. Chas. Bromwell, Corps Engrs., U. S. A., 3232 Prytania St., New Orleans.

Tulalip, Wash.—Bids are wanted Feb. 10 for furnishing material for constructing a wharf at the U. S. Indian School. Address Chas. M. Buchanan, Supt., U. S. Indian School Service.

Los Angeles, Cal.—A press report states that Waldo S. Waterman, of San Diego, has secured the contract for completing the jetty work at San Diego harbor (bids opened Jan. 15), 108,108 tons, at $1.85 per ton.

Los Angeles, Cal.—The following bids for constructing breakwater at San Luis Obispo Harbor were received by Capt. Edgar Jadwin, Corps Engrs., U. S. A.: Jan. 21, amount to be expended, $47,000; *a*, total number of short tons; *b*, price per ton: A. A. Polhamus, San Diego, *a*, 25,269; *b*, $1.86. Wm. H. Healy, San Francisco, *a*, 21,461; *b*, $2.19. City St. Improv. Co., San Francisco, *a*, 25,134; *b*, $1.87.

Seattle, Wash.—The following bids were opened Jan. 20 by Major John Millis, Corps Engrs., U. S. A., for dredging Tacoma Harbor: *a*, price per cu. yd.; *b*, total: Puget Sound Bridge & Dredging Co., Seattle, *a*, 8.67 cts.; *b*, $182,070. R. A. Perry, San Francisco, Cal., *a*, 6.44 cts.; *b*, $135,240. Seattle Bridge Co., Seattle, *a*, 10.75 cts.; *b*, $225,750. Pacific Coast Dredging & Reclamation Co., San Francisco, *a*, 11 cts.; *b*, $231,000.

San Francisco, Cal.—The lowest bid received on Jan. 20 for rebuilding the Oakland Harbor light station was that of W. H. Healy, of San Francisco, for $15,223.

MISCELLANEOUS.

Buffalo, N. Y.—Bids are wanted Feb. 6 for deepening, widening, dredging, improving and clearing of obstructions in the Buffalo River and the City Ship Canal. Francis G. Ward, Comr. Dept. of Pub. Wks.

New York, N. Y.—Bids will be received Feb. 3 by Geo. Livingston, Comr. of Pub. Wks., for furnishing and delivering 20,000 cu. yds. of sand, 100,000 gal. No. 6 paving cement, 1,000 bbls. Portland cement, 2,500 cu. yds. of gravel and 2,500 cu. yds. gravel screenings, 2,500 cu. yds. trap rock broken stone and 1,200 cu. yds. trap rock screenings.

Trenton, N. J.—Bids will be received Feb. 2 by the Bd. of Park Comrs. for improving Monument Park by constructing concrete walks and granite curbing and erecting a lodge building. Wm. Roberts, Chmn.

Newark, N. J.—Local press reports state that bids will be received by Street Com. until Feb. 4 for constructing a city dock.

Brooklyn, N. Y.—Bids will be received Feb. 9 by C. B. J. Snyder, Supt. of School Bldgs., for furnishing and delivering plumbing, steamfitters' and other supplies to the workshop of the Dept. of Educ.

Milwaukee, Wis.—Mayor Rose has signed the $40,000 park bond ordinance.

Marinette, Wis.—The Dixon Dredge & Dock Co., of Milwaukee, is stated to have secured a $30,000 contract at Marinette to lower an intake pipe below Menominee River.

Chicago, Ill.—The following bids are reported to have been opened Jan. 21 by the Drainage Bd. for dredging and docking which will be done during the ensuing year incident to the widening of the south branch of Chicago River. Ch. Engr. Randolph estimates that there will be dredged 237,223 cu. yds. of material and that 3,744 lin. ft. of new dock will be built—*a*, price per cu. yd. for dredging; *b*, price per lin. ft. for dock: Lydon & Drews Co., Chicago, *a*, 24.9 cts.; *b*, $24.50. Buffalo Dredging Co., Buffalo, *a*, 27.5 cts.; *b*, $29.00. C. H. Starke Dredging & Docking Co., Milwaukee, Wis., *a*, 26 cts. Hausler-Lutz Co., Chicago, *a*, 25.3 cts.; *b*, $25.40. L. P. & J. A. Smith, Cleveland, O., *a*, 29.6 cts.; *b*, $28. The Fitz Simons & Connell Co., Chicago, *a*, 28 cts.; *b*, $26.65.

Vicksburg, Miss.—John T. Crass, of Chattanooga, Tenn., has secured the contract for grading culverts, roadway, etc., at Vicksburg Natl. Military Park, for $29,270.

Denver, Colo.—Asst. City Engr. Rinehart Schuetze is reported to be preparing plans for the improvement of the 35 acre addition to Washington Park. The principal feature will be the construction of a driveway along the edge of the lake.

Winnipeg, Man.—The time for receiving bids for the supply of from 15,000 to 20,000 bbls. of cement has been extended to Mar. 3, as advertised in The Engineering Record.

NEW INDUSTRIAL PLANTS.

The Kentucky Portland Cement Co., 71-72 Todd Bldg., Louisville, Ky., will erect a plant to have a daily capacity of 2,000 bbls. and to cost about $500,000.

The Kalamazoo, Mich., Portland Cement Co., Ltd., will erect a 10-kiln plant to have a steam power plant and electrical transmission.

The Wisconsin Condensed Milk Co., Burlington, Wis., will equip a building at Pecatonica, Ill., for making milk cans and expects next spring to add a 2-story, 40x100-ft. building.

The Fuller & Johnson-Shugart Co., Council Bluffs, Ia., makers of farm implements and wagons, gasoline engines, etc., is erecting a 4-story and basement, 85x145-ft. building to be used as warehouse, offices and show room. An elevator of 4,000 lbs. capacity and an electric light plant will be installed.

Stehli & Co., 103 Greene St., New York, will build a silk mill at High Point, N. C. C. Emlen Urban, Lancaster, Pa., is preparing plans.

The Rutherford Paper Co., Tarentum, Pa., expects to erect a one-machine mill, and will install a power plant of 300-H.-P. A. C. Rutherford, Supt.

The G. & H. Barnett Co., Philadelphia, Pa., will erect a 30x60-ft. engine room and another 50x200-ft. building, and install a 700-H.-P. Corliss engine.

Soren Hanson, Blackfoot, Idaho, has let a contract to E. H. Dyer & Co., Cleveland, O., for a beet-sugar factory at Idaho Falls to have a daily capacity of 1,200 tons. The factory is to be completed Oct. 1.

The New Castle, Pa., Forge & Bolt Co. expects to double the capacity of its forge shop by erecting a 70x300-ft. steel and brick building and installing bolt and rivet machines. An electrical power plant of 300-H.-P. will be installed.

The White Lumber Co., Elkins, W. Va., will erect a number of portable saw-mills. Alfred A. Rudy, Mgr.

Boston, Mass.—The following bids were opened Jan. 20 by the Transit Comn. for completing Section C of the East Boston tunnel:

Bidders.	6,000 cu. yds. earth exc.	7,000 cu. yds. exc. in station.	40 tons cast iron rods, etc.	100 tons tie-rods.	500 cu. yds. Port. conc.	2,000 cu. yds. conc. without skin of mort.	3,000 cu. yds. concrete, station.	Rem. brk bulkhds around air-lock & divr. said locks on surface.	4,000 sq. yds. cem. mortar.	200 cu. yds. grout.	Supporting and protecting buildings.
H. P. Nawn, Roxbury	$9.00	$9.00	$20.00	$10.00	$18.00	$17.00	$17.00	$1,500	$0.50	$10.00	$60,000
McGawley & Coughlin, Boston.	6.00	8.00	30.00	20.00	17.00	17.00	17.00	1,000	.60	18.00	73,000
Metropolitan Cont. Co., Boston	6.08	11.50	6.00	15.00	18.00	15.50	16.00	1,150	.70	20.00	40,000
Jones & Meehan, Boston	6.00	9.00	20.00	20.00	16.00	12.00	20.00	2,000	.75	25.00	46,000
*P. McGovern, Roxbury	6.50	9.25	3.00	3.00	16.00	15.00	17.50	1,250	.75	20.00	32,000

Totals—H. P. Nawn, Roxbury, $279,800; McGawley & Coughlin, Boston, $270,505; Metropolitan Cont'g Co., Boston, $255,753; Jones & Meehan, Boston, $251,090; P. McGovern, Roxbury, $235,995.

*Awarded contract.

The Griswold Mfg. Co., Erie, Pa., will erect a 180x280-ft. foundry, a power plant with electrical distribution, a tumbling mill room and a casting inspection and storage room. The company erected during the past year a large machine shop.

The Perry Side Bearing Co., 1023 Monadnock Block, Chicago, will erect a 60x160-ft. factory, partly two stories, at Joliet. About 40 to 50-H.-P., obtained by electric transmission from the water power at that place, will probably be used.

John Repp, Glassboro, N. J., will erect a 60x100-ft. cold-storage plant to have a capacity of 10,000 bbls., and be ready by Sept. 1.

The Emerson Steam Pump Co., Alexandria, Va., has been incorporated with a capital of $1,000,000, and will erect commodious shops, including iron and brass foundries, and equip them with modern tools and appliances. The company owns and controls numerous patents on steam vacuum pumps, foot valves and strainers for suction pipes of pumps and these will be its principal product.

The Dan River Power & Mfg. Co., Danville, Va., will soon ask for bids for the construction of a 43,000-spindle cotton mill building; also weave shed and cloth house. R. A. Schoolfield, Treas.. Lockwood, Greene & Co., Boston, Mass., Archts. and Engrs.

D. M. Reaves, Toccoa, Ga., has purchased buildings in which he will make spools, bobbins, etc. He intends to add a foundry and machine shop.

BUSINESS NOTES.

The St. Paul, Minn., Foundry Co. is erecting a 70x160-ft. addition to its structural steel shop, with a 35x80-ft. lean-to to be used as a template room, and a 105x150-ft. addition to the foundry. As soon as the addition to the foundry is completed, it is intended to remodel the old foundry so that the whole shop will be up-to-date.

The Roe Stephens Mfg. Co., Detroit, Mich., maker of valves, will erect a 40x130-ft. brass foundry and a 70x150-ft. iron foundry, the machinery for which has been ordered. The company expects later to erect an office, shipping-room, ware-room and iron finishing department.

The Newton Machine Tool Works, 24th and Vine Sts., Philadelphia, have let contract for a 3-story, 100x200-ft. addition to its works; the works will then cover an entire block. All contracts for machinery have been placed.

The Mansfield, O., Engineering Co. has just built a new power plant, equipped with boilers and a 100-H.-P. tandem compound engine of the company's make connected to a Phoenix generator. Further equipment will be added to the power plant in a few months.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Detroit Iron & Steel Co., engines for three 350-H.-P. horizontal direct-connected units; Charles City, Ia., Lighting & Heating Co., engines for two direct-connected units of 600-H.-P. capacity.

The Susquehanna Iron & Steel Co., Columbia, Pa., is about to install an electric power distribution plant in its mills. A recent purchase from the Westinghouse Electric & Mfg. Co. comprises a 400-Kw., alternating-current generator, a 200-H.-P. induction motor, and 300 to 400-H.-P. in motors, ranging in size from 50 to 20-H.-P. The Anaconda Copper Mining Co. is about to put in operation a new 5,000-ton-per-day reduction plant, which will be equipped with electrical apparatus for power distribution. A recent contract with the Westinghouse Electric & Mfg. Co. embraces seven motors of an aggregate of 185-H.-P., to be added to the present installation of about 30 Westinghouse motors of an aggregate of over 1,000-H.-P.

The annual meeting of the stockholders of the Fort Pitt Bridge Works was held at the company's Pittsburg office on Jan. 27. It was announced that the improvements under construction during the past year are now complete, increasing the annual capacity to 25,000 tons. The old board of directors was re-elected and the management continued as heretofore.

The Locomotive and Machine Co. of Montreal, Ltd., 51 Street Railway Chambers, Montreal, Que., has been incorporated and will erect the following buildings: 420x132-ft. machine shop, 300x66-ft. forge and blacksmith shop, 300x66-ft. erecting shop, 340x66-ft. boiler shop, 160x66-ft. foundry, 104x82-ft. power house, 100x66-ft. carpenter and pattern shop, structural shop, 200 ft. square; 100x66-ft. pattern storage and 200x80-ft. steel casting plant. The power plant will include 1,000-H.-P. Babcock & Wilcox boiler with underfeed stoker and induced draft, 600-H.-P. cross compound condensing engine, 400-Kw. generator, and a 2,000 cu. ft. per minute compound condensing air plant. All contracts have been let. M. J. Haney, Pres.; T. J. Davis, Vice-Pres.; Geo. P. Brophy, Mgr.; R. T.

Recent orders for Roney mechanical stokers, sold by Westinghouse, Church, Kerr & Co., include the following: No. Jersey St. Ry. Co. and Jersey City, Hoboken & Paterson St. Ry. Co., 12 quadruplex stokers for plant extensions aggregating 6,250 H.-P.; Indianapolis St. Ry. Co., 12 duplex and quadruplex stokers for 4,200 H.-P. B. & W. and Zell boilers; Indiana, Lebanon & Frankfort Ry., 12 duplex stokers for 3,000 H.-P. plant of Stirling boilers; Utah Light & Power Co., Salt Lake City, 6 duplex stokers for a lighting plant containing 1,250 H.-P. Heine boilers; Phoenix Iron Co., 6 quadruplex stokers, for rolling mill plant, fifth order, 2,700 H.-P. extension. Heine boilers; Schlitz Brewing Co., Milwaukee, 4 duplex stokers for plant extension, 600 H.-P. horizontal return tubular boilers; Youngstown, O., Consolidated Gas & Electric Co., third order, quadruplex stokers for central lighting, railway and power plant, 1,050 H.-P. B. & W. boilers; American Locomotive Works, Schenectady, central power station, fifth order, 700 H.-P. Heine boilers, quadruplex stokers; Carnegie Steel Co., sixth order, 500 H.-P. Aultman-Taylor horizontal boilers for pumping station, duplex stokers; Rhode Island & Suburban Ry., plant extensions, quadruplex stokers, 1,050 H.-P. B. & W. boilers, 12,000 H.-P. ultimate; Penn. R. R. Altoona, Juniata Shops, quadruplex stokers for Sederholm boilers; Pressed Steel Car Co., seventh order, duplex stokers, Aultman-Taylor horizontal boilers, 1,000 H.-P., new power plant; Hartford Carpet Corporation, Thompsonville, Conn., new plant, 760 H.-P. Aultman-Taylor horizontal boilers, quadruplex stokers.

The directors of the Stanley Electric Mfg. Co., at a meeting held on Jan. 10, passed a resolution providing that the capital stock of the company be increased from $3,000,000 to $10,000,000 and the stockholders will meet on Feb. 11 to approve this action of the board. The company recently secured an order from the New York Edison Co. aggregating over $500,000 for dynamos and other electrical apparatus, some of which is to be the largest of its kind ever constructed. Funds will be provided by the increase of capital for certain important developments which the engineers of the company have been planning for some time. Among these developments is a new system of operating for heavy long distance electric railways which, it is claimed, possesses marked advantage over systems previously experimented with.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Feb. 2.	Chicago Heights, Ill.	Jan. 31
Feb. 2.	Bloomington, Ill.	Jan. 24
Feb. 2.	Wessington Springs, S. D.	Jan. 17
Feb. 2.	Rayne, La.	Jan. 17
Feb. 2.	Winnipeg, Man.	Jan. 10
Feb. 2.	Gillett, Wis.	Jan. 10
Feb. 6.	Wellsville, O.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 6.	Pipe, etc., Milwaukee, Wis.	Jan. 31
Feb. 6.	Pipe, etc., North Milwaukee, Wis.	Jan. 31
Feb. 7.	Port Arthur, Tex.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 12.	Conduits, Findlay, O.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 12.	Augusta, Ark.	Jan. 31
Feb. 14.	Pipe, etc., South McAlester, Ind.	Jan. 31
Feb. 14.	Lakewood, O.	Jan. 14
Feb. 16.	Pipe, etc., North Milwaukee, Wis.	Jan. 31
Feb. 17.	Cincinnati, O.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 18.	St. Francisville, La.	Jan. 31
Mar. 1.	Fort Morgan, Ala.	Jan. 24
Mar. 2.	Pumping Engine, Winnipeg, Man.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Mar. 14.	Dillon, Mont.	Jan. 10
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Feb. 2.	Plans, Delphos, O.	Jan. 24
Feb. 2.	Slayton, Minn.	Jan. 24
Feb. 2.	New Orleans, La.	Nov. 29
	Adv., Eng. Record, Nov. 29 to Jan. 31	
Feb. 3.	New York, N. Y.	Jan. 31
Feb. 5.	Cleveland, O.	Jan. 31
Feb. 5.	Cicero, Ill.	Jan. 31
Feb. 5.	Morton Park, Ill.	Jan. 31
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 7.	Independence, Mo.	Jan. 31
Feb. 7.	Philadelphia, Pa.	Jan. 10
Feb. 9.	Toledo, O.	Jan. 31
Feb. 9.	New York, N. Y.	Jan. 31
Feb. 9.	Cincinnati, O.	Jan. 17
Feb. 14.	Lakewood, O.	Jan. 24
Feb. 14.	Washington, D. C.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 16.	Toledo, O.	Jan. 24
Feb. 19.	Cleveland, O.	Jan. 31
Feb. 23.	Wabash, Ind.	Jan. 31
Mar. 1.	Peoria, Ill.	Jan. 17
	BRIDGES.	
Feb. 3.	Muscatine, Ia.	Jan. 24
Feb. 3.	Spencer, Ind.	Jan. 24
Feb. 9.	New Castle, Ind.	Jan. 24
Feb. 9.	Fredericton, N. B.	Jan. 17
Feb. 10.	Arkadelphia, Ark.	Jan. 10
Feb. 10.	Castroville, Tex.	Jan. 3
Feb. 11.	Camden, N. J.	Jan. 24
Feb. 14.	Bay City, Mich.	Jan. 17
	Adv., Eng. Record, Jan. 17, 24.	
	PAVING AND ROADMAKING.	
Feb. 2.	Cincinnati, O.	Jan. 24
Feb. 3.	Tipton, Ind.	Jan. 31
Feb. 3.	Winnipeg, Man.	Jan. 31
Feb. 3.	Springfield, Mo.	Jan. 24
Feb. 3.	Cleveland, O.	Jan. 10
Feb. 4.	Brooklyn, N. Y.	Jan. 24
Feb. 4.	Portland, Ind.	Jan. 17
Feb. 4.	Sandusky, O.	Jan. 10
Feb. 4.	Cincinnati, O.	Jan. 10
Feb. 5.	Morton Park, Ill.	Jan. 31
Feb. 7.	Road Roller, Akron, O.	Jan. 31
Feb. 9.	New York, N. Y.	Jan. 31
Feb. 9.	Madison, Wis.	Jan. 24
Feb. 9.	Toledo, O.	Jan. 17
Feb. 10.	St. Louis, Mo.	Jan. 31
Feb. 10.	Sioux City, Ia.	Jan. 31
Feb. 10.	Buffalo, N. Y.	Jan. 31
Feb. 10.	Newark, O.	Jan. 17
Feb. 13.	Kenton, O.	Jan. 24
Feb. 14.	Dallas, Tex.	Jan. 31
Feb. 14.	Chippewa Falls, Wis.	Jan. 31
Feb. 14.	Lafayette, Ind.	Dec. 27
Feb. 16.	Burlington, Ia.	Jan. 31
Feb. 16.	Cincinnati, O.	Jan. 31
Feb. 17.	Three Rivers, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 18.	Cleveland, O.	Jan. 31
Feb. 20.	Iowa City, Ia.	Jan. 31
Feb. 23.	Morristown, N. J.	Jan. 31
Feb. 23.	North Manchester, Ind.	Jan. 31
Feb. 23.	Fond du Lac, Wis.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
Mar. 2.	Newburgh, N. Y.	Jan. 31
Mar. —	San Diego, Cal.	Jan. 31
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Feb. 2.	Rayne, La.	Jan. 17
Feb. 7.	Port Arthur, Tex.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 10.	Granbury, Tex.	Jan. 17
Feb. 11.	Bluffton, Ind.	Jan. 31
Feb. 12.	Guayaquil, Ecuador	Dec. 20
Feb. 18.	St. Francisville, La.	Jan. 31
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
———	Hyattsville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Feb. 2.	Ft. Wadsworth, N. Y.	Jan. 10
Feb. 3.	New York, N. Y.	Jan. 10
	Adv., Eng. Record, Jan. 10, 17.	
Feb. 3.	San Francisco, Cal.	Jan. 3
Feb. 4.	Algiers, La.	Jan. 17
Feb. 4.	Boston, Mass.	Jan. 10
Feb. 5.	Grand Rapids, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10 to 31.	
Feb. 5.	Ft. Apache, Ariz.	Jan. 10
Feb. 6.	West Point, N. Y.	Jan. 31
Feb. 6.	Ft. Logan, Colo.	Jan. 10
Feb. 7.	Sewer, Philadelphia, Pa.	Jan. 10
Feb. 7.	Dry dock, Philadelphia, Pa.	Dec. 20
Feb. 9.	San Diego, Cal.	Jan. 17
Feb. 9.	Superior, Wis.	Jan. 17
Feb. 9.	Little Rock, Ark.	Jan. 10
	Adv., Eng. Record, Jan. 10 to 31.	
Feb. 10.	Tulalip, Wash.	Jan. 31
Feb. 10.	Chicago, Ill.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 10.	Memphis, Tenn.	Jan. 17
Feb. 10.	Boston, Mass.	Jan. 10
Feb. 11.	Ft. Mansfield, R. I.	Jan. 31
Feb. 11.	Newport, R. I.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 12.	New Orleans, La.	Jan. 31
Feb. 12.	Memphis, Tenn.	Jen. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 12.	St. Augustine, Fla.	Jan. 17
	Adv., Eng. Record, Jan. 17, 24.	
Feb. 12.	Boston, Mass.	Jan. 17
Feb. 12.	Newport, R. I.	Jan. 10
	Adv., Eng. Record, Jan. 10 to 31.	
Feb. 13.	Norfolk, Va.	Jan. 17
	Adv., Eng. Record, Jan. 24.	
Feb. 16.	New Bedford, Mass.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 16.	Ft. Riley, Kan.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 16.	New York, N. Y.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 16.	Boston, Mass.	Jan. 17
Feb. 17.	Phoenix, Ariz.	Jan. 24
Feb. 18.	Boston, Mass.	Jan. 24
Feb. 18.	Dallas, Tex.	Jan. 24
Feb. 18.	San Francisco, Cal.	Jan. 17
Feb. 19.	Ft. Dade, Fla.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 19.	Duluth, Minn.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 19.	Grand Rapids, Mich.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 19.	Chilocco, Okla. Ter.	Jan. 21
Feb. 19.	Ft. D. A. Russell, Wyo.	Jan. 24
Feb. 19.	Burlington, Ia.	Feb. 17
	Adv., Eng. Record, Jan. 17, 24.	
Feb. 20.	Burlington, Vt.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 20.	New York, N. Y.	Jan. 24
Feb. 20.	Boston, Mass.	Jan. 24
Feb. 21.	Boston, Mass.	Jan. 24
Feb. 21.	Bldg., Philadelphia, Pa.	Jan. 17
Feb. 24.	Ashland, Wis.	Jan. 31
Feb. 24.	Chicago, Ill.	Jan. 24
Feb. 25.	Creston, Ia.	Jan. 17
	Adv., Eng. Record, Jan. 17, 24.	
Feb. 28.	Nashville, Tenn.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 28.	Ft. Terry, N. Y.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Feb. 28.	Mobile, Ala.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Mar. 2.	Jamestown, N. Y.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Mar. 3.	Helena, Mont.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Mar. 5.	Haines, Alaska	Jan. 24
Mar. 5.	Janesville, Wis.	Jan. 24
Mar. 11.	Wilkesbarre, Pa.	Jan. 31
	Adv., Eng. Record, Jan. 31.	
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
	BUILDINGS.	
Feb. 2.	School, Willimantic, Conn.	Jan. 31
Feb. 2.	School, New York, N. Y.	Jan. 24
Feb. 2.	Court House, Hamburg, Ark.	Jan. 24
Feb. 2.	School, Syracuse, N. Y.	Jan. 24
Feb. 2.	School, Darien, Wis.	Jan. 17
Feb. 2.	Hotel, Beaumont, Tex.	Jan. 10
Feb. 2.	Warehouse, Aberdeen, S. D.	Jan. 10
Feb. 2.	City Hall, Houston, Tex.	Dec. 13
Feb. 3.	School, Clinton, La.	Jan. 24
Feb. 3.	School, Columbus, O.	Jan. 10
Feb. 4.	Church, Guttenberg, Ia.	Jan. 31
Feb. 5.	School, Buffalo, N. Y.	Jan. 31
Feb. 6.	Htg. Pub. Bldg., New York, N. Y.	Jan. 31
Feb. 6.	School, Chicago, Ill.	Jan. 31
Feb. 6.	Pub. Bldg., Boone, Ia.	Jan. 24
Feb. 7.	Court house, Warren, O.	Jan. 31
Feb. 7.	School, Toledo, O.	Jan. 17
Feb. 9.	Engine house, New York, N. Y.	Jan. 31
Feb. 9.	School, New York, N. Y.	Jan. 31
Feb. 10.	School, Huntington, W. Va.	Jan. 24
Feb. 10.	Court house, Lawrence, Kan.	Jan. 17
Feb. 11.	Pub. Bldgs., Brooklyn, N. Y.	Jan. 31
Feb. 14.	School, Weatherford, Okla. Ter.	Jan. 31
Feb. 14.	Library, Norfolk, Va.	Jan. 10
Feb. 15.	Library, Portsmouth, O.	Jan. 31
Feb. 16.	Pub. Bldg., Oshkosh, Wis.	Jan. 31
Feb. 16.	Gymnasiums, Columbus, O.	Jan. 31
Feb. 16.	Office Bldg., Flint, Mich.	Jan. 31
Feb. 16.	Court house, Franklin, La.	Jan. 31
Feb. 17.	Church, Carrollton, Ky.	Jan. 17
Feb. 18.	Court house, Lawrence, Kan.	Jan. 24
Feb. 18.	Church, Selma, Ala.	Jan. 17
Feb. 20.	Court House, Newport, Ind.	Jan. 24
Feb. 25.	Pub. Bldg., Des Moines, Ia.	Jan. 31
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
Mar. 5.	Hospital, Springfield, O.	Jan. 31
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
	MISCELLANEOUS.	
Feb. 2.	Park Work, Trenton, N. J.	Jan. 31
Feb. 2.	Ash carts, etc., Brooklyn, N. Y.	Jan. 24
Feb. 3.	Supplies, New York, N. Y.	Jan. 31
Feb. 3.	E. Ry. franchise, Pasadena, Cal.	Jan. 17
Feb. 4.	Dock, Newark, N. J.	Jan. 31
Feb. 4.	Levee Work, Shreveport, La.	Jan. 17
Feb. 5.	Levee Work, Bossier City, La.	Jan. 10
Feb. 6.	Dredging, Buffalo, N. Y.	Jan. 31
Feb. 9.	Supplies, New York, N. Y.	Jan. 31
Feb. 20.	Garb. Disp., Kansas City, Mo.	Jan. 31
Mar. 1.	Grading, Beaumont, Tex.	Jan. 24
Mar. 3.	Cement, Winnipeg, Man.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	R. R. work, Cincinnati, O.	Dec. 20

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Water Waste in New York City.

There has just been made public considerable definite data of an interesting character regarding the waste of public water in the city of New York. A full and detailed account of the operations now being carried on by the Commissioner of Water Supply, Gas and Electricity was published in The Engineering Record of January 31. As explained in that statement, these operations consist in the actual measurement of water which flows into a clearly defined district delimited for this particular investigation. The number of people, both resident and transient, in the district, is carefully ascertained by the most reliable means available. A house to house inspection is made to determine with certainty the condition of the plumbing, and equally positive means are employed to ascertain whether there is leakage in the street mains. In other words, the amount of water flowing into a well defined district is measured by the most accurate means available in hydraulic engineering at the present time, and then measures of equal accuracy are also taken to ascertain in just what way the water is consumed, so that all elements of the problem, including useful consumption, wasteful consumption and actual waste may become definitely known. The plans of procedure have been so fully and accurately outlined in this journal, that it is not necessary to make more than incidental reference to them here.

It is the intention of the Department of Water Supply, Gas and Electricity, to select a number of these well defined districts so as to make them truly characteristic of all portions of the city, and then secure accurate data bearing upon all the conditions of water consumption and waste. In all these measures the co-operation of the Committee on Additional Water Supply, recently created, is actively enlisted as a part of their prescribed duties. Complete data for two of these districts only have been obtained, although actual instrumental measurements by the pitometer, have been completed. When these data for the third district, as well as for others to follow, shall have been completed, the results, it is understood, will be given to the public as have been those for the first and second districts.

The first district treated contains some of the highest class of residences in New York city, as it is bounded by 34th Street and 42d Street, on the south and north, and by Sixth Avenue and Lexington Avenue on the west and east, respectively. This district also includes a number of the largest and best hotels in the city, so that the effect of the non-resident public on the consumption per capita may easily be discovered. Out of a population of a little over 12,000 in this district, the transient portion is about 3,760, or nearly one-third. The total daily amount flowing into this district at the beginning of the investigation was 223 gallons per head per day. After making what was practically a house to house inspection of the plumbing and discovering and stopping a few leaks in the mains, the total quantity per head was reduced to 175 gallons, these rates applying to the resident population only. If the results of the investigation be applied to the total population of the district, both resident and non-resident, the first daily rate of consumption is reduced to 154 gallons per head, and after the stoppage of the preventable waste, to 121 gallons per head. The inclusion, therefore, of the non-resident population in the district reduces the consumption per head per day by about one-third of that which would be found if the total consumption were charged to the resident population only. This single instance shows that the neglect of the transient population in the city of New York leads to a gross error in estimating the consumption per head per day, and gives strong emphasis to the editorial comments of January 10, on the same feature of New York City's water supply and consumption. Again, it is important to observe that the stoppage of the preventable waste saved a little less than one-fourth of the total consumption, this saving being accomplished under the immediate presence and criticism of the inspectors.

The per capita consumption of the total population in this district even after the stoppage of preventable waste, was 121 gallons per day, which is in striking contrast with the unqualified statement of some well-meaning, but ill-informed amateurs in the daily press, who stated that 30 gallons was so abundant a supply that it probably could not be used without a good deal of waste. This feature of the investigations confirms with conclusive force the point also made in our editorial, that the habits of the people must be taken into account when considering per capita consumption of water. In this district practically all the people are in the habit of using water, as well as other things, with lavish abundance. Amateur critics of water supply may call this wasteful or extravagant, but it is a requirement of people who consume water usefully though abundantly, and it is a demand which must be reckoned with. Too much insistence cannot be made upon this point. This lavish use of water in great cities is one that must be provided for, simply because a large portion of the population who are able and willing to pay for it, demand it, and will not be satisfied with anything else.

District No. 2 possesses a residential character at the other extremity of the line. It is situated between 86th Street and 80th Street, on the north and south, and Second Avenue and East River on the west and east; it is a dense tenement district in which the requirements of the people dwelling there are a minimum. Probably no set of dwellers, in any large city can be found whose use of water would be less per head than that in this district. The population is about 40,000, and practically all resident. The total amount of water flowing into the district at the beginning of the investigation was only 37 gallons per head, and after the elimination of preventable waste, that quantity was reduced to 27½ gallons per head per day. Rather curiously the reduction by elimination of waste was a little less than one-fourth the gross amount, precisely the same percentage as in district No. 1. The consumption in this portion of the city represents what may reasonably be expected, where the least possible amount of water is used for personal cleanliness and other requirements of the least civilized life which can be tolerated in a large city and it presents just about the quantity to which the ambitious amateurs, to whom reference has already been made, would reduce the entire city according to their own statements. In short, it represents the most meagre allowance of water per head which can be assigned to that unfortunate class who would probably mostly avoid all use of it if they could.

Although these investigations are but partial and apply to two comparatively small districts only, one of the most important results disclosed is that which has been the subject of exceedingly erroneous interpretation in some quarters heretofore. In district No. 1, the high class residential district, it was observed that the rate of night flow between 2 a. m. and 4 a. m. was about 90 per cent. of that during the active hours of the day. This has frequently been interpreted heretofore to mean that a large amount of water was running to waste in some way, perhaps through seriously leaky mains. As a matter of fact, it was shown in this instance to be due to the flow into the tanks of hotels, private houses and other buildings, the supply for which must be daily replenished in this manner. In district No. 2 of the dense tenement class, water tanks are a far smaller element in the problem and the rate of night flow was but 50 per cent. of that for the day, as the small tank volume requires a correspondingly small amount of water to replenish it. This particular result of the investigation has most important significance, and shows that the night flow to replenish tanks depleted in the daytime may account for a large portion of the daily supply of New York city which has commonly been charged to waste.

Another important result of these investigations bears upon the financial feature of the water situation. When the frontage rates of payment for district No. 1 and district No. 2 are reduced to a charge per 1,000 gallons of water on the basis of the quantities consumed, as actually measured, it is found that the tenement house people are paying approximately 10 cents per 1,000 gallons of water as against 7 cents for district No. 1, the high class residential district. The system of frontage rates, therefore, requires the tenement population to pay nearly 50 per cent. more for the same quantity of water than the wealthiest people of the city. A more severe comment upon the frontage rate as compared to the rational meter system could not be made. There is one simple remedy for this injustice of the present conditions, and that is to make a reasonable meter rate and then install the meter system throughout the entire city.

An Unusual Sewer Entrance is being constructed in St. Paul. By a boring about 15 feet deep in the sand rock beneath the basement of the city hall access will be provided to the city's extensive system of sewer tunnels excavated in the rock.

Hotel Belmont.

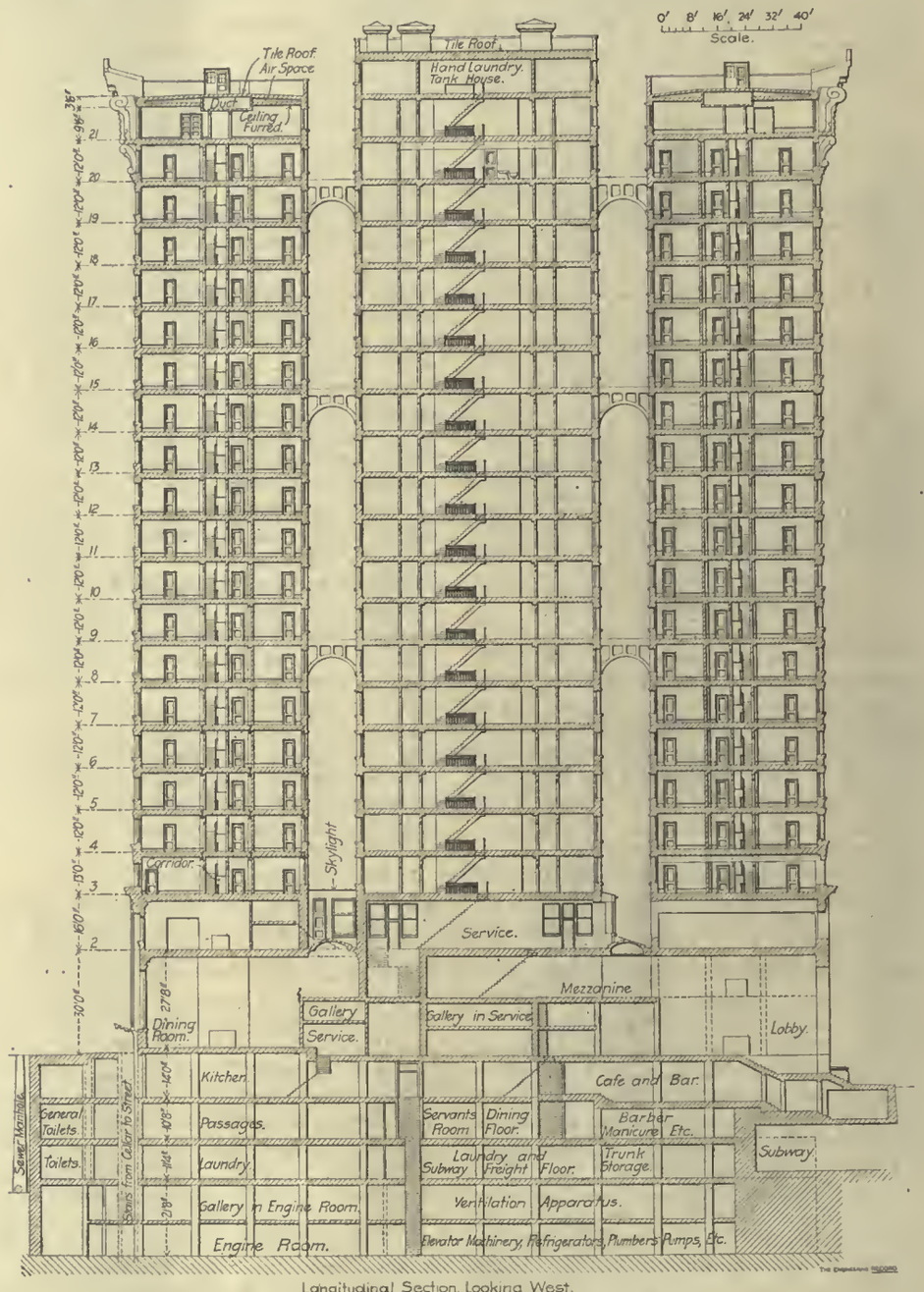
At the southwest corner of Park Avenue and 42d Street, New York, there is now being built a twenty-six-story steel cage fireproof hotel which extends from 41st to 42d Streets. The design is of interest on account of the magnitude of the structure; the provisions made for large unobstructed rooms and for wind bracing; the system of plate girders above the street level which carry many stories of heavy columns; and because five of the twenty-six stories are built below the surface of the street in a pit excavated in solid rock. The four tracks of the Rapid Transit Railway, which emerge near the hotel from the Park Avenue tunnel, turn into 42d Street with a minimum radius of 180 feet and pass under the corner of the building with their rails at a level about 25 feet below the surface of the street. The subway structure here rests on solid rock and is built with steel columns and roof girders filled in with brick and concrete. The roof girders are made special, and are proportioned to carry above the tracks a number of main columns of the building which are twenty-three stories in height and have loads of as much as 2,360,000 pounds each.

Unusual conditions and requirements were met with in the execution of the work which was of especially difficult character for the substructure. The excavation extended about 40 feet south of the building line to the center of 41st Street, and at that point was carried down to a depth of over 60 feet below the surface, all but the upper 5 feet being through solid rock. The surface of the ground sloped downwards about 10 feet to the 42d Street curb, and the surface of the rock was inclined in the same direction at a steeper slope so that it was about 20 feet below the surface at that point, leaving an excavation of 35 feet through it to subgrade on the north side of the building. This involved the excavation of about 11,000 yards of earth and 40,000 yards of rock; and its removal at one of the most congested points of the city's traffic, where a considerable obstruction existed and very difficult work was already in progress. The building of the Rapid Transit Subway, partly in open trench and partly in tunnel was being carried on over a part of the hotel site and adjacent to it on both sides. Three sides of the lot are bounded by the streets. At the fourth side a tall and massive brick building, containing the Lincoln bank and safe deposit vaults, extended to the party line and required absolute protection from any displacement or injury. This made the work of blasting and handling the rock very difficult and costly, and necessitated special methods, which have proved safe and satisfactory.

The rock is in strata from 1 to 4 feet thick, dipping about 30 degrees from the vertical, down towards the west. It is irregular in character, some portions being sound and hard, others soft, decayed and very shaky, with numerous water bearing seams. It was found to quarry best from east to west, and the excavation was therefore made from an initial trench about 10 feet wide that was driven from north to south across the center of the lot in successive benches about 10 feet deep. As fast as each bench was excavated, work was begun at the north end of the lot in quarrying out faces from both sides of it to the east and the west. These were also worked about 10 feet deep and as fast as room was secured and the middle trench was carried down, additional ones were started on both sides. Hence subgrade was first reached in the middle of the north side of the lot, and excavation progresed in a fan-shaped area toward the south side, affording opportunity for drilling, blasting and removing the stone to be constantly in uninterrupted progress.

All of the rock was handled by four stiff-leg derricks with 60-foot 5-ton booms, each operated by a double-drum Lidgerwood hoisting engine with swinging gear. One derrick was seated at the bottom of the pit (and later on a tower) near the middle of the west side and commanded all of the work, except what could be reached by the three derricks which were seated on top of the bank. The pit derrick was located so as not to be moved horizontally, and handled probably 10,000 yards of material from the same position. As the excavation descended, the derrick was raised on a tower 40 feet high to enable it to deliver to the wagons in the street. On the east side of the lot the steep pitch caused the rock to slide down in great masses from the working face and single blasts have thus dislodged as much as 1,000 yards of stone.

On the west side of the lot the same inclination of the strata operated to prevent the rock from sliding and was a most fortunate condition for the safety of the Lincoln Bank Building. The high brick side wall of this building had an ordinary concrete footing on the surface of the rock from 5 to 25 feet below the street level. The excavation was carried down in the vertical plane of the face of this wall and the utmost care was taken to avoid any injury to the wall. As the rock sloped down towards the wall, there was no tendency for it to slide out into the excavation. Had the conditions been reversed, or the wall located on the east side of the lot, it would have been very difficult, if not impossible, to make the excavation to so great a depth. Three-inch vertical holes from 6 to 8 inches apart on centers were drilled to a depth of 18 feet along the entire face of the wall. A parallel row of 3-inch holes 2 feet apart were drilled 2 feet from the wall and were loaded with light charges of 40 per cent. dynamite. No charges were put in the first row of holes; but they were so close together that when the second row was fired the rock was shattered and broke off on a weakened cross section through the line of these holes. The blasts were protected by heavy timbers about 10 feet long chained together in groups of ten and placed on end



Longitudinal Section Looking West.

HOTEL BELMONT, NEW YORK CITY.

WARREN & WETMORE, ARCHITECTS; F. A. BURDETT, CONSULTING ENGINEER.

slightly inclined against the working face. Three or four of these groups were used together and were covered with a net woven from heavy rope suspended over the upper edge of the working face.

On the north-east corner of the lot it was at first intended not to carry the excavation below the floor of the subway; but the rock there was found to be so unsound and shaky that it was necessary to excavate pits to subgrade and build in them concrete piers 24 feet high to carry the main columns. The face of the rock underneath the subway was also so unsound that it was necessary to protect it with a heavy retaining wall of concrete strengthened by vertical steel I-beams. Similar walls were built around all sides of the excavation and were grouted solid against the irregular rock face and braced across the lot by the beams and girders in the floor systems, which were calculated to resist any possible thrust from exterior earth or water pressure. This thrust was not considered so large on the north and south sides; but on the east side it was much greater on account of the dip of the strata, and the wall there was made very heavy and well braced.



View of Excavation, Looking toward Forty-first Street.

The sidewalk across the end of the lot on the north side of 41st Street was abandoned at the beginning of operations and pedestrian traffic was transferred to the opposite side of the street. Vehicular traffic was not impeded, and in order to carry it over the excavation a trench was dug down to the surface of the rock on the curb line across the street front and in it a heavy combination truss 10 feet deep and 100 feet long was set with the upper chord about 5 feet above the surface of the street, so as to form a solid protecting hand rail or barrier. It was supported by a sill at the west end and by trestle bents in the middle and at the east end, all seated on the surface of the rock. From this truss were suspended the north ends of wooden floor beams, which were laid on top of the original asphalt roadway surface and extended to the curb on the south side of the street. These transverse girders were covered with 4-inch longitudinal planks on which was nailed a wearing surface of 2-inch diagonal planks. This slightly raised the surface of the street and allowed the excavation to be continued farther southward from the lot to the center of the street underneath the bridge and still afforded ample bearing for the south ends of the floor beams on the undisturbed pavement. The truss was calculated to carry the heaviest possible load of automobiles and heavy trucks for a clear span of 60 feet.

The excavation was commenced under the west end of the bridge for a length of about 40 feet, where a north and south slot was first cut. From it the rock was blasted off on the east side, throwing it to the west by taking advantage of the stratification. When the excavation had been carried 40 feet east of the end of the truss, a vertical post was set on the east side of it to support the truss intermediately, and the trestle-bent, which had previously been placed on the surface of the rock near that point to carry the middle of the truss was removed. Knee-braces were run from the bottom chord to a point 20 feet below the top of the post and to a similar position in the face of the west side of the excavation, and their feet were connected by a horizontal timber strut, which gave additional rigidity to the vertical post.

Another section of rock, 40 feet long from east to west, was then excavated underneath the bridge and at the west end of it a second vertical post corresponding with the one already described was set to support the truss about 20 feet from the end. It had two knee braces to the lower chord of the truss, and being thus secured in opposite directions did not need the horizontal brace. The end of the truss overhung the top of the outer knee brace by about one panel, and although it was calculated to have ample strength as a cantilever additional security was provided by supporting the extremity on a heavy transverse beam reaching from the top of the subway wall to a vertical post on the rock under the street surface, which helped to carry the truss after the trestle bent, which had previously been set on top of the sloping rock surface, was removed.

All of the stone removed from the excavation was delivered by the derricks to wagons, which carried away the larger pieces for use in riprap work. The smaller stone was crushed and used for concrete which was mixed near the work in a Ransome drum mixer. A large quantity of water was encountered and was collected in several small sumps from which it was delivered by steam siphons to a central sump which was emptied by a large Worthington pump. About twenty 3¼x6-inch Rand drills were used on the work and they, together with the hoisting engines and pump, were at first operated by compressed air from the contractors' plant at East 42d Street. When the maximum quantity of power was required a 150-horse-power battery of steam boilers was installed. About one hundred men were employed in each of two eight-hour shifts working from seven in the morning until eleven at night, and using torches and a few Well's lights for artificial illumination. The contractor for the excavation was the Degnon-McLean Contracting Company, Mr. H. C. Sanford, chief engineer.

The steel framework is approximately symmetrical about the east and west line through the center, although there are minor variations in the framing and in the arrangement of columns and girders on the opposite sides. There are in the upper stories seventy-two main columns with closed rectangular sections made with two channels and two cover plates. They are located from 15 to 28 feet apart at the intersections of six north and south and thirteen east and west lines, as shown in the half beam plan for tier J at the fifth floor. The principal girders are generally pairs of 12-inch 40-pound channels separated about 15 inches back to back with their webs riveted across the faces of the columns. In some places the long-span girders are single 20-inch 80-pound I-beams. The floor beams are single I-beams most of them from 9 to 12 inches deep and from 5 to 7 feet apart, with riveted web connections to the girders. Where they are connected to the double girders, the webs of the latter are connected by vertical transverse riveted diaphragms made of plates and angles in the planes of the floor beams. The wall girders are generally single I-beams bracketed out beyond the faces of the columns and having intermediate connections to the floor beams on the center lines or inner faces of the wall columns. Tier J, in the fifth floor above the ground level, is typical of the general arrangement, connections and dimensions of the floor beams and girders in most of the floors above the fourth. The third tier differs from it in the arrangement and spacing of beams, and the location of columns which are carried on heavy plate-girders spanning the unobstructed dining-room.

The extended bases of all columns inside the line of the subway are seated on I-beam grillages, except adjacent to the Lincoln Bank Building, where the columns have small bases and are seated in groups of three on long triple-web girders. The regular grillages are about 7 feet square, and are generally made with single layers of 15-inch or 20-inch I-beams. The grillages are set on beds of concrete leveled up in the bottoms of shallow pits dug below the level of the cellar floor, so as to bring the tops of the grillages below the floor level and prevent any obstruction, except that due to the column itself. This construction was considered more economical than to dress the surface of the rock to a level bearing. The grillages were proportioned for a pressure of 16 tons per square foot on the concrete. The accompanying foundation plan of the northeast corner of the building indicates the general arrangement of the column footings, and shows the position of the retaining wall for the subway, and the location of the columns beyond it which are carried on the subway girders.

The plan of the subway roof shows its construction on the curve where it has an entrance underneath the hotel, and indicates the location of the subway columns and girders which carry the hotel structure above the tracks. In this plan the positions of the subway columns, which support the girders, are indicated by their dotted cross sections, and those of the hotel columns, which are carried on the girders, are indicated by small full circles. The positions of the subway tracks are indicated by their center lines and the roof girders and beams are shown supported at the ends, in some instances, by the wall columns of the subway and in others on bearing plates resting directly on the masonry of the retaining walls. The subway columns are made with special sections to carry loads up to 2,228,000 pounds each. They are built up with plates and channels and have closed rectangular cross sections which are sometimes reinforced by a center web consisting of two channels riveted together back to back. The cap plates are wide enough to give bearing for the full width of the girder flanges and are supported beyond the column sections by gusset plates and vertical stiffener angles, as indicated in the typical detail.

The columns have their lower ends milled for butt joints with pedestals which correspond in cross section to the body of the column. Where the columns are seated directly on the grillages, these pedestals have vertical webs or gusset plates in the planes of the column cover-plates, which extend from the bases to the full width of the grillages, and are reinforced by pairs of vertical stiffener angles. They are connected to the columns with horizontal flange angles riveted to the channel webs and with cover-plates which are shop-riveted to the pedestals and project beyond them to form jaws which are field-riveted to the columns. The pedestals are connected to the grillages by bolts which engage bent washers fitted to the beveled undersides of the top flanges of the latter. The heavily loaded columns are seated on triple web distributing girders across the tops of the grillages. Their pedestals correspond to the cross sections of the columns and have no projecting web plates, but are reinforced by vertical stiffener angles riveted to the channel webs and cover-plates and milled at the lower ends to bear with connecting flanges and without base plates on the tops of the distributing girders.

The plate girders in the subway roof have multiple webs and are seated across the caps of the subway columns to which they are connected with 1-inch turned bolts through their lower flanges. The girder webs are reinforced at column bearings by pairs of vertical web stiffener angles riveted together back to back with filler plates between them, as indicated in the diagram of the typical cross section and of the bearing over column 65 which carries a load of 2,362,000 pounds. This column supports one end of one of the heaviest girders in the subway roof which carries, directly above column 65, a hotel column with 1,840,000 pounds load and about 18½ feet beyond it another hotel column with 1,320,000 pounds load. The girder is nearly 30 feet long and is supported at the opposite end by column 64, which is loaded with 2,228,000 pounds from it and from the girder 64-63 which makes a butt joint with girder 64-65 in the center of the cap of column 64 and carries two hotel columns 15 feet apart with loads of 1,380,000 pounds and 1,350,000 pounds.

Tiers G, H and I are special on account of the long-span girders in the ceiling over the first story and in the next two floors above. All of the tiers below are special on account of the change of grade, the introduction of Mezzanine and gallery floors, the heavier loads for which they are proportioned and for the variations in the plan caused by the clearances for the subway, and by the extension under 41st Street. They do not, however, contain any long-span girders or special features of interest in their details and connections. The second floor girders are proportioned to carry only the ceilings of the dining-room and lobby, and the loads in the story above; but are not designed to carry any part of the weight of the upper stories because such service would either



View of Excavation, Looking toward Park Avenue.

Outside of the curb line the hotel girders and beams were proportioned for maximum bending stresses of 20,000 pounds per square inch and 10,000 pounds shear; with 25,000 pounds bearing and 12,500 pounds shear for shop-driven rivets and 25 per cent. less for field-driven rivets. Inside the curb line the maximum bending stresses in girders and beams are 14,000 pounds and 16,000 pounds per square inch respectively. The shear is 9,000 pounds and the columns are loaded to 14,000 pounds per square inch of cross section. Shop-driven rivets have 20,000 pounds bearing and 10,000 pounds shear and field-driven rivets have 20 per cent. less. In the lower stories the spaces between the webs of the floor-beams are filled with flat concrete arches leveled up to 7½ inches below the tops of the upper flanges for all beams and girders less than 33 inches deep. Where the girders are more than 33 inches deep, the concrete arch is full centered, and is leveled up to a height of 25½ inches above the lower flanges.

have required them to be made extremely heavy or with so great a depth that they would have projected too far below the ceiling line. They were therefore made about 3½ feet deep, and have their lower flanges enclosed in ornamental ceiling panels.

The girders, 33-42, 34-41, 35-40, and corresponding ones on the south side of the south light court, in the H tier next above, are made much deeper and are arranged in three sets on each side of the light courts. They have spans of about 46 feet clear and are divided into three panels where there are bearings for two intermediate columns nineteen stories high. These girders are made with triple webs, and are seated on the cap plates of the second story columns. As the girder flanges are much wider than the normal sections of the columns, the columns are provided with special short upper ends, like reversed pedestals, which are

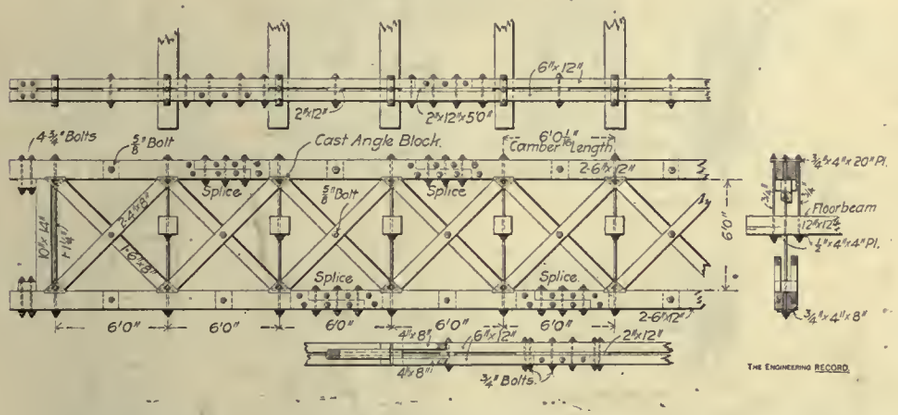
shipped separate and field-riveted to the columns when the latter are erected. The girders have vertical end plates which are field-riveted to their web stiffener angles and project above the upper and lower flanges to engage the cover plates of the third and second story columns and thoroughly splice all the members together. Lateral stiffness is also provided at this point by solid web knee braces to the upper and lower flanges at the end of the girder.

In one case the clearance was not sufficient to permit deep girders in this tier, and shallower ones were used which carried the third floor only and were suspended by vertical members from deep girders in the I tier. These are pairs of separate single web plate girders 5 feet deep and about 48½ feet long over all, and carry two columns eighteen stories high at points 7 feet each side of the center. They are made, as shown in the detail, with ½-inch web plates about 10¾ feet long with shop-riveted splices, and will be shipped complete from the bridge shops.

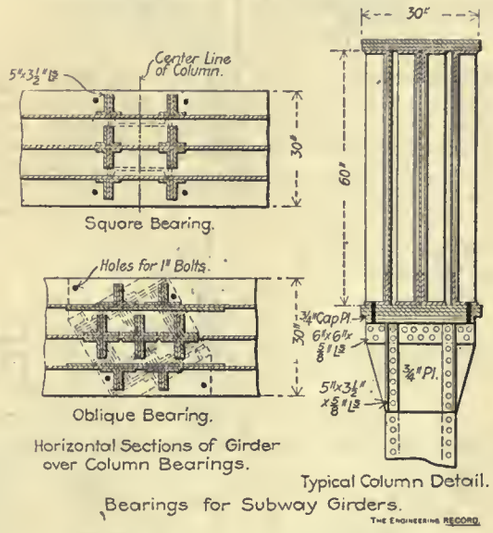
The floor beam flanges are flush with the highest part of the top flange cover plates and are notched to clear the girder flanges, which latter are made with pairs of 8x8x⅞-inch angles and 18-inch cover plates. The bent vertical hanger plate, which is shop-riveted to the web stiffeners on one side of the girder at the center point, is field-riveted between two pairs of 6x6x⅜-inch angles riveted together back to back, making a cruciform cross section. At the bottom they engage a similar web plate which serves as a transverse diaphragm web-connected at the ends, by short vertical angles, to the pair of 12-inch channels back to back which forms the third story floor girder. The other third floor girders are 5½ feet deep and of similar construction to the I tier girder already described. They are seated on the extended caps of the second story columns and each carries two intermediate columns 14 feet apart, as 69 and

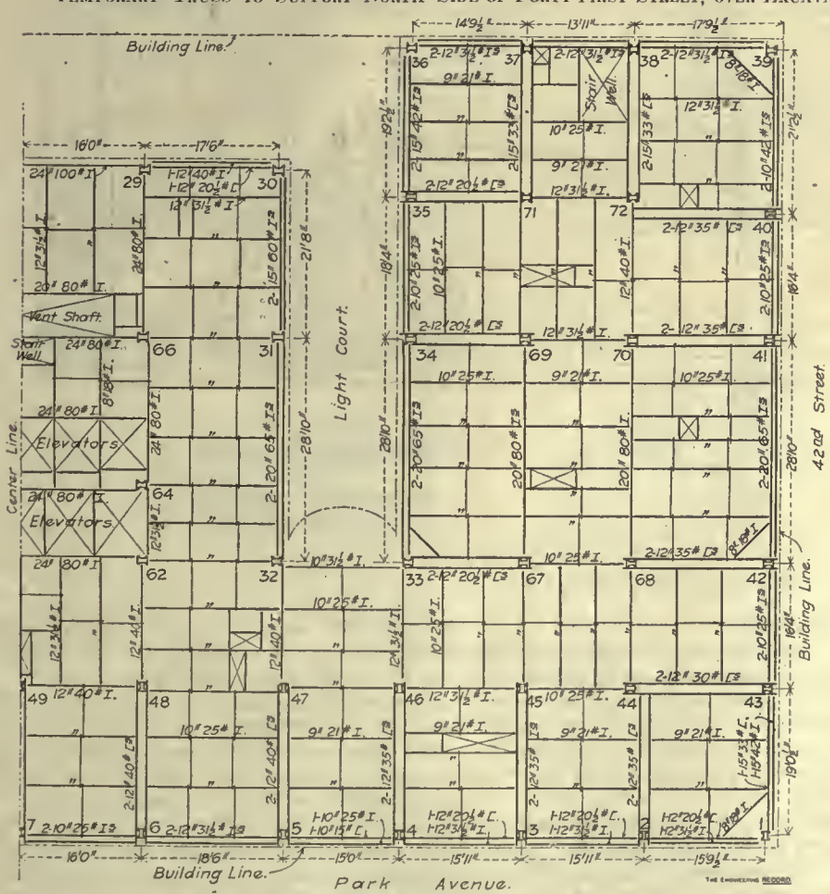


Plan of Subway Roof under Belmont Hotel, showing Girders which support Hotel Columns.

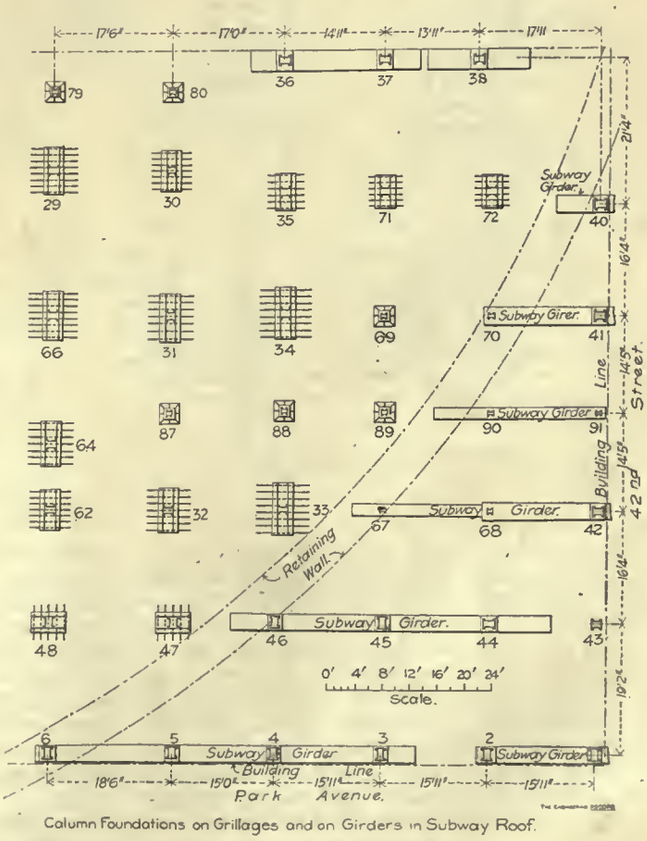


TEMPORARY TRUSS TO SUPPORT NORTH SIDE OF FORTY-FIRST STREET, OVER EXCAVATION.





Part of Fifth Floor Beam Plan, Tier J.



Column Foundations on Grillages and on Girders in Subway Roof.

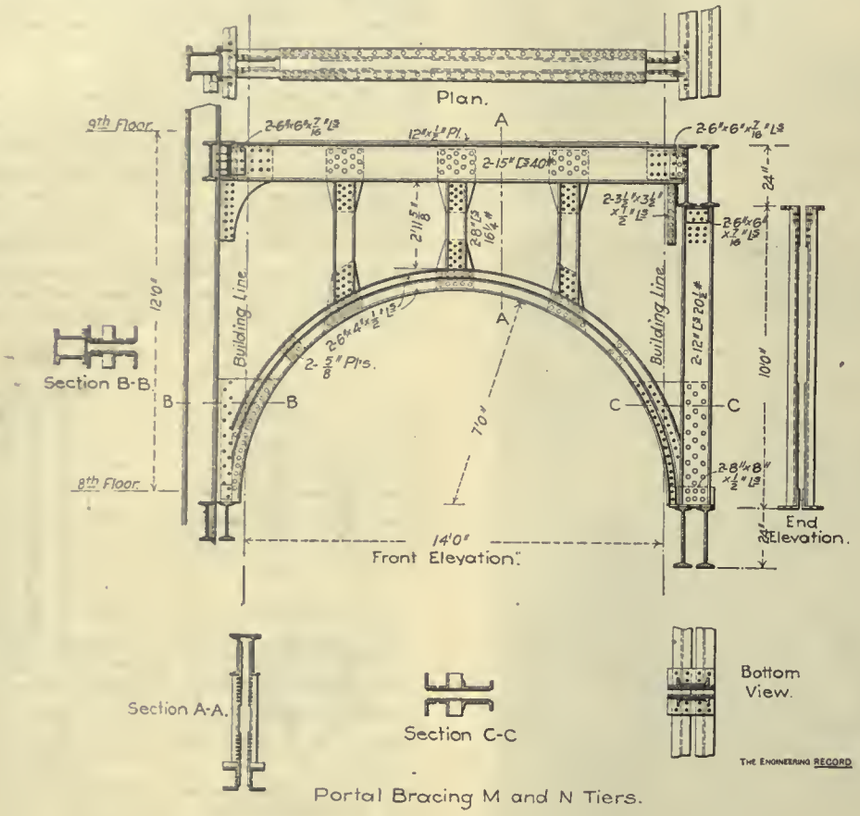
HOTEL BELMONT; TYPICAL BEAM PLAN, FALSEWORK TRUSS, SUBWAY ROOF AND GRILLAGE.

70, 71 and 72, etc. Their flanges are reinforced to a maximum thickness of 3¼ inches with four thicknesses of 18-inch cover plates, and the webs are stiffened with double pairs of 6x4-inch vertical angles riveted together back to back under the centers of the upper columns and with single pairs of intermediate stiffener angles from 4 to 6 feet apart.

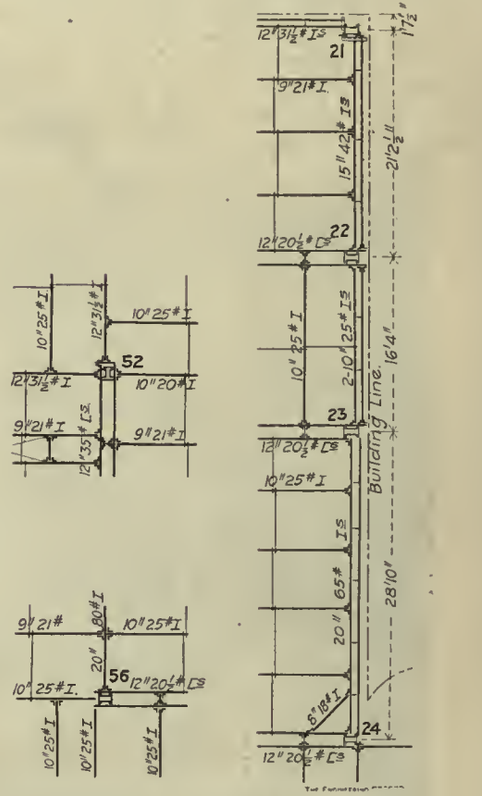
The building is proportioned to resist a wind pressure of 30 pounds per square foot of exposed vertical surface. The floors are connected across the light courts in three stories by heavy portal arches as shown in the elevation. It is assumed that the transverse stresses will be absorbed by the inertia of the building and by the solid floors which are stiffened by the lines of heavy plate girders at different levels with their deep and well-riveted connections to the columns. In the floors where the portal girders occur horizontal diagonal bars are riveted across the beams and girders to truss the floors, and in all floors the corners have 18-inch diagonal I-beams forming horizontal knee braces, as shown in the diagram of tier J. The floors are of the Roebling cinder concrete construction with segmental arches for the heavy loading up to street level, and with flat slabs in the upper stories, and are proportioned above the first floor, for a dead load of 70 pounds and live load of 60 pounds per square foot. The roof is of the same construction and is proportioned for a total load of 120 pounds per square foot. The columns are proportioned, according to the New York building law, to carry the full combined floor loads, minus 5 per cent. deducted for each story from the roof down. Columns 65 and 66 have loads of 1,796,000 pounds for which there is provided in the lower sections, a cross sectional area of 149 square inches made up of two 15-inch channels, six 18x¾-inch cover plates, two 14x⅝-inch and two 14x¾-inch cover plates. The maximum loads are carried on columns 15, 16, 41 and 42, which are proportioned for over 1,250 tons each.

All columns are made in two-story sections down to tier C, below which there is in most cases one three-story section. They are spliced with flange angles riveted to their webs, and with pairs of splice plates shop-riveted to the cover plates at the upper ends of the section to form jaws which are field-riveted to the lower ends of the columns above. Vertical angles are shop-riveted to the webs and cover plates for the field-riveted connections to floor-beams and girders, both of which are also supported in some cases by shelf angles under the lower flanges. A typical connection of beams and girders to an interior column is shown in the detail of column 14 where the pair of 15-inch channels, which form the double girder, are field-riveted across a plate which is parallel to the webs of the column channels and engages the flanges of vertical angles on the edges of the cover plates. The 15 and 20-inch floor beams are web-connected to these girders and to the faces of the column.

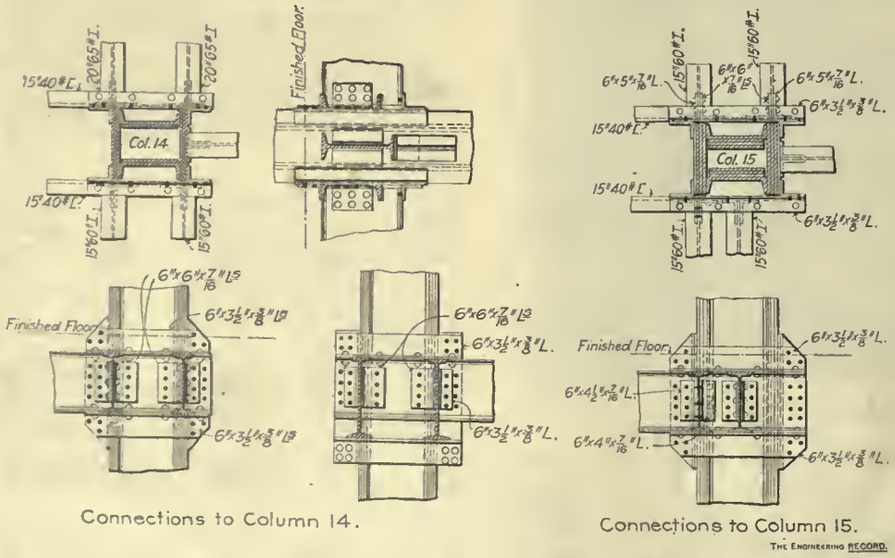
The details of column 15 show the connections in the 42d Street wall. The other columns correspond to these general features with such modifications as are developed by the different positions of the floor beams and girders. The extended bases of the columns are of the type shown in the detail, and are substantially equivalent to very deep, short girders spliced to the ends of the columns and distributing their loads over the grillage beams as before

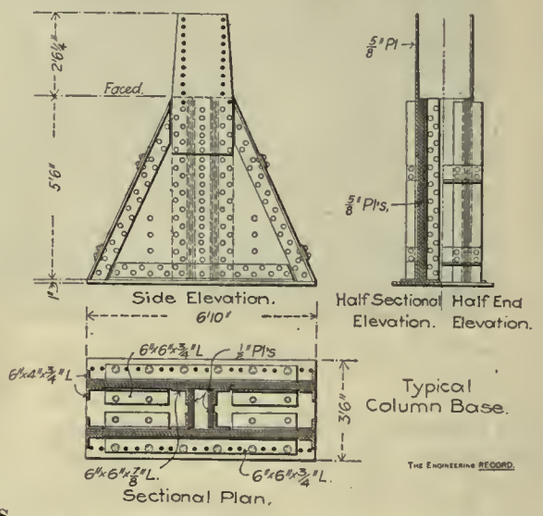


Portal Bracing M and N Tiers.



Details of Framing in South Half of Floors.





HOTEL BELMONT, FRAMING DETAILS.

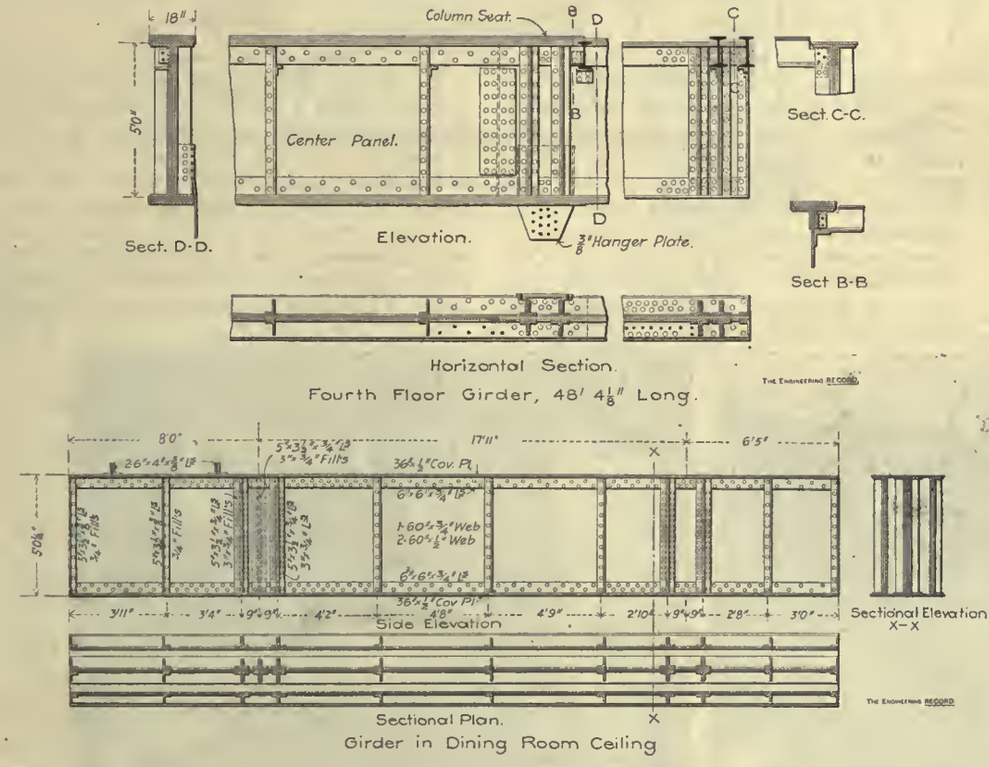
described. They have heavily reinforced double webs with flanges on the inclined edges which are braced together by tie plates. The bases are 1 inch thick, about 3 feet wide and 6 feet long. The webs are ⅝ inch thick and the angles are 6x6x¾ inches. The bases are shipped separate with the splice plates shop-riveted to them and projecting above the top to form jaw plates which are field-riveted to the columns.

The six portal braces which connect the floors across the ends of the light courts in the 8th, 14th and 19th stories are practically duplicates of the one between the M and N tiers which is shown in the accompanying detail. The arch has an I-shaped cross section made with two pairs of angles riveted together back to back and web-connected at one end to vertical flange angles on the sides of the columns. The other end is supported on the wall girders intermediate between columns, and is web-connected to a vertical strut which engages the wall girders in the eighth and ninth floors, and is connected with the upper transverse strut, which has end knee braces and short spandrel posts to the curved angles, thus giving the effect of an arch 5 feet deep at the crown and relieved with open panels between spandrel posts. All the members are covered with cinder concrete enclosed in wire lath finished with cement plaster. This protection is intended to afford thorough fireproofing and insure the protection of the strut even if subjected to fierce flames drawn through the flue-like shaft of the light court.

The sides of the cellar excavation are faced with a solid concrete wall reinforced by vertical I-beams about 5 feet apart and having their inner flanges flush with the inner face of the wall, and plastered with cement mortar. The height of this wall is 55 feet on the 41st Street side and is somewhat reduced to correspond with the slope of the ground on the Park Avenue and 42d Street sides. Adjacent to the subway there is a special section of it about 20 feet high to retain the unsound rock below the subway tracks. This portion is curved to a radius of about 160 feet on the vertical inner surface, and is 6 feet thick and not battered. Resistance to horizontal thrusts is provided at both ends, and it is assumed to possess considerable strength as an arch and is not reinforced by steel beams. There are, however, buttresses built on the convex side about 10 feet apart which are seated on the steep slope formed by the dip of the strata and are carried full width to the top of the wall and serve where necessary as footings for the subway columns.

On the 41st Street and 42d Street sides the wall is about 2 feet thick made of 1:3:5 Portland cement concrete and rammed in 6-inch layers around the I-beams and against the irregular rock face of the excavation, which is practically vertical. The lower ends of the I-beams have extended wing plates riveted across their flanges and to horizontal base plates. These are set in cement mortar on the surface of the rock and are bedded to a height of 16 inches in the solid concrete floor which thus affords horizontal reaction for thrust at the foot of the wall. The beams are 20 inches deep and weigh 65 pounds to the linear foot up to a height of 23 feet above the rock bottom where they are spliced to 15-inch 42-pound I-beams by pairs of horizontal flange angles riveted to their webs. The webs of the beams are connected by horizontal tie rods about 6 feet apart vertically. At the different floor levels the beams are braced horizontally by I-beams which have short vertical angles shop-riveted to the ends of their webs and field-riveted to the flange of the beam and to the retaining wall.

All exterior columns are built into the main walls, and have their inner surfaces enclosed by extensions to the brick work which is laid up close to the faces of the columns and thoroughly flushed with cement mortar. The interior columns are enclosed with common brick shells which have air spaces across the channel webs of the columns and are faced with tiles on the outer surface. The floor beams and girders have their webs and lower flanges entirely enclosed in cinder concrete which is filled inside of an envelope of wire netting. Where the girders project below the ceiling line, the concrete is formed against metal furring which receives the finishing plaster outside, uniform with the ceiling which is suspended from steel bars in the floor above, thus giving an additional security by the enclosed air space of a thickness approximately equal to the depths of the floor beams. The partitions and the ducts, which enclose the steam pipes for the heating system, are made of concrete or cement mortar on metal furring of the standard Roebling system.



The cellar walls and floor are waterproofed by tarred felt which covers the surface of the concrete, and is protected by cement mortar or brick work. Special provision was made for waterproofing the bases of the columns. The bottoms of the shallow pits in which the grillages are contained below the cellar floor, are leveled up with mortar and covered with 4-ply tar paper laid in hot asphalt. On this surface another course of cement mortar is spread to receive the grillage beams, the interstices between which are also grouted or filled with concrete which encloses them to a depth of 2 inches outside. The corners of this concrete are carefully rounded, and the brick fireproof protection, which surrounds the column is built on it. The tar paper is flashed up around the concrete which encloses the grillage about 4 feet high on the brick work, and is protected by 1:3:5 concrete made with very fine broken stone and filled in over the tar paper in the corners and upper part of the grillage pit. Above the cellar floor the flashing is plastered with cement mortar, in which the tiles for the column faces are laid.

Excavation was very nearly completed in December, 1902, the erection of steel was commenced in January, 1903, and it is expected that the building will be ready for occupation by the latter part of this year. Messrs. Warren and Wetmore are the architects. Mr. F. A. Burdett is the consulting engineer for the steel construction. Marc Eidlitz & Son are the general contractors, and the American Bridge Company is the contractor for the 7,000 tons of structural steel, which is being built at their Brooklyn plant. The Roebling Construction Company is the contractor for the roof, floors, partitions and fireproofing.

Good Roads in South Dakota are being constructed by good Indians. It is reported that about 500 Indians were employed in this way last summer.

American Cement to the value of nearly $700,000 was imported into Canada last year in spite of a duty of 12½ per cent., according to press reports.

The Septic Tank Experiments of the Massachusetts State Board of Health as described in the last annual report of the Board, indicate quite strongly that with certain sewages and under certain conditions, the process may be a successful addition to a sewage purification plant, but that success cannot be depended upon with all sewages and under all conditions. The results indicate that, when treating ordinarily fresh domestic sewage, an accumulation of sludge within the septic tank must be expected, amounting to a considerable percentage of that primarily present in the sewage entering the tank. With an older sewage, which has undergone considerable mechanical, chemical and bacterial action before entering the tank, it is possible that the action of the tank will be as nearly perfect as could be desired, that the accumulation within it will be small, that much matter in suspension will be removed from the sewage and liquefied or changed to gaseous forms, and that its effluent will be easily purified upon sand or contact filters. With a still older sewage, however, like that entering the Andover septic tank, the bacterial processes in the tank may be not only unnecessary, but harmful, in that they render the sewage difficult to purify by subsequent oxidation.

Wood Block Paving and Other Features in Connection With a Small Drawbridge in Brooklyn, N. Y.

At the point where Washington Avenue crosses the Wallabout Canal, in the neighborhood of the Brooklyn Navy Yard, there is a short-span drawbridge of the retractile type, over which an exceedingly heavy and continuous traffic passes. This bridge was built in 1893. It is of simple construction, consisting of three girders, supported, when the bridge is drawn, by diagonal tie rods attached to the tops of the posts in the center of the bridge. When the bridge is closed the ends come to a firm bearing on wedges. The floor system is supported from the lower flanges of the girders, as shown on the cross-section; and until recently the wearing surface of the flooring was composed of 3-inch untreated yellow pine planking. It was necessary to renew this flooring about once a year, and for this and other reasons, it was rather an unsatisfactory material for this position.

Accordingly the Bridge Department of the Borough of Brooklyn recently entered into a contract with the United States Wood Preserving Company, of New York, for the paving of the roadway of this bridge with creo-resinate yellow pine blocks. As this is the first time that such a pavement has been used for bridge flooring in the city of New York, and as it will be subjected to the wear and tear of a very heavy traffic, the result of the experiment is being looked forward to by the city officials with considerable interest.

Although the use of the wood blocks is somewhat of an experiment, it is one in which there is no risk to the city, and in fact it will result in a saving. The contract price for the paving was $2 per square yard, accompanied by a five-year guarantee. Mr. J. S. Langthorn, the engineer of the Bridge Department, who has supervised this work, has estimated that the ordinary pine plank flooring previously used, cost about $1.20 per square yard, and as it had to be renewed every year, the cost per square yard at the end of five years amounts to $6, which means that the city will save $4 per yard in five years' time due to the use of this pavement.

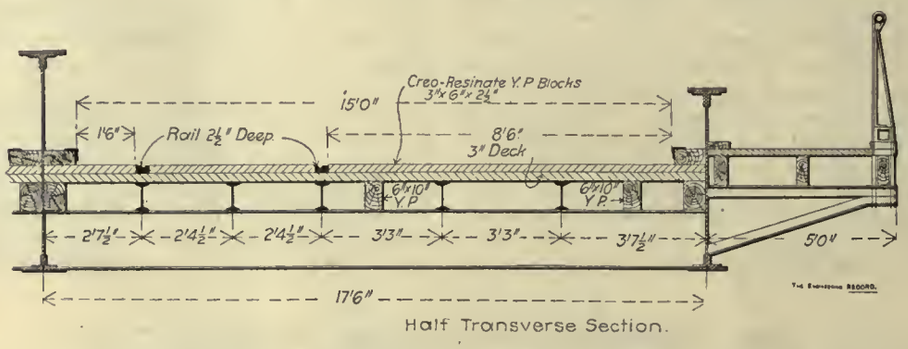
There is a trolley track on each side of the bridge, the tracks of which divide the paving into three sections, 8½ feet, 4 feet 2 inches, and 18 inches wide respectively. The arrangement of the blocks between the rails at the end of the bridge is clearly shown in the accompanying photographs. The finished pavement is seen at the left of the photographs, thoroughly sanded over. At the ends 3x10 inch oak planks were used to pave against. The blocks were put in place with no greater care than was required to secure straight, even courses, and the work was very rapidly done. The blocks are 3 inches high, 6 inches long and 2½ inches wide, and can be easily cut to fit irregular spaces.

The total surface on the bridge occupied by the paving is 387 square yards. The foundation was a 3-inch creosoted deck, on which the blocks were placed directly with no cushion of sand or other material. The peculiar advantage of the creo-resinate blocks over other brands of wood blocks is claimed by the manufacturers to lie in the use of a considerable percentage of rosin with the creosote oils employed in the treatment of the wood. This rosin it is claimed fills the pores of the wood, and hardening, prevents the evaporation of the more volatile constituents of the treating liquid. Creo-resinate blocks were used for the paving of the Harvard bridge over the Charles River at Cambridge, Mass., where 11,425 square yards were laid, and it has been successfully tried in many other large cities in various parts of the country.

To show that the traffic over the Washington Avenue bridge is very heavy, it may be stated that on June 25, 1902, there were counted 4,229 vehicles crossing the bridge between 4 A. M. and 8 P. M. It is in the immediate neighborhood of Wallabout Market, and there are two large railroad freight depots near by, so that the individual loads are often very heavy.

As the traffic over the bridge is so continuous, it was found that the old method of hauling the boats through by hand was the cause of many delays; and in the fall of 1900, an electric capstan was installed to haul the boats through. As this is somewhat of a novelty, a photograph of it is reproduced as being of interest to those having to deal with similar conditions. The capstan was built by the American Ship Windlass Company, of Providence, and the motor which runs it by the General Electric Company, of Schenectady, the motor being classed as a GE-800 motor, of about 20 horse power. The controllers for moving the bridge and for turning the capstan are placed side by side inside the bridge house, and both are handled by one man. A ¾-inch wire cable is used to do the hauling.

On an average the draw is opened fifteen times a day, and the capstan is used twelve out of the fifteen times. These openings are nearly all made between 7:30 A. M. and 5:30 P. M. During 1902 the draw was opened 4,546 times, of which 3,698 were capstan tows. No charge whatever is made for towing the boats through the draw. In comparison with the 20-minute delays that formerly occurred when the bridge was opened, a record was recently made of the time required to open the draw, tow the boat through and close the draw again, this time being found to be 2 minutes and 35 seconds. This was done under very favorable conditions, as there was plenty of room to let the boat go in, but it illustrates the great saving in time effected by the use of this capstan.



Half Transverse Section.



Electric Capstan for Towing Canal Boats.


Wood Block Paving, Washington Avenue Bridge.

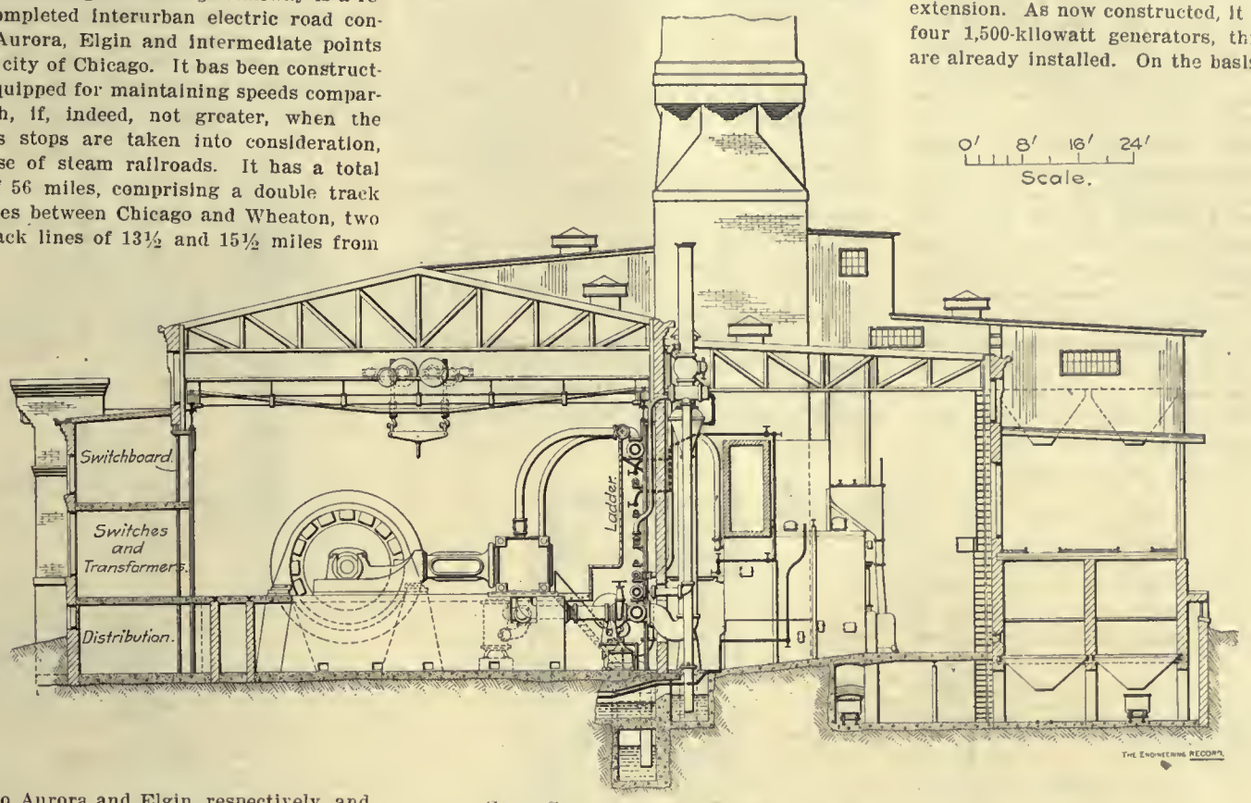
Municipal Control of London's Water Supply and that of certain adjoining districts, is provided for in an act for establishing a metropolitan water board and transferring to this board the undertaking of the Metropolitan Water Companies. The board will consist of 66 members representing the various boroughs in the district, and there will be besides, a chairman and a vice-chairman, elected by the board. The London County Council will have 14 representatives, and the Common Council of the City of London two representatives upon the board. Hitherto the works have been controlled by the private companies.

Power Plant of the Aurora, Elgin & Chicago Railway.

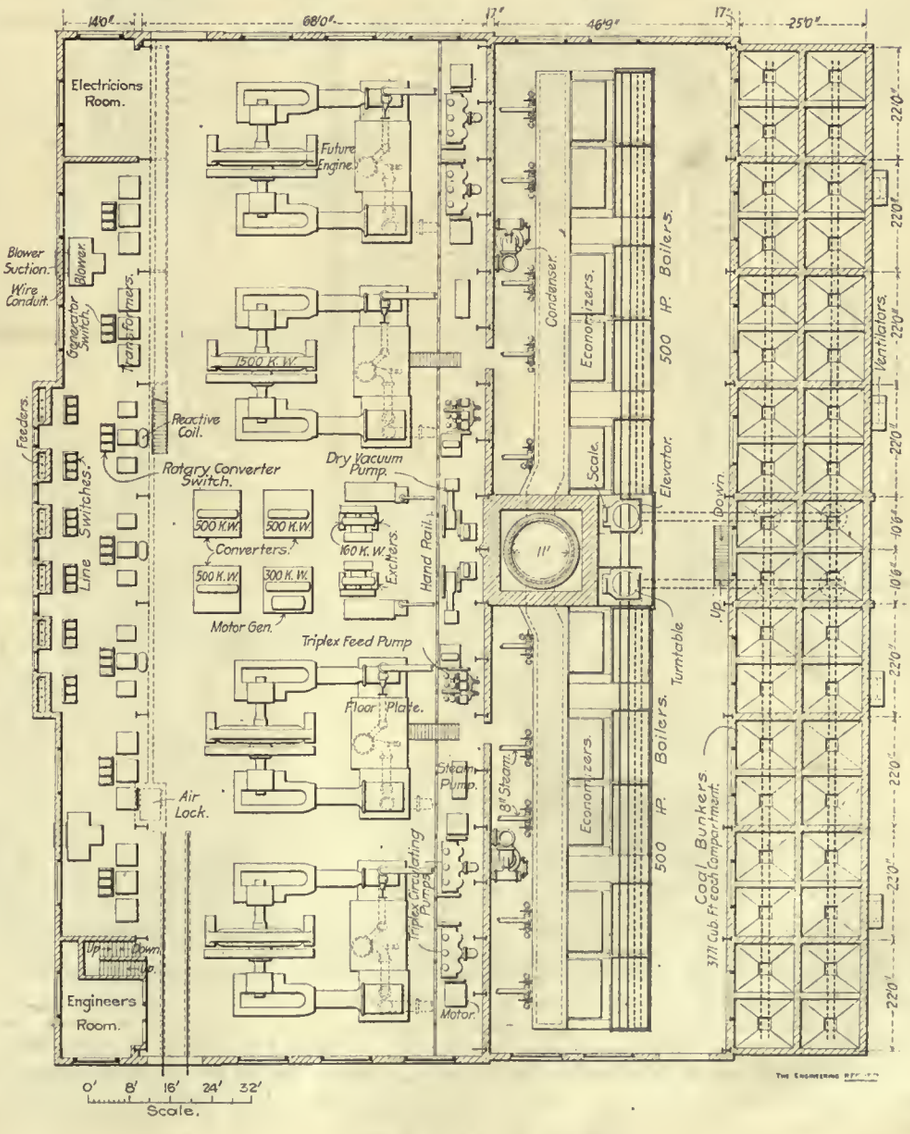
The Aurora, Elgin & Chicago Railway is a recently completed interurban electric road connecting Aurora, Elgin and intermediate points with the city of Chicago. It has been constructed and equipped for maintaining speeds comparable with, if, indeed, not greater, when the numerous stops are taken into consideration, than those of steam railroads. It has a total length of 56 miles, comprising a double track of 21 miles between Chicago and Wheaton, two single track lines of 13½ and 15½ miles from Wheaton to Aurora and Elgin, respectively, and a single track line of 7 miles from Eola Junction on the Aurora branch to Batavia. At Batavia is located the power house, which possesses an unusually interesting steam-electric plant, particularly on account of an extensive use of electricity for driving auxiliary machinery. The steam engines are operated condensing, and the absence of steam-actuated auxiliaries has resulted in the exclusion of steam feed-water heaters. Instead feed water is heated only by economizers. Of the more conspicuous features of the plant are the method of handling coal and ashes, comprising a large number of gravity-spouting hoppers and narrow-gauge railway cars, and the location of all the main piping against the engine room wall, in full sight, uncrowded and under ready control. The transformation of energy from the coal to the electric current takes place progressively across the station in a clearly defined manner.

The plant is arranged in the usual way for large stations, having boiler and engine rooms side by side with a longitudinal partition wall between them. It is 200 feet long and 160 feet wide. The first 25 feet of the width is taken up by the coal hoppers, the next 47 feet by the boiler room, the next 66 feet by the engine room and the remainder by the switchboard gallery, transformer and other rooms, which are largely open with the engine room. There is a basement under the engine room, but the engine room floor stops short of the partition wall, leaving a longitudinal light well from the engine room into the basement, for the various pumps. Under this well is a concrete-lined tunnel extending the length of the building for the condensing water. The boiler room floor level is about that of the engine room basement, but it also has a basement in which the coal and ash cars are run.

The building is of 17-inch walls, of Illinois buff brick and white stone trimmings, with iron truss roof covered with planking, and of concrete floors. The engine room has large windows at each end and line of smaller windows around the upper part of its three outside walls, and the boiler room is similarly lighted. A 50-ton electric traveling crane, built by Messrs. Alfred Box & Company, spans the engine room and commands the end of a railroad siding which enters the building at the engine room floor level. The plant is designed for endwise extension. As now constructed, it has space for four 1,500-kilowatt generators, three of which are already installed. On the basis of the total



Cross-Section of the Power Station.

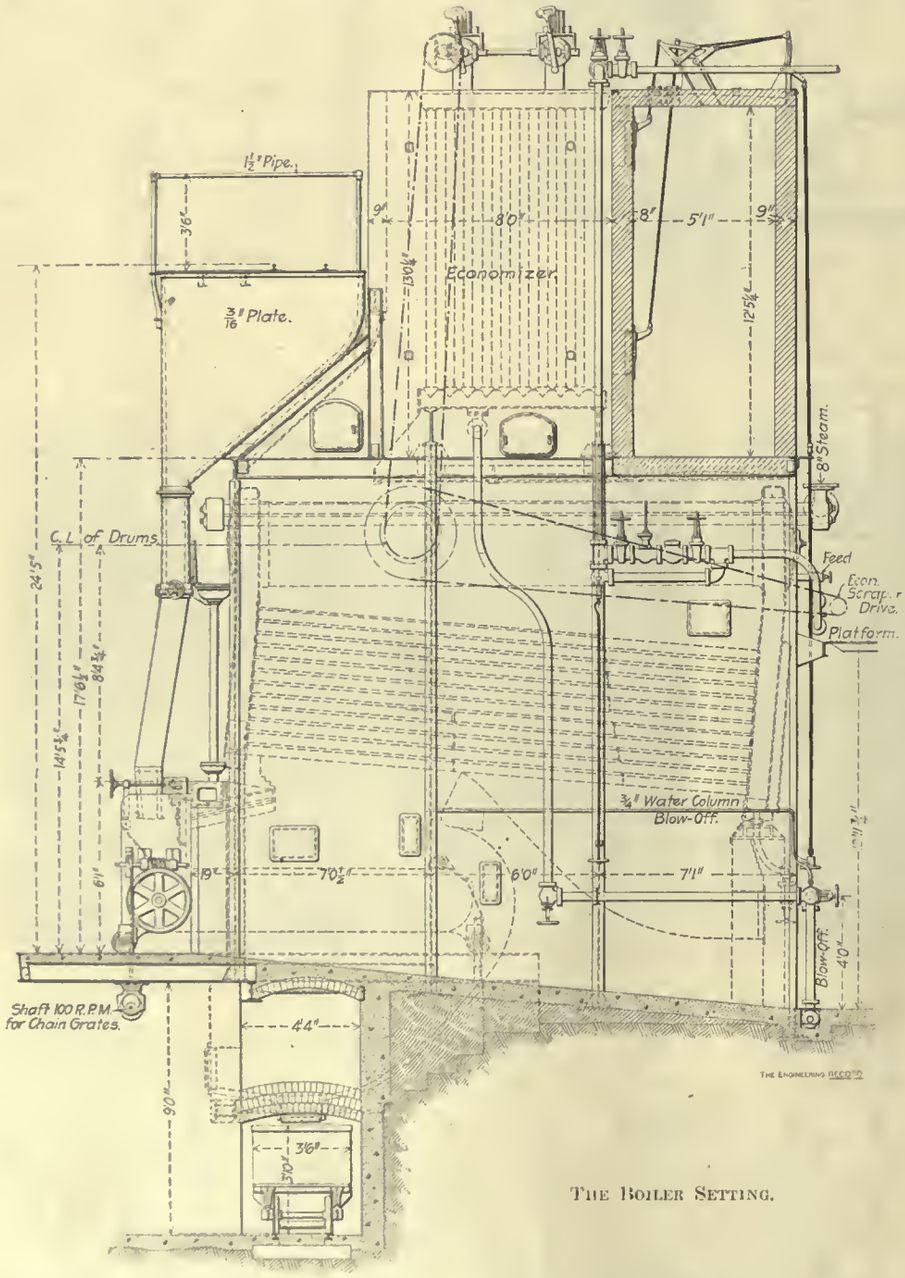


Plan of the Power Station.

ground area of the plant 5¼ square are required per kilowatt of rated output.

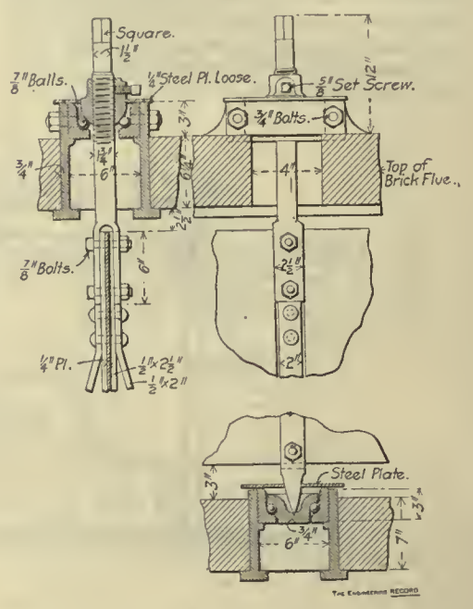
Coal is delivered to the plant by railroad cars which dump directly into the coal hoppers. There are two tracks for this purpose running the entire length of the building, inside of a steel-frame structure covering the hoppers. The hoppers are built of 17-inch brick wall compartments with steel-plate hopper bottoms, two hoppers per compartment. The cubical contents of each compartment measures 3,771 cubic feet, so that, allowing 37.7 cubic feet per ton, each has a capacity of 100 tons. The eighteen compartments which there are thus provide for 1,800 tons storage. Subdividing the storage space in this manner makes it possible to carry different kinds of coal, to empty compartments in succession and to prevent the spread of fire, besides making a simpler construction for the support of the railroad tracks. The basement of the boiler room extends underneath the hoppers and two lines of narrow-gauge tracks imbedded in the concrete floors are located under the hoppers with turntables at the center for pushing the cars upon elevators which rise through the boiler room at the chimney. For ventilating the boiler room basement space, ventilator grates are placed in the boiler room floor, every 10 or 11 feet, and communication with the outer air is had by means of four flues which drop from a point above ground level to the basement, opposite every other compartment, as indicated on the accompanying general plan and the transverse section of the station.

In connection with the coal storage, a detail drawing has been made to show the discharging bottom of the hoppers. They are of 5/16 inch metal, and are brought down to a square 30 inches on a side, but inside of the hopper there is an arrangement, as shown, by which the coal is directed to opposite sides and discharged through two openings, each about 10x30 inches. These openings are provided with curved gates, fastened by steel castings to a shaft of 1½-inch extra heavy pipe which is turned by a ¾-inch pipe handle outside the hopper. The cars are of special construction, with roller bearing axles and a hinge dumping bottom operated by means of a combined ratchet lift and friction drop. They are of 1 ton capacity each. Their general construction may be seen in an accompanying drawing.



The Boiler Setting.

From the coal storage the coal cars are lifted by special Otis elevators, of which there are two, to another longitudinal line of track supported overhead across the fronts of the boilers. Each elevator has a turntable on which the cars can be weighed by Fairbanks scales while on the elevator car and the car is then pushed upon the overhead track system. This system passes over a line of coal hoppers of special shape, feeding into the stokers with which the boilers are equipped. The hoppers are built of 3/16 inch plate, bolted to a framing of I-beams which form part of an elaborate boiler setting; they have a capacity of about 6 tons, and each delivers by a chute upon the stoker, which is of the McKenzie chain-grate type. The ashes dumped from the inner end of the stoker fall into a special shaped ash pit and are then discharged at will into the same style of cars used for coal. For this work there is a brick arch roof tunnel extending along underneath the ashpits. The ashes, in the cars, can be weighed and are elevated to still another system of tracking at the level of the lower chord of the boiler room roof trusses. These tracks run out across the railroad and there is a group of ash hoppers from which empty cars on the coal tracks can be filled.



Damper Details.

The boiler equipment of the plant will consist of ten water tube boilers of large capacity, each having a rating of 500 horse power. Five have already been installed and were built by the Edge Moor Iron Company, of Edge Moor, Del. They consist of 234 tubes, 4 inches in diameter and 17 feet 4 inches long, and of three 36-inch drums. They are accredited 4,500 square feet of heating surface each, and 500 square feet of superheating surface. The form of setting is very interesting, involving a compact grouping of smoke and economizer passages, coal hoppers, ash tunnels and piping, and is shown in transverse elevation. The boilers are arranged in a line the length of the boiler room with the chimney in the center. The smoke passage is of brick, of a constant cross-section of about 63 square feet throughout its length. As indicated, the products of combustion are ordinarily discharged through the economizer and thence into the smoke duct, the dampers being located in the partition wall between economizer setting and smoke passage and controlled by means of rods and levers extending to a point about 5 feet above the floor behind the boiler.

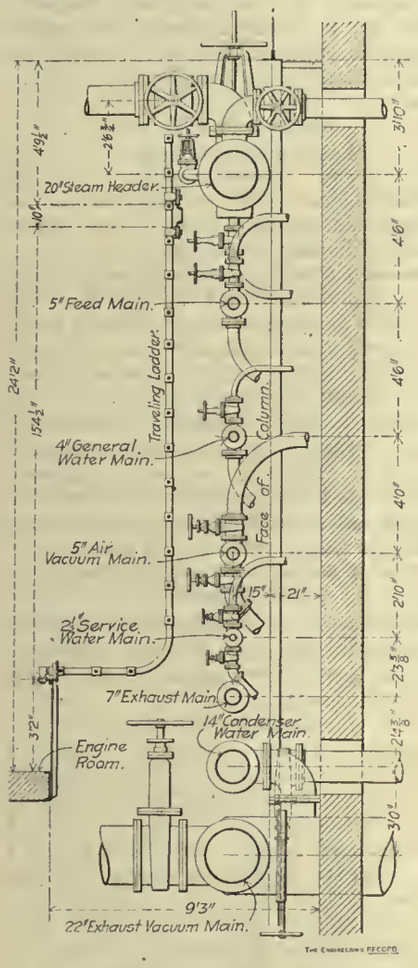
Each boiler has an economizer of 20 sections, 200 tubes, made by the Green Fuel Economizer Company, which when filled, weighs, with the setting 35 tons. Each economizer has 2,600 square feet of heating surface.

The economizer, as well as the smoke passage, and the coal hopper, is supported by a steel-frame work enclosing the boiler setting. The hopper drops somewhat low in front of the boiler and although the spout is hinged in the regular way, it was desirable to provide some ready means to reach easily the boiler tubes.

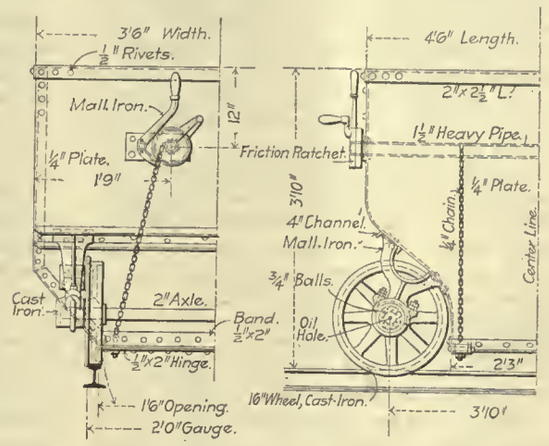
On this account a steel rolling door, made by the Kinnear Manufacturing Company, rolling into the space in front of the steam drums and behind the coal chute was fitted to each boiler. It will be noticed that both feed and steam connections are made at the rear of the boiler, at ready command from a platform running behind the boiler, 13 feet above the floor. Here also is the line of shafting from which the economizer scrapers are worked. The stokers, which have a grate surface of 128 square feet, are driven from a shaft in the basement, as shown. The blow-off main is located in a concrete trench behind the boilers and the pipes leading to it are fitted with the Morris patent blow-off valve.

The chimney is located, as stated, in the center of the boiler room and has been designed to serve the ten boilers which will extend in a line of five on each side of it. It is a self-supporting structure, 228 feet high above its concrete foundation, 23½ feet square at the base, and 13 feet 2 inches in exterior diameter at the top. It is built of stone throughout its square octagonal portion, and of brick above, where it is circular in section. It has an inside diameter of 11 feet throughout the greater part, and consists of two shells, the inner stopping 60½ feet short of the top and lined for 75 feet from the bottom with 4½ inches of firebrick. From the bottom of the shaft, where the thickness of the outer shell is 36 inches to the beginning of the chimney cap, where the thickness is 13 inches, the distance is 197 feet and the batter 62 inches, that is, 0.315 inch per foot. The inner surface of the outer shell is corbelled out in a usual way over the top of the inner shell to prevent the direct lodgment of debris in the air space between shells. The end of the horizontal smoke duct from the boilers, at the chimney, is provided with an automatically operated damper which is mounted on a ball-bearing axis shown in an accompanying detail drawing. The entire station foundation is carried to rock, and that for the chimney consists of a concrete footing 15 feet deep.

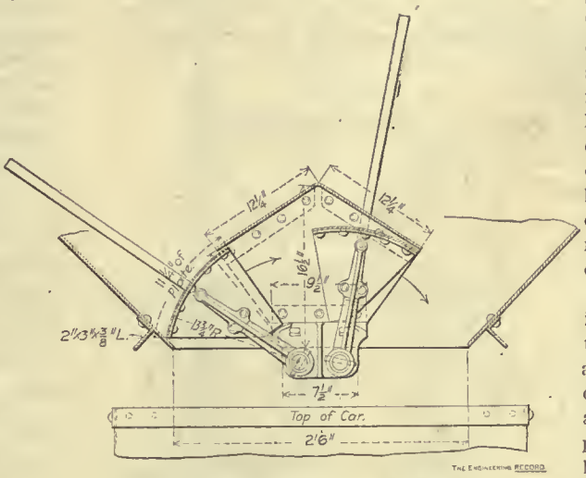
One of the distinguishing points of the plant is the location of steam and water piping in the engine room against the partition wall, and an elevation and a cross-section view of this construction is given herewith. The pipes are all supported by brackets, those for the larger pipes having expansion rollers, and are reached by a traveling ladder. This is formed of pipe uprights and steps and is mounted on track-



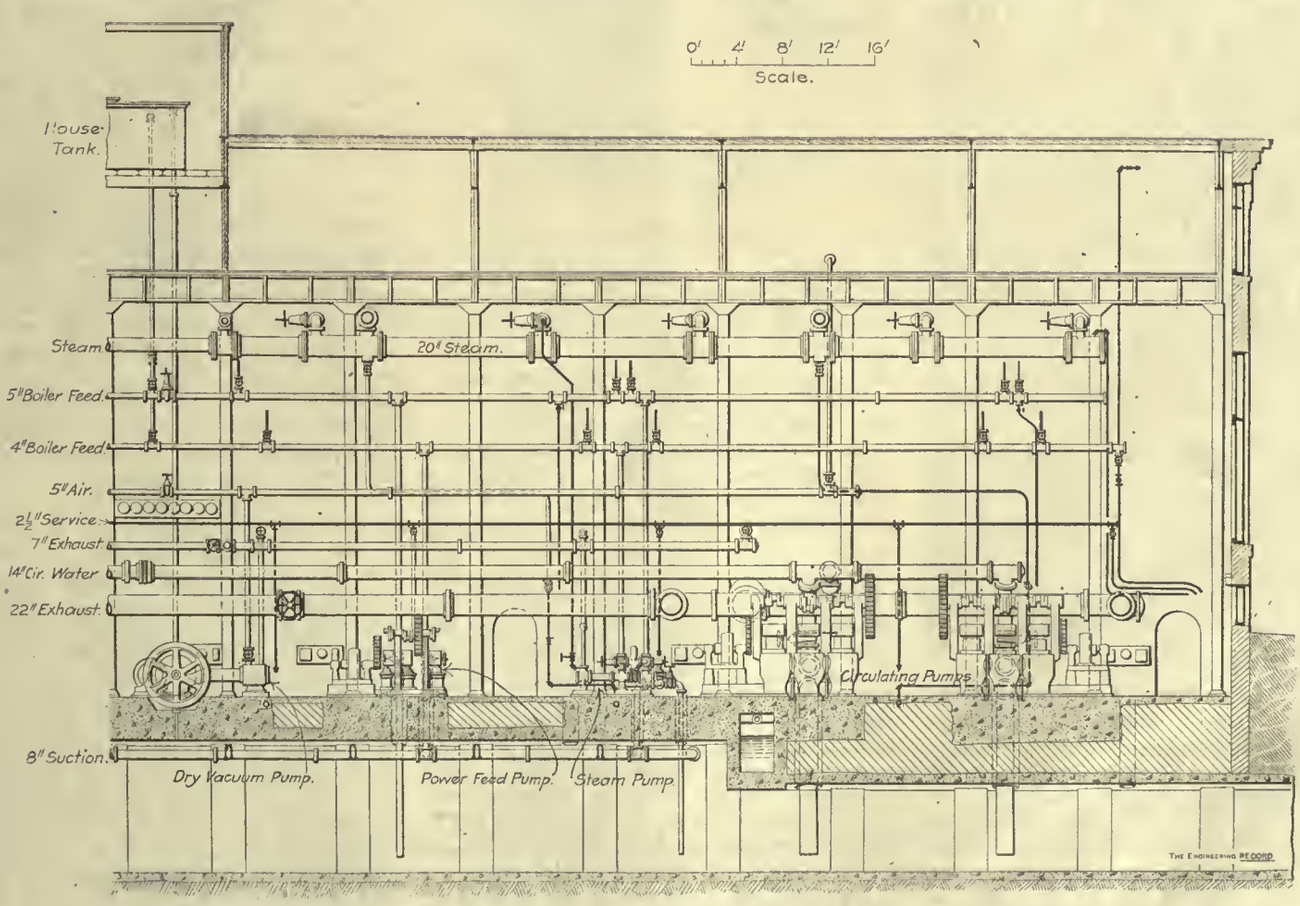
ELEVATION OF MAIN PIPING.



COAL AND ASH CARS.



DISCHARGE OF THE COAL HOPPERS.



PIPING ON THE PARTITION WALL OF THE POWER STATION.

ing which is supported overhead by the brackets carrying the steam main and at the bottom by a railing or fence which overlooks the light well or pump pit. The steam main is located uppermost and is fed from each boiler by an upward bend connected into the top. It supplies each engine by a sweeping bend which likewise starts from the top. The main is drained at the points where the steam is taken to the engines. The main exhaust line is located in the lowest position and only receives the discharge from the main engines.

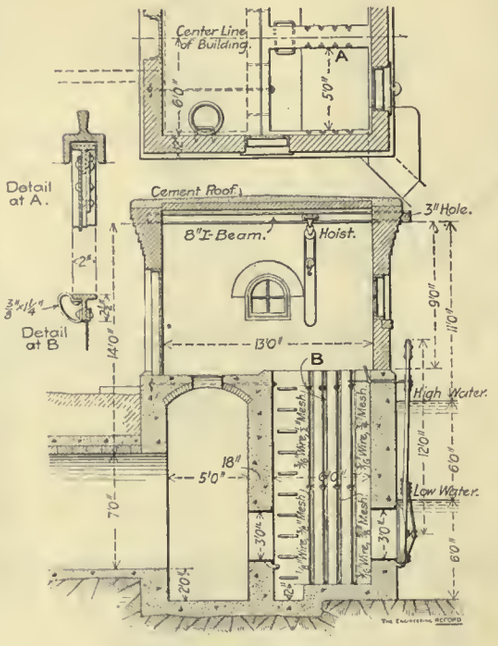
The central jet condensing system has been installed, comprising one 30-inch elevated Worthington condenser for the two generating units, a duplicate installation of 19x15-inch Worthington triplex circulating pumps and an 18x18-inch Worthington dry vacuum pump. When the present building is fully equipped, that is, when the four generating units are in place, the condenser installation will be in duplicate, there will be four circulating pumps and two dry vacuum pumps. For the circulating pumps 35 horse power Akron motors have been provided, and for the air pumps, 25 horse power motors.

Condensing water is obtained from the Fox River and is conducted through a concrete lined tunnel which is continued under the pump pit its entire length. A considerable amount of attention was paid to the design of the intake and a screen house was built in that connection. This building was carried to the bottom of the river and is of concrete to a height of 2 feet above the high-water line, and of brick above. The concrete portion consists of three compartments, two of them intakes and the third a common chamber with which each intake chamber communicates and at which the tunnel to the station building begins. The general construction and arrangement is shown in an accompanying illustration, but a few details may well be pointed out. The gate to each intake chamber consists of a disk, or cover, formed of two thicknesses of pine boards with a sheet of thin rubber between them and an annular ring, of 1 inch square rubber, by which the disk is seated. To open the intake and lift up the disk a wooden lever is provided, with its lower end or fulcrum fitted into a ring, or lug, as indicated. Each intake chamber is provided with four sets of screens, arranged with decreasing size of mesh, so as to eliminate debris without clogging the screens any more than necessary, the screen first encountered by the water, stopping the larger particles, and the last, the smallest particles. There are two screens of each size mesh in each chamber and they are all provided with a ring top for lifting them up, two hands hoists of 500 pounds being provided, suspended from a trolley on an I-beam, one hoist corresponding to each screen chamber.

For boiler feed, the water from the condenser intake tunnel is used, or, when desired, from the public water supply mains. Two feed pumps are employed, one an 8x10 inch Worthington triplex pump, driven from a 35 horse power motor, and the other, held in reserve, a 10x6x10-inch Worthington duplex steam pump. Both pumps can draw from either the river water, as indicated in the elevation of piping, or from the public supply, and can deliver into either a 5-inch boiler feed main or a 4-inch general water supply main for the building. These mains are likewise interchangeable, both being tapped opposite each boiler with a pipe leading to the economizer, and both having a connection to an elevated house tank. The feed water is discharged through the economizer before final delivery into the boilers.

The engine room has floor space for four 1,500-kilowatt units, two 160-kilowatt steam-driven exciter units, three 500-kilowatt rotary converters and one 300-kilowatt motor generator. Two of the main units are already in place, and the third is nearing completion. The motor generator and both of the 160-kilowatt units have been installed. The main engines are 32 and 64x60-inch Cooper Corliss engines, and are directly connected to General Electric alternators. The engines have a normal rating of 2,200 horse power at a speed of 75 revolutions per minute and a steam pressure of 150 pounds, and an overload capacity of 50 per cent. The engines are horizontal, cross-compound, with a receiver between cylinders located in the basement. The shaft is of hammered wrought iron, 27 inches in diameter, and the bearings are water jacketed, 23 inches in diameter and 46 inches long. The output of the alternators consists of three-phase current, 377 amperes per phase at 2,300 volts.

The 160-kilowatt units consist of 14½x15-inch engines, built by the Phoenix Iron Works Company, of Meadville, Pa., direct connected to 125-volt direct-current General Electric dynamos, while the motor generator comprises a 125-volt direct-current machine mounted on the shaft of an induction motor. Either the steam-driven or the motor-driven direct-current dynamos can thus be used to furnish excitation and to operate the various pump motors, which are of the direct-current type. The Siegrist lubricating system is in use with Cross filters.



Condensing Water Intake.

The switchboard is located in a gallery open with the engine room. The center sections are devoted to the line feeders and those at each end to the generators. Underneath the latter portion of the gallery are the switches for the generators and the transformers for stepping up the voltage. Underneath the center of the complete board space is reserved for six line switches, and the converter switches and corresponding groups of transformers. The bus wires are all carried in compartments in the basement and the outgoing feeders are carried up the six shafts or flues shown on the general plan. Above the roof level they are covered in a special housing, or roof, shown in elevation in the station cross-section drawing, the lightning arresters are there connected, and the feeders pass out at the side. These are of aluminum and go to rotary substations for the supply of direct current to the third rail.

The plant was designed by Mr. William L. Norris, mechanical engineer of the road. Mr. Charles Jones was chief engineer, Mr. Ernest Gonzenbach, electrical engineer, and Mr. E. H. Arnold, construction engineer. The general manager during construction was Mr. Will Christy, president of the Cleveland Construction Company, and the consulting electrical engineer, Mr. W. E. Davis, vice-president of the Cleveland Construction Company. The operation of the road is in charge of Mr. Warren Bicknell.

Rapid Station Building.

A creditable record was recently made by the construction department of the Long Island Railroad in building a temporary depot to replace one which was burned December 18th. The new structure is a wooden building 20 feet wide and 150 feet long, which has 38 windows and 6 doors, with runways leading to the train platforms. The frame is covered with novelty siding and gravel roof, and it is equipped with stoves, electric lights, ticket offices, information bureau, telegraph office and station master's office. Part of the work was done in the rain, and the whole was finished for occupation with seventeen and a half hours actual work, by the railroad company's employes, under the direction of Superintendent Joseph Cummins.

Serious Explosions of Dynamite unfortunately occurred in connection with two or three of the plants now under construction as parts of the Philadelphia filtration system, on two or three occasions within the last few weeks. On the morning of December 29 about 50 pounds of dynamite exploded at the Oak Lane reservoir, killing one of the employes. On January 10 about 1,500 pounds of dynamite, stored in a small building at the Torresdale filtration plant, exploded, injuring five persons and causing the death of one man by overturning a stove upon him in a house about 100 yards away. The shock was felt nearly 20 miles distant in Germantown, Pa., and Vineland, N. J. In the first instance dynamite is said to have been placed close to an engine, and this circumstance was thought to have been responsible for the accident. In the second case, the dynamite magazine caught fire, possibly from superheated steam pipes, before the explosion occurred.

The Niagara Falls Power Company was visited by lightning at 10:45 o'clock on the night of January 29. The covered masonry bridge carrying the cables from Power House No. 1 to the transformer house was struck, causing short circuits of the cables and starting a fire, which, fed by the insulation of the cables, put the 52 cables housed on the bridge, out of use, spread into the transformer house, and seriously damaged a portion of that building and part of the bridge. As soon as the fire was discovered, all the generators in Power House No. 1 were stopped. Within an hour the local service was restored, by 4:30 p. m., of the following day a sufficient number of cables had been replaced to deliver 10,000 horse power to Buffalo, and on the second day the plant was in operation at its normal load of 50,000 horse power. That lightning should have selected the slate roof bridge is remarkable, but what really calls for comment is the company's well proved ability to rise to emergencies. The fire is unquestionably the severest breakdown the plant has yet experienced, but by the prompt assistance of its employes and with its reserve supply of cable it performed a feat of engineering that must retain the confidence of its customers. In the light of this accident, it may be stated that the cables from Power House No. 2 to the transformer house pass underground.

Ventilation and Heating and Mechanical Plant in the Lying-In Hospital, New York.—II.

The ventilating and heating of the Lying-In Hospital, in New York City, has already been the subject of an article in this journal's issue of January 3. In that connection the building itself was briefly described and most of the ventilation was discussed, but the plant is so extensive that it was found necessary to defer to the present issue any reference to the design of the heating system and the arrangement of the mechanical plant. As was stated in the preceding installment, the method of warming is particularly interesting from the fact that in general direct radiators were not allowed, since they were looked upon as catch-alls for dust and dirt, and that sheet-iron radiating surface was used instead, finished with a hard, cream white, smooth surface continuous with that of the walls of the room. Before giving any extended description of the direct radiation, however, it may be well to conclude the account of the ventilation in the building.

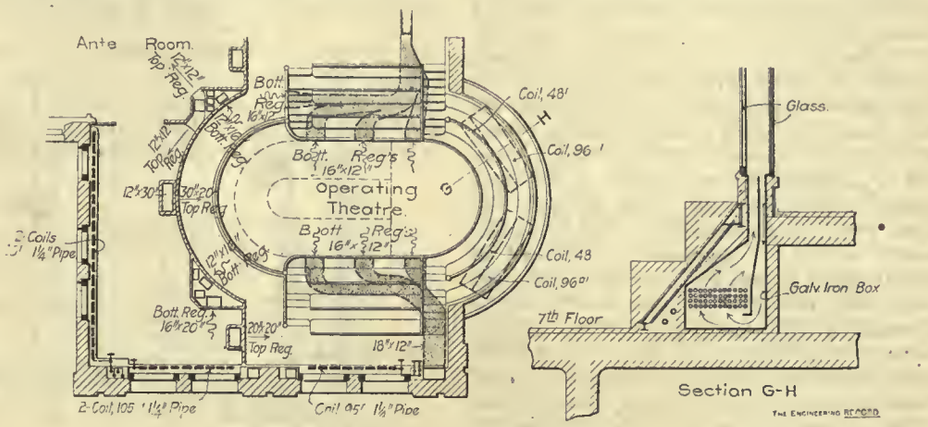
The seventh and last system to be described comprises two disk fans and connecting ducts by which they supply and exhaust, respectively, the operating theater and accessory rooms on the seventh and eighth stories. Two detail drawings are shown in this case, one showing the grouping of the fans and the other the method of warming the operating theater. The two fans are mounted on a vertical shaft, the supply below the exhaust and both driven by the one motor. In this connection mention can be made of fan C, which is located near them and which exhausts the air from all the rooms supplied by the office-system blower in the sub-basement except that delivered to the dining-rooms, which, as has been described, are served by exhaust fan F. A diagram of the location of the fans was given in the first article.

The fresh air for the seventh and eighth story system is received through louvered windows in the main stairway tower and passes successively through a cheese-cloth screen, tempering coils and fan. It is delivered into the operating theater through openings high up in the story and makes its exit through openings at the arena floor and two side wall openings, as shown. Two thousand cubic feet per minute is the normal amount of air it is intended to furnish, which means a change of air 7½ times per hour. The exhaust openings are designed to take about three-fourths of the incoming air, being designed on a change 6 times an hour. The velocities in ducts, flues and openings in this system are, for the fresh air, 20, 10 and 5 feet per second, respectively, and for the exhaust system 16, 8 and 4 feet per second.

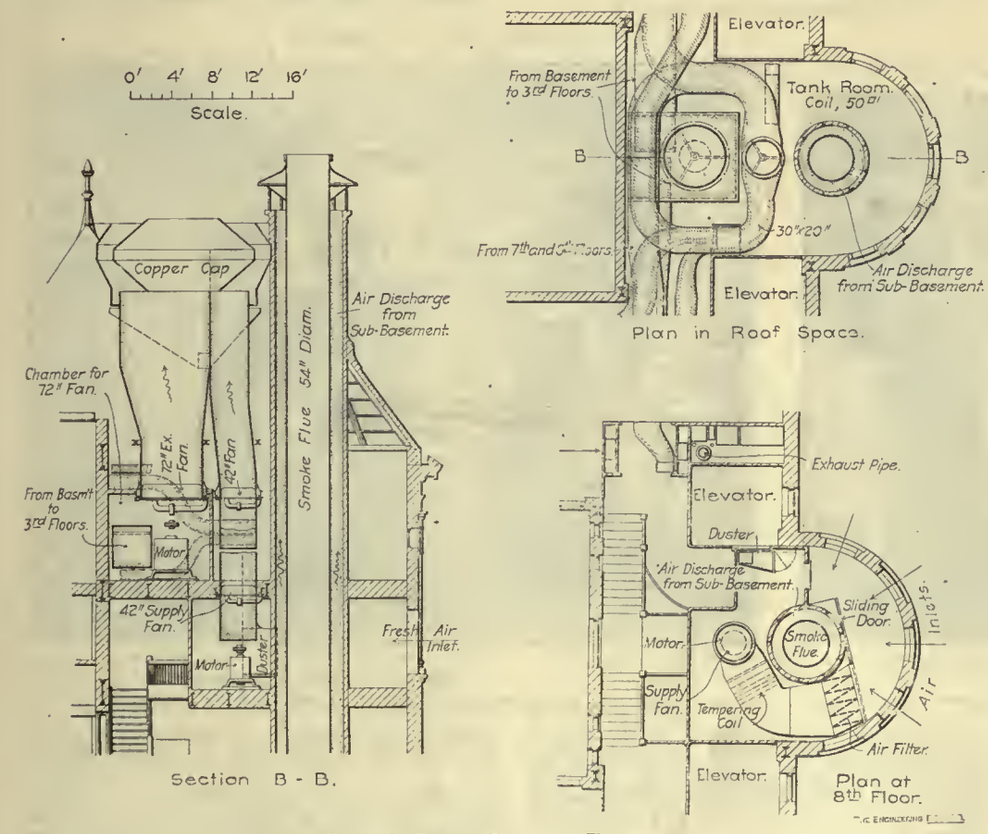
One of the interesting features of this part of the plant is the method employed for warming the room. One end, as indicated, is all of glass and to offset a flow of heat from the air in the room to the outside atmosphere, the glass wall was built double to enclose an air space 12 inches thick and steam radiating coils were installed in the lower part of this air space, underneath the theater seats. By the use of a partition or diaphragm within the coil casing which forms the bottom part of the air chamber, the warm air is made to rise upward along the inner glass plate, thus keeping that warm and to return along the outer glass plate and thence to the space below the coils. The casing is air tight so that an advantage of the scheme is that no dust is churned up through the theater as would likely be the case were the heating coils in communication with the air in that room.

It may be interesting to include a few additional figures relative to the supply of air to the wards described in the first article and illustrated in the plan of the sixth story there shown. In the ward at the southern end of the building, the left end of the engraving, there are 20 beds. The supply of air provides 2,700 cubic feet per minute, that is, 135 cubic feet per minute, equal to 8,100 cubic feet per hour, per bed. As each bed supports a bracket cradle, at its foot, the room may be considered as having 40 occupants, and is therefore given ventilation at the rate of 4,050 cubic feet per hour per occupant. There are 1,610 cubic feet of room space per bed. These figures for ventilation are the average for all the wards, including the private rooms in the third story; the space per bed, however, averages about 1,560 cubic feet. In the delivery room, which has three beds, there are 1,100 cubic feet supplied per minute to a space of 13,000 cubic feet. This means 22,000 cubic feet of air supplied per bed per hour, and 4,333 cubic feet of space per bed. In the rooms of the septic departments, each room with one exception having but one occupant, there is an average air supply of 10,800 cubic feet per hour. In one case this amounts to 13,800 cubic feet.

The fresh air to the three ward stories is carried from the sub-basement ducts in 69 flues. For the greater part these are of three sizes although not necessarily intended to conduct equal quantities of air in the three cases. In other words, while the general dimensions of air passages are based on maximum velocities, as stated in the first article, the spaces available for flues and the desirability of having a few standard sizes for flues, has resulted in restricting the number of sizes. Where equivalent size flues are to carry different amounts of air, the short duct connections in the sub-basement differ from each other in size. A similar interesting method has been adopted to compensate for the different amounts of resistance to air flow offered by the flues depending on their length. For example, the flues for the three ward floors are arranged generally in groups of three. Those of each group are of the same size and are designed to carry equal amounts of air, but that running to the sixth story is longer than that running to the fourth story, and of course, other things being equal, presents a greater amount of resistance. The distribution of air is equalized by giving the fourth-story flue a smaller duct connection in the sub-basement than the sixth-story flue; and in that way, together with such use as it may be necessary to make with dampers, which for these systems are placed in the sub-basement branch ducts,



The Operating Theater, Seventh Floor.



Fans C, D and E in the Tower.

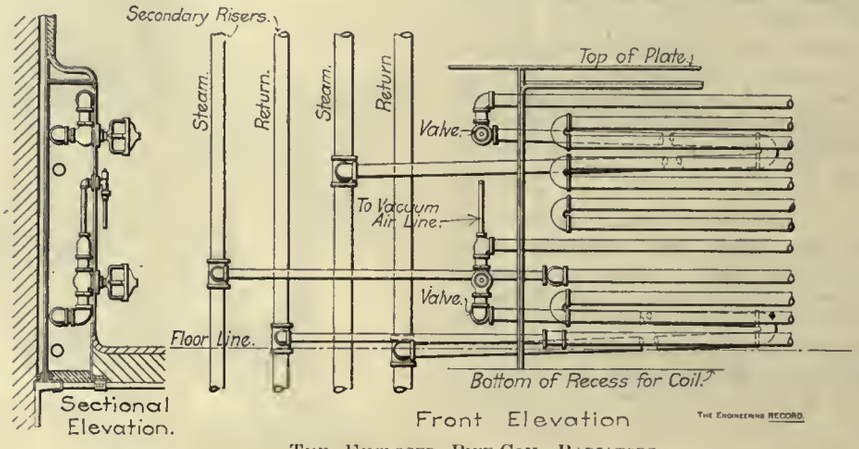
the resistances are equalized. There are 30 10x12-inch flues, for instance. For the fourth story supply, the sub-basement branch ducts are 5x12, 6x12 and 7x12 inches; for the fifth story supply the ducts are 5x12, 6x12, 7x12 and 8x12 inches; for the sixth story, 6x12, 7x12, 8x12 and 9x12 inches.

The heating of the building is done by direct radiation. A large amount of this consists of sheet steel enclosing an air space in which pipe coils are located. A detail sketch of this construction is given among the accompanying drawings. The coils are made up of two separate parts, one located above the other. The upper part, called the primary coil, usually consists of 8 pipes or two-thirds of the total pipe length; the lower part, or secondary coil, consists generally of four pipes. They are made up of 1¼-inch pipe, with return bends, one row deep, placed closely against the inside of the steel plate. The pipes are supported on rollers on wrought-iron stands. The upper part of the coil is controlled by thermostats in the room heated, with diaphragm valves on both the steam supply and return connections. The secondary coils are independently connected to special risers, so that for a tier of the enclosed coils there are four vertical lines of pipes through the building, two supply risers and two return risers. The 26 sets of secondary risers which there are, also have diaphragm valves, these controlled pneumatically either by ten cold-air thermostats or from a switchboard in the engineer's quarters. By this division of the heating coils, two-thirds of the heating medium for each room is cut in or out automatically, according to the local temperatures and without affecting the rest of the building, and the one-third need only be used in severe weather, and at points more or less exposed, this portion of the heating plant being put under steam by thermostats ordinarily when the outside temperature drops to about 40 degrees, but each pair of secondary risers capable of being controlled, as stated, by the engineer.

To determine the action of the enclosed coils, a number of tests were made in 1899 with a coil comprising 16 1-inch pipes, each 10 feet long located behind a ¼-inch wrought iron plate 10 feet 10 inches long and 3 feet 4 inches high. The surface of the steam coil amounted to 54 square feet and that of the iron plate to 35 square feet. The conditions being selected to represent those likely to be met in the actual installation, observations were taken of temperature and steam condensation and separate runs made with the entire coil and each half in operation and with the thermostats in service. It was found that about 220 British thermal units were transmitted per square foot of the sheet iron surface per hour, when the entire coil was in use, and about 150 heat units per square foot of coil surface; and it is on this basis that the heating plant has been designed. The same relation between size of coil and size of plate has practically been maintained in the actual plant.

The method of calculating the required amounts of radiating surface can best be illustrated by reference to the sixth floor plan given in the first article. The radiation is installed in sufficient quantity to give off all the heat that will be transmitted through the walls of the room into the outer air, each different class of wall being considered separately and in addition a factor being introduced to take into account the more or less exposed location of the room. The coefficients used for the heat transmission are those ordinarily used by Mr. Alfred R. Wolff, based on his own experience and on German government experiments. They are given in the form of a chart in "Steam Heating and Ventilation," by Mr. William S. Monroe. Each room is considered by itself and the heat transmission is figured for the outside walls only, the inside walls being exposed on each side with air at the same, or practically the same, temperature. The roof space occurs over some of the sixth story rooms, the seventh story, as stated, not occupying the entire floor area of the building, and in these cases the ceiling was considered.

The southern ward has 1,780 square feet of outside wall surface, 600 square feet of glass surface and 1,300 square feet of ceiling that is not under some seventh story room. The outside wall is taken equivalent to a 32-inch brick wall, and in zero weather has a conducting power of 11 British thermal units per hour and, therefore, for the whole room 19,600 thermal units. The windows are of single thickness and for a difference of 70 degrees Fahrenheit inside temperature and zero outside, will transmit 85 thermal units per square foot per hour, or for all the windows 51,000 thermal units. Considering the ceiling as formed of 12-inch brick arches, and that the roof space is at a temperature of, say, 45 degrees, the transmission per hour per square foot for the 25 degrees difference in temperature is 6 thermal units, and for the 1,300 square feet, 7,800 thermal units. The total dissipation of heat from the room is thus 78,400 thermal units per hour. To allow for the inevitable inleakage of air and the cooling effect of winds in carrying off the heat, this amount has been increased by 20 per cent., making the amount of heat to be supplied by the direct radiation 94,000 thermal units per hour. It will be noticed by reference to the sixth story plan that there are four pairs of inclosed coils installed, below the windows, aggregating in length 1,530 linear feet of 1¼-inch pipe. From the ratio of coil and plate surface, it will be found that the surface of the sheet steel radiating surface amounts to 445 square feet. To supply 94,000 thermal units per hour, there will be an average delivery by the radiating surface of 211 units



THE ENCLOSED PIPE-COIL RADIATORS.



THE MAIN PUMP ROOM.
Showing the distributing drum for the heating system.



NORTH END OF BOILER ROOM.
Showing refuse destructor and fresh air supply spouts.

per square foot per hour. The cubic contents of the room being 32,200 cubic feet, the ratio of space heated to the sheet steel surface is 72.5 to 1. The ratio of space heated to coil surface is 48.5 to 1.

The north-east ward has 703 square feet of wall surface, 166 square feet of single windows, 138 square feet of double windows and 994 square feet of ceiling. The same heat transmission coefficients apply, together with 40 thermal units per square foot per hour for the double windows which are located on the north side of the room. The total heat dissipation found in this way is increased for exposure in this case by 30 per cent., making the total hourly amount of heat to be supplied in zero weather 43,500 units. There are 735 linear feet of coils installed with a corresponding direct radiation surface of 213 square feet. The ratio of cubic contents to radiation is 80 to 1.

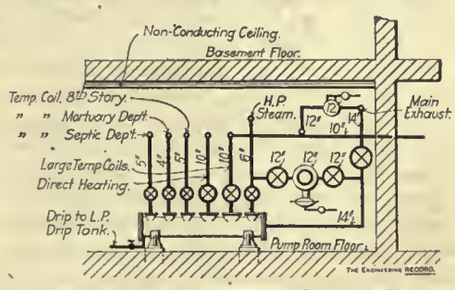
The rooms along the front or east of the building, between the wards, are treated in the same way but the exposure factor is 25 per cent. The ratio of contents to direct radiation in the day room is 76 to 1. In delivery room, which like the rest of the north rooms has double windows on the north side, the exposure factor, or increase to offset the additional cooling effect to be provided for owing to location, is 35 per cent.; in the waiting ward, it is 30 per cent.; and in the north-west ward 25 per cent. The ratios of contents to sheet-steel radiation are, for the three rooms, 78 to 1, 85 to 1 and 97 to 1. The exposure factor for the isolating room, the serving room and the dining room is 15 per cent. in every case. The other rooms facing on the court, including the stairway, are more or less subject to winds and the exposure factor is 35. The ratio of contents to radiating surface in these cases averages about 37 to 1.

The power, light, heat and refrigeration service is furnished from the building's own plant, comprising 650 horse-power in water-tube boilers and 450 kilowatts in direct-connected electric generating units. It is located in the sub-basement, which is finished with the same general regard to cleanliness conspicuous throughout the building. The walls have a hard cream-white smooth surface and there is an absence of sharp edges and of recesses at the junctions of walls.

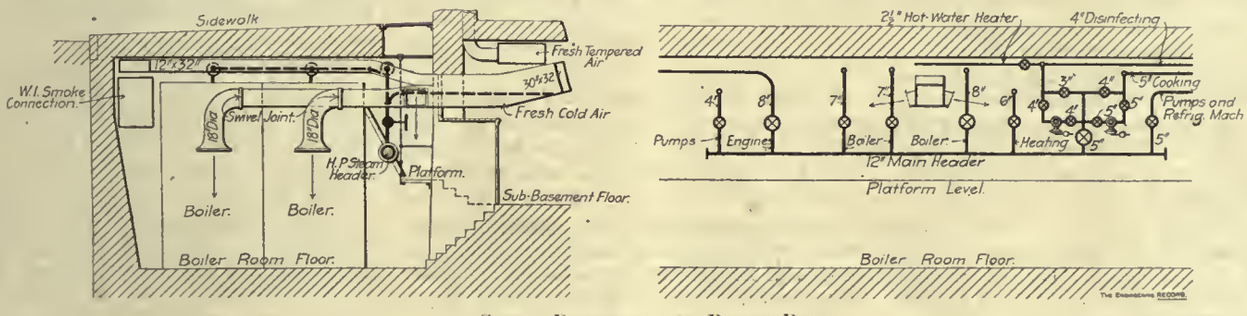
The boiler plant occupies vault space underneath the front sidewalk and obtains a headroom of 20 feet. The boilers are Babcock & Wilcox water-tube boilers, aggregating 6,508 square feet of heating surface with 146 square feet of grate, a ratio of 44.5 to 1. Two have ten sections of 4-inch tubes, nine tubes high per section and 18 feet long and one has 14 sections. Each has two 36-inch steam drums of ⅜-inch open-hearth steel, 20 feet 4 inches long. The two boilers of equal size are set in one battery facing the third, which has an independent setting alongside a garbage destructor. The boiler settings are faced with white glazed brick, which together with the light colored walls, give the room an unusually bright appearance. An accompanying reproduction of a photograph shows the larger boiler and the garbage destructor which is of the Morse type.

The discharge outlets by which fresh air is delivered to the boiler room appear in the upper part of the view. A smoke connection of No. 10 black iron, 20 square feet in cross-sectional area, conducts the products of combustion to the smoke stack which has an area of 15.9 square feet and a height above the grates of about 195 feet. Coal storage for about 250 tons is provided in the vault.

Steam is generated at 120 pounds per square inch. It passes from the steam drums of each boiler through Potter mesh separators in them and the three steam pipes corresponding to the boilers connect into a header 12 inches in diameter supported along the inner wall of the boiler room. This is about 39 feet long, and is built of extra strong wrought-iron pipe, as is all the steam piping subjected to boiler pressure, which can be carried at 150 pounds. All the main lines of piping are taken from the header and to reach the valves, which for the high-pressure work are of the Walworth extra-heavy pattern, a suspended platform has been provided, as indicated in an accompanying sketch. Five systems of piping lead from the header. One for the generating units, one for the main pumps, one for the refrigerating plant, one for the auxiliary supply of live steam for heating, and one for the supply of medium-pressure steam for disinfecting and cooking purposes.



Distributing Drum for Heating System.



Steam Piping in the Boiler Room.

The generating units consist of tandem-compound horizontal side-crank engines of the Dick & Church design built by the Phoenix Iron Works, directly connected with 116-volt direct-current compound wound Westinghouse dynamos. The accompanying table gives the data regarding their sizes. The normal point of cut-off is 0.4 of the stroke, so that at the rated speeds of the engines assuming all in use at the same time and taking steam for that percentage of the stroke, the velocity in the steam main is 2,000 feet per minute. Above the engine throttle valve, the live steam passes through a De Rycke vertical steam separator which is utilized to act more or less as a reservoir. The engines are placed on a concrete foundation formed as one solid mass having an average depth of 4 feet. The piping is supported by pipe stanchions from the floor, and the foundation is isolated from the building foundation and structure by two 1-inch layers of hair felt. In addition to the light painted walls, the generator frames and bases are painted white with gold striping and the engine cylinders are sheathed in polished galvanized iron which matches the aluminum bronze finish given to machine parts. All piping is covered with Keasbey magnesia sectional covering wrapped in canvas and bound by brass bands. The machinery and appurtenances stand in marked contrast with a dark stained cement floor.

Engine, I.H.P.	Dynamo, Kw.	Diam. cyl., ins.	Stroke, ins.	Speed, r.p.m.	Total weight, lbs.
320	200	16 and 28	18	200	50,000
240	150	13¾ and 24	18	200	47,500
160	100	11 and 20	15	230	27,000

There is also in the engine room a 10-kilowatt motor driven booster used in connection with a storage battery of 2,500 ampere-hours capacity, the main switchboard and a gauge board. The battery was installed to equalize the load and to allow the generating plant to be shut down at times of light load. It consists of 60 cells furnished by the Electric Storage Battery Company. The switchboard consists of four panels of 2-inch Knoxville gray marble, 24 feet in total length. The panels are for light feeders, power feeders, battery connections and generator control, the light panel at one end and the power at the other. There are two sets of bus bars and corresponding to each dynamo there are two switches, each single throw and three pole. Any generator can thus be placed on either or both busses. The feeder switches are double-pole single-throw. On the gauge board there are three gauges corresponding to the three boilers and three gauges for indicating the pressure on the heating, the disinfecting and the kitchen systems, respectively, and a recording steam gauge. Extending lengthwise of the room, there is an overhead beam with a trolley carriage for hoisting heavy machine parts when necessary. The refrigerating plant consists of a 12-ton Steele & Condict ammonia-absorption equipment, with provision for making 1 ton of ice per day, and circulating calcium brine throughout the building through some thirty refrigerators.

The exhaust steam from the steam-driven machinery is carried under the sub-basement floor in trenches and is collected into a Potter muffler tank in the pump room. This is 4½ feet diameter and 6½ feet high and contains 24 disks of galvanized wire through which the steam must pass.

From the top of the muffler tank the steam passes into or around a feed-water heater, as may be necessary, or desired, the heater being located also in the main pump room and a few feet away from the muffler tank. The heater is of the Berryman type with 180 square feet of heating surface in 2-inch seamless brass pipe. It is 40 inches in diameter and 120 inches high. The distribution of exhaust steam beyond the feed heater is indicated in one of the sketches herewith. The exhaust main is 14 inches in diameter and subdivides into a 12-inch exhaust line to the atmosphere, with back-pressure valve, and a 14-inch connection to an exhaust steam header. The header, which

is a distributing drum 15 inches in inside diameter for the heating system, is covered with magnesia blocks which are wrapped in Russia iron on the cylindrical portion with brass bands and trimmings and brass heads. It is shown in a view herewith of the main pump room.

In this room there is a house pump and a fire pump, the two cross-connected to do house duty, two heating return pumps, two air compressors for the temperature regulating system and a Ward feed-water filter, besides the apparatus mentioned. As shown in the photograph the pumps have foundations with a glazed brick facing. The heating return pumps receive the water of condensation from the direct heating system and from the small tempering coils which can drain by gravity to them. They are 7½x4½x10-inch Blake duplex pumps, and are operated under control of a Kieley pump governor to feed the boilers. The tempering coils for the wards and offices have a 6x4x6-inch pump with governor for each set, the two pumps being connected so that either may handle the water from both sets of coils. Behind the boiler room is another pump room containing high and low pressure drip tanks, each with its own pump and governor and a blow-off tank, together with cesspool and blow-off pumps, the latter two 7½x8½x6-inch pumps with an automatic regulator for the control of the water-level. The blow-off, high-pressure and low-pressure drip tanks have 100, 40 and 30 lineal feet, respectively, of 3-inch brass pipe through which cold feed-water can be drawn successively. The feed pumps deliver ordinarily through both the filter and feed heater in turn before discharging into the boilers.

The architect for the building, as stated in the first article, was Mr. R. H. Robertson, of New York, and the consulting mechanical engineer, Mr. Alfred R. Wolff, of the same city. The electrical work was in the charge of Mr. C. O. Mailloux, consulting electrical engineer.

Personal and Obituary Notes.

Mr. O. B. Huntington, Jr., has been elected water master of Springville, Col.

Mr. Frank T. Dodge has been re-elected superintendent of the Water Board of Portland, Ore.

Mr. Thomas Tracy has been appointed superintendent of public buildings of Cambridge, Mass.

Mr. S. M. Shelley, city engineer of Ballard, Wash., has appointed Mr. G. P. James deputy engineer.

The Pittsburg Engineering Co. has been organized at Pittsburg with Mr. Guy P. Thurber president.

Mr. F. D. Carlisle has been re-engaged as superintendent of the City Water Works Co., of Bowling Green, O.

Messrs. Manning Brothers, of Boston, have been appointed landscape architects of the Park Board of Harrisburg, Pa.

Prof. W. H. Williams has been appointed assistant professor of electrical engineering in the University of Illinois.

Dr. L. P. Kinnicutt has been appointed councillor at large to the American Chemical Society, to serve three years.

Civil Engineer F. R. Harris has been transferred from the Charleston navy yard to the New York navy yard at Brooklyn.

Mr. J. Carl Thayer has been appointed city engineer of Middletown, N. Y., succeeding Mr. Charles H. Smith, Jun. Am. Soc. C. E.

Mr. Charles Spence Boyd, of New York, has been nominated by Governor Odell to be Superintendent of Public Works of the State.

Mr. N. Carl Hamilton and Mr. Charles B. Cooke have been elected president and city engineer, respectively, of Wheeling, W. Va.

Mr. Lewis F. Louer has been appointed business representative of The Engineering Record in Chicago, with office at 1140 Monadnock Block.

Mr. C. H. Kinter has been elected general manager of the Harrisburg (Pa.) Light, Heat & Power Co., and Mr. W. R. Fitzpatrick, superintendent.

Mr. Samuel M. Gray, M. Am. Soc. C. E., has been retained to prepare plans and specifications for the improvements of the water system of Lancaster, Pa.

The Portsmouth, (Va.) Berkley & Suffolk Water Works has recently changed hands, but Mr. George Hornung, M. Am. Soc. M. E., remains as general manager.

Mr. John P. Cranford, a member of the well-known paving contracting firm of Cranford Co., of Brooklyn, died at his home in Wakefield, N. Y., February 2, aged 79 years.

Mr. Lincoln Bush, principal assistant engineer of the Delaware, Lackawanna & Western Railroad, has been appointed chief engineer of the system with headquarters at Hoboken.

Prof. R. H. Richards, of the Massachusetts Institute of Technology, completed last week, a short course of lectures at the Missouri School of Mines at Rolla, Mo., on ore dressing.

Mr. George H. Gibson has resigned his position with the Westinghouse Companies' Publishing Department, of Pittsburg, to accept a position with the B. F. Sturtevant Co., of Boston.

Mr. E. M. Scofield, Assoc. M. Am. Soc. C. E., president of the National Bridge Co., has been appointed supervising engineer in the erection of the Mill Creek viaduct for Mahoning County, Youngstown, O.

The Burke Engineering Co., with headquarters in Providence, R. I., has been incorporated. Mr. George R. Babbitt, of Providence, is president, and Mr. Thomas P. Burke, of Pawtucket, superintendent.

Mr. William J. Wilgus, M. Am. Soc. C. E., chief engineer of the New York Central & Hudson River Railroad, has been appointed fifth vice-president, and Mr. H. Fernstrom has been appointed chief engineer.

Mr. Franklin B. Locke, M. Am. Soc. C. E., has been appointed city engineer of North Adams, Mass., succeeding Mr. John H. Emigh, M. Am. Soc. C. E., who has been city engineer since the city was incorporated seven years ago.

Mr. A. E. Martin, for seventeen years superintendent of the South Framingham, Mass., Water Co., has severed his connection with that corporation to become superintendent of the water works at Springfield, Mass. Mr. George F. Chace, of Taunton, succeeds Mr. Martin.

The board of officers who are to conduct the examinations for appointments in the Corps of Civil Engineers, in the U. S. Navy, on the basis of examinations February 23, consists of Civil Engineer R. E. Peary, U. S. N., as president, and Civil Engineers F. T. Chambers, A. C. Cunningham, Fred Thompson and L. F. Bellinger.

Mr. George A. Berry has been appointed engineer of bridges of the New York Central & Hudson River Railroad succeeding Mr. F. L. Chase, whose resignation was noted last week. Mr. Jens H. Holst succeeds Mr. Berry as assistant engineer of bridges. Mr. R. P. Mills has been appointed acting supervisor of buildings on the eastern division.

Mr. John W. Grove, former treasurer and general manager for James W. Grove & Co., of Pittsburg, and Mr. L. L. Knox, former Pittsburg manager for Messrs. M. H. Treadwell & Co., have formed a co-partnership under the name of Grove & Knox, to engage in furnace engineering and contracting. Until April 1, when they will take quarters in the Farmers' National Bank building, their office will be Peoples' Bank building, that city.

Lieut.-Col. Andrew N. Damrell, Corps of Engineers, U. S. A., in charge of the seventh and eighth lighthouse districts, with headquarters at Mobile, Ala., has been placed on the retired list, and his duties will be performed temporarily by Capt. Spencer Cosby. He was graduated from the U. S. Military Academy in 1864 and served throughout the Civil War. As a result of his retirement Major James B. Quinn, at Norfolk, has been nominated by the President to be lieutenant-colonel and Capt. Edward Burr, at the Washington barracks, to be major. First Lieut. M. L. Walker is in line to become captain and Second Lieut. Edward N. Johnston, first lieutenant.

David Philipps Jones, passed assistant engineer of the U. S. Navy and one of the consulting engineers of the Louisiana Purchase Exposition, died in Pittsburg, January 30, aged 62 years. He entered the navy service in 1862, in 1873 was attached to the Bureau of Steam Engineering, and from 1874 to 1879 was instructor in steam engineering at the Naval Academy. During an extended leave a few years after the Civil War, he was constructing engineer of the St. Louis & Southern Railroad. From 1885 to 1888 he was professor of mechanical engineering at the Kansas Normal College. He was retired from the Navy in 1892.

Mr. Frank E. Winsor, until recently division engineer on construction of the Weston aqueduct for the water works of Boston, has been appointed assistant engineer by the Commission on Additional Water Supply for New York. Mr. Ernest G. Hopson, formerly with the Metropolitan Water Board at Clinton, Mass., has been appointed engineer in charge of surveys for the commission. Mr. D. W. Cole, formerly assistant engineer with the Metropolitan Water Board, and later principal assistant engineer in charge of the construction of the Wigwam dam and reservoir for Waterbury, Conn., has received the appointment of assistant engineer to the commission.

Trade Publications.

The Stanley Electric Mfg. Co., Pittsfield, Mass., has issued three new bulletins. No. 129 gives an illustrated description of the construction in detail of the S. K. C. revolving field generators, No. 180 gives information concerning the S. K. C. 401 railway motor, and includes a cut of a 600-kilowatt direct-current generator for railway service; and No. 131 gives much instructive matter on the use of the rotary converter in interurban railroad work.

The Richardson Scale Co., 16 Park Row, New York City, has just printed a new catalogue on automatic weighing machinery which treats of the manifold forms in which the scale is made for the weighing of grain, coal, flour, cement, etc. The numerous types are illustrated, several of the cuts showing the scale in actual use.

"From Steelton to Mandalay" is the title of an interesting monograph from the bridge and construction department of the Pennsylvania Steel Co., at Steelton, Pa. It pertains to the building of the Gokteik Viaduct, in one of the Shan States of Upper Burma, and includes an account of the opening ceremonies in June, 1901, also an article from the "World's Work," by the company's resident engineer, and a gen-

eral description of the work, reprinted from The Engineering Record of Jan. 12, 1901. The shipped weight of the viaduct was 9,760,000 pounds and the distance traveled, 10,599 miles. By profuse illustrations a pictorial history of the progress of the work is shown, covering the nine months in which the erection was accomplished.

The Archer Iron Works, 34th Pl. and Western Ave., Chicago, manufacturers of steel wheel barrows, lumber carts, ore and coal cars, and trucks and wheels of all kinds, describe and list their products in their tenth annual catalogue, just issued.

The results of government tests made at the Watertown Arsenal, on concrete mixed by a portable gravity concrete mixer, together with a reprint from the "Railway and Engineering Review," describing the construction and use of the mixer, are being distributed by the makers, the Contractors Plant Co., 37 Pittsburgh St., Boston, Mass.

The 1903 catalogue of the H. W. Johns-Manville Co., 100 William St., New York, shows asbestos in many conditions, from the natural state as it is mined to the various non-conducting forms into which it is manufactured, for both heat and cold insulation, packing for all kinds of service, pipe covering, asbestos paper and millboard for fire-proof construction, electrical insulation, fire resisting cements, and sundries such as asbestos gloves and household articles. Each section has its own table of contents and there is also a complete alphabetical index, so that quick reference may be made to any article.

A 168-page general catalogue of pumping machinery has been issued recently by the Laidlaw-Dunn-Gordon Co., 114 Liberty St., New York. The firm manufactures machines for all classes of pumping—water, oil, air, etc.—but is able to list only the patterns in most common use. Many illustrations are given of the various types and their application to different kinds of service, and a space in the back is reserved for tables and useful information.

The General Electric Co. has issued three pamphlets relating to transformers. No. 9114 is an extended treatise on type H transformers, including a discussion of the elements of their design and operation. No. 9115 is a record of tests of core losses, regulation and copper losses. No. 9116 is devoted to sheet steel for transformers, giving an unusually interesting series of photo-micrographs of different classes of steel, showing the effect of mechanical work and of heat. These publications can be had by addressing the Publication Bureau at Schenectady, N. Y.

The Joseph Dixon Crucible Co., Jersey City, N. J., has prepared a souvenir of an inspection trip made by the American Society of Civil Engineers to the new terminal of the North German Lloyd Steamship Co., giving eight valuable views of the construction of the piers. The company's publication "Graphite" for February, contains a number of interesting, short articles.

Mechanical arithmetic is the subject of a pamphlet issued by the Felt & Tarrant Mfg. Co., 52 Illinois Street, Chicago, to describe its Comptometer. It is a desk machine for performing arithmetical operations, such as addition, multiplication, division and extracting the square root.

The American Blower Co., Detroit, Mich., has collected in its publication No. 145, a number of views of heating plants in well-known factories and shops, to illustrate its method of heating and ventilating manufacturing establishments. A brochure has also been prepared describing apparatus for drying lumber.

Johnson & Morton, Utica, N. Y., has published in pamphlet No. 1008, a catalogue of panel boards and accessories for electric circuits. It comprises a list of all styles of boards and fittings in common use, and this is accompanied by detailed tables of prices.

An advance catalogue has been issued by the Pacific Flush Tank Co., Chicago, on siphonic apparatus for bacterial sewage filters. By the aid of excellent illustrations it shows the Miller and the Adams patents covering single, double, triple and plural automatic alternating siphons, the automatic sewage feed and automatic timed siphons.

Charles Millar & Son Co., Utica, N. Y., has issued Catalogue M, covering plumbing goods and sanitary specialties. It is a 150-page book 9x12 inches in size with stiff board covers and is printed on heavy paper. It is profusely illustrated.

The Pratt & Whitney Co., Hartford, Conn., has issued a 38-page pamphlet describing a new model of turret lathe. The different parts are treated in detail and the text is accompanied by excellent illustrations.

Edward C. Hart & Co., 59 Dearborn Street, Chicago, have prepared an interesting catalogue devoted to centrifugal pumps. They are furnished with as many as four impeller wheels per pump, and their varied scope of application is indicated by a number of drawings.

The Pillsbury extension manhole frame is described in a circular being distributed by the Chelmsford Foundry Co., 159 Devonshire Street, Boston.

Any one interested in the planning of a town can probably obtain a photographic reproduction of a map of Zion City, Ill., in a pamphlet issued by Mr. Burton J. Ashley, until recently that city's engineer.

The Raymond Concrete Pile Co., Merchants' Loan & Trust Building, Chicago, describes concrete pile construction in a 36-page pamphlet. It has fifteen very interesting half-tone views of the methods of driving, and drawings are introduced to compare the use of concrete piles with ordinary timber ones.

The Pittsburgh Gage & Supply Co., Pittsburg, Pa., has published its calatogue for 1903, which is a book of 670 pages, bound in boards. It appears to cover everything in the line of mill, mine, machinists' and railroad supplies and steam plant specialties. In view of the scope of the book and detailed tables of dimensions as well as prices, the catalogue will prove a very valuable source of reference. A conspicuous feature is a number of colored inserts showing stock of various articles on hand. An extended index occupying 24 pages has been provided.

The Westinghouse Electric & Mfg. Co., Pittsburg, has issued Circular No. 1061, devoted to outfits for charging automobiles. Westinghouse, Church, Kerr & Co., 10 Bridge Street, New York, have prepared for general distribution a reprint of Mr. E. H. Sniffin's paper on the steam turbine, read before the American Street Railway Association at Detroit. The Westinghouse Air Brake Co., Pittsburg, describes in a pamphlet its electro-pneumatic system for the control of railway and other motors and has printed in that connection a booklet of instructions for the operation and inspection of the system.

The Philadelphia Pneumatic Tool Co., 21st Street and Allegheny Avenue, Philadelphia, is distributing on application, a pamphlet on the care and use of pneumatic tools, treating of such subjects as cleaning, oiling, air strainers, etc., and a circular on the Keller pneumatic tampers.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 168, 23, 24 and 26.

WATER.

Ft. McKinley, Me.—See "Government Work."

Enfield, N. H.—The Legislature has passed the bill authorizing the Fire Dist. to construct and maintain a water system for domestic and fire purposes.

Easthampton, Mass.—The question of enlarging the water supply, at a cost of about $9,500, is reported under consideration by the Water Bd.

Plymouth, Mass.—See "Sewerage and Sewage Disposal."

Bristol, Conn.—A press report states that the Bristol Water Co. will construct this spring a storage reservoir near the site of the standpipe on Federal Hill. It will be of masonry, 75 ft. square and 35 ft. deep.

Waterbury, Conn.—The Bd. Pub. Wks. is reported to be planning to expend about $15,000 in extending the water mains.

Pawtucket, R. I.—The contract to supply 400 pieces of 8-in. pipe and 700 pieces of 6-in. pipe, cast iron, is reported to have been awarded to the Builders' Iron Foundry of Providence. The Pawtucket Steam & Gas Pipe Co. is reported to have secured the contract to supply 10,000 ft. of 1-in. and 5,000 ft. of 2-in. wrought iron tarred pipe; total amount of contracts reported to be about $48,000.

Ft. Totten, Willets Point, N. Y.—See "Government Work."

Dubois, Pa.—Bids will be received Feb. 18 by the Water Com. for furnishing 32,738 ft. 6, 16, 20 and 30-in. cast iron water pipe, stop valves and air valves; bids will also be received Feb. 25 for delivering and laying said pipe. W. A. Eagleman, Chmn.

Elmerton, N. Y.—The Town Bd. of Tonawanda is stated to have granted the petition of the Elmerton Water Co., of Elmerton (the new village in the Town of Tonawanda) for incorporation. Geo. Davis, Mgr. American Cabinet Co. of Elmerton, is reported interested.

North Tonawanda, N. Y.—The Bd. of Pub. Wks. is stated to have begun preparations for the construction of another 24-in. water main across Niagara River from the pumping station on Tonawanda Island; probable cost of work, $6,000.

Meadville, Pa.—The Select Council has passed the bill providing for the purchase of boilers for the new water works pumping station.

Lancaster, Pa.—The Water Comm., which will have the expenditure of $145,000 for the improvement of the city's system, is stated to have retained Samuel M. Gray, of Providence, R. I., to prepare plans and specifications.

Reading, Pa.—The Council has passed the ordinance making an appropriation of $210,000 to the Dept. of Water for the next fiscal year.

Wilmington, Del.—The Water Comrs. are stated to have decided to lay new water mains in the 9th Ward. The Levy Court will be asked to appropriate $7,000 to install a water plant at the New Castle County Hospital.

Washington, D. C.—The following bids for 29 filters and for cement were opened Jan. 28 by Lieut. Col. A. M. Miller, Corps Engrs., U. S. A.; A, N. Y. Continental Jewell Filtration Co., N. Y. City, which bid also for 24 filters, at a total of $1,258,225; B, Harmer & Quinn, Phila., who bid $2,190,393 for 24 filters; C, D. J. McNichol, Phila., who bid $1,937,265 for 24 filters; these totals and those of the table, however, not verified. The Portland cement, amounting to 135,000 bbls., was bid for separately, as follows: Lawrence Cement Co., Phila., at $1.88; B. Wallis & Co., Baltimore (Alsen cement), at $2.40; Alpha Port. Cem. Co., Easton, Pa., at $2.23 (60,000 bbls.); Atlas Port. Cem. Co., N. Y. City, at $2.195; Virginia Port. Cem. Co., N. Y. City, at $2.035:

Bids for 29 Filters.

Bidders.	A	B	C
Exc., 880,010 cu. yds.	$0.40	$0.57	$0.38
Embank., filters, 65,400 cu. yds.	.50	.50	.48
Other embank., 46,700 cu. yds.	.40	.50	.43
Filling over filters, 123,400 cu. yds.	.50	.50	.48
Puddle, 2,000 cu. yds.	1.40	6.00	6.20
Seeding, 31 acres	100.00	200.00	110.00
Sodding, 9,700 sq. yds.	.50	.25	.39
Conc. floors, 39,300 cu. yds.	5.00	6.75	6.96
Concrete walls, 26,300 cu. yds.	5.25	7.75	7.76
Concrete piers, 8,200 cu. yds.	5.50	9.10	9.26
Concrete vaulting, 37,400 cu. yds.	6.00	9.05	8.16
Granolithic pavement, 35,000 sq. yds.	1.25	1.55	.90
Steel pipe	81,000	83,000	81,015
Cast-iron pipe	66,000	75,000	77,811
Sand washer pipe	36,500	21,000	16,126
Pressure pipe	1,500	1,500	1,315
Exterior drainage	25,000	27,000	25,469
Central under drains, 7,900 ft.	1.85	1.93	1.65
Interior drainage, per filter	500.00	490.00	560.67
Filter gravel, 42,300 cu. yds	...	3.58	3.15
Filter sand, 140,200 cu. yds.	...	3.58	3.40
Placing materials in masonry, per filter.	300.00	82.00	60.00
Roof drainage	600.00	360.00	597.00
Totals	$1,388,870	$2,479,540	$2,209,678

Philadelphia, Pa.—Bids are wanted Feb. 16 for improvement, extension and filtration of the water supply, including Lardners Point pipe distribution system, foundation and superstructure for the lower Roxborough preliminary filters, filters, material and underdrains for the Belmont filters, etc. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Filters.

Pittsburg, Pa.—Local press reports state that a new town is to be established on the Perrysville Road, in Ross Township, the property for the purpose having been purchased by the Allegheny-Bellevue Land Co. for $675,000. It comprises 632 acres and extends about 1½ miles along Perrysville Road. The land is already being plotted and the company has set aside $400,000 to defray the cost of grading, sewering and paving about 150 streets and alleys, laying water mains, natural gas lines and installing an electric lighting system for the streets and dwellings.

Port Perry, Pa.—It is stated that the Baltimore & Ohio R. R. Co. will soon begin the construction of water purifying plants at Port Perry and Griffin, to cost about $15,000. J. M. Graham, Ch. Engr., Baltimore, Md.

Middletown, Md.—Water bonds amounting to $10,000 are reported sold.

Middletown, N. Y.—The following bids were opened by Geo. R. Wengenroth, Clk. Water Comrs., Jan. 24 for enlargement of water works—*a*, 20-in. pipe conduit; *b*, roadway and aerator: Dilliard & Morgan, East Bangor, Pa. (awarded both contracts), *a*, $18,-105; *b*, $3,707. Chas. Sundstrom, New York, *a*, $22,-707; *b*, $4,631. D. E. Olds & Co., Newark, N. J., *b*, $5,159. The conduit contract includes 321 lin. ft. trench with 157 ft. pipe laying and 663 ft. tunneling with 2,200 ft. pipe laying.

Orange, Va.—It is stated that a committee has been appointed, composed of Mayor Perry, W. H. Ricketts and C. W. Woolfolk, to ascertain the cost of water works. A bill authorizing a bond issue will be offered in Legislature.

Savannah, Ga.—Bids will be received Feb. 18 by the Water Com. for furnishing f. o. b. 4,200 ft. 6 and 16-in. standard cast iron water pipe, 24 6-in. and 3 16-in. gate valves, etc. A. J. Garfunkel, Chmn.

Sandersville, Ga.—W. A. Bell, City Clk., writes that it is proposed to construct water works and an electric light plant, at a cost of $40,000. Engineer, Mr. Wilcox, of Macon.

Hawkinsville, Ga.—T. J. Holden, City Clk., writes that it is proposed to construct water works and a sewerage system; probable cost, $40,000.

Cleveland, O.—Bids will be received by the Clk. Bd. of Control, Feb. 28 for furnishing and delivering valves, as advertised in The Engineering Record.

Shelbyville, Ind.—The Citizens' Water, Heat, Light & Power Co. is reported to have purchased a site and will soon construct a plant, at a cost of $300,000.

Evanston, Ill.—J. H. Moore, City Engr., writes that M. Foley, of Evanston, has secured the contract for a 6-in. water main in Madison St.

Rockford, Ill.—It is stated that $25,000 will be expended in extending water mains during the coming year.

Kenosha, Wis.—The Bd. of Water Comrs. is stated to have decided to erect a standpipe.

Marquette, Mich.—The Bd. of Fire & Water Comrs. is stated to have decided to expend about $5,000 in water works improvements.

Bird Island, Minn.—J. H. Feeter, Village Recorder, writes that the citizens voted Jan. 27 to construct water works.

Blackduck, Minn.—L. G. Townsend, Village Clk., writes that it was voted Jan. 17 to expend $7,000 for water works.

Lake Park, Minn.—It is reported that $11,000 bonds have been voted for water works.

Lake Wilson, Minn.—Martin Forest, Village Recorder, writes that W. D. Lovell, of Des Moines, Ia., has been selected to prepare plans for water works. The question of bonding will probably be submitted to the voters in March.

Toledo, O.—The State Bd. of Health is stated to have approved the plans of the Engineering Comn. for an improved water supply in Toledo.

Elizabeth, Ill.—W. M. Perry, Village Clk., writes that M. Tschurgi, of Dubuque, Ia., is the engineer for the proposed water works, to cost $10,000.

Springfield, O.—It is stated that bids are wanted Feb. 10 for $10,000 water works bonds. R. N. Lantz, City Clk.

Burlington, Ia.—Bids will be received by the Citizens Water Co., Burlington, Feb. 27, for water pipe and special castings, as advertised in The Engineering Record.

Dyersburg, Tenn.—W. S. Droper, Recorder, writes that contracts have already been let for water works and electric light plant. This bill was recently passed in Legislature.

Knoxville, Tenn.—The House is stated to have passed the bill authorizing Knoxville to issue bonds and buy the plant of the Knoxville Water Co.

Memphis, Tenn.—Bonds amounting to $1,250,000 are reported to have been sold to be used for the purchase of the water works.

Augusta, Ark.—Bids will be received by the Bd. of Water Comrs. Feb. 12 for wells, pumps, engine, generator, power station, etc., as advertised in The Engineering Record.

Crowley, La.—The question of calling an election to vote on issuing $100,000 bonds for water works and an electric light plant is reported under consideration by Council.

St. Francisville, La.—Bids are wanted Feb. 18 for constructing water works and an electric light plant, as advertised in The Engineering Record.

Washington, La.—Ira W. Sylvester, of Alexandria, has been selected to prepare plans for water works.

Ardmore, Ind. Ter.—A later press report states that the American Light & Water Co. of Indianapolis, Ind., secured the contract for the water works at $49,-340, with the exception of the boilers and engines, which were rejected. New bids will be received for the latter.

South McAlester, Ind. Ter.—Bids will be received by the City Clk. Feb. 28 for furnishing material and building water works and a sewerage system, as advertised in The Engineering Record.

St. Louis, Mo.—The John O'Brien Boiler Wks. Co., of St. Louis, has secured the contract for installing 6 furnaces in the Low Service Pumping Sta. for $7,-589. Edw. Flad, Water Comr.

Chinook, Mont.—M. F. Marsh, Town Clk., writes that contracts will probably be let about May 1 for the construction of water works, to cost about $24,-000. Engineers, Loweth & Wolff, St. Paul, Minn.

Merrill, Mont.—The Merrill Ditch Co. has been incorporated, with a capital of $20,000, for irrigation purposes, and taking water from the Yellowstone River in Sweet Grass County. Directors: Matthew Miller, Ed. Cardwell and Olaf Lafverson, all of Merrill.

Denver, Colo.—The South Boulder Power & Irrigation Co., of Denver, has been incorporated, with a capital of $300,000, by John A. Ebersole, W. E. Porter and Henry V. Johnson.

The Platte Valley Ditch & Reservoir Co. has been incorporated, with a capital of $1,200, to operate in Arapahoe County, with principal office in Denver. Jas. W. Wier, Jos. W. Fassett and Lucy W. Hartman are the incorporators.

Ashland, Ore.—The City Council is stated to have authorized the purchase and installation of about 1 mile of 18-in. main to supplant the 10-in. main next the intake., to cost about $8,000.

Freewater, Ore.—The Milton, Freewater & Hudson Bay Irrigation Co. has been incorporated, with a capital of $5,000, to irrigate a portion of the arid Hudson Bay Dist. from Walla Walla River. Incorporators: J. C. Hodgson, Wm. Shaw and W. C. Gallagher.

Oceanside, Cal.—H. D. Brodie, City Clk., writes that an election will be held Feb. 16 to vote on issuing bonds to the amount of $15,000 for new water mains and reservoir, and $10,000 for wharf extension. W. S. Schuyler, Engr.

Mountainview, Cal.—The Bd. of Trade is reported to be agitating the proposition of a water system for the town. It has been recommended by the Bd. that the town erect the plant, but in case that is not practicable it is hoped a private corporation will take up the matter.

Gridley, Cal.—Jas. D. Schuyler, of San Francisco, is reported to be the engineer and representative of capitalists who propose to bring 180,000 acres of the lands in the region of Gridley and Biggs under irrigation with water from Feather River.

Lordsburg, Cal.—The Cetras Water Co. has been incorporated, with a capital of $20,000. F. G. Wyman, of Lordsburg, is one of the incorporators.

Long Beach, Cal.—John Carroll is stated to have secured from the City Council a franchise to establish a water system.

Salt Lake City, Utah.—The Davis County Canal & Irrigation Co. is reported as being formed by Hyrum Stewart, of Kaysville; O. P. Hatch, of Bountiful, and others, to construct a 9 mile flume or a 5 mile tunnel, for irrigation purposes, the tunnel to cost $310,-000, and the flume, $325,000.

Sacramento, Cal.—C. M. Phinney, Deputy City Surveyor, writes that $150,000 water bonds have been sold, and that the Bd. of Trus. have authorized the City Surveyor to prepare plans and specifications for mains.

The following bids were received, according to press reports, Jan. 26 for a 10,000,000 gal. pump for the water works: *a*, horizontal cross compound; *b*, horizontal triple expansion; *c*, vertical triple expansion; *d*, vertical cross compound; *e*, duplex double acting: Chas. C. Moore & Co., *a*, $26,659; *b*, $33,309, $34,007 and $31,354; *c*, $41,169; *d*, $35,214. Holly Mfg. Co., Lockport, N. Y., *c*, $41,700. Laidlaw-Dunn-Gordon Co., Cleveland, O., *a*, $21,450 and $23,950; *b*, $28,500 and $31,000. Henry R. Worthington Co., Brooklyn, N. Y., *b*, $21,950. Allis-Chalmers Co., Milwaukee, Wis., *c*, $39,500; *e*, $29,305; *a*, $26,000; *d*, $30,000. Risdon Iron Wks., San Francisco, *d*, $41,375; *c*, $49,-080; *b*, $39,650; *a*, $37,350.

Shoshone, Idaho.—Bids will be received by the Twin Falls Land & Water Co., Salt Lake City, Utah, until Feb. 14 for constructing a canal system of 86 miles of canal, with masonry headgates, waste gates and culverts; also dam across Snake River near Shoshone. W. G. Filer, Mgr.

SEWERAGE AND SEWAGE DISPOSAL.

Everett, Mass.—The Common Council is stated to have passed the order authorizing the Mayor to petition the Legislature for authority to borrow $100,000 to be expended in completing the surface drainage system.

Fall River, Mass.—See "Paving and Roadmaking."

Plymouth, Mass.—At a town meeting Jan. 25 the citizens are stated to have voted to construct sewers in the northerly part of the town, at a cost of $27,000, and to expend $20,000 for the purchase of a pump and pumping station for the water works.

Waterbury, Conn.—The Bd. of Pub. Wks. on Jan. 20 is stated to have authorized the City Engr. to prepare plans for storm water drains in numerous streets.

Stamford, Conn.—The City contemplates enlarging its sewer system to extend over the East Side, and the City Engr., Paul Nash, has made an estimate of the cost of the work. The extension will consist of two parts, the first to be connected with the present system and running to the pumping station; the cost to be $19,668. The 2d portion will be independent of the present system and will be a gravity system; estimated cost is $56,422. Contracts will probably be let some time in April.

Corinth, N. Y.—The Village Trus. are reported to have adopted the plans of J. S. Mott & Son for the proposed sewerage system, to cost about $25,000.

Long Island City, L. I., N. Y.—Bids are wanted Feb. 14 for constructing 6,075 ft. of 12 to 24-in. vitrified salt glazed sewer pipe, 42 manholes, 15 receiving basins, etc., in several streets in the Boro. of Queens. Jos. Bermel, Comr. of Pub. Wks.

Weehawken, N. J.—The lowest bid received by the Township Com. Jan. 27 for constructing sewage disposal works and an outlet sewer is reported to have been submitted by Thos. Cavanagh, for about $40,000.

Pittsburg, Pa.—Bids are wanted Feb. 9 for constructing 9, 15, 18, 20 and 24-in. pipe and 30 and 36-in. brick sewers in portions of numerous streets. J. Guy McCandless, Dir. Dept. of Pub. Wks.

Pittsburg, Pa.—See "Water."

South Bethlehem, Pa.—Thos. Ganey, Boro. Secy., writes that it is proposed to construct a sewerage system, at a cost of $100,000. Detail plans and specifications have been adopted and contracts will probably be let in March. R. E. Neumyer, 3d and Birch Sts., is the Engr. in Charge.

Ft. Totten, Willets Point, N. Y.—See "Government Work."

New York, N. Y.—The following bids were opened Feb. 3, by Geo. Livingston, Comr. Pub. Wks., for alterations to sewer in St. Nicholas Ave., 149th to 155th Sts., and a new sewer in St. Nicholas Ave.:

Brick sewer—	Walter J. Ford.	Wm. J. Moore.	F. Thilemann, Jr.	Wm. E. Welch.	Norton & Dalton.
3′ 6″x2′ 4″, Class I., 845 ft.	$12.00	$9.00	$12.00	$12.00	$15.00
3′ 6″x2′ 4″, Class II., 850 ft.	12.00	9.00	13.00	13.00	15.00
18-in. vitrified pipe, 250 ft.	8.00	4.00	....	10.00	10.00
12-in. vitrified pipe, 75 ft.	6.00	2.00	11.00	5.00	2.00
Rock excavation, 1,350 cu. yds.	5.00	3.00	5.00	4.00	5.00
Timber and planking, 75,000 ft.	.01	20.00	30.00	40.00	30.00
Timber in foundation, 1,000 ft.	30.00	30.00	30.00	40.00	30.00
6-in. cast iron spurs, 16	3.00	5.00	15.00	2.00	4.00
Iron soil pipe, 100 ft.	3.00	1.00	3.00	2.00	1.00
6-in. cast iron ¼-bends, 16	3.00	5.00	15.00	2.00	2.00

New York, N. Y.—The following bids were opened Feb. 3 by Geo. Livingston, Comr. Pub. Wks., for alteration and improvement to outlet sewer in Broad St., between East River and Wall St., and several connecting sewers:

	Terence A. Smith.	N. Y. Sewer Constr. Co.	F. Thilemann, Jr.	Wm. J. Moore.	Wm. E. Welch.
4-ft. wood barrel sewer, Class A, 966 ft.	$25.00	$15.00	$35.00	$13.00	$20.00
Brick sewer—					
4-ft. twin, Class I., 8 ft.	20.00	39.00	50.00	30.00	30.00
4-ft. reducer, Class II., 8 ft.	25.00	55.00	50.00	30.00	20.00
4′x6′ 8½″, Class III., 336 ft.	25.00	32.00	38.00	20.00	18.00
5-ft., Class IV., 1,665 ft.	18.00	17.00	19.00	14.00	16.00
4-ft., Class V., 230 ft.	16.00	16.00	19.00	14.00	15.00
4-ft., Class VI., 110 ft.	12.00	11.00	16.00	14.00	15.00
4′x2′ 8″, Class VII., 10 ft.	10.00	11.00	16.00	10.00	15.00
3′ 6″x2′ 4″, Class VIII., 1,540 ft.	10.00	14.00	16.00	10.00	17.00
3′ 6″x2′ 4″, Class IX., 40 ft.	9.00	10.00	16.00	10.00	15.00
12-in. vitrified pipe, 450 ft.	....	1.50	6.00	2.00	5.00
12 receiving basins	50.00	100.00	200.00	100.00	200.00
Timber and planking, 100,000 ft.	5.00	20.00	35.00	20.00	.01

Stroudsburg, Pa.—John L. Westbrook, Boro. Engr., estimates the cost of a sewer 2,462 ft. in length for the borough, at about $5,786.

Washington, D. C.—The District Comrs. have executed a contract with Ambrose B. Stannard, of New York, N. Y., for the construction of the sewage pumping station at the ft. of New Jersey Ave., S. E. The total of the contract is $548,220, of which $269,220 is for the foundation work and $279,000 for the building.

Augusta, Ga.—Hankinson & Son are reported to have secured the contract for constructing the sewer for West End, at about $5,000.

Atlanta, Ga.—Bids will be received by the Mayor and Gen. Council Feb. 16 for furnishing material and supplies consisting of cement, cast iron manhole and catch-basin covers, vitrified sewer pipe, setting curb brick and laying sidewalks for sewer work. R. M. Clayton, City Engr.

Hawkinsville, Ga.—See "Water."

Newark, O.—The following bids were received Jan. 27 for the construction of a tile sewer on N. 4th St. (C. H. Wells, City Engr.): F. H. Kinney, Newark, $6,028; Wm. R. Davis, Newark, $6,626, and F. D. Sullivan, Columbus, $8,014.

Akron, O.—Resolutions have been passed by Council providing for the construction of sewers in Charles, Wheeler, Yale and Campbell Sts., and also for the preparation of a plan of sewerage and drainage for Sewer Districts Nos. 6 and 7. Chas. H. Isbell, City Clk.

Dayton, O.—Plans have been submitted to the Bd. of City Affairs for 5 miles of sanitary sewers by F. M. Turner, City Engr.

Evanston, Ill.—Jas. Wigginton, of Evanston, has secured the contract for a vitrified tile pipe sewer on Lake St. J. H. Moore, City Engr.

Cleveland, O.—Bids will be received Feb. 12 by the Bd. of Control for constructing sewers in portions of several streets; bids will also be received Feb. 26 for constructing sewers in portions of 5 streets. Chas. P. Salen, Dir. of Pub. Works.

Irvington, Ind.—City Engr. Jas. Nelson, of Indianapolis, is reported to be preparing plans for the sewerage system for Irvington.

Boone, Ia.—Bids will be received Feb. 14 by Archie Patterson, Co. Aud., for furnishing 7,500 ft. 8, 10, 12 and 15-in. tile required in the construction of county drain No. 7 in Garden Township.

Dyersburg, Tenn.—W. S. Droper, Recorder, writes that it is proposed to construct a sewerage system, at a cost of $25,000. Bonds for same have not yet been voted.

South McAlester, Ind. Ter.—See "Water."

St. Louis, Mo.—At a conference of the Bd. Pub. Improv. Com. of Council, Comptroller Player, City Counselor Bates, Sewer Comr. Hermann and other interested officials Jan. 29 it was practically decided to build the Cabanne sewer this year. It is estimated that the total cost of establishing the new district will be approximately $350,000, of which the property owners must pay about $250,000 and the city $100,000.

Guthrie, Okla. Ter.—Cooper Bros., of Springfield, Mo., are stated to have secured the contract for constructing 3 main sewers in West Guthrie, for $6,980.

Smithfield, Tex.—The Smithfield Sewerage Co. is reported organized, with A. B. Mayfield, Pres., and Geo. Hill, Secy. A 50-year franchise is stated to have been received from the city.

Ft. Scott, Kan.—See "Paving and Roadmaking."

Bisbee, Ariz.—The City Council is reported to be considering a proposition to call an election to vote on issuing bonds for a sewerage system.

Spokane, Wash.—The following bids are reported opened by the Mayor and Bd. Pub. Wks. for the construction of the 4th Ward sewer system: Mitchell Bros., $75,950; J. A. Clarke, $74,700; August Ilse, $69,300, and Jas. Broad, $69,124 (awarded contract).

Portland, Ore.—Local press reports state that among the improvements contemplated for the coming year is the construction of the Brooklyn sewer, to be located in the southesstern part of city. It will be 3 miles in length. Wm. C. Elliott, City Engr.

Ventura, Cal.—The Town Clk. writes that it was voted Jan. 26 to issue $8,000 bonds for the extension of the sewerage system.

San Francisco, Cal.—Local press reports state that the Bd. of Pub. Wks. will soon let contracts for the reconstruction of the 6th St. sewer and sewers in its vicinity; probable cost, $50,000.

BRIDGES.

Bridgeport, Conn.—The Bd. of Apportionment's Com. on the Pub. Wks. Dept., Roads & Bridges, is in favor of building the steel bridge across Berkshire Pond, at an estimated cost of $21,000, as recommended by Dir. of Pub. Wks. Kennedy.

Providence, R. I.—See "Paving and Roadmaking."

New York, N. Y.—Bids will be received Feb. 18 (readvertisement) by the Aqueduct Comrs. for furnishing material and building 14 highway bridge steel superstructures in Westchester Co. Wm. H. Ten Eyck, Pres.

Donora, Pa.—A bill has passed the House authorizing the Donora Southern Ry. Co. to construct a bridge across Monongahela River, between Donora and Monessen.

Dauphin, Pa.—Press reports state that the Engineers of the Pennsylvania R. R. are preparing to build a 2 track steel bridge across Susquehanna River, between Dauphin and Marysville.

Pittsburg, Pa.—The House has passed a bill authorizing the Eastern R. R. Co. to construct a bridge between Hazelwood Ave., Pittsburg and St. Clair Township.

Press reports state that Capt. W. L. Sibert, Corps Engrs., U. S. A., has served official notice on the Union Bridge Co. to raise its bridge at the point to a height of 70 ft. above pool level.

Philadelphia, Pa.—Lieut. Col. Raymond, Corps Engrs., U. S. A., is reported to have approved the plans of the Rapid Transit Co. for the bridge that is to be built across Schuylkill River, for the elevated railroad trains. Local press reports state that as soon as plans have been approved by the Secy. of War, bids for placing piers will be asked by the Transit Co.

Washington, D. C.—The House and Senate have passed the bill providing for an appropriation of $35,000 for the rebuilding of the Aqueduct Bridge, in order to provide for the laying of a single track across said bridge for the purpose of accommodating an electric street railway. It is reported that the bridge is to be rebuilt by the Great Falls & Old Dominion Ry. Co. according to plans approved by the District Comrs.

Bids will be received at the U. S. Engr. Office, Washington, Mar. 27, for constructing a highway bridge across Potomac River, at Washington, as advertised in The Engineering Record.

Baltimore, Md.—See "Railroads."

Erie, Pa.—A resolution has been adopted by the City Council authorizing the City Engr. to prepare plans for a bridge to be built across Mill Creek, at 3d St.

Middletown, Pa.—Press reports state that the Boro. Council has decided to change the original plans for the Catharine St. subway so as to include a driveway. Probable cost, $10,000.

Warwick, Del.—The building of a drawbridge across Indian River, at a probable cost of $15,000, is reported to be under consideration.

Remington, Va.—The Virginia Bridge & Iron Co. is reported to have secured the contract to construct a 3 span steel bridge (each span 68 ft. long), having stone abutments and 2 piers, across Rappahannock River, at Remington.

Clarksburg, W. Va.—Press reports state that the Directors of the Clarksburg Industrial Co. are receiving bids for constructing a bridge across Elk Creek, from Main St. to their property. Probable cost, $30,000.

Parkersburg, W. Va.—The Wabash R. R. Co. is reported to have submitted to the Pittsburg Coal Exchange for approval, plans for the bridge which it is proposed to build across Ohio River, just below Parkersburg.

Springfield, O.—A. K. Hahn, Co. Aud., writes that contracts for a bridge over Mad River on Enon Road (bids opened Jan. 28) have been awarded as follows: Superstructure to the Canton Bridge Co., of Canton, for $5,987, and substructure to Jos. Bolun, of Springfield, for $2,758.

East Peoria, Ill.—Robt. M. Orr, City Clk., writes that all bids received Jan. 27 for a bridge over Farm Creek, have been rejected and new bids will be received; probable cost, $5,700.

Freeport, Ill.—It is stated that the building of a viaduct across the tracks of the Illinois Central & Northwestern R. R. at Jackson St. is contemplated.

New London, Wis.—The Modern Steel Co., of Waukesha, is reported to have received the contract to construct 2 bridges across Little Wolf River, for $8,150.

Bay City, Mich.—Press reports state that the Governor has signed a bill authorizing Bay County to issue $135,000 bridge bonds.

St. Paul, Minn.—Local press reports state that the Comr. of Pub. Wks. has been authorized to receive bids for removing the Broadway bridge piers.

Sioux City, Ia.—The Aldermen have, according to press reports, decided to build a viaduct at Wall St.

Cincinnati, O.—The Bd. of Pub. Service is reported to have under consideration the building of a viaduct at Ridgeway Ave.

Ft. Sheridan, Ill.—See "Government Work."

Grand Rapids, Wis.—Press reports state that the officials of the Wisconsin Central R. R. have decided to construct a bridge across Wisconsin River, just below the Green Bay and Western bridge. Chas. N. Kalk, Ch. Engr., Milwaukee, Wis.

La Crosse, Wis.—The officials of the Chicago, Burlington & Northern R. R. intend, according to reports, to remove the viaduct across the tracks of the Chicago, Milwaukee & St. Paul R. R. on the North Side, and replace it with a heavier structure.

Albion, Ind.—The citizens of Cassia and Lincoln Counties are said to have under consideration the building of a $10,000 wagon bridge across Snake River.

Youngstown, O.—Local press reports state that the contracts for constructing the Mill Creek bridge have been awarded as follows: To Honston & Cleveland, representing the American Bridge Co., for the superstructure at $150,000, and for the substructure to Niedermier & Restle, at $24,239.

Kansas City, Mo.—Press reports state that the Hannibal & St. Joseph R. R. Co. has had plans prepared for rebuilding their bridge across Missouri River. It is stated that the plans call for repairing the piers and for a new steel superstructure which shall accommodate 2 tracks.

Local press reports state that plans have been submitted to the City Engr. by the Chicago & Alton R. R. Engrs. for a viaduct 1,000 ft. long, to be built at Lydia Ave., at an estimated cost of $100,000.

Local press reports state that a survey has been completed for a bridge to be built by the Kansas City & Clay County Toll Bridge Co. across Missouri River at Holmes St.

Asher, Okla. Ter.—A company has been incorporated, with a capital of $20,000, to construct a toll wagon bridge across South Canadian River, at Asher. The incorporators are: J. C. Milner, of Asher; I. A. Smith, of Tecumseh; B. F. Hamilton, of Shawnee, and others.

Sneedville, Tenn.—A bill has passed the Senate authorizing the construction of a bridge across Clinch River, Tenn.

Leaksville, Miss.—It is stated that the Alabama & Mississippi R. R. Co. has secured permission from the Secy. of War to construct a bridge across Chickasabay River, near Leaksville.

Parkville, Mo.—The House Com. on Commerce has reported favorably the bill authorizing the Kansas City, Parkville & St. Joseph Electric Ry. Co. the right to construct a bridge across Missouri River at Parkville.

Morgan, Tex.—Press reports state that the officials of the Southern Pacific Co. are contemplating the building of a bridge across Berwick Bay at Morgan. E. B. Cushing, Engr., Maintenance of Way, Houston.

Colorado Springs, Colo.—Local press reports state that the building of a viaduct across the Santa Fe R. R. tracks and Shooks Run at Huerfano St., is under consideration. Probable cost, $75,000.

Buckley, Wash.—The Comrs. of Pierce and King Counties are reported to have under consideration the building of a bridge across White River at Buckley, to replace the steel and wood bridge recently washed away.

Yankton, S. D.—A bill has passed the Senate authorizing the construction of a bridge across Missouri River at Yankton.

Stockton, Cal.—A. W. Burrell is stated to have secured the contract to construct a bridge across Mokelumne River at Miller's Ferry, for $13,948.

Nome, Alaska.—The Senate has passed a bill authorizing the construction of a bridge across Snake River at Nome.

St. Mary's, Ont.—It is stated that bids are wanted Feb. 16 for constructing a steel bridge, 178 ft. long, across River Thames. L. Harstone, Town Clk.

PAVING AND ROADMAKING.

Fall River, Mass.—Local press reports state that the following estimates for appropriations for the Highway Dept. during the year have been prepared by Supt. Thurston and submitted to the Finance Com.: Highways, $240,000; paving, $30,000; sewers, $100,000; street lights, $102,000.

Providence, R. I.—It is stated that the Consolidated R. R. Co. will spend about $155,000 in overhead street improvements in this city. This will include the building of a bridge at Acorn St.

Binghamton, N. Y.—Local press reports state that the State Engr. has sent to Clk. A. W. T. Back, of the Co. Bd. of Superv., plans and specifications for improving Deposit road, in the town of Sanford, length, 2¾ miles, cost, $27,200; Tunnel road, in Colesville, length, 1¾ miles, cost, $13,750; Bridge road, in Chenango, length, 1½ miles, cost, $10,150. The State will contribute half of the cost of these roads.

Buffalo, N. Y.—The lowest bids for paving opened Jan. 30 by Francis G. Ward, Comr. of Pub. Wks., were as follows: Carroll St., 3,303 sq. yds., asphalt, Eastern Construction Co., $5,300; brick, Barber Asphalt Paving Co., $6,705; stone, F. V. E. Bardol, $8,100. Emslie St., 3,407 sq. yds., asphalt, Barber Asphalt Paving Co., $5,690; brick, L. H. Gipp, $6,500; stone, F. V. E. Bardol, $9,400. Sycamore St., 2,961 sq. yds., asphalt, H. P. Burgard, $4,175; brick, Barber Asphalt Co., $6,188, and stone, F. V. E. Bardol, $8,600. Bidders all of Buffalo.

Cubbebackville, N. Y.—The building of a State road from this town to Middletown is reported to be under consideration, and surveys are being prepared by State Engr. Flanigan.

Mendon, N. Y.—State Surveyors are reported to be making a survey for a State road to be built from Mendon to Framingham.

Newburgh, N. Y.—Bids are wanted Mar. 2 for paving a portion of Bway with telford macadam and brick, as advertised in The Engineering Record.

Cape May, N. J.—Local press reports state that ex-Senator Wm. Flinn, representing the syndicate which has purchased the East Cape May beach and Two Mile beach, has made a proposition to the City Council of Cape May to build a boulevard and boardwalk along the beach from Madison Ave. east to Sewell's Point, a distance of about 2 miles, and agreeing to pay ⅓ of the cost, provided the ⅓ does not exceed $50,000.

Harrisburg, Pa.—City Engr. Cowden is preparing plans for paving Second St.

Pittsburg, Pa.—See "Water."

Washington, D. C.—The Comrs. D. C. have ordered the paving with brick or asphalt block on the alleys in the west half of square 250, estimated to cost $2,350, and the alleys in square 158, estimated to cost $4,500.

Salisbury, Md.—Press reports state that the paving with brick of about 6,125 sq. yds., at an estimated cost of $15,312, is under consideration.

Baltimore, Md.—The Mayor has signed the bill authorizing the paving of E. Fayette St.

Brooklyn, N. Y.—The following bids were opened Feb. 4 by Wm. C. Redfield, Comr. Pub. Wks. of Brooklyn, for granite paving on sand foundation on Fulton St., from Crescent St. to Queens Co. line:

	Granite, 6,190 sq. yds.	New curb, 2,845 ft.	Earth exc., 1,760 cu. yds.	Cement walk, 12,230 sq. ft.
Dennis Norton	$2.57	$0.88	$0.80	$0.20
Edward Roche	2.63	.70	.35	.17
George & Farrell	2.32	.75	.28	.17
James H. Holmes & Co.	2.99	.99	.65	.25
John O'Grady	3.19	1.00	.20	.21
Daniel Douglas	2.65	.95	.25	.17
Murphy Bros.	3.50	.90	.50	.05
Sterling Constr. Co.	2.57	.85*	.25	.20

*Additional bid for Medina sandstone curb, 75 cts.

Bids were also opened for paving with granite blocks and sand joints on sand foundation Rogers Ave., from Malbone St. to Flatbush Ave., as follows—A, Michael Fitzgerald; B, Edward Roche; C, Murphy Bros.; D, Dennis Norton; E, Sterling Constr. Co.; F, Jas. H. Holmes & Co.:

Bidders.	Granite, 32,567 sq. yds.	New curb, 17,623 ft.	Old curb reset, 1,070 ft.	Earth exc., 15,490 cu. yds.	Cement walks, 74,591 sq. ft.
A	$2.23	$0.75	$0.30	$0.25	$0.20
B	2.31	.65	.20	.35	.16½
C	2.40	1.00	.25	.50	.18
D	3.50	.88	.30	.50	.21
E	2.37	.85*	.30	.30	.19
F	3.05	.89	.35	.75	.27

*Additional bid for Medina sandstone curb, 75 cts.

The lowest bid Feb. 4 for asphalt paving on Cleveland St., from Arlington to Atlantic Aves., was that of the Cranford Co., 215 Montague St., as follows: 3,100 sq. yds. asphalt, at $1.50; 430 cu. yds. of concrete, at $5.75; 11 manhole covers, at $6.00; total, $7,189.

Brooklyn, N. Y.—The Boro. Authorities are reported to have under consideration plans to improve Coney Island Ave., from the Park Circle to Kings Highway, at a probable cost of $300,000.

Rochester, N. Y.—The Rochester Vulcanite Co. is reported to have secured the contract to repair the Trinidad asphalt pavements on which the guarantees have expired, for $14,200. It is stated that the contract for repairing the rock asphalt pavements was not awarded, and that new bids will be asked.

Pittsburg, Pa.—Bids are wanted Feb. 9 for furnishing material, grading, curbing and paving with asphalt and block stone on portions of numerous streets. J. Guy McCandless, Dir. Dept. Pub. Wks.

Albany, N. Y.—The City Council has passed an ordinance authorizing the paving of a portion of Bway. with asphalt.

Union, N. J.—The following bids for block andasphalt paving on New York Ave. were received by Bd. of Town Council, Emil Bantz, Town Clk., Jan. 26:

Bidders.	2,900 cu. yds. earth exc.	1,600 cu. yds. sand fill.	7,000 sq. yds. trap rock.	550 sq. yds. asph. pavg.	3,000 lin. ft. new curb.	Total.
August Thiel, West New York, N. J.	$0.30	$1.30	$1 38.	$2.70	$0.35	$16,470
Henry & McGibney, 15 Exchange Pl., Jersey City.	.35	1.30	1.70	2.10	.45	19,101
Henry M. Schneider, West Hoboken, N. J.	.40	1.50	1.60	2.10	.50	18,958
Callary & Murphy,* Weehawken, N. J.	.01	.01	1.75	2.95	.40	16,327
Robt J. Emmer, Weehawken, N. J.	.30	1.00	1.80	1.95	.35	18,510
Henry & Horning, West New York, N. J.	.35	1.40	1.51	2.00	.33	17,075
P. H. Flaharty & Co., Hoboken, N. J.	.40	.08	1.47	1.90	.41	16,953
John Lenahan, Union.	.35	1.20	1.65	2.05	.39	18,284

*Contract awarded.

Baltimore, Md.—Bids are wanted Feb. 11 for grading, curbing, recurbing and paving with vitrified brick on a portion of Hoffman St. B. T. Fendall, City Engr.; Thos. G. Hayes, Pres. Bd. of Awards.

Brooklyn, N. Y.—Bids will be received Feb. 18 by J. Edw. Swanstrom, Boro. Pres., for regulating, grading and paving with asphalt on a concrete foundation, repairing and maintaining asphalt pavements, curbing and laying sidewalks on portions of numerous streets. Engineer's estimate as follows: 45,958 sq. yds. asphalt pavement, 4,800 sq. yds. granite pavement with sand joints, 7,335 cu. yds. concrete, 28,070 lin. ft. concrete carb, 32,518 lin. ft. new curb, 201,136 sq. ft. cement sidewalk, 50,000 cu. ft. asphalt wearing surface, delivered and laid in place of old wearing surface destroyed or removed, etc.

Utica, N. Y.—Clk. J. H. MacGarrity, of the Bd. of Superv., has received from State Engr. Boyd plans for the improvement of the second section of the Utica-Oneida Castle road, extending from Lairdsville to Oneida-Castle, a distance of about 8½ miles, at a total cost of $67,100.

Baltimore, Md.—The Councils have reported favorably to the Highway Com. the following paving ordinances: Asphalt block on portions of Dolphin St., cost, $27,200; Columbia Ave., cost, $235,000; E. North Ave., cost, $19,000; Chase St., $11,000; Lexington St., with wooden block, $9,200; Exeter St., with Belgian block, $28,000; North Ave., from Pennsylvania Ave. to 10th St., with asphalt block, $100,000; Payson St., with asphalt block, $6,000; Calhoun St., with wooden block, $33,000; North St., from Eutaw St. to Greenmount Ave., with asphalt block, $88,000, and for repairing O'Donnell St., with vitrified brick, $35,000.

Savannah, Ga.—The Council has passed an ordinance providing for the paving of a portion of E. Broad St. with vitrified brick.

Savannah, Ga.—Bids are wanted Feb. 21 for furnishing the city with about 50,000 sq. yds. No. 1 vitrified paving brick. Geo. M. Gadsden, Dir. Pub. Wks.

Atlanta, Ga.—Ordinances have been approved by the City Council to pave with asphalt on portions of Peachtree and Peters Sts.

Ft. De Soto, Fla.—Bids will be received on Mar. 6 by Frank S. Long, A. Q. M., U. S. A., for constructing roads, walks and gutters at Ft. De Soto, as advertised in The Engineering Record.

Cincinnati, O.—H. Dieckmeier is reported to have submitted the lowest bids for paving with brick on a portion of Westwood Ave., at $35,457. Engineer's estimate, $38,409.

The Bd. of Pub. Service is said to be considering the paving with bituminous macadam on a portion of Herschel St. and the improving of a portion of Chatham St.

Findlay, O.—City Engr. Riegle estimates the cost of paving with vitrified or asphalt block on a portion of E. Lima St. at $11,419, on a portion of W. Front St. at $19,769, and on a portion of E. Hardin St. at $4,475.

Salem, O.—Ordinances have been adopted by the City Council to pave with asphalt block on portions of 4 streets and with fire clay block on portions of Itace and East Dry Sts.

Richmond, Ind.—The City Engr. estimates the cost of paving on Main St. from 6th to 9th Sts., at $5,000.

Ocosso, Mich.—The following are the 5 lowest bids opened on Jan. 30 by the Bd. of Public Wks. for 14,283 sq. yds. brick or block paving: Campbell & Osborne, Bay City, $33,985; Clarken & Clancey, Ann Arbor, $34,260; Geo. H. Kneal, Lansing, $34,333; H. F. Lithart, Detroit, $34,712; Savage Const. Co., Chicago, Ill., $34,747. All the above bids were rejected and new bids will be received Feb. 20, as advertised in The Engineering Record.

St. Paul, Minn.—L. G. Washington is reported to have secured the contract to construct 40,000 ft. of cement sidewalks for $41,049. The contract for macadamizing a portion of Concord Ave. is reported to have been awarded to P. H. Thornton, at $10,171, for the city's portion of the work. The street car company's portion will cost $6,300.

The City Engr. estimates the cost of curbing and boulevarding Dale St. at $8,300.

Canton, O.—Bids are wanted Feb. 23 for paving portions of So. Cherry, South and Ninth Sts. Possibly vitrified block will be used. Phil. H. Weber, City Engr.

Chicago, Ill.—The Bd. of Local Improv. has ordered the paving of W. Lake St. with asphalt at an estimated cost of $63,000, and the paving of North Ann St., with granite, at an estimated cost of $16,500.

Sioux City, Ia.—Local press reports state that M. L. Flinn has received the contract to pave with brick on a natural cement concrete foundation, W. 3d, 6th and 7th Sts., in all about 24,832 sq. yds., at $1.93 per sq. yd.

Toledo, O.—Bids will be received Mar. 2 by Chas. H. Nauts, City Clk., for furnishing material and improving portions of Union St. by grading and paving with blocks on a 6-in. concrete or 8-in. sand foundation; also portions of Paine Ave. with vitrified paving blocks or asphalt blocks on a concrete or sand or broken stone foundation.

Cincinnati, O.—Bids are wanted Feb. 11 for improving portions of Roll Alley by grading, setting curbs and paving the roadway with brick. Robert Allison, Pres.

Freeport, Ill.—Ordinances have been passed for the construction of 35,000 sq. yds. macadam and 20,000 lin. ft. cement curb and gutter. G. W. Graham, City Engr.

Keokuk, Ia.—Bids will be received by Rice H. Bell, Clk. of Council, for grading, paving and curbing two blocks. Approximate quantities: 1,800 cu. yds. excav., 3,175 sq. yds. brick paving, and 1,424 lin. ft. stone curbing. J. Ross Robertson, City Engr.

Covington, Ky.—The City of Covington will expend $50,000 during this season in the construction of brick streets. W. E. Gunn, City Engr.

Lexington, Ky.—The Ways & Means Com. has recommended to the Council the appropriating of $9,000 for repairing the brick streets of the city.

Birmingham, Ala.—The City Council has decided to accept the bid of Byron & Sanders for sidewalk improvements in this city at $9,329.

Mobile, Ala.—Bids will be received Feb. 10 by the Bd. of Pub. Wks. for furnishing approximately 37,000 sq. yds. asphalt paving and 20,200 lin. ft. granite curbing. C. Lawrence Lavretta, Pres.

Tiptonville, Tenn.—It is stated that the question of bonding the county for the purpose of constructing a macadam road, 22 miles long, is under consideration.

Ft. Worth, Tex.—Press reports state that the paving with brick on a portion of 3d St. is being agitated.

Ft. Scott, Kan.—Contracts will soon be let for about 22 blocks brick paving and a large district sewer. U. S. Stoner, City Engr.

Bowling Green, Ky.—Bids will be received Feb. 16 by E. P. Harris, Co. Road and Bridge Superv., for furnishing and delivering gravel or macadam on the different pikes in Warren Co.

Pasadena, Cal.—The paving of a portion of E. Colorado St. with asphalt is reported to be under consideration.

Loveland, Colo.—W. A. Riley, of Loveland, is reported to have secured the contract to construct the Estes Park road, at $27,000.

San Francisco, Cal.—The following work has been authorized: Grading, constructing a basalt block pavement, basalt block gutters and storm water inlets with pipe culverts on Spear St., between Mission and Market; also for constructing stone curbs on both sides of the street, repaving a portion of the crossing of Mission and Spear Sts., and the intersection of Market and Spear Sts., and the reconstruction of stone sidewalks, at a total estimated cost of $11,200.

Salt Lake City, Utah.—The paving of E. South Temple St., at a probable cost of $150,000, is said to be under consideration.

Montreal, Que.—Local press reports state that the Road Com. has decided to purchase a stone crusher.

Winnipeg, Man.—Bids will be received by the Chmn. Com. on Works, Mar. 3, for 300 to 600 tons of asphalt for street paving, as advertised in The Engineering Record.

POWER PLANTS, GAS AND ELECTRICITY.

Springfield, Mass.—The stockholders of the Springfield Gas Light Co. are reported to have voted to double the size of their coal gas plant.

Providence, R. I.—The stockholders of the Narragansett Electric Light Co. are stated to have voted to authorize the issue of $1,000,000 new debentures to take up the indebtedness and provide for the enlargement of the plant.

Johnstown, Pa.—It is stated that work will begin in about 2 weeks on the construction of the plant of the Consumers' Light, Heat & Power Co.; cost of plant, not including the outside wiring and conduits, is reported to be about $115,000.

Philadelphia, Pa.—See "Railroads."

Pittsburg, Pa.—A permit has been issued for a power plant, to cost $425,000, to be erected in Cecil Alley, 120 ft. south of Duquesne way, by Henry Phipps. The structure will be the distributing point for the power to be used in the Phipps holdings in that part of the city, will be constructed of steel and brick and be 10 stories high.

The Manufacturers' Light & Heat Co. is stated to have decided to build a gas main from its fields in W. Virginia to Pittsburg, at a cost of $3,000,000. The line will be 60 miles long, and will be built of 20-in. pipe.

Glassboro, N. J.—The South Jersey Gas, Electric & Traction Co. is stated to have purchased the local electric light plant, and will increase the capacity of the plant and extend the wires.

Frederick, Md.—It is stated that the Frederick Gas Co. will expend this spring about $25,000 in laying new mains and properly equipping the plant. Jacob Rohrback, Pres., Frederick.

Schenectady, N. Y.—The Mohawk Gas Co will construct a gas plant.

Oneida, N. Y.—It is reported that bids will probably be received Apr. 7 for constructing electrical plant at Lime Kills Falls; estimated cost about $100,000. De Witt C. Hadcock is reported interested.

Pittsburg, Pa.—See "Water."

Sandersville, Ga.—See "Water."

Georgetown, O.—The Town Council is reported to be considering the proposition to issue $8,000 bonds for improving the electric light plant.

Shelbyville, Ind.—See "Water."

Beloit, Wis.—Robt. Caldwell, City Engr., writes that the Council is figuring on constructing an electric light plant. Nothing definite yet.

St. Croix Falls, Wis.—The St. Croix Falls Minnesota Improvement Co. has been incorporated, with a capital of $50,000, by Eugene A. Merrill, Edw. P. Wells, and others, all of Minneapolis. This company, together with a similar organization to be incorporated in Wisconsin, and known as the St. Croix Falls Wisconsin Improvement Co., is formed for the purpose of developing the water power at St. Croix Falls for manufacturing, production of electricity and other commercial purposes. The promoters have already secured an option for the purchase of Neever's Dam, above the falls of the St. Croix.

The U. S. Senate has passed a bill permitting the building of a dam across St. Croix River at or near the village of St. Croix Falls.

Wauwatosa, Wis.—Press reports state that bids will be received Feb. 9 by Edw. Coulthard, City Clk., for lighting the streets and public places with 9 arc lights of 2,000 c. p., or 100 Welsbach lights of 60 c. p.

Bemidji, Minn.—The Warfield Electric Co. will expend about $10,000 in improvements. The improvements include one 400-H.-P. Corliss engine, one 300-Kw. generator, brick building, etc.

Dubuque, Ia.—Sargent & Lundy, of Chicago, Ill., are reported to be preparing plans for a power plant for the Union Electric Co.; the machinery will cost about $100,000. Mr. Dame, Supt.

Findlay, O.—Bids will received Feb. 14 by Frank C. Ray, City Clk., for lighting the streets and public places of said city with electric arc-lights, for 5 years.

Noblesville, Ind.—S. M. Smith is stated to have secured a franchise for a steam and hot water heating plant.

Delroy, Mich.—A press report states that the Edison Co. will construct a plant at Delray for the manufacture of electricity, and will supply electric power for heating and lighting in the city of Detroit. Chas. W. Wetmore, Pres., New York, N. Y. Alex. Dow, of Detroit, is Mich. agent for the company.

Durand, Mich.—Bids will be received Mar. 2 for $100,000 municipal light and improvement bonds.

Odessa, Mo.—It is stated that the power plant owned by the city has been seriously damaged by fire.

Dyersburg, Tenn.—See "Water."

Florence, Ala.—The Florence Ice & Coal Co. is in the market for 1,200 or 1,500 incandescent light plant.

Augusta, Ark.—See "Water."

Crowley, La.—See "Water."

St. Francisville, La.—See "Water."

Salina, Kan.—Chas. E. Banker, City Clk., writes that the contract for lighting the city expires Aug., 1904, and the city will be glad to receive propositions from a new company. Population, 8,000.

Greenville, Miss.—J. A. Gaboury is stated to have sold the plant of the Greenville Light & Car Co. to a Chicago syndicate, which proposes to expend about $75,000 in improvements and extensions. J. A. Gaboury will retain the management until all improvements are made.

Lake Preston, S. D.—L. S. Brooks, Town Clk., writes that there is some talk of a lighting plant.

Grand Junction, Colo.—A resolution has been passed by Council providing for the appointment of a committee of 3 to confer with the City Attorney as to the legality and feasibility of submitting to the voters at the coming spring election a proposition to issue $28,000 of bonds for the purpose of building an electric light plant.

An ordinance is also reported to have been introduced in Council granting H. R. Bull and A. R. Wells a franchise to construct and operate a gas, steam power and electric light plant.

Placerville, Cal.—It is stated that S. P. Jewett has applied for a franchise to erect and maintain poles and wires for electric transmission; also for laying gas pipes, and that bids for said franchise will be received until Feb. 16. W. N. Murphy, City Clk.

Toronto, Ont.—A press report states that the Italny River Pulp & Paper Co. is about to let contracts for the construction and equipment of a water-power plant to be built on Sand Island River, a few miles north of Mine Center. The water power which is to be utilized has a 16-ft. fall, and is estimated to be capable of developing 1,800-H.-P. Geo. E. Foster and W. J. Elliott, of Toronto; Wm. Blackwood and R. M. Simpson, of Winnipeg, Man., are reported interested.

Niagara Falls, Ont.—The Queen Victoria Park Comrs. are stated to have consented that a franchise be granted the Toronto & Niagara Power Co. All that now remains to be done is for the Ontario Legislature to confirm this action

ELECTRIC RAILWAYS.

Turner, Me.—Jas. Mitchell, of Boston, Mass., is reported interested in the construction of an electric railway from Turner to Auburn.

Naugatuck, Conn.—Geo. A. Lewis, of Naugatuck, is reported interested in the construction of an electric railway from Seymour, through Beacon Falls to Naugatuck.

Nashua, N. H.—Alonzo Elliott, of Manchester, is reported interested in the construction of an electric railway from Concord to Nashua and Edw. Hardy, Silas M. Spalding, and others, of Hollis, are reported interested in the construction of a line from Hollis to Nashua.

Leominster, Mass.—The Selectmen are stated to have granted a franchise to the Worcester Consolidated St. Ry. Co.

Sandwich, Mass.—The Selectmen are reported to have granted a franchise to the Sandwich, Hyannis & Chatham St. Ry. Co.

Orange, Conn.—The W. B. Gill Co., of Philadelphia, Pa., is reported to have secured the contract for building 3½ miles of track for the Connecticut Ry. & Lighting Co. from the Orange town line to Derby.

Binghamton, N. Y.—The Binghamton Ry. Co. is stated to have filed with the County Clk. declaration of intention to extend its system by 4 different routes. J. P. E. Clark, Mgr.

Brocton, N. Y.—The Village Trus. are stated to have granted a franchise to the Lake Shore Traction Co.

New York, N. Y.—A franchise was granted on Jan. 30 to the New York Interborough Ry. Co. by the Bd. of Estimate & Apportionment for the operation of a trolley road in Bronx Boro.

Atlantic City, N. J.—The Council is stated to have granted a franchise to the Atlantic City & Chelsea Ry. Co. to construct a line about 4 miles in length.

Weehawken, N. J.—The Bergen Turnpike Trolley Co. is stated to have petitioned the Weehawken Township Com. for a franchise to construct, msintain and operate a trolley line on 18th, 19th and Clinton Sts. and Gregory Ave., connecting at one end with the present Willow Ave. line and at the other with the tracks on the Hackensack Plankroad.

Blairsville, Pa.—It is stated that the Blairsville & Derry St. Ry. Co. will begin work in the early spring on the construction of its line from Latrobe to Derry and Blairsville.

Elizabethtown, Pa.—The Elizabethtown & Middletown St. Ry. Co. has been incorporated; capital, $54,000. Edw. Bailey, Harrisburg; H. K. Alwine, Middletown, and Isaac R. Herr, Lancaster, are directors.

Girard, Pa.—The Girard & Conneaut Traction Co. has been incorporated: capital, $36,000. Robt. L. Forrest, Philadelphia; Walter H. Wood, Holmesburg, are directors.

Meadville, Pa.—The Meadville, Conneautville & Albion Traction Co. has been incorporated; capital, $100,000. J. J. De Kinder, Pres., Philadelphia.

Monaca, Pa.—The Monaca Heights St. Ry. Co. has been incorporated; capital, $7,500. Jas. H. Welch and John T. Taylor, both of Monaca, are directors.

New Castle, Pa.—The New Castle St. Ry. Co. is reported to have plans for 5 new extensions, to cost about $250,000.

Pittsburg, Pa.—The Pittsburg Rys. Co. (J. Murphy, Gen. Supt., Pittsburg) is reported to be planning a street car line, either surface or elevated in Grant Boule. The route for the new line has been filed in the Allegheny County Recorder's Office as an extension to the Grant and Liberty St. Ry., chartered in December.

Sewickley, Pa.—The Sewickley & Leetsdale Electric St. Ry. Co. has been incorporated; capital, $18,000. W. A. Park and J. D. White, Rochester, and John Warren, Beaver Falls, are the directors.

Baltimore, Md.—The United Rys. & Electric Co. (D. B. Banks, Ch. Engr., Baltimore) is stated to have signed a contract for the perpetual lease of the Baltimore, Sparrow's Point & Chesapeake Ry., 43 miles of track. The line will connect this city by trolley with the Maryland St. Works at Sparrow's Point, and will be extended to and along Chesapeake Bay Shore below North Point, where summer resorts will be established.

Utica, N. Y.—D. W. Lewis, 177 Chambers St., New York, is reported interested in the construction of an electric railway from Utica to Deposit, via Masonville, Rock Royal and Cannonsville.

Harrisburg, Pa.—The Harrisburg Traction Co. is reported to have decided to improve its system, including the construction of an additional power plant and building lines to Hummelstown and Dauphin. F. B. Musser, Supt., Harrisburg.

Ravenswood, W. Va.—The City Council is stated to have granted a franchise to H. L. Smith.

Lancaster, O.—Contracts are stated to have been awarded by the Scioto Valley Traction Co. for the heavy electrical machinery for its power house and sub-stations to the Bullock Electrical Co. of Cincinnati for about $100,000. The contract for the work for the high tension line was awarded to the Pittsburg Deduction Co. Within the next 30 days specifications for the power house at Reese's Station will be prepared by Electrical Engr. W. E. Baker, of New York, N. Y. The contract for grading the roadbed from Circleville to Chillicothe will be awarded as soon as the surveys and right-of-ways can be adjusted.

Marion, O.—C. C. Wade and Geo. Karb are about to petition the Council for a franchise for an electric railway between Marion and Findlay.

The City Council is stated to have granted a franchise to the Columbus, Delaware & Marion Electric Ry. Co.

Peoria, Ill.—It is reported that the Peoria & Pekin Union Ry. Co. will expend about $250,000 this spring in improvements.

Berlin, Wis.—A. L. Hutchinson, of the Madison Northeastern Electrical Ry. Co., is stated to have petitioned for a franchise for a line through the city.

Plover, Wis.—The Wisconsin River Ry. & Power Co. of Plover has been incorporated, with a capital of $100,000, to construct and operate a street railway from Plover, through Stevens Point and Wausau. The company will also conduct a business of electric lighting and heating, to operate grist and flour mills and many other mills which may be run by electricity. Incorporators: Neal Brown, Walter Alexander, and C. D. Jones.

Kenosha, Wis.—The power house of the Kenosha Gas & Electric Co. is reported to have been damaged by fire to the extent of about $11,000.

La Crosse, Wis.—The contract for the construction of a trolley line from La Crosse to Viroqua, to be built by the La Crosse & Eastern Ry. Co., is stated to have been awarded to Collins & Co., of Chicago, Ill.

Two Rivers, Wis.—H. C. Higgins, of Sterling, Ill., is reported interested in the building of an electric line from Two Rivers, Wis., to Door County.

West Bay City, Mich.—Local press reports state that Busch Bros., of Buffalo, N. Y., have prepared plans, estimates, etc., for an electric railway to be constructed through West Bay City, Saginaw, Bridgeport, Clio, Mt. Morris, Flint, Fenton and Holly to Pontiac; estimated cost of road is $1,000,000.

Minneapolis, Minn.—The St. Ry. Co. is reported as having the plans drawn for its Hennepin Ave. power station. It is expected that the company will expend $100,000 on the new plant. Work will begin in the spring. The new building will also contain the general offices of the company.

Keokuk, Ia.—The Keokuk Electric Ry. & Power Co. has completed a survey for an interurban electric railway from Keokuk to Ft. Madison, a distance of about 20 miles.

Ashtabula, O.—The Ashtabula & Lake Shore Ry. Co. is reported formed, to construct an electric railway between Ashtabula and Woodland Beach Park. W. S. McGeehan, of Youngstown, is reported interested.

Cincinnati, O.—It is stated that the Cincinnati & Columbus Traction Co. will build an electric line from Cincinnati to Washington C. H.

Genoa, O.—The Lake Shore Electric Ry. Co. is reported to be considering the construction of a line from Genoa to Lakeside, a distance of about 30 miles. F. J. Stout, Gen. Supt., Toledo.

Sullivan, Ind.—The Indiana Coal Belt Traction Co., of Sullivan, has been incorporated, with a capital of $100,000, by Chas. I. Davis, Wm. H. Crowder, and others.

Des Moines, Ia.—It is reported that the Interurban Ry. Co. will construct about 80 miles of new road during the coming year. Jas. Welch, Ch. Engr., Des Moines.

Louisville, Ky.—The Council is stated to have granted a franchise to the Falls City Belt Line Co.

Prosperity, Mo.—It is reported that the Southwest Missouri Electric Ry. Co. will expend about $1,000,000 his year in improvements. The capital will be increased from $800,000 to $1,500,000. New engines and dynamos and new rolling stock will be added to the equipment. The line will be extended at once from Prosperity to Duenweg and from Joplin to Carl Junction, a distance of 10 miles. Another line will probably be built from Galena to Baxter Springs, Kan. E. J. Pratt, Ch. Electrician, Webb City.

Greenville, Miss.—See "Power Plants, Gas and Electricity."

Newport, Ky.—Col. A. S. Berry is reported interested in the construction of an electric railway between Newport and Alexandria, Ky.

Owensboro, Ky.—A company is being organized here to construct an electric railway from this city through Curdsville, Delaware, Calhoun, Livermore and Hartford, a distance of about 50 miles. John G. Deikeer, of Owensboro; C. A. Hopkins, of Loveland, and Wade Cushing, of Cincinnati, are among the incorporators.

Louisville, Ky.—Peyton N. Clarke is reported interested in the construction of an electric railway from Louisville to Mt. Washington.

Texarkana, Tex.—The Texarkana Traction Co., of Texarkana, has been incorporated, with a capital of $100,000. Incorporators: E. J. Spencer, R. W. Rogers, and others.

Omaha, Neb.—Local press reports state that the Omaha St. Ry. Co. will construct a power plant, at a cost of about $500,000.

Casper, Wyo.—C. H. King, of Casper, is reported interested in the construction of an electric railway between Casper and Lander.

Snohomish, Wash.—The Council is stated to have granted a franchise to the Everett & Snohomish Rapid Transit Co.

Tacoma, Wash.—The Council has granted E. J. Felt a franchise to construct and operate a street railway in Tacoma.

Santa Ana, Cal.—W. S. Collins, Pres. of the Newport Beach Co., and promoter of the proposed Santa Ana & Newport Beach Electric R. R., is stated to have petitioned the City Council for a franchise. Length of proposed line is 12 miles.

Ashland, Neb.—E. C. Hurd, of Akron, O., and H. H. Wilson, of Lincoln, are reported interested in the construction of an electric railway from Lincoln to Omaha and Ashland.

RAILROADS.

Attleboro, Mass.—The New York, New Haven & Hartford R. R. Co. is stated to have completed surveys for the abolishment of the grade crossings in Attleboro, the work having been done under Asst. Ch. Engr. Hardy, of Roxbury. The plans contemplate a 4-track system between Attleboro Centre and Hebronville.

Philadelphia, Pa.—Local press reports state that the Dirs. of the Pennsylvania R. R. Co. and of the Pennsylvania Co., operating the lines west of Pittsburg, at a meeting at the Broad St. Station Jan. 28, approved plans for a low grade freight cut-off to run from Enon, on the Ft. Wayne road, to Red Bank, on the low grade division of the Allegheny Valley R. R., and ordered that contracts be let at once. The road will be double tracked, with enormous freight yards at both ends, and will cost about $6,000,000. They also authorized the construction of an electric plant at the 12th St. yards, Chicago, Ill., to cost $40,000; additional coal dumping machinery to be built at Ashtabula, O., to cost $50,000; a power plant at Cleveland, O., to cost $115,480, and a power plant at Erie, Pa., to cost $27,000.

New Castle, Pa.—It is stated that the Big Run branch of the Buffalo, Rochester & Pittsburg R. R. Co. is to be extended from New Castle to Butler, a distance of about 20 miles. J. M. Floesch, Ch. Engr., Rochester, N. Y.

Pittsburg, Pa.—The Jones & Laughlin Steel Co. is reported to have asked the Pittsburg & Lake Erie R. R. Co. to change the line of its Monongahela division, a distance of 2 miles, at a cost of $800,000.

Local press reports state that plans are being prepared by the engineering department of the Pittsburg & Lake Erie R. R. for freight terminal improvements on the Southside, involving an expenditure of about $1,000,000. J. A. Atwood, Ch. Engr., Pittsburg.

The Select Council is stated to have passed the ordinance granting a franchise and right of way to the Pittsburg, Carnegie & Western R. R., the Wabash extension. Jas. Ramsey, Jr., Pres., St. Louis, Mo.

Baltimore, Md.—A press report states that the Baltimore & Ohio R. R. Co. will expend $1,000,000 for improvements on the division terminals of the Cleveland, Lorain & Wheeling R. R. at Holloway, O. The improvements include new yards, 1½ miles long, containing 50 tracks, and a roundhouse with 26 engines capacity. The company also proposes constructing a cut-off road from Wheeling, W. Va., through Greene County, Pa., to the Fayette County coke region. The surveys have been made. By bridging the Monongahela near Masontown and running a line to Waynesburg and from there to Wheeling, a route 65 miles long from Monongahela River to Wheeling will be secured. J. M. Graham, Ch. Engr., Baltimore.

Barmore, S. C.—Application for a commission and charter has been filed by the Ware Shoals Mfg. Co. to build a railroad from Barmore to Ware Shoals, 5 miles. R. W. Shand, of Columbia, is one of the incorporators; capital, $10,000. Name to be Ware Shoals Ry. Co.

Parkersburg, W. Va.—Press reports state that contracts will soon be let for the construction of a railroad between Zanesville and Parkersburg, a distance of about 68 miles; probable cost of construction is $4,760,000. J. T. Blair, of Parkersburg, Pres. Little Kanawha R. R., is reported interested.

Fairmont, W. Va.—L. B. Harr, M. L. Hutchinson, and others, of Fairmont, are stated to have applied for a charter for the Fairmont Short Line R. R. to be constructed from Hoult, by way of Fairmont, to Colfax.

Magnolia, W. Va.—A charter has been granted to the Morgan County R. R. Co., of Martinsburg, W. Va., to build a road from Magnolia to Deep Gully; capital, $10,000. Incorporators: Fred. G. Griffith, of Baltimore, Md.; John J. Bumbardner, of Westminster, Md., and others.

Paw Paw, W. Va.—The Potomac R. R. Co. has been incorporated, with a capital of $10,000, to construct and operate a railroad from Paw Paw to the State line of West Virginia and Maryland. Incorporators: Fred. G. Griffith, of Baltimore, Md.; John J. Bumbardner, of Westminster, Md., and others.

Danville, Ill.—The Big Four R. R. Co. is reported to be planning extensive improvements at Danville, Ill., to be made during the year. A new line will be built from Vermillion Heights to Tilton. A roundhouse capable of housing 5 engines will be built this spring, at a cost of $45,000, and a new freight station also will be built, at a cost of $12,000. G. W. Kittredge, Ch. Engr., Cincinnati, O.

Dodge City, Ia.—It is stated that the Santa Fe will build at once from Dodge City to Liberal, Kan., connecting the Santa Fe main line with the Rock Island. W. B. Storey, Ch. Engr., Topeka.

Chicago, Ill.—The Chicago, Terre Haute & Southern Ry. Co. has been incorporated, with a capital of $200,000, to construct a railroad from Chicago into Lake County, Ind., and through the counties of Lake, Newton, Benton, Warren, Fountain, Vermillion, Parke and Vigo, to a point in Sullivan County; length of the road will be about 200 miles. Incorporators: Wm. B. Cloyes, Geo. E. Pottinger, and others, all of Chicago.

A charter has been granted to the Manufacturers' Junction Ry. Co. to build a railroad from a point on the west bank of the south branch of Chicago River, between Lake and 16th Sts., in a southerly and westerly direction to a terminus at or near section 20, Township 38 north, Range 13 east; capital, $1,000,000. Incorporators: Henry A. Rust, Ivor Jeffrey, Leverett Thompson, and others, all of Chicago.

Newton, Miss.—It is stated that the Mobile, Jackson & Kansas City R. R. Co. is to construct a line from Newton to New Albany, a distance of 160 miles. It also proposes constructing a branch line into Ellisville.

Dyer, Ark.—The Arkansas Coal & Mineral R. R. Co. has been incorporated, with a capital of $350,000, to construct a railroad from Dyer through the coal mining districts of Huntington and adjacent territory for a distance of 50 miles. Incorporators are citizens of Clarksville, Huntington and Fort Smith. E. T. McConnell and John J. Goldsby are among the principal stockholders.

Helena, Ark.—The Eastern Arkansas Ry. Co. is reported incorporated, with a capital of $1,650,000, to construct a line 110 miles in length from Helena through St. Francis Valley to the Missouri line.

Huntington, Ark.—A charter has been granted to the Arkansas Coal & Mineral R. R. Co., with a capital of $350,000. Incorporators: John F. Williams, Pres., Huntington; John W. Goolsby, Secy., Waldron.

El Reno, Okla. Ter.—The Denver, El Reno & New Orleans R. R. Co. has been incorporated, with a capital of $5,000,000. The proposed line will be 1,000 miles in length and will run through the counties of Beaver, Woodward, Dewey, Blaine, Canadian, Cleveland and Pottawattomie in Okla. Principal office to be at El Reno.

Houston, Tex.—It is stated that the Southern Pacific R. R. Co. is considering the building of a tunnel under its tracks on Montgomery Ave., in the 5th Ward; probable cost, $115,000. Wm. Hood, Ch. Engr., San Francisco, Cal.

Dallas, Tex.—The St. Louis Southwestern Ry. Co. of Tex. on Jan. 24 is stated to have decided to borrow $500,000 with which to complete the road into Dallas, and for depot betterments in that city. M. L. Lynch, Ch. Engr., Tyler, Tex.

Tacoma, Wash.—A press report states that the Canadian Pacific R. R. Co. will next year construct a railroad from Tacoma to Sumas, a distance of about 180 miles. Edwin H. McHenry, Ch. Engr., Montreal, Que.

Shaniko, Ore.—The Columbia Southern R. R. Co., which now operates a line 70 miles in length between Shaniko and Beggs, is reported to be preparing to extend the road south about 150 miles to South Bend, in the southern part of Crook County. A. E. Hammond, Ch. Engr., Shaniko.

Ottawa, Ont.—The survey of the Ottawa, Brockville & St. Lawrence Ry. is reported completed. The new line will be 56 miles in length.

Vancouver, B. C.—Thos. W. Jones, of Victoria, is reported interested in the construction of a railroad from Vancouver to New Westminster and east through Surrey, Langley, Matsqui and Sumas to Chilliwack.

PUBLIC BUILDINGS.

Everett, Mass.—Bids are wanted Feb. 10 for erecting a police station. Geo. Dockum, Secy. Police Station Com.

New York, N. Y.—Plans have been filed for the erection of a 2-story brick and stone edifice at 143d St. and Willis Ave. for the congregation of the Congregational Church of N. Y., to cost $50,000. Architects, Dodge & Morrison, 82 Wall St.

Philadelphia, Pa.—The National Water Tube Boiler Co., of New Brunswick, N. J., is stated to have submitted the lowest bid for the installation of 2 water tube boilers at the Philadelphia Hospital, at $9,500.

Buffalo, N. Y.—F. G. Ward, Comr. of Pub. Wks., is in favor of a new public market, built of steel and glass, with a granolithic floor, and no wood in it.

Wilmington, Del.—The Council has authorized the City Solicitor to prepare an ordinance providing for a bond issue for the erection of a city hall.

Buffalo, N. Y.—It is stated that plans are being prepared for a quarantine hospital, to be erected on the site of the East Ferry St. structure; probable cost, $50,000.

Perth Amboy, N. J.—Plans are stated to have been prepared for an edifice for the Congregation of St. Mary's R. C. Church, to be erected at Center and Mechanic Sts., at a cost of $60,000. Rev. B. T. O'Connell, Pastor.

Rankin, Pa.—Jos. Rankin & Co., of Braddock, are stated to have received the contract for the erection of an edifice for the Congregation of the Croatian Catholic Church in Rankin, to cost $40,000.

The Italian Catholic Congregation are reported to be considering plans for the erection of an edifice in Rankin, to cost $50,000.

Homestead, Pa.—Bids are wanted Feb. 16 for erecting the Greek Catholic Church on Dixon and 10th Sts. Address Architect de Bolula, Zanesville, O.

Baltimore, Md.—John Cowan, 106 W. Madison St., is reported to have received the contract for the erection of the surgical building for the Johns Hopkins Hospital. The structure will be a 5-story brick building and cost about $125,000.

New Martinsville, W. Va.—The North M. E. Church is reported destroyed by fire. Rev. D. A. Denton, Pastor.

Canton, O.—Melbourne Bros., of Canton, have secured the contract for erecting the market house and auditorium, for $129,747.

Dayton, O.—Wicoff & Harrison are stated to have received the contract for erecting a church for the Raper M. E. Society, at a cost of $30,000. Rev. J. J. McCabe, Pastor.

Logansport, Ind.—The Bd. of School Trus. are having plans prepared for a public library building, to cost $25,000. Quincy A. Myers, Secy. of Bd.

Terre Haute, Ind.—Crawford Fairbanks is stated to have offered this city $50,000 for the erection of a library.

Jackson, Mich.—All bids received Jan. 27 for erecting the Carnegie Library are stated to have been rejected. New bids will again be received. Ferry & Clas, Archts., Milwaukee, Wis. B. L. Carlton, Secy.

St. Paul, Minn.—The Senate is stated to have passed a bill providing for an appropriation of $1,500,000 for the completion of the Capitol.

Council Bluffs, Ia.—It is stated that the First Congregational Society will erect a $30,000 church.

Marion, Ind.—Richards, McCarty & Bulford, Architects, of Columbus, O., write that contracts for erecting a jail in Marion have been awarded to P. B. Patton, of Marion, and to the Champion Iron Co., of Kenton, O.; total bid, $92,600.

Cincinnati, O.—Bids are wanted Mar. 16 for $100,000 bonds to be used for erecting one or more hospitals. Edwin Henderson, City Clk.

Portsmouth, O.—Bids will be received Feb. 16 by E. D. Poffenberger, Secy. Library Bd., for furnishing material and erecting a library. Richards, McCarty & Bulford, Archts., Columbus, O.

Shelbyville, Ind.—Press reports state that bids recently received by the Bldg. Com. of the City Council for erecting city hall have been rejected, lowest bid being $37,800, and it is stated that new bids will be received Feb. 17.

Hamburg, Ark.—It is stated that bids are wanted Feb. 23 for erecting a court house. W. F. McCombs, Co. Comr.

Bakersfield, Cal.—The Congregation of the Methodist Episcopal Church is reported considering the erection of an edifice, to cost $20,000.

Fremont, Neb.—Bids are wanted Feb. 10 for enlarging and improving German Lutheran Orphan Asylum. A. H. Dyer, Archt., Miller & Loomis Bldg.

Omaha, Neb.—John McDonald, N. Y. Life Bldg., is stated to have prepared plans for a brick edifice for the Congregation of the First Christian Church, to cost $40,000.

Libraries.—Andrew Carnegie is stated to have made the following cities offers for libraries: Augusta, Ga., $50,000; Hornellsville, N. Y., $25,000.

BUSINESS BUILDINGS.

Boston, Mass.—The 5-story brick building at 215 Franklin St. is stated to have been destroyed by fire Jan. 27. Owner, Horace B. Taylor.

Pittsfield, Mass.—The Stanley Electric Co. is having plans made for a storage building, to cost $20,000; also contemplate other new buildings in the spring.

Binghamton, N. Y.—The Y. M. C. A. is about to purchase a site for new building.

Brooklyn, N. Y.—It is stated that the Bedford branch of the Brooklyn Y. M. C. A. will erect a building at Monroe St. and Bedford Ave.; probable cost, $250,000.

The Congregation of the St. Thomas' P. E. Church is reported to be considering the erection of a brick parish building. Architect, Herbert R. Brewster, 45 Exchange Pl., New York City.

Buffalo, N. Y.—It is stated that the Buffalo Realty Co. will erect a business building at Main and Washington Sts., to be occupied by the Wm. Hengerer Co. The structure will be 6-story, and measure 137x200 ft.

Jersey City, N. J.—The plans of Edw. M. Patterson, 76 Montgomery St., are stated to have been accepted for the erection of a 5-story brick building at Henderson St. and Newark Ave. for Emanuel Gross, to cost between $50,000 and $60,000.

Allegheny, Pa.—It is stated that Cruikshank Bros. will erect a 6-story warehouse at Preble and Island Aves.

McKeesport, Pa.—It is reported that the Elks, of this city, will erect a temple on 5th Ave., to cost $50,000.

Pittsburg, Pa.—A permit is stated to have been granted the Pittsburg Opera House Co. for remodeling its building to conform with the widening of Diamond St.; estimated cost, $100,000.

Baltimore, Md.—Jackson C. Gott, 218 N. Charles St., is stated to have been selected to prepare plans for a 6-story brick 52x90-ft. business building, to be erected on Light and Balderson Sts., for Albert Gottschalk.

It is stated that Nixon & Zimmerman will erect a 100x160-ft. theater on Howard St., to cost about $300,000. B. H. Marshall, of Chicago, Ill., Archt.

Blairsville, Pa.—Press reports state that bids will be received Feb. 14 by Chas. M. Robinson, Archt., 1910 W. Chestnut Ave., Altoona, Pa., for erecting the First National Bank, estimated cost about $50,000.

Roanoke, Va.—The Norfolk-Western Ry. Co., Geo. P. Johnson, Div. Supt., is reported as having plans prepared for a stone depot to be erected here, to cost about $100,000.

Jacksonville, Fla.—The Consolidated Naval Stores Co. and the Consolidated Grocery Co. are reported to be considering the erection of a 5-story 100x134-ft. brick office building and warehouse on West Bay St.

Cleveland, O.—Fugman & Uhlrich, 89 Euclid Ave., are stated to have prepared plans for the 9-story brick office building to be erected at Huron St. and Euclid Ave., to cost $350,000.

Columbus, O.—It is stated that the Pabst Brewing Co. will erect a 3-story office building at 19th St. and Mt. Vernon Ave., at a cost of $25,000.

Morgantown, W. Va.—Riter-Conley Co., 55 Water St., Pittsburg, Pa., is reported to have received the contract for the erection of a building for the West Virginia Plate Glass Co.; approximate cost, $85,000.

Danville, Ill.—See "Railroads."

Chicago, Ill.—The warehouse of the Plankinton Packing Co., at 16th St. and Muskegon Ave., and that of Adolph Melacke are reported destroyed by fire Jan. 21.

La Crosse, Wis.—A correspondent writes that $120,000 has been raised toward the erection of a hotel. Frank Nixon and J. J. Hogan, of La Crosse, are reported interested.

Sheboygan, Wis.—Ferry & Clas, of Milwaukee, are stated to be preparing plans for a brick 60x120 ft. theater for the Sheboygan Theater Co., at a cost of $25,000.

Saginaw, Mich.—Isaac Bearinger, of this city, contemplates the erection of a 6-story business building here in the spring. Architect, W. T. Cooper, Saginaw.

Council Bluffs, Ia.—Chas. Cleaves, of Omaha, Neb., has prepared plans for a 4-story brick building, to be erected at S. Main and 9th Sts.

Minneapolis, Minn.—The Twin City Rapid Transit Co. (it. C. Taylor, Ch. Engr.) is reported as having plans prepared for an office building to be erected at 11th St. and Hennepin Ave.; probable cost, $100,000.

Cairo, Ill.—The W. P. Halliday heirs are reported to be having plans drawn for a 3-story brick business building to be erected at 4th St. and Ohio Levee. Kelly & Kusener, 1916 Commercial Ave., Archts.

Chicago, Ill.—D. H. Burnham & Co., 1142 Rookery Bldg., are reported to have prepared plans for a 12-story building for the Union League Club of this city; probable cost, $1,000,000.

The Madison Bldg. Co. is reported incorporated, with a capital of $400,000, to erect an office building. Incorporators: Wm. C. Boyden, Robt. S. McClure, and others.

Faribault, Minn.—A. F Ganger, of St. Paul, is stated to have prepared plans for a 2-story, 44x100 ft. business building, to be erected at Central Ave. and 4th St., for W. N. Cosgrove.

Sullivan, Ill.—Plans are stated to have been accepted for the erection of a series of buildings, including 4 dormitories, an administration building and a power house for the Orphans' and Old Folks' Masonic Home, to be erected here, to cost from $300,000 to $400,000.

Superior, Wis.—The Keystone Blk. at 7th St. and Tower Ave. is reported destroyed by fire Jan. 28. Peter Truax and W. Luby, of Eau Claire, are the proprietors.

Waterloo, Ia.—Henry Myers is reported to be considering the erection of an opera house at Park Ave. and Sycamore St., to cost $40,000.

Joliet, Ill.—M. Bolig will soon erect a business block on Jefferson and Joliet Sts.; cost, $25,000. Architect, H. Boehme, 101 Ottawa St.

St. Paul, Minn.—It is stated that Foley Bros. & Kelly will erect a 6-story, 200x100 ft. warehouse on Bway, to cost $175,000. Architects, J. Walter Stevens, Drake Blk.

Oak Park, Ill.—It is stated that C. B. Scoville will erect a business building at Lake St. and Oak Park Ave., to cost $200,000.

Covington, Ky.—S. W. Spinks will build a $10,000 warehouse at 13th and Madison Sts.

Houston, Tex.—A permit is stated to have been issued to H. Prince for the erection of the Olympic Opera House on Prairie Ave., at a cost of $20,000.

San Antonio, Tex.—It is stated that G. Bedell Moore will erect a 5-story brick business building at Ave. C and Houston St., to measure 145x110 ft.

St. Louis, Mo.—Herbert C. Chivers is stated to have prepared plans for the building for the Woman's Magazine, to be erected by the Mail Order Publishing Co. on Delmar Ave. The structure will be 5-story stone and brick building, containing a printery.

Chattanooga, Tenn.—Chas. and Geo. Reif, of the Chattanooga Brewing Co., are reported to be having plans prepared for a 5-story hotel, to be erected at 9th and Chestnut Sts., at a cost of $250,000.

Hot Springs, Ark.—It is stated that the Security Bank Co. will erect a 6-story office building, to be equipped with electricity.

Dallas, Tex.—See "Railroads."

Seattle, Wash.—Magnus Kjelsberg is reported to be considering the erection of a 7-story hotel at 4th and Madison Sts.; probable cost, $100,000.

Colorado Springs, Colo.—The Colorado National Bank Bldg. Co. is stated as having plans prepared for a 4-story brick office building to be erected at Huerfano and Tejon Sts. for the Colorado National Bank. W. S. Nichols is reported interested.

Spokane, Wash.—It is stated that the Medical Lake Hotel & Sanitarium Co., recently formed, will erect a 70x120 ft., 3-story hotel and sanitarium at Medical Lake. C. J. Johnson is reported interested.

Eugene, Ore.—Bids are wanted Feb. 14 for furnishing material and erecting a brick building for storerooms and theater purposes. W. D. Pugh, Archt., Salem, Ore. F. L. Chambers, Pres., Eugene Theater Co.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

52 and 54 Bank St, 6-story br tenemt and stores, c, $20,000; o, Chas M Straub; a, Horenburger & Straub.

231 to 235 Eldridge St, 2 6-story br tenemts and stores, c, total, $80,000; o & b, Abraham Silverson; a, Geo F Pelham.

70 and 72 W 49th St, 9-story br and stone hotel, c, $175,000; o, Collins Bldg & Const Co; a, Small & Schumann.

11th Ave and 28th St, 2-story br freight house, c, $30,000; o & a, Erie Land & Impt Co.

Park Ave and 156th St, 5-story br factory, c, $70,000; o, Sigmund Feust; a, Chas Baxter & Son.

30 and 32 E 29th St, 4-story extension to 3-story br and stone telephone exchange, c, $80,000; o, N Y Telephone Co; a, C L W Eidlitz; m, D C Weeks & Son.

27 W 43d St, 4-story extension to 4-story br and stone club house, c, $185,000; o, Racquet & Tennis Club; a, C L Eidlitz; m, Marc Eidlitz.

Bway and 44th St, alterations to 5-story br and stone theater and bali, c, $100,000; o, Klaw & Erlanger; a, J B McElfatrick & Son.

1204 to 1210 Bway, alterations to 4-story br dwell and stores, c, $25,000; o, Maurice Roganair; a, Tracy & Swartwout.

BROOKLYN, N. Y.

Butler St and 5th Ave, 5-story br factory, c, $65,000; o, Morsbeimer & Oldenbush; a, F H Quimby.

DWELLINGS.

Alton, Ill.—Plans have been prepared for a $20,000 rectory for St. Mary's R. C. Church.

Covington, Ky.—Henry Feltman will build a $12,000 flat on Greenup St. W. P. Bausmith, 8th St., is the architect.

Denver, Colo.—W. E. Fisher, McPhee Bldg., has prepared plans for a brick and stone apartment house at 2150 Champa St., to cost $18,000.

SCHOOLS.

Boston, Mass.—The Sch. House Comm. on Jan. 29 opened the following bids for installing a ventilating and heating system in grammar school to be erected on Heath St., Roxbury Dist.: Huey Bros., $15,567; Bradlee & Chatman Co., $15,890; A. B. Franklin, $15,965; Pierce & Cox, $15,995; Lynch & Woodward, $16,671; The Merrill Co., $16,877; Cleghorn Co., $18,840, and A. A. Sanborn, $19,785.

Bids will be received Feb. 9 by the Schoolhouse Comrs. for ventilating and heating the primary school, George Putnam Dist., on School St., West Roxbury. It. Clipson Sturgis, Chmn.

Bids will be received Feb. 9 by the Schoolhouse Comrs. for installing a plumbing system in the grammar school, Lowell Dist., Heath St. R. Clipston Sturgis, Chmn.

Buffalo, N. Y.—F. G. Ward, Comr. of Pub. Wks., has been directed to prepare plans and specifications for an 8-room school on Leroy Ave. and Grider St.

Carthage, N. Y.—D. D. Kieff, of Watertown, is stated to have been selected to prepare plans for a 50x80 ft. high school, to be erected at James and Fulton Sts.

Chautauqua, N. Y.—The plans of Albert Kelsey, of Philadelphia, Pa., are stated to have been adopted by the Chautauqua Institution, at Chautauqua, as the best designs for a permanent model city to cost $2,000,000, to be laid out on about 185 acres of land at Chautauqua. At present only 4 buildings will be erected: A Hall of Philosophy, an Arcade, a Grangers Bldg., and a Business Men's Club House.

New York, N. Y.—The following bids were opened Feb. 2 by C. B. J. Snyder, Supt. School Bldgs., for sanitary work in School No. 188, Boro. of Manhattan: Kirschhof & Brown, $33,200; Jas. Harley, 288 Flatbush Ave., Brooklyn, $19,768 (awarded contract); Jasper & Goebel, $33,743; Jas. Fay, $24,473; Edw. J. Renehan, $26,000.

Bayonne, N. J.—The Bd. of Educ. is stated to have passed a resolution providing for the issue of $100,000 bonds for the erection of a school.

Elizabeth, N. J.—Council has passed an ordinance providing for the issue of $20,000 bonds for the erection of an addition to School No. 5.

Scranton, Pa.—Bids are wanted Feb. 9 for erecting a high school at Adams Ave. and Gibson St. Gilbert N. Edson, Archt., Council Bldg. Eugene D. Fellows, Secy. Scranton Bd. of Control.

Salem, Va.—The Bd. of Trus. of Roanoke College is stated to have approved plans for the erection of a science hall, to cost $25,000.

Lakewood, O.—The Citizens are stated to have voted to issue $75,000 bonds for the erection of a school.

Marietta, O.—Bids are wanted Feb. 24 for erecting a school. J. E. Klintworth, Clk.

Crawfordsville, Ind.—Bids are wanted Feb. 11 for erecting a school in Union Township. L. Walter Breakes, Trus. Bd. Educ.

Marion, Ind.—James Long is reported to have received the contract for erecting the high school, for $39,190.

Colfax, Ill.—A high school to replace one destroyed by fire on Jan. 28th is being considered by the Bd. of Educ.; probable cost, $30,000.

Jackson Center, O.—Bids will be received Feb. 25 by the Bd. of Educ. for furnishing material and erecting a school. F. E. Pool, Clk.

Cleveland, O.—Bids will be received Feb. 23 by the Bd. of Educ. for furnishing material and erecting a school.

Montgomery, Ala.—Geo. I. Lovatt, of Philadelphia, Pa., is stated to have prepared plans for the 2-story brick, 110x40 ft. lecture hall, for St. Joseph's College.

Durant, Ind. Ter.—The citizens are reported to have voted to issue $15,000 school bonds.

El Reno, Okla. Ter.—The Citizens are stated to have voted to issue $30,000 bonds for the erection of a school.

Dallas, Tex.—Geo. W. Dodson, 395 Main St., has secured the contract for erecting a 3-story brick building for Dallas Commercial College, for $11,020. J. D. Mathews, Archt., 395 Main St.

Hespeler, Ont.—Bids will be received Feb. 21 by A. J. Brewster, Secy. Pub. School Bd. for erecting an addition and for changes to Hespeler school, including mason work, steam heating, brick and iron work, etc.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—The lowest bids, opened Feb. 2 by John McG. Woodbury, Comr. of St. Cleaning, were as follows, for furnishing 250 steel ash carts: Thos. Hill, for $110 each; for 1,000 iron ash cans, the Natl. Enamelling & Stamping Co., 78 Beekman St., at $2.33 each, and for 200 combination can and bag carriers, D. J. Barry & Co., 123 Chambers St., $11.87 each.

Syracuse, N. Y.—Henry Funda, 609 N. Geddes St., is stated to have secured the contract for the construction of a garbage plant for the Syracuse Reduction Co.; probable cost, $30,000.

Orange, N. J.—Wm. Schluer, Secy. Bd. Health, in his annual report calls attention to the need of a garbage crematory.

Easton, Pa.—H. A. Smith, representing the International Waste Utilization Co., is reported to be conferring with Mayor Lehr and Select Councilman Tonkin on the question of establishing a garbage crematory here.

South Bend, Ind.—A committee of the Common Council, headed by Dr. H. T. Montgomery, of the Ways & Means Com., has been appointed to investigate a site for a garbage crematory and devise means for raising the necessary funds to install a crematory soon.

Alexandria, Ind.—City Engr. W. J. Overman is reported to be investigating the cost of constructing of a new garbage furnace.

Spokane, Wash.—Local press reports state that bids are wanted by the Bd. of Pub. Wks. Feb. 12 for furnishing materials and constructing a garbage plant.

GOVERNMENT WORK.

Ft. McKinley, Me.—Bids will be received by Capt. A. W. Yates, Q. M., U. S. A., at Portland, Mar. 2, for installing a water system at Ft. McKinley, Me., as advertised in The Engineering Record.

Boston, Mass.—The U. S. Senate has passed the bill appropriating $100,000 for the establishment of a light house depot for the 2d Dist. in Boston Harbor, Mass.

Newport, R. I.—The following bids were opened on Jan. 30 by Major Geo. W. Goethals, Corps Engrs., U. S. A., for constructing a breakwater at Point Judith Harbor of Refuge, R. I., price given per net ton: John T. Donovan, 1 Madison Ave., New York, N. Y., $2.75; E. S. Belden & Sons, Hartford, Conn., $3.97.

New London, Conn.—Capt. E. F. Ladd, Q. M., U. S. A., writes that Henry H. Morgan, of New London, submitted the lowest bid Jan. 31 for a 40-H.-P. boiler for the pumphouse at Ft. H. G. Wright, at $1,665.

Buffalo, N. Y.—The Buffalo Dredging Co. is stated to have secured the contract for work on the Lake Erie entrance to Black Rock Harbor, for $802,250.

Jamestown, N. Y.—Bids are wanted Mar. 9 for installing a conduit and electric wiring system for the U. S. Post Office at Jamestown. Jas. Knox Taylor, Supervy. Archt., Washington, D. C.

New York, N. Y.—Bids will be received at the U. S. Engr. Office, Army Bldg., Mar. 4, for dredging in Raritan and South Rivers, N. J., as advertised in The Engineering Record.

Washington, D. C.—The U. S. Senate has passed a bill authorizing the building of dams and other improvements on the Columbia River in Washington.

Ft. Totten, Willets Point, N. Y.—Bids are wanted Mar. 3 for constructing sewer and water systems at this post. A. Hasbrouck, Q. M.

Ft. Hancock, N. J.—Bids are wanted Feb. 19 for constructing a dead house and addition to hospital, including plumbing, electric wiring, etc., at this post. Address John M. Dunn, Q. M.

Philadelphia, Pa.—The following bids for constructing bulkhead in Delaware River were received by Lieut. Col. C. W. Raymond, Corps Engrs., U. S. A., Jan. 29:

Bidders.	Round piles, 570,000 lin. ft.	South'n long leaf yel. pine timber, 3,455,000 ft. B. M.	Screw bolts, nuts & washers, 309,000 lbs.	Spikes, 68,000 lbs.	Total.
Sanford & Brooks Co., Baltimore, Md.	15½	$37.50	4	4	$232,992
The Baltimore Construction Co., Wilmington, Del.	14¾	36.00	4½	4½	225,420
Henhoeffer & Vaughan, Philadelphia	20	48.00	5	4	298,010
David Peoples, Philadelphia	19	38.50	5	4½	259,827
John L. Grim, Philadelphia	17	37.50	4½	4½	243,427
Armstrong & Printzenhoff, Philadelphia	16½	38.50	3½	3½	240,262
F. K. Wills Construction Co., Wilmington, Del.*	12⅛	31.80	2 13/16	2 5/16	189,245
Michael J. Hogan, Philadelphia	16	37.50	3.05	2.55	231,921
Frank Pidgeon, Saugertles, N. Y.	20	48.00	4	4	294,920
A. F. Chapman & Co., Buffalo, N. Y.	17	32.00	4	4	222,540
John F. Donovan, New York, N. Y.	18	38.00	4½	4½	250,855
E. F. Fonder, Philadelphia	18.9	33.20	4	3.8	237,380

*Recommended for acceptance.

Alexandria, Va.—Bids will be received Mar. 4 at the office of Superv. Archt., Treas. Dept., for the construction, including plumbing, heating and electric wiring of the extension to U. S. Custom House and Post Office at Alexandria, as advertised in The Engineering Record.

Richmond, Va.—J. Clement Shafer, of Richmond, is stated to have secured the contract for dredging, jetty and dike work, and removing rock in James River, for $236,978.

Cincinnati, O.—Bids will be received at the U. S. Engr. Office, Cincinnati, on Mar. 5 for raising crest of Dam No. 9, Muskingum River, O., with concrete, as advertised in The Engineering Record.

Ft. Sheridan, Ill.—Bids are wanted Feb. 27 for constructing an iron bridge at this post. Address Maj. W. H. Miller, Q. M., U. S. A., Chicago, Ill.

Ashland, Wis.—Bids will be received at U. S. Engr. Office, Duluth, Minn., Feb. 24, for furnishing and placing about 26,000 tons of riprap at Ashland, as advertised in The Engineering Record.

Milwaukee, Wis.—Bids will be received at the office of the U. S. Engr., Milwaukee, on Mar. 2 for the following 5 contracts, as advertised in The Engineering Record: 1st, for building crib piers, crib breakwater, pile revetment, etc., and dredging at Milwaukee Harbor, Ill.; 2d, for building crib piers at Sheboygan Harbor, Wis.; 3d, for building crib breakwater at Manitowoc Harbor, Wis.; 4th, for dredging and rock removal at Sturgeon Bay and Lake Michigan Ship Canal, Wis., and 5th, for furnishing Oregon fir timber and plank.

Detroit, Mich.—Bids will be received at the office of Light House Engr., Detroit, on Mar. 2 for removing and rebuilding the foundation pier of the Cheboygan Crib Light Station, Mich., as advertised in The Engineering Record.

Ft. Brady, Mich.—The U. S. Senate has passed a bill appropriating $128,400 for replacing burned buildings at Ft. Brady, Mich.

Grand Rapids, Mich.—Bids will be received at the U. S. Engr. Office, Grand Rapids, Mich., Mar. 4, for repair of piers at Pentwater and White Lake, Mich., and repair of piers and revetment at Charlevoix, Mich., as advertised in The Engineering Record.

Duluth, Minn.—The Illinois Steel Co., of Chicago, Ill., is reported to have secured the contract for furnishing 240,000 sacks of Portland cement, to be used in the construction of the new south pier at the Wisconsin entrance to the Duluth-Superior Harbor; contract reported to amount to $117,000.

Janesville, Wis.—Bids are wanted Mar. 12 for furnishing the low-pressure steam heating apparatus for the U. S. Post Office at Janesville. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Ft. Riley, Kan.—Bids will be received by G. O. Cress, Q. M., U. S. A., for constructing 2 double sets of non-commissioned staff quarters, as advertised in The Engineering Record.

St. Louis, Mo.—The Van Etten-Lane Electric Co., of St. Louis, has received the contract for installing an ash elevator in the U. S. Custom House and Post Office, of St. Louis, for $1,094.

Ft. Smith, Ark.—Bids will be received at the office of the Superv. Archt., Treas. Dept., Washington, D. C., for the construction (except heating and elevator) of the extension to the U. S. Court House, Post Office, etc., at Ft. Worth, Ark., as advertised in The Engineering Record.

Seattle, Wash.—The War Dept. is reported to have awarded to the Puget Sound Bridge & Dredging Co., of Seattle, the contract for dredging in Lake Washington canal, for $113,270, and for dredging Olympia harbor, for $16,445.

Cheyenne, Wyo.—Bids are wanted Mar. 2 for installing the low pressure steam heating and ventilating apparatus for the U. S. public building at Cheyenne. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Ft. Duchesne, Utah.—The following bids for Sewer Work at this post were received by Lieut. Col. J. W. Pope, Ch. Q. M., Denver, Colo., Jan. 29: Holm & Nichols, Salt Lake City, Utah, $14,080; D. J. Tirsway, Denver, Colo., $16,200; John B. Hughes, Denver, Colo., $17,100.

San Francisco, Cal.—Bids are wanted Feb. 24 for furnishing the Navy Yard, Mare Island, with a quantity of broken stone, conduit, manhole frames, covers, etc. A. S. Kenny, Paymaster Gen., Bureau of Supplies and Accounts, Washington, D. C.

MISCELLANEOUS.

Boston, Mass.—Bids will be received by the Children's Institute Trus. until Feb. 12 for building a coal shed and addition to wharf at Rainsford Island, Boston Harbor, Mass.

Brooklyn, N. Y.—Bids will be received Feb. 10 by Homer Folks, Comr. Dept. of Pub. Charities, N. Y. City, for furnishing the Boro. of Brooklyn and Queens with engineers, plumbing, electrical supplies, etc.

Chautauqua, N. Y.—See "Schools."

New York, N. Y.—The lowest bid opened by Bd. Pub. Wks. Feb. 3 for 20,000 cu. yds. sand was the Phoenix Towing & Transportation Co., 17 State St., for 54½ cts. per yd.

John Monks & Son, 130 Water St., have the contract for building a pier and bulkhead shed for the New York & Baltimore Transportation Line on Pier 11, East River. Dimensions of shed are: 33 ft. wide, 450 ft. long, the inner 50 ft. being 2-story. The bulkhead shed is about 50x50 ft.

Marietta, O.—Bids will be received by the Secy. of the Water Works Trus. until Mar. 7 for furnishing from 10,000 to 15,000 bbls. of Portland cement, as advertised in The Engineering Record.

Sidney, Ia.—It is reported that the county will expend $80,000 in straightening Nishnabotne River. Seth Dean, Engr.

Shreveport, La.—W. H. Hoffman, Secy. Bd. State Engrs., New Orleans, writes that the following bids were opened Jan. 28 by the Bd. State Engrs., New Orleans, for Thompson Levee, on Red River, Caddo Parish: J. R. Bobbitt, Magna Vista, Miss., 30.5 cts. per cu. yd. and R. T. Clark, 29.95 cts. per cu. yd. The bids were rejected, and new bids will be received Feb. 9th.

Kaysville, Utah.—F. B. Williams, City Recorder, writes in regard to the construction of a canal from Weber River to the end of the county line, that the company is not fully organized and final surveys have not been made; the work will probably cost $500,000. Thos. H. Phillips, Engr. in Charge.

Stockton, Cal.—The Assembly Committee on Swamp & Overflowed Lands took favorable action on the bill appropriating $60,000 for securing rights of way for a canal to connect Mormon Channel and Calaveras River. This canal is projected in the interest of Stockton harbor. Colvin Brown, Secy. Chamber of Commerce, of Stockton, is reported interested.

Oceanside, Cal.—See "Water."

Ft. Douglas, Utah.—Bids are wanted Mar. 2 for constructing 2 barracks, including heating, plumbing, gas piping and electric wiring, at this post. Address Capt. Sam'l V. Ham, Q. M., Salt Lake City.

Cross Point, Que.—Bids are wanted Feb. 9 for constructing a wharf. Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa.

NEW INDUSTRIAL PLANTS.

The Wood Knitting Co., Morristown, Tenn., will probably be in the market later for a gasoline engine.

Haug & Scheurman, Saginaw, Mich., have completed plans for a $10,000 factory for the Waldo Mfg. Co., makers of banjos, mandolins, etc.

E. H. Davis, Scranton, Pa., has prepared plans for a 2-story, 50x100-ft. brick silk mill.

The Williamson Bros. Co., Aramingo Ave. and Cumberland St., Philadelphia, Pa., will erect several buildings for foundry purposes, including a 150x55-ft. snap moulding shop; 208x55-ft. floor moulding shop; 2-story, 35x208-ft. charging house; 3-story pattern-storage building and a 3-story building for shipping, cleaning and storing castings. Several of these buildings will be equipped with electric traveling and jib cranes, and the power will be supplied by the company's present power plant.

The Ahnapee Veneer & Seating Co., Algoma, Wis., has purchased 11⅓ acres of land in Memphis, Tenn., and will erect a plant. Two 100-H.-P. boilers and a Corliss or automatic slide valve engine will be installed.

C. H. McClare, Cambridge, Mass., is preparing plans for a factory to cost $12,000 to $14,000 for Russell & Co., confectioners. Steam power, electric work and refrigeration will be installed.

Dr. S. B. Fowler, Gainesboro, Tenn., whose flour mill was recently burned, is in the market for milling machinery. The power plant was not burned.

George Skene, Elizabeth, Ill., is promoting the Topeka, Kan., Bridge & Iron Works. The main part of the building to be erected will be 60 ft. wide and not less than 300 ft. long.

The Medicated Salt & Mfg. Co., Colorado, Tex., is in the market for a press for pressing fine salt into block form.

BUSINESS NOTES.

The Pennsylvania R. R. Co. is installing in the new Camden station four 250-H.-P. cross compound engines, each direct-connected to Westinghouse alternators. These alternators will run in parallel, and engines are equipped with synchronizing devices. The Ball Engine Co., Erie, Pa., furnish the engines.

The Ohio Brass Co. has decided to substitute alternating-current power distribution for the direct-current system at present in use in its shops at Mansfield, O. A recent purchase from the Westinghouse Electric & Mfg. Co. comprises a 180-Kw., 7,200-alternation, two-phase alternator, together with exciter, switchboard equipment and nine induction motors aggregating 237 H.-P.

The Otis Elevator Co. reports the following contracts recently closed: North German Lloyd Steamship Co., Hoboken, N. J., ten electric passenger elevators; Kean, Van Cortlandt & Co. Building, 28 to 32 Pine St., four hydraulic elevators; Hotel Willard, Washington, D. C., four hydraulic elevators and two electric elevators; and the Belvidere Hotel, Baltimore, Md., seven plunger elevators with a car travel of 160 ft.

Among the orders booked by the Bradley Pulverizer Co. during the month of January for Griffin Mills have been the following: Penn Allen Portland Cement Co., Allentown, Pa., grinding machinery for new works; Lehigh Portland Cement Co., grinding machinery for 2,000-bbl. plant to be erected at Ormrod, Pa.; Quaker Portland Cement Co., grinding machinery for 4,000-bbl. plant to be erected at Stockertown, Pa.; additional mills for the Lehigh Portland Cement Co., at their Mill D in Mitchell, Ind., Mill A in Ormrod, Pa., and Mill B in West Copley, Pa.; additional grinding machinery for the Iroquois Portland Cement Co., Caledonia, N. Y., and also for the Wolverine Portland Cement Co., Coldwater, Mich., and the Bronson, Mich., Portland Cement Co.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Feb. 12.	Conduits, Findlay, O.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Feb. 12.	Augusta, Ark.	Jan. 31
	Adv., Eng. Record, Feb. 7.	
Feb. 14.	Lakewood, O.	Jan. 24
Feb. 14.	Shoshone, Idaho	Feb. 7
Feb. 16.	Philadelphia, Pa.	Feb. 7
Feb. 16.	Pipe, etc., North Milwaukee, Wis.	Jan. 31
Feb. 17.	Cincinnati, O.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 18.	Savannah, Ga.	Feb. 7
Feb. 18.	Dubois, Pa.	Feb. 7
Feb. 18.	St. Francisville, La.	Jan. 31
	Adv., Eng. Record, Feb. 7.	
Feb. 20.	Pipe, etc., Washington, D. C.	Feb. 7
	Adv., Eng. Record, Feb 7	
Feb. 27.	Pipe, etc., Burlington, Ia.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Feb. 28.	Valves, Cleveland, O.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Feb. 28.	South McAlester, Ind. Ter.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 1.	Ft. Morgan, Ala.	Jan. 24
Mar. 2.	Pumping Engine, Winnipeg, Man.	Jan. 17
	Adv., Eng. Record, Jan. 17 to Feb. 7.	
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 14.	Dillon, Mont.	Jan. 10
May 1.	Chinook, Mont.	Feb. 7
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Feb. 9.	Pittsburg, Pa.	Feb. 7
Feb. 12.	Cleveland, O.	Feb. 7
Feb. 14.	Long Island City, N. Y.	Feb. 7
Feb. 14.	Boone, Ia.	Feb. 7
Feb. 14.	Lakewood, O.	Jan. 24
Feb. 14.	Washington, D. C.	Jan. 17
	Adv., Eng. Record, Jan. 17 to Feb. 7.	
Feb. 16.	Atlanta, Ga.	Feb. 7
Feb. 16.	Toledo, O.	Jan. 24
Feb. 19.	Cleveland, O.	Jan. 31
Feb. 23.	Wabash, Ind.	Jan. 31
Feb. 26.	Cleveland, O.	Feb. 7
Feb. 28.	South McAlester, Ind. Ter.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 1.	Peoria, Ill.	Jan. 17
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
	BRIDGES.	
Feb. 10.	Arkadelphia, Ark.	Jan. 10
Feb. 10.	Castroville, Tex.	Jan. 3
Feb. 11.	Camden, N. J.	Jan. 24
Feb. 14.	Bay City, Mich.	Jan. 17
	Adv., Eng. Record, Jan. 17. 24.	
Feb. 16.	St. Mary's, Ont.	Feb. 7
Feb. 18.	New York, N. Y.	Feb. 7
Mar. 27.	Washington, D. C.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
	PAVING AND ROADMAKING.	
Feb. 9.	Pittsburg, Pa.	Feb. 7
Feb. 10.	Mobile, Ala.	Feb. 7
Feb. 10.	St. Louis, Mo.	Jan. 31
Feb. 10.	Sioux City, Ia.	Jan. 31
Feb. 10.	Buffalo, N. Y.	Jan. 31
Feb. 10.	Newark, O.	Jan. 17
Feb. 11.	Baltimore, Md.	Feb. 7
Feb. 11.	Cincinnati, O.	Feb. 7
Feb. 13.	Kenton, O.	Jan. 24
Feb. 14.	Dallas, Tex.	Jan. 31
Feb. 14.	Chippewa Falls, Wis.	Jan. 31
Feb. 14.	Lafayette, Ind.	Dec. 27
Feb. 16.	Bowling Green, Ky.	Feb. 7
Feb. 16.	Burlington, Ia.	Jan. 31
Feb. 16.	Cincinnati, O.	Jan. 31
Feb. 17.	Three Rivers, Mich.	Jan. 10
	Adv., Eng. Record, Jan. 10.	
Feb. 18.	Brooklyn, N. Y.	Feb. 7
Feb. 18.	Cleveland, O.	Jan. 31
Feb. 20.	Owosso, Mich.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Feb. 20.	Iowa City, Ia.	Jan. 31
Feb. 21.	Savannah, Ga.	Feb. 7
Feb. 23.	Canton, O.	Feb. 7
Feb. 23.	Morristown, N. J.	Jan. 31
Feb. 23.	North Manchester, Ind.	Jan. 31
Feb. 23.	Fond du Lac, Wis.	Jan. 3
	Adv., Eng. Record, Jan. 3 to 17.	
Mar. 2.	Toledo, O.	Feb. 7
Mar. 2.	Newburgh, N. Y.	Jan. 31
	Adv., Eng. Record, Feb. 7.	
Mar. 3.	Winnipeg, Man.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 6.	Ft. De Soto, Fla.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. —	San Diego, Cal.	Jan. 31
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Feb. 9.	Wauwatosa, Wis.	Feb. 7
Feb. 10.	Granbury, Tex.	Jan. 17
Feb. 11.	Bluffton, Ind.	Jan. 31
Feb. 12.	Augusta, Ark.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Feb. 12.	Guayaquil, Ecuador	Dec. 20
Feb. 14.	Findlay, O.	Feb. 7
Feb. 16.	Pincerville, Cal.	Feb. 7
Feb. 18.	St. Francisville, La.	Jan. 31
	Adv., Eng. Record, Feb. 7.	
Mar. 4.	Franchiae, Manila, P. I.	Nov. 15
Apr. 7.	Oneida, N. Y.	Feb. 7
———	Hyattsville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Feb. 9.	Little Rock, Ark.	Jan. 10
	Adv., Eng. Record, Jan. 10 to 31.	
Feb. 10.	Tulalip, Wash.	Jan. 31
Feb. 10.	Chicago, Ill.	Jan. 17
	Adv., Eng. Record, Jan. 17 to Feb. 7.	
Feb. 10.	Memphis, Tenn.	Jan. 17
Feb. 10.	Boston, Mass.	Jan. 10
Feb. 11.	Ft. Mansfield, R. I.	Jan. 31
Feb. 11.	Newport, R. I.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Feb. 12.	New Orleans, La.	Jan. 31
Feb. 12.	Memphis, Tenn.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 12.	St. Augustine, Fla.	Jan. 17
	Adv., Eng. Record, Jan. 17, 24, Feb. 7.	
Feb. 12.	Boston, Mass.	Jan. 17
Feb. 12.	Newport, R. I.	Jan. 10
	Adv., Eng. Record, Jan. 10 to 31.	
Feb. 13.	Norfolk, Va.	Jan. 17
	Adv., Eng. Record, Jan. 24, Feb. 7.	
Feb. 16.	New Bedford, Mass.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Feb. 16.	Ft. Riley, Kan.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Feb. 16.	New York, N. Y.	Jan. 17
	Adv., Eng. Record, Jan. 17 to Feb. 7.	
Feb. 16.	Boston, Mass.	Jan. 17
Feb. 17.	Phoenix, Ariz.	Jan. 24
Feb. 18.	Boston, Mass.	Jan. 24
Feb. 18.	Dallas, Tex.	Jan. 24
Feb. 18.	San Francisco, Cal.	Jan. 17
Feb. 19.	Ft. Hancock, N. J.	Feb. 7
Feb. 19.	Ft. Dade, Fla.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Feb. 19.	Duluth, Minn.	Jan. 24
	Adv., Eng. Record, Jan. 24 to Feb. 7.	
Feb. 19.	Grand Rapids, Mich.	Jan. 24
	Adv., Eng. Record, Jan. 24 to Feb. 7.	
Feb. 19.	Chilocco, Okla. Ter.	Jan. 24
Feb. 19.	Ft. D. A. Russell, Wyo.	Jan. 24
Feb. 19.	Burlington, Ia.	Jan. 17
	Adv., Eng. Record, Jan. 17, 24.	
Feb. 20.	Burlington, Vt.	Jan. 24
	Adv., Eng. Record, Jan. 24 to Feb. 7.	
Feb. 20.	New York, N. Y.	Jan. 24
Feb. 20.	Boston, Mass.	Jan. 24
Feb. 21.	Boston, Mass.	Jan. 24
Feb. 21.	Bldg., Philadelphia, Pa.	Jan. 17
Feb. 24.	San Francisco, Cal.	Feb. 7
Feb. 24.	Ashland, Wis.	Jan. 31
	Adv., Eng. Record, Feb. 7.	
Feb. 24.	Chicago, Ill.	Jan. 24
Feb. 25.	Creston, Ia.	Jan. 17
	Adv., Eng. Record, Jan. 17, 24.	
Feb. 27.	Ft. Sheridan, Ill.	Feb. 7
Feb. 28.	Nashville, Tenn.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Feb. 28.	Ft. Terry, N. Y.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Feb. 28.	Mobile, Ala.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Mar. 2.	Milwaukee, Wis. (5 advs.)	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 2.	Detroit, Mich.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 2.	Ft. McKinley, Me.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 2.	Cheyenne, Wyo.	Feb. 7
Mar. 2.	Ft. Douglas, Utah	Feb. 7
Mar. 2.	Jamestown, N. Y.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Mar. 3.	Ft. Riley, Kan.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 3.	Helena, Mont.	Jan. 24
	Adv., Eng. Record, Jan. 24, 31.	
Mar. 4.	New York, N. Y.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 4.	Alexandria, Va.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 4.	Grand Rapids, Mich.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 5.	Cincinnati, O.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 5.	Haines, Alaska	Jan. 24
Mar. 5.	Janesville, Wis.	Jan. 24
Mar. 9.	9. Jamestown, N. Y.	Feb. 7
Mar. 11.	Wilkesbarre, Pa.	Jan. 31
	Adv., Eng. Record, Jan. 31, Feb. 7.	
Mar. 10.	Ft. Smith, Ark.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. 12.	Janesville, Wis.	Feb. 7
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
	BUILDINGS.	
Feb. 9.	School, Scranton, Pa.	Feb. 7
Feb. 9.	School, Boston, Mass.	Feb. 7
Feb. 9.	Engine house, New York, N. Y.	Jan. 31
Feb. 9.	School, New York, N. Y.	Jan. 31
Feb. 10.	Asylum, Fremont, Neb.	Feb. 7
Feb. 10.	Police Station, Everett, Mass.	Feb. 7
Feb. 10.	School, Huntington, W. Va.	Jan. 24
Feb. 10.	Court house, Lawrence, Kan.	Jan. 17
Feb. 11.	School, Crawfordsville, Ind.	Feb. 7
Feb. 14.	Bus. Bldg., Eugene, Ore.	Feb. 7
Feb. 14.	Bank, Blairsville, Pa.	Feb. 7
Feb. 11.	Pub. Bldgs., Brooklyn, N. Y.	Jan. 31
Feb. 14.	School, Weatherford, Okla. Ter.	Jan. 31
Feb. 14.	Library, Norfolk, Va.	Jan. 10
Feb. 16.	Library, Portsmouth, O.	Feb. 7
Feb. 16.	Church, Homestead, Pa.	Feb. 7
Feb. 16.	Pub. Bldg., Oshkosh, Wis.	Jan. 31
Feb. 16.	Gymnasiums, Columbus, O.	Jan. 31
Feb. 16.	Office Bldg., Flint, Mich.	Jan. 31
Feb. 16.	Court house, Franklin, La.	Jan. 31
Feb. 17.	City Hall, Shelbyville, Ind.	Feb. 7
Feb. 17.	Church, Carrollton, Ky.	Jan. 17
Feb. 18.	Court house, Lawrence, Kan.	Jan. 24
Feb. 18.	Church, Selma, Ala.	Jan. 17
Feb. 20.	Court House, Newport, Ind.	Jan. 24
Feb. 21.	School, Hespeler, Ont.	Feb. 7
Feb. 23.	Court house, Hamburg, Ark.	Feb. 7
Feb. 23.	School, Cleveland, O.	Feb. 7
Feb. 24.	School, Marietta, O.	Feb. 7
Feb. 25.	School, Jackson Center, O.	Feb. 7
Feb. 25.	Pub. Bldg., Des Moines, Ia.	Jan. 31
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
Mar. 5.	Hospital, Springfield, O.	Jan. 31
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
	MISCELLANEOUS.	
Feb. 9.	Levee Work, Shreveport, La.	Feb. 7
Feb. 9.	Wharf, Cross Point, Que.	Feb. 7
Feb. 9.	Supplies, New York, N. Y.	Jan. 31
Feb. 10.	Supplies, Brooklyn, N. Y.	Feb. 7
Feb. 12.	Wharf, Boston, Mass.	Feb. 7
Feb. 12.	Garb. Plant, Spokane, Wash.	Feb. 7
Feb. 20.	Garb. Disp., Kansas City, Mo.	Jan. 31
Mar. 1.	Grading, Beaumont, Tex.	Jan. 24
Mar. 3.	Cement, Winnipeg, Man.	Jan. 17
	Adv., Eng. Record, Jan. 17 to 31.	
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. 7.	Cement, Marietta, O.	Feb. 7
	Adv., Eng. Record, Feb. 7.	
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	R. R. work, Cincinnati, O.	Dec. 20

PROPOSALS.

Water Pipe.

ealed proposals addressed to the Citizens er Company, Burlington, Iowa, will be re- ed at the office of the company until noon riday, February 27, 1903, for the delivery . B. cars at Burlington, Iowa, of 200 tons ight inch; 300 tons of six inch and 20 of four inch cast iron water pipe and 12 of special castings.

he four inch pipe to be of Class K; the inch pipe of Class I and the eight inch of Class G of the Standard Specifications Cast Iron Water Pipe and Special Cast- of the New England Water Works Asso- ion which will be made a part of the con- t.

he right is reserved to reject the lowest ll bids. FRANK LAWLOR,
Superintendent.

. S. ENGINEER OFFICE, MILWAUKEE, Jan. 31, 1903.—Sealed proposals for ishing Oregon fir timber and plank will eceived here until 3 o'clock P. M., March 903, and then publicly opened. Specifica- n, blank forms, and all available informa- will be furnished on application to this e. J. G. WARREN, Major, Engineers.

PROPOSALS.

Electric Light Plant and Wells.

AUGUSTA, ARKANSAS.

Sealed proposals, addressed to the Board of Water Works Commissioners of Augusta, Ark., will be received by said commissioners until 8 P. M., Thursday, Feb. 12th, 1903, for supplying material, and doing work as follows:

(a) 80-H.-P. Engine, 66x16-ft. boiler; 60-Kw. generator, exciter and switchboard; arc lamps, transformers and pole line, complete.

(b) Power Station, 38x41 ft.

(c) Two 6-in. wells, 100 ft. deep, and deep-well pumps.

Certified check for $500 to accompany proposal. The right is reserved to reject any and all bids.

Plans and specifications are on file with the City Recorder, Augusta, Ark., and at the offices of the Engineers, 43½ Madison St., Memphis, Tenn.

Address all inquiries to
WEATHERFORD & HILDEBRAND,
Engineers, Memphis, Tenn.

E. H. CONNER,
J. R. VINSON, Commissioners.

PROPOSALS.

U. S. ENGINEER OFFICE, MILWAUKEE, Wis., Jan. 31, 1903.—Sealed proposals for building crib piers at Sheboygan Harbor Wis., will be received here until 3 o'clock P. M., March 2, 1903, and then publicly opened. Information furnished on application. J. G. WARREN, Major, Engineers.

U. S. ENGINEER OFFICE, 2001 I ST., N. W., Washington, D. C., Feb. 6, 1903.—Sealed proposals for construction of a highway bridge across Potomac River at Washington, D. C., will be received here until 12 M., March 27, 1903, and then publicly opened. Information furnished intending bidders on application. CHAS. J. ALLEN, Lt. Col., Engrs.

FORT RILEY, KANS., FEB. 1, 1903.—Sealed proposals, in triplicate, will be received here until 11 A. M., March 3, 1903, for construction of Two Double Sets of Non-Commissioned Staff Quarters. Information furnished upon application, here; also at offices of Depot Quartermasters, Chicago, Ill., St. Louis, Mo., and Omaha, Nebraska. Bidders will state in their bids the time in which they will complete the work, as time will form an important consideration in the award. United States reserves the right to accept or reject any or all bids, or any part thereof. Envelopes to be indorsed "Proposals for Public Buildings," and addressed Captain G. O. CRESS, Q. M.

PROPOSALS.

U. S. ENGINEER OFFICE, CUSTOM-house, Cincinnati, O., February 4, 1903.—Sealed proposals for furnishing material and all labor for raising crest of Dam No. 9, Muskingum River, Ohio, with concrete, will be received here until noon, standard time, March 5, 1903, and then publicly opened. Information furnished by Assistant Engineer Edmund Moeser, Zanesville, O., or by Major ERNEST H. RUFFNER, Engineers, Cincinnati, O.

U. S. ENGINEER OFFICE, MILWAUKEE, Wis., Jan. 31, 1903.—Sealed proposals for building crib piers, crib breakwater, pile revetment, removal of portion of old pier, and dredging at Waukegan Harbor, Ill., will be received here until 3 o'clock P. M., March 2, 1903, and then publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. J. G. WARREN, Major, Engineers.

FORT DE SOTO, FLA., FEB. 6, 1903.—Sealed proposals, in triplicate, for constructing roads, walks, and gutters, Fort De Soto, Fla., will be received here until 4 P. M., March 6, 1903. U. S. reserves right to reject or accept any or all proposals or any part thereof. Information furnished on application. Envelopes containing proposals will be addressed, "Proposals for constructing roads, walks, and gutters." FRANK S. LONG, A. Q. M.

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Engineering Reports.

Three reports of current interest are reviewed in this issue of The Engineering Record. The report on the "Improvement of the Park System of the District of Columbia" treats of a matter of national interest and patriotic pride, and the character and ability of the men whose names are subscribed should command for it earnest consideration and effective action. Many modern engineering works of great magnitude are accomplished with a rapidity which even now seems almost marvelous; but this cannot be true of all undertakings and perhaps in no line are the earliest results seemingly so inadequate and the development so slow, the need of a thoroughly studied and intelligently prepared scheme so necessary and continued perseverance in well-doing so essential as in the development of a great park system and the creation of a national capital.

The report of the New York State Water Storage Commission enters a field of engineering activity in which but little has been done in this land although more has been suggested. In Europe, especially in France, the importance of the regulation of the rivers by means of storage reservoirs has been more fully appreciated, and many such works have been constructed. The Passaic Valley District Sewerage and Drainage Commissioners attacked an old problem with which two previous commissions had wrestled without bringing to pass the construction of any works for the improvement of the river. However, the earlier studies and the data collected have been of use to the present commissioners. Since the scheme of the commissioners to collect the wastes of the valley into a large trunk sewer with an outlet in New York Bay, near Bayonne, has been made public, much adverse comment has been made by citizens of New York. This makes the problem one of inter-state interest and the legal complications bid fair to rival the engineering difficulties. In current newspaper discussions, the fact that the sewage is now being discharged into the bay by the river seems to be lost sight of and objection is raised to the plan as if sewage were to be brought from a new district

Report of the New York State Water Storage Commission.

In view of the agitation in New York State and its legislature for improved canal facilities, the current interest in water power developments and the annually recurring damages from floods, the report, recently rendered to the legislature by the New York State Water Storage Commission, has a timely interest. The commission as appointed by Governor Odell on April 16, 1902, consisted of Attorney-General John C. Davies, State Engineer and Surveyor Edward A. Bond, State Superintendent of Public Works Charles S. Boyd, State Commissioner of Forests, Fish and Game D. C. Middleton, ex-officiis, and Prof. Olin H. Landreth, of Union College, Schenectady; Mr. John L. King, Syracuse; Mr. Elnathan Sweet,* of Albany; Mr. George W. Rafter, Rochester, and Mr. George R. Finch, Glens Falls. The Attorney-General was elected chairman, but was followed shortly by his successor in office, Mr. John Cuneen.

The detailed study of the rivers was subdivided by assigning two members of the commission to each of four districts, into which the State was partitioned. These sub-committees collected such data as could be obtained, and gave the matter as thorough consideration as the limited time would permit. To aid in the collection of information about 1,750 circular letters were sent out.

The information gathered showed that the pecuniary damages from floods throughout the State aggregated during 1902 more than $3,000,000, but besides this loss there was loss and danger to life, interference with traffic and business, flooding of sewer systems and other unfortunate results which cannot be stated in money. The primary cause for the freshets is evidently the irregularity of the rainfall, and two general methods of correcting the difficulty are recognized, viz.: The improvement of the river channels and the construction of storage reservoirs. A study of some of the streams indicated that the former method only could be economically applied to them while upon other watersheds suitable sites for reservoirs were found. The latter method has many advantages in that the stored water can be utilized for water power, for municipal water supply or for improving the condition of the larger streams with regard to navigation.

It is estimated that about 200,000 acres including some of the most productive lands in the State could thus be reclaimed for cultivation. As an example of the possibilities of these betterments, the Hudson River may be mentioned. Proper regulation of the run-off from the watersheds of the upper tributaries of the river would increase the depth of minimum flow in the upper part of its navigable reach by more than 1 foot, and would probably prevent the continual formation of bars involving costly dredging to keep this part of the river in a safe navigable condition. The portion of the river above Troy has a watershed of about 4,500 square miles, a maximum flow of approximately 60,000 cubic feet, a minimum flow of less than 1,500 cubic feet per second, and a rated water power development aggregating 70,000 horse-power. Most of these power developments, however, have auxiliary steam plants to sustain operations during low-water periods, and it is probable that if they were estimated upon their reliable hydraulic efficiency, they would not aggregate more than 35,000 horse power. Assuming conservatively 60 per cent. efficiency from the regulated flow, the commission estimates that the reliable horse power that could be developed would be 260,000, an increase of 225,000 horse power. Similar studies of the Genesee and Black rivers indicate that the total additional power which could be made available on the three streams mentioned by proper systems of regulation, would amount to 366,000 horse-power.

The commission perceived that the advantages to be derived from a proper control of the streams had not been wholly unappreciated, but recognized that under the existing State laws relating to water rights, it is impossible for individuals, or even for corporations, to successfully carry out any extensive scheme. Furthermore, the scope of the problem of itself demands that an authority of wider jurisdiction should take the matter in hand, for, in order to secure the best results, each stream system should be treated as a unit, and no method of local diking, straightening or enlarging of channels would be efficient. The importance of the matter is now believed to be such that only State supervision and control would be adequate, and, in order that something definite may be brought to pass, the commission recommends legislation embracing the following essential features:

"It should entrust the inauguration and execution of the system to a permanent commission.

"The initiative of a work of improvement under this act should be by publication by the commission of a notice of intention to make the improvement or by petition by riparian owners showing facts from which they deem it necessary to regulate the flow of the stream in the interest of the public health or safety, and notice to all interested of time and place to hear objections.

"It should be made the duty of such commission to investigate the subject matter presented in such petitions and to approve or disapprove the work they contemplate. If they approve the work, the act should empower and direct them to prepare the necessary maps, plans, specifications and estimates and to execute the work by contract, and stringent regulations and safeguards should be provided in the act for its execution in this matter.

"For the acquisition of the necessary property rights the act must obviously confer the right of eminent domain, and it should clearly provide adequate machinery for carrying out condemnation proceedings, reserving the right of appeal conferred by similar statutes of this State. When the entire cost of any such work of improvement shall have been ascertained, the act should make it the duty of the Water Storage Commission to assess the aggregate cost of each improvement equitably upon all the beneficiaries in proportion to the benefits accruing to each, and to provide methods of collection conformable to the tax provisions of our statutes.

"To insure the progress of such improvements without financial hardship upon the beneficiaries, the act should provide for the issue of bonds limited in amount to the aggregate assessments upon such beneficiaries and secured by such assessments as is done in all important public improvements, and providing in the usual manner for sinking funds and interest charges and the cost of maintenance in determining the yearly taxable assessments.

And the commissioners add: "We are firmly convinced that the prompt inauguration of such a policy by the legislature would more profoundly influence the progress and prosperity of the commonwealth than any public enterprise to which its attention can be directed."

*From Mr. Elnathan Sweet, whose sudden demise was mentioned in the issue of January 31, The Engineering Record received the copy of the report from which this abstract was prepared.

Report of the Park Commission to the Senate Committee on the District of Columbia: A Review.

By Arthur A. Shurtleff.

Engineers and architects are as well aware of the difficulties of holding their clients to the constant pursuit of a definite plan and policy for the conduct of work requiring a number of years for its execution, as they are of the necessity for such constancy to bring extensive undertakings to an efficient close. To such professional men the recent report of the commission appointed by the United States Senate to prepare plans for the improvement of the park system of the District of Columbia, should be of especial interest for two reasons. First, because it vindicates a plan and a policy defined over a century ago for a great municipal enterprise, which until very recent years have been pursued with singular persistency; and second, because its interpretation and extension of the details of this venerable plan to embrace modern municipal requirements, are of great technical interest. In meeting these practical requirements the Commission has not forgotten to consider that ancient and happily most modern requirement which we are learning to specify for our public works, namely, the aesthetic appearance of the result. Founding its recommendations upon practical convenience and long-sighted economy, the Commission has kept steadily in view the aesthetic opportunities which are offered the District in virtue of its remarkable site, its peculiar relation to business, and its occupation by the seat of our national government.

It is the fate of most cities to be founded and to develop as by chance without definite plan and subject to the caprice of the countryside upon which their precincts expand. Rural street systems laid out by drovers or farmers, and later adopted by small villages, are absorbed at last and elaborated within city limits. Retribution for the absorption of these unplanned streets has always been meted out to such cities since the days of Rome in terms of the costly widening, straightening, regrading, and relocation of their thoroughfares. Most modern cities in attempting to remove the practical disabilities of such streets, have also tried to improve their appearance by arranging their courses, intersections, and subdivisions in such wise as to enhance the aspect of abutting buildings and the streets themselves. To this end, and for the pleasure and health of their inhabitants, they have usually provided squares and parks, even at the expense of the demolition of houses.

A plan for the City of Washington was prepared by Major Peter Charles l'Enfant, under the direction of George Washington and his Secretary of State, Jefferson, in 1790. The essential features of this plan are reproduced in an accompanying drawing. The design was studied carefully on the ground to afford proper sites for federal buildings, together with a system of avenues at once conveniently and agreeably related to these buildings, to certain public squares, and to the subdivision of the territory by lesser streets, which were to be occupied by dwellings, markets, shops, and manufactories. The dominating feature of the design was the great "Congress House" in relation to which the "President's House" and important federal buildings, together with public open spaces in proportion to their size, and avenues in so far as they converged upon it or its related edifices, were to stand related as visual, as well as practical, dependencies. The city was laid out in pursuance of this plan, and has realized year by year many of the fondest hopes advanced by its designers. Departures from the design, notably in the vicinity of its crowning buildings, have been made during recent years, however, which promise so far to defeat the very objects for which the rest of the city had been planned, and in accordance with which it had been built, as to awaken popular as well as technical protest.

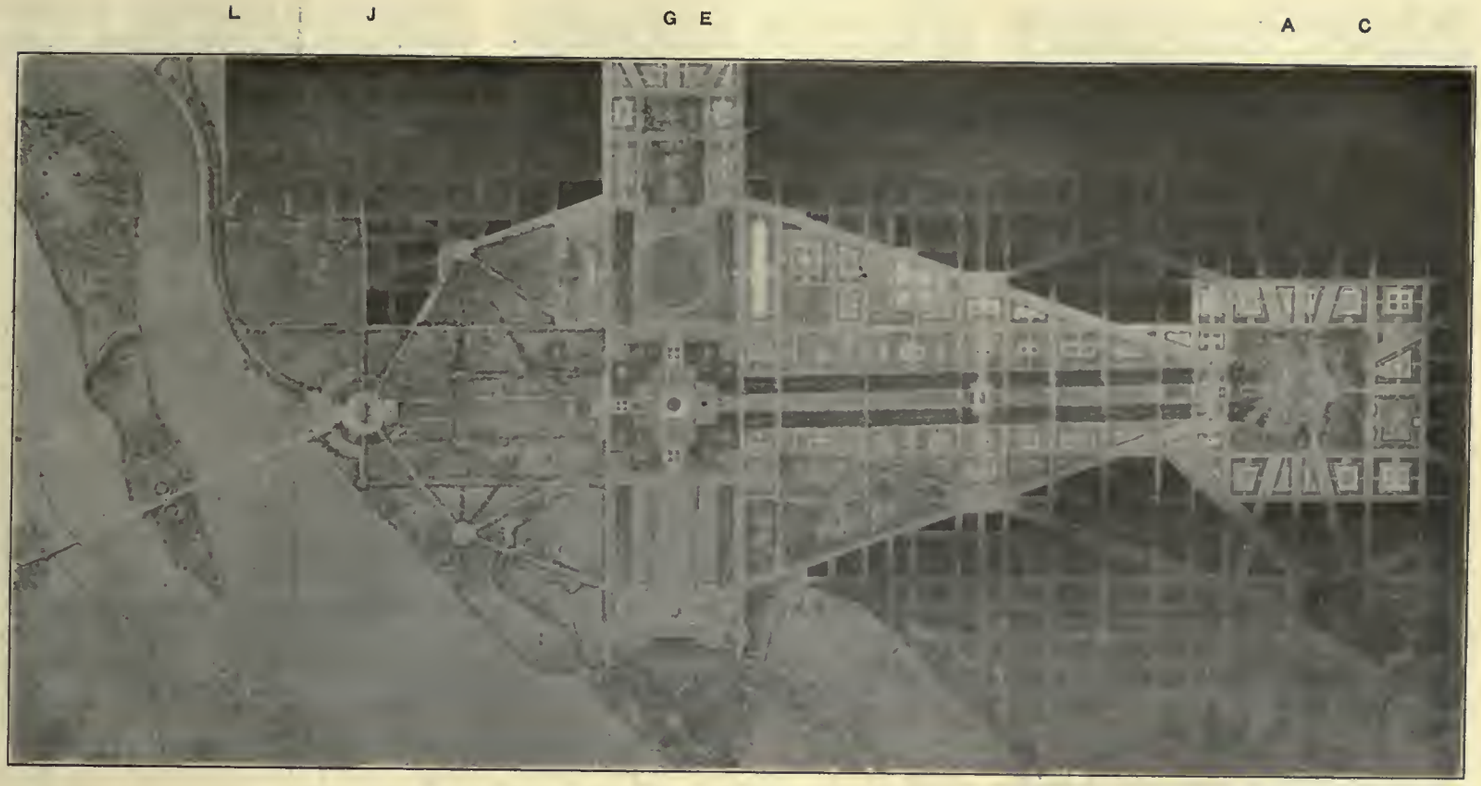
It was during the celebration of the one hundredth anniversary of the removal of the seat of government to Washington, held by the citizens of the District of Columbia, in December, 1900, when a joint committee of the two Houses of Congress co-operated in the celebration, that effective presentation of the protest was made. The keynote of the anniversary was the improvement of the District of Columbia. At this time the American Institute of Architects had this improvement under discussion in a convention attended by prominent architects and landscape architects. Their discussions reached the ear of the Senate Committee, with the result that the Senate ordered the preparation and submission of a general plan for the improvement of the entire park system of the District. This order resulted in the appointment of a commission of four unpaid members to prepare such plans. The members are Daniel H. Burnham, architect, of Chicago; Charles F. McKim, architect, and Augustus St. Gaudens, sculptor, both of New York, and Mr. Frederick Law Olmsted, Jr., landscape architect, of Brookline, Mass.

The published report of the commissioners occupies a volume measuring 6x9 inches, containing 175 pages of text and over 100 half-tone illustrations, 6 plans and 3 large lithographic maps. Among the illustrations are reproductions of photographs taken by members of the commission in the course of their official visit to some of the chief capitals of Europe, which occupied them during the early part of their government service. Photographs of an interesting plaster model, representing the heart of Washington as it exists to-day, and as it would appear under the improvements advocated by the Commission, are also reproduced. For the purposes of a brief review, the subjects treated by the report may be grouped under the following general headings: First, the vicinity of the Capitol and the White House, including the Washington Monument and the near banks of the Potomac; second, the river borders immediately above and below these banks, including Washington Channel, the mouth of the Anacostia River, and Rock Creek; and third, the system of parks and boulevards embracing the landward side of the city, and including the tidal plains bordering the Anacostia River.

By reference to the first illustration which is a reproduction of one of the model series representing the vicinity of the Capitol in its present state, it will be seen that the territory between the Capitol, the Washington Monument, and the White House is so related to these structures in virtue of its position and boundaries that the office which it might fulfil as a setting for them and a means of expressing their relationship is evident. That the territory is encumbered by trees in such a way as to defeat this office at present, and that the unrelated groups of buildings which are springing up within it threaten in short time to render



Model of the Mall Showing Present Conditions. Looking West.



General Plan of the Mall System.

A-B—Capitol.
C-D—Railroad Terminal.
E-F—Washington Monument.
G-H—White House.
G-I—Basin—Washington Common.
J-K—Lincoln Memorial.
L-M—Potomac and Memorial Bridge.

such a service impossible forever, is quite as clearly to be discovered. The eccentric position of the Washington Monument with regard to the axes of the Capitol and White House, is also to be observed in the illustration. The original plans for the city specify that this territory should serve the very evident office which it now fails to serve. The Capitol and White House vistas were to be kept open and were to be accentuated and defined by dignified rows of trees behind which were to be grouped in effective order and conveniently at hand, various government buildings. At the point of intersection of these avenues, was to stand a Washington Memorial.

Plans and descriptions in the report make clear what is not obvious in the photograph—the further mutilation of the original scheme by a main line of railroad crossing that part of the area nearest the Capitol known as the Mall, from the south to a terminal station upon its northern boundary. At the time the Commission entered upon its duties, the railway company was about to rebuild its terminal and raise the tracks upon an elevated structure. How serious an additional injury this would have worked the Mall is painful to picture. In considering the improvement of the Capitol vicinity, the Commission decided that the original treatment indicated for the territory between it and the White House could not be improved, and that in spite of the encumbrances which stood in the way of a return to that treatment, it should nevertheless be accomplished to gain the splendid practical and aesthetic ends which it promised. By a happy circumstance the Commission shortly saw the removal of the most serious difficulty which threatened a return to the l'Enfant scheme. It so happened



Model of the Mall Showing Proposed Treatment. Looking West.

that the railway company in employing Mr. Burnham, of the Commission, as architect for the proposed new terminal station, became interested in the improvement of the Mall, and were led by him to a realizing sense of the irrevocable injury which their tracks and particularly their elevated structure would work the scheme contemplated by his associates.

President Cassatt was at last led to decide: "That if Congress intended to make of the Mall what the founders of the city intended it to be, no railroad should be allowed to cross it; and that he was willing to vacate the space provided the matter could be arranged without sacrificing the interests of the stockholders of the Pennsylvania Railroad." This unexpected turn of affairs made it possible for the Commission, in finding a new site for the proposed terminal, to relieve the Mall of a most serious encumbrance. With regard to the position of this passenger station, as well as other edifices which are to border the Mall, the report makes evident that the commissioners' thoughts are directed as strongly toward the workaday convenience of such a grouping of buildings as they are toward the visual effect. How great an area would be needed in the course of time for the offices of the Federal Government, the makers of the original plan only partly realized, and it has therefore become the duty of the Commission in more than one instance, to suggest extensions of these areas in keeping with the spirit of the plan, but in elaboration of its precise specification, as in the case of the sites chosen for public buildings surrounding the Capitol seen in the second illustration.

The accompanying plan of the Mall system makes evident the adjustments of the cross axes of the Capitol-White House scheme which have been found necessary to reconcile them to the eccentric position of the Washington Monument. At the time the erection of this shaft was undertaken, over half a century ago, the territory about it was so undeveloped, and the relation which it bore to the Capitol and the White House seemed so intangible, that its precise site was chosen with a greater regard to cheapness of immediate construction than to economy of the great plan of which it was inevitably to become a focal point.

The detailed treatment suggested for that portion of the commissioners' design about the monument is shown in a series of remarkable perspective drawings which form one of the most interesting and attractive portions of the report. A series of similar drawings and rendered plans indicate the treatment suggested for the southern end of the transept-like White House axis, which is to terminate in an ample tract known as Washington Common. This area is to contain a large playground and stadium, together with a tidal basin, which relate to an enclosing group of buildings, among which are suggested a gymnasium, theatre, baths and other structures for athletic purposes. While the commission regards these provisions for recreation as essential to any well organized city, they feel that they are especially requisite for Washington. To the inhabitants of the city as a whole, and especially to government employes who are little likely to become enured to the oppressive summer climate during their comparatively short periods of residence, the Commission feels that the shades of avenues of trees and groves, as well as the refreshment offered by fountains and basins, together with recreative facilities, should be regarded as a very important element in the development of the city.

The Commissioners' report discusses in detail the advantages of grouping the buildings for the departments of Justice, State, War and Navy about Lafayette Square, in association with the White House, to which they bear evident relation. It also recommends sites for a District market, armory, police court, and other buildings which relate to the administration of city, rather than of national affairs, in a tract between the Mall and Pennsylvania Avenue, where they should find sites at once convenient, dignified and in happy relation to the Government buildings upon the south.

The model of the suggested improvements makes evident the proposed extension of the Mall system to the Potomac River over the low and unhealthful flats which the Government has already taken steps to reclaim. One of the most interesting features in the extension is a proposed water basin 3,600 feet in length and 200 feet wide, which extends from the vicinity of the monument to the rim of the great circular concourse terminating the Mall. Within this circular area, commanding upon one hand the Capitol, and the shaft of the Washington Monument and upon the other the distant shores of Virginia, is suggested a memorial to Lincoln, which in this position would symbolize the union of North and South which he effected.

not to mention the quiet landscape of the hill country, receive the severe criticism of the Commission.

In advocating improvements for the borders of the Potomac, including Washington Channel and Anacostia River, the commissioners have still kept in mind the practical business uses of property bordering and within the limits of the national domain. Those tracts of river border which promise to be of little value for business or residence purposes, and which would be valuable as recreation areas, are selected for needed parks. Pleasure thoroughfares starting from the concourse are arranged to traverse these park areas. Upon crossing the borders of the public domain, the parkways continue to follow the vicinity of the river banks but at such an elevation that the traffic between the city and the waterways is allowed to be effected beneath them by means of subpassages in a manner which has proved successful in many cities of Europe, as indicated in the last illustration. The immediate river borders are to be defined by a broad paved stone quay, founded in water sufficiently deep to allow vessels to be moored against its smooth

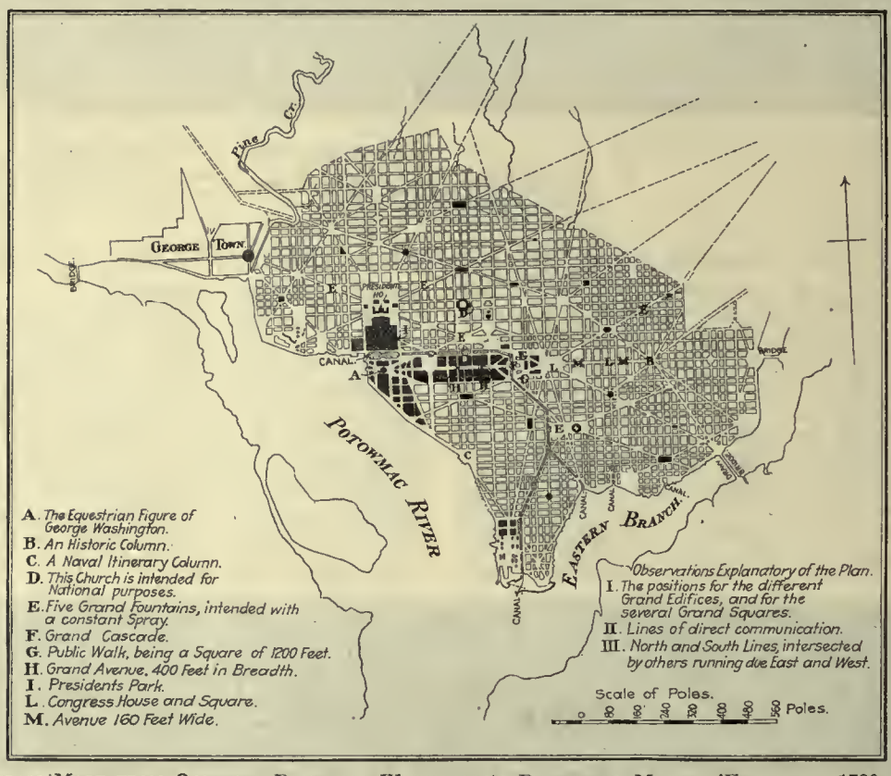


Diagram Made from Original Plan for Washington Drawn by Major L'Enfant in 1790.
(Many notes on the original are necessarily omitted.)

The Commission advises that the long-contemplated memorial bridge be made to spring from this concourse and proceed to the Arlington shore upon a line cutting the ancient Mansion House and making direct approach to the National Cemetery, and the road to Mount Vernon after crossing Analostan Island. The Commission outlines briefly elements which should control the design of the bridge on either side of the island, first with regard to land and water traffic, and second in relation to its memorial character. In connection with the bridge as an approach to the National Cemetery, at Arlington, the report dwells upon the urgent need of controlling the designs and the disposition of the sepulchral monuments which are erected in this burial ground and in other places of interment in the District. The incongruous character of the more elaborate monuments to officers and their families, their ill-ordered relation to one another, and their disturbing effect in association with the simple graves and memorials of the private soldier, masonry face. The quay would thus form a landing platform for the river traffic, which would gain intimate connection with manufactories and storehouses through ample arches under the high level pleasure way. While conflict of pleasure vehicles with the economic operations upon the water front would be avoided by this device, the interesting activity of the stream course and its borders could be enjoyed with unusual advantage from the elevated road and footway.

Parkways of this type or of a kind otherwise adjusted to the business uses of the water front are suggested for the northern side of Washington Channel and the lower reaches of Anacostia River, together with the Rock Creek approaches. The report contains a number of illustrations made from views of foreign streams which have enjoyed similar combined pleasure and traffic development. It should be observed that the design for the Mall and its associated formal dependencies also provides frequent traffic crossings. The scale of the de-

sign is such that the passage of vehicles and street cars across it is thought to offer it an attractive element of life and movement, and at the same time to allow it to be enjoyed in passing by those who cannot follow its bordering carriageways.

The proposed extension of an arm of the river border parkway into the narrow valley of Rock Creek, leads the Commission to review at some length the engineering propositions which have been advanced for building a covered waterway to accommodate the stream, and to obliterate its deep gorge-like bed. The details of this argument, of especial interest to engineers, together with all other details of the report, must be sought in the document itself. It may be observed here, however, that the commissioners advocate a retention of the present stream course and its naturalistic borders on account of economy, and to form an interesting association with the proposed parkway. This treatment also promises to furnish a thoroughfare which can be made to enjoy a degree of dignity and seclusion in passing through a community which is likely for many years to offer, as it does at present, only shabby and irregular files of tenements and factories for the borders of a formal boulevard upon their level.



TYPICAL SECTION OF PROPOSED POTOMAC QUAY.

An adequate review of the Commissioners' recommendations for additional parks and parkways upon the landward side of the city, cannot be made without reference to maps similar to those contained in the report which show the contour of the ground, the size and disposition of the present parks, as well as those semi-public tracts to which the public are generally admitted, the position of existing lines of roads and railway, together with the proposed additions to the recreation areas and pleasure connections advocated by the Commission. Additions to the present system are recommended upon the ground that the present park area is insufficient for the demands which are even now being made upon it by a growing population, and if the present opportunity for securing lands unhurt and unoccupied by houses is not speedily seized, it can only be regained in the future at great expense. It is also observed that while a large amount of park territory is shortly to be acquired by reclamation of tidal flats, the system should be still further elaborated to embrace country of a more varied kind, as for example, certain hilltops and other heights of vantage which command extensive views, and certain river and brook valleys possessing scenery of a romantic character.

The Commission feels that the park system should be planned with greater liberality than is usually bestowed upon commercial cities—for the same reason that its public buildings deserve unusual settings—since they are all to form a part of the nation's Capitol. A visitor to Washington should be shown a park system comparable with the traditions of the District, and one which would symbolize the national, rather than a circumscribed and local attitude toward parks. The diagrams, much reduced from their originals in the report, illustrate the relative park areas of Washington, Boston, New York and Paris, and are to be studied with the relative populations of these cities in mind. The report makes specific recommendations for parks by means of the maps upon which their suggested boundaries are plotted. Suffice to say that the areas are distributed about the city in regions of greatest attractiveness, particularly where land on account of its unsuitableness for building sites may be profitably used for recreative purposes.

The proposed treatment of the great swampy basin of the Anacostia River, which at present menaces the health of the southern side of the city, is particularly interesting in this connection, and also on account of the engineering operations which its reclamation entails. The Commission proposes a dam to keep out the tides of the Potomac which alternately flood and expose large flats within this tract. The shallow portions of the waterway are then to be excavated or filled, as economy may dictate, in connection with the filling operations near the mouth of the Anacostia. A water park with naturalistic borders may thus be formed, having shores sufficiently high and water sufficiently deep to redeem it from its present malarial condition, and to form a fitting addition to the city's public recreation areas. Connecting the several existing and proposed parks with one another and with the city, the maps show a system of parkways which are further illustrated in the text and by typical cross-sections and perspective views. Among other recommendations illustrated and described in detail by the report, may be mentioned playgrounds, a zoological park, a receiving reservoir, and public baths.

The Commissioners' hopes for the future of the recommendations which they have offered may be best expressed by a quotation from Senator McMillan's introduction to the report:

"The plans as prepared call for systematic, continuous work, which of necessity must be prolonged through a considerable number of years. The park system of the District of Columbia is placed by law under the control of the Chief of Engineers of the United States Army, but individual portions of the system are subject to separate control. It is essential to the harmonious and successful development of the improvements that there shall be a greater concentration of authority, and the constant employment of professional advice. No work should be entered upon without the preparation of detailed plans, to be approved by the highest possible authority as being in accord with the general system.

"Obviously it is impossible to make even an approximate estimate of the cost of improvements which are to be completed in an indefinite future; nor is such an estimate necessary. From time to time new buildings must be constructed to meet the constantly increasing needs of the government, and as appropriations come to be made the buildings should be located so that each new structure will fit into its appropriate place in the great scheme. Year by year lands must be secured for government or municipal institutions, and by foresight and good judgment these purposes can readily be made to enhance the beauty and utility of the park system.

"By the patient and steadfast co-operation of all those persons charged with the upbuilding of the District of Columbia, a result may be attained such as has been reached in no other capital city of the modern world. The task is indeed a stupendous one; it is much greater than any one generation can hope to accomplish. The very hearty and intelligent co-operation that the plans have received by the officers of the Government, the committees of Congress, and by the public generally, makes it reasonably certain that the development of the National Capitol will be prosecuted along the general lines proposed; and that the city which Washington and Jefferson planned with so much care and with such prophetic vision, will continue to expand, keeping pace with national advancement, until it becomes the visible expression of the power and taste of the people of the United States."



DIAGRAM SHOWING RELATIVE PARK AREAS.

The Approach to the Pennsylvania Railroad Bridge at Fifty-second Street, Philadelphia.

Several million dollars are being expended by the Pennsylvania Railroad Company in improvements on their main lines, much of which is for the benefit of the passenger traffic and to separate it as completely as possible from the freight traffic. Heretofore express trains have been obliged to run through or across the freight yards at Philadelphia, but changes are being made so that the through line tracks will be entirely clear of the freight yards and tracks. At 52nd St. there are a number of freight tracks at grade, and the passenger tracks of the Schuylkill division have recently been changed so that the inbound track crosses in a tunnel and the outbound track, on an overhead skew bridge. This bridge includes a pin-connected 388-foot through span, a 105-foot lattice girder deck span and many plate girder spans, some supported on masonry piers and some on steel trestle bents.

Single-track deck spans 1 to 14, inclusive, each have three lines of plate girders carrying solid steel plate floor for ballast and passenger platforms. The west end of span No. 1 rests on the east abutment of the 388-foot span and between spans 9 and 10 is the 105-foot lattice girder span. The ends of the girders are seated on bed plates set directly on top of stone piers 5 feet wide under the coping, except those for the lattice girder span which are 7½ feet wide and have short columns under the ends of the plate girders to support them from the level of the bottom chords of the trusses. There are seven plate girder spans of about 35 feet, four of about 36 feet, two of about 32 feet and one of about 33½ feet. The girders have a uniform depth of 4 feet 8½ inches, back to back of flange angles, and are spaced so as to be approximately symmetrical with the track and sidewalk, but unsymmetrical with the axis of the bridge. They are braced together transversely at two intermediate points between piers, as shown in the general cross section. The track girders of spans 1, 2, 3, 4, 5, 6 and 7 are symmetrical with the chords of a 6 degree curve, the other spans are on a tangent.

There are no stringers nor floor beams in this section of the bridge and the track is located wherever necessary on ballast carried in the transverse floor troughs, which are about 7 inches deep over all and 22 inches apart on centers. Each trough is made with two 6-inch Z bars and a 12-inch bottom plate and the troughs are connected by 9-inch horizontal plates riveted across their top flanges. The troughs are about 14 feet long and overhang the outside girders 4½ feet to carry the full width of ballast, in which a gutter is formed. Several troughs are riveted together at the shops to form sections of a convenient size for shipment, which are field-riveted together in place by rivets through the top flange plates. The bottom plates of the troughs are flush with the lower edges of fascia girders which are connected to them by short vertical angles field-riveted to the webs of the Z-bars.

The fascia girders have 23x7/16-inch webs and three 4x4x⅝-inch flange angles, the inside lower flange angles being omitted to clear the ends of the troughs. Every second trough has a solid-web knee brace to the lower edge of the top flange of the fascia girder. The fascia girders are made the full lengths of the spans, serve to stiffen the floor troughs and close their ends so as to make a neat finish and retain the ballast. Adjacent girders in consecutive spans have their ends connected by double web-splice plates which are shop-riveted to the web of one girder to form open jaws with slotted holes to receive bolts through the web of the adjacent girder and allow it to expand and contract with temperature variations.

The passenger platform alongside the track on all the spans, except No. 1, is supported on 15-inch I-beams about 9½ feet long, having center bearings on the third main girder and field-riveted on the inner ends to the fascia girders for the trough floor. At the opposite ends they are web-connected to fascia girders.

The lattice-girder span between plate girder spans 9 and 10 has lower chord pin bearings 105 feet 4 inches apart, and accommodates a passenger platform at one side of the track corresponding with the plate girder spans. The track floor consists of rectangular transverse troughs about 16 feet long, which are laid on the top chords of the trusses and have their ends closed by a fascia girder on the side opposite the sidewalk only. At the other ends the troughs overlap the anchor ends of cantilever floorbeams for the sidewalk and the ballast above the top plates is retained by the 16-inch longitudinal girder which is set on them to receive the ends of the sidewalk planks and form a sort of curb. The sidewalk beams are supported near their centers by knee-brace brackets and have their outer ends connected by fascia girders. The floor troughs are made up of plates and angles with about the same dimensions as the Z-bar troughs and have similar knee-braces to the fascia girders.

The trusses are divided into eight panels by the zigzag diagonal members. The top chords are supported over the bottom chord panel points by vertical posts and they are made in the usual way with four angles, two web plates and a 23-inch cover plate having open holes for the field-riveted connections of the floor troughs. The bottom chord is made with two 15-inch channels with the flanges turned in and connected, top and bottom, by 9x12-inch tie plates. All the web members of the trusses are made with pairs of latticed channels with their flanges turned in.

Zigzag bottom lateral angles were field-riveted to horizontal connection plates shop-riveted across the lower flanges of the bottom chord channels, and all members were shipped separately and riveted together in the field. The 5¾-inch end lower chord pins take bearing in ordinary double-web shoes having lateral connection plates riveted to their base plates. The expansion end shoes rest on nests of eight 3-inch rollers with bed plates which have transverse angles protecting the ends of the rollers. The outside angles have angles riveted to their vertical flanges to make Z-shaped sections with the upper flanges projecting inwards over the edges of the base plates so as to thoroughly enclose the rollers. The fixed end bed plates are built up to a thickness equal to that of the expansion end plates and rollers combined. They have an 11/16-inch top plate and ⅞-inch base plate separated by alternate longitudinal and transverse layers of 9/16-inch flat bars 3½ and 5 inches wide with 1 inch spaces between their edges.

Spans 15 to 47, inclusive, are similar to spans 1 to 14, except that they are all on a tangent and have a uniform grade of 1.5 feet per 100. Spans 15, 16, 17, 18, 19, 20 and 21 are 36 feet 3½ inches, spans 34 and 35 are 37 feet and span 47 is 35½ feet long center to center of piers; all the rest are 35 feet. Each span has only two girders, braced together like the track girders shown in the cross section of the three-girder spans. The top flanges directly support the 17-foot Z-bar floor troughs which overhang the centers of the girders 4½ feet on each side and make the cross section of the span similar to a section symmetrical about the center line of the three-girder span section and corresponding to the half opposite the sidewalk platform. The 35-foot girders are made with a 56x9/16-inch web in a single length and two 6x6x⅝-inch angles and a full length 15x⅝-inch cover plate in each flange. At each end there are two pairs of vertical web stiffener angles about 16 inches apart, back to back, and there is a 15x⅜-inch plate, corresponding to the flange cover plates, riveted to the backs of the outside angles. Five intermediate pairs of vertical angles divide the web into panels about 5½ feet long. The expansion end of each girder has a planed base plate sliding on three 5x11/16-inch flat strips on a 20x22x¾-inch sole plate secured by two 1¼-inch bolts passing through round holes in it and slotted holes in the girder flanges. The connection at the fixed end is exactly the same except that the girder holes are not slotted. The bearing strips on the sole plates are planed to a longitudinal bevel to correspond with the track grade.

At the 52nd St. station the viaduct widens to a maximum width of about 52 feet and has four lines of plate girders supporting the main line eastbound track on one side and the track of the Schuylkill division on the opposite side of a platform about 105 feet long, 21 feet wide at one end and 13 feet wide at the other end. The Schuylkill track is on a 10-degree curve, and beyond the station platform has one single-track span of 57 feet 2 inches and one of 21 feet 5⅝ inches. Under and opposite the platform the girders are in two spans of about 31 feet 10 inches and one span of about 21½ feet. The construction here is of through plate girders, as shown in the general cross section of approach, with floor beams supporting longitudinal Z-bar troughs under the tracks and a buckle plate passenger floor platform between the tracks. The arrangement and connections of the floor troughs are shown in the detail. The troughs were made in 20-foot lengths, reaching across two floor beam panels.

The space between the tracks is spanned by 10-inch I-beams about 3¾ feet apart with buckle plates riveted across their top flanges. The buckle plates are stamped in several panels on transverse sheets reaching nearly or quite across the platform. The ends of the platform beams overhang both their supporting girders and are faced with solid-web curb girders about 3 feet deep, made with a single flange angle which is on the outside of the lower edge and is field-riveted to the tops of the floor beams. The upper edge of the girder web is plain on the platform side and is stiffened by a half round bar on the track side. The track floor beams are 2 feet deep and have their lower flanges just clearing the upper sides of the bottom flanges of the main girders, to which they are web connected in the usual way with special end sections of web plates projecting above the top flanges of the floor beams so as to form gusset plates reaching to the top flanges of the girders.

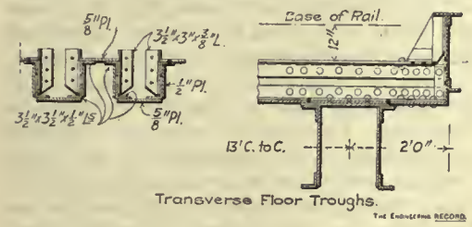
The buckle plates are made of 41¾x⅜-inch transverse sheets reaching entirely across the platform with a maximum length of over 18 feet and stamped in five 30-inch square panels with 6-inch flat spaces between them, on which longitudinal 4-inch T-bars are shop-riveted. At the oblique edge of the platform the plates are left flat in the triangular space beyond the ends of the stamped panels and are stiffened there with longitudinal T-bars 15 inches apart, shop-riveted on the upper side.

The girders are seated on the caps of trestle bents with pairs of vertical columns about 16

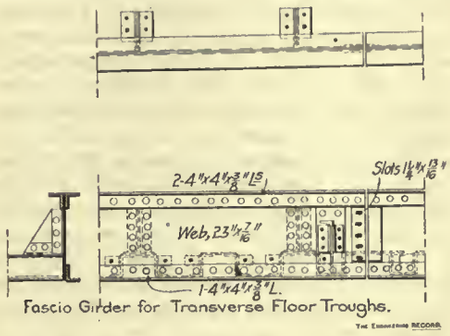
feet high and 14 and 16 feet apart, braced together with top and bottom horizontal struts and X-bracing composed of pairs of angles and channels field-riveted between double connection plates shop-riveted to the columns to form jaws. The details of these bents are similar to those of the bents on top of the masonry piers for the lattice-girder span which support the ends of the adjacent plate girder spans 9 and 10. The latter bents are somewhat shorter and have three columns and two panels of sway bracing. The tops of the columns are reinforced by heavy longitudinal vertical diaphragms on the center lines of the main girders.

The edges of the buckle plate platform are protected by a gas pipe hand rail with flange connected vertical posts about 10 feet apart. Elsewhere the narrow platforms alongside the single tracks are protected on the side away from the track by hand rails carried on braced angle-iron posts which are made of pairs of 3x3-inch angles spliced to short lengths of 3x4-inch bottom angles and having clearance between them for the top flange of the fascia girder, to the web of which the 3x4-inch angles are field-riveted. The posts are stiffened laterally by pairs of curved brace angles in the transverse plane shop-riveted to the vertical angles with web connection plates, as shown in the detail.

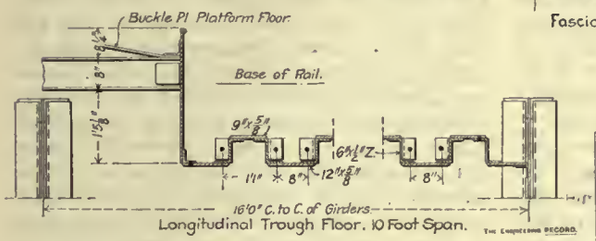
The passenger platform has a shelter about 11 feet wide and 217 feet long which extends over the lattice girder span and has a single pitched roof supported on bents of vertical columns. The columns are braced at the top by curved knee braces, in both transverse and longitudinal planes, and support roof beams which cantilever toward the track. The columns are flange-riveted to the floor beams and fascia girders, as shown in the detail elevations, and have special cross sections, made up for those nearest the tracks, of an I-beam and two T-bars riveted to the center line of its web, and, for the outside row, of two angles and a T-bar riveted together to make an unsymmetrical I-shaped cross section. The columns on the side away from the track are connected by two lines of horizontal struts and



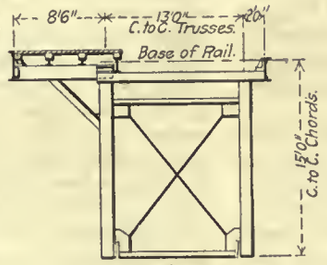
Transverse Floor Troughs.



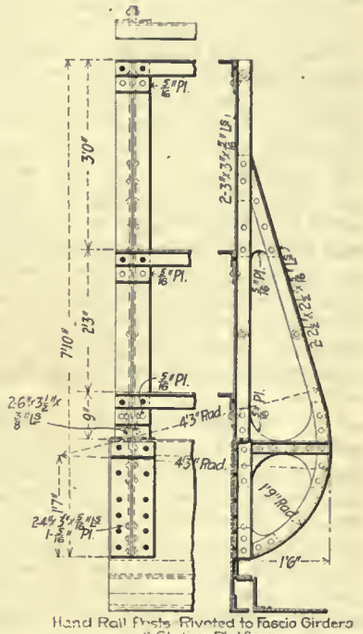
Fascia Girder for Transverse Floor Troughs.



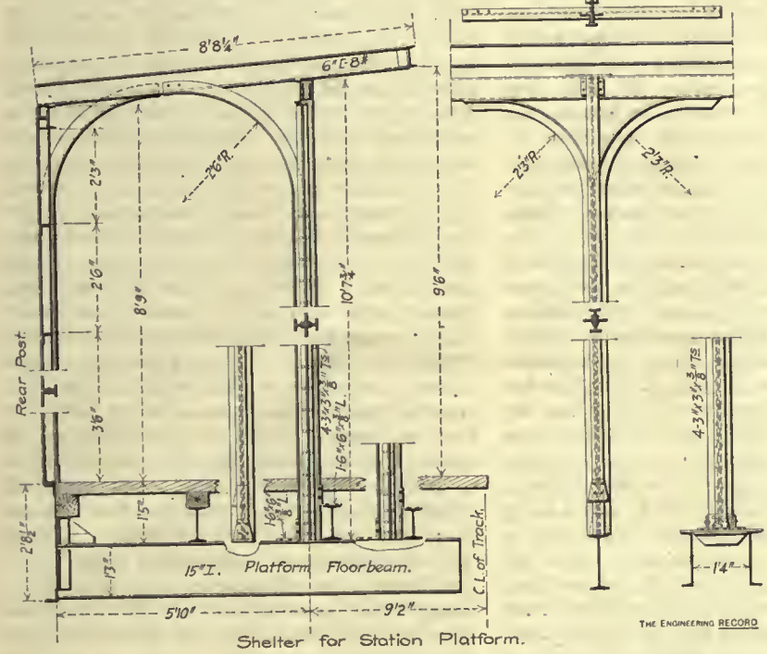
Longitudinal Trough Floor. 10 Foot Span.



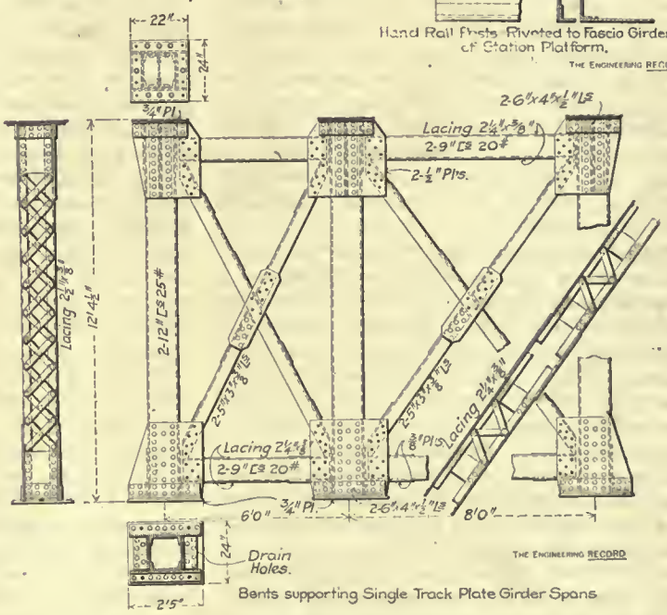
105 Foot Lattice Girder Span.



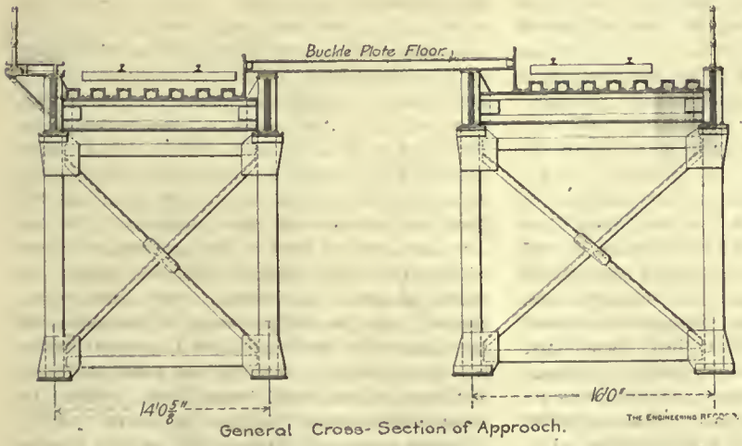
Hand Rail Posts Riveted to Fascia Girders of Station Platform.



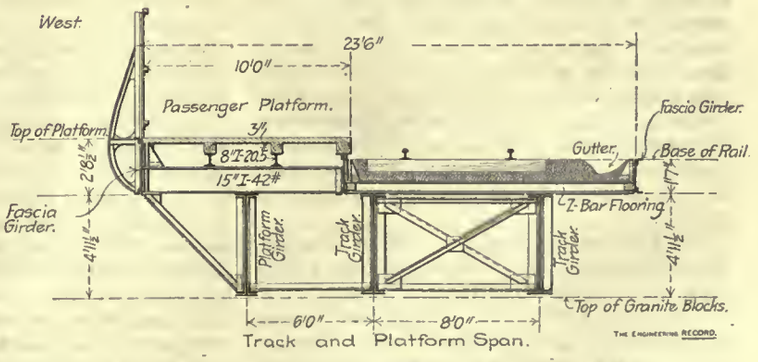
Shelter for Station Platform.



Bents supporting Single Track Plate Girder Spans.



General Cross-Section of Approach.



Track and Platform Span.

SECTIONS AND DETAILS OF PENNSYLVANIA RAILROAD VIADUCT AT FIFTY-SECOND STREET, PHILADELPHIA.

have two intermediate verticals in each panel to form a framework to receive the wall sheathing.

The steel work was built according to the specifications of the Pennsylvania Railroad Company, Mr. W. H. Brown, chief engineer; Mr. W. A. Pratt, assistant to chief engineer and formerly engineer of bridges, and Mr. H. R. Leonard, now engineer of bridges and buildings. The superstructure was built at the Pencoyd plant of the American Bridge Company, Mr. Paul L. Wolfel, chief engineer.

Report of the Passaic Valley District Sewerage and Drainage Commissioners.

Until a comparatively recent date the idea has been widely prevalent in this country that one of the chief uses of our streams was to carry off wastes of the communities situated on or near their banks. Within the last few years, however, it has come to be realized that these streams were of much greater value in their unpolluted state as adornments to the landscape and places for recreation as well as for commerce. One of the most shamefully abused rivers in the eastern part of the country is the once beautiful Passaic, flowing through a populous section of northern New Jersey. Methods for improving this river by removing the polluting matters have been under discussion for some time. In our issue of January 31 we made brief mention of the report proposing a scheme of relief.

Five commissioners were appointed by the Governor April 22, 1902, to study the problem of relief of the Passaic Valley district and report to the legislature. A preceding study of the case having shown a high cost for a trunk sewer to convey the waste matter to the sea, the present commission at first attempted to discover some other method of disposal. Chemical precipitation plants at Worcester, Mass., and Providence, R. I., were visited, but this method of disposal was rejected because of its cost of operation, only partial purification, the difficulty of dealing with the sludge, and the common objection to having such a plant for a neighbor. Septic treatment was considered but, as it had not been successfully used for any large community and because it is still regarded as somewhat experimental and of doubtful success in treating sewage containing much manufacturing waste, it also was deemed unsuitable for the Passaic district. Broad irrigation for taking care of the sewage of a population of 1,500,000, which it is thought necessary to provide for in the future, was estimated to require at least 15,000 acres of land. Furthermore, the land for this purpose should have a soil of a peculiar character such as was not anywhere to be found in the district. These and other considerations led the commissioners to discard this method.

Intermittent filtration was regarded somewhat more favorably, but because of the difficulty of securing a sufficient and suitably located area of land of the proper sort and the cost of the scheme, it also was rejected. Hence the remaining method of disposal in the sea was considered the only available one and the success attained by the Boston Metropolitan sewerage system, some parts of which meet conditions very similar to those of the Passaic district, seemed to assure success for this method.

The technical study of the problem was put into the hands of Mr. Rudolph Hering, of New York, from whose report the following items of interest have been taken. The estimated cost of construction is approximately $8,700,000, to which must be added the expense of securing the right of way. The project involves an intercepting sewer with all necessary connections and appurtenances to receive and convey all polluting waters, now entering the river, from near Great Falls in Paterson to a point of final disposal into the waters of the Upper New York Bay.

The waters of the Hudson River and the tidal low from the Lower New York Bay and the East River, together furnish such a large quantity of water that the proper discharge of sewage into the same from a population of many millions cannot be noticed by the senses. At present the sewage of nearly 4,000,000 persons finds its way directly into these waters from Manhattan, Bronx, Brooklyn, Queens, Richmond, Jersey City and Hoboken. The only visible effects herefrom is the floating matter which has resisted the comminuting effects of waves and currents. Such matter will be excluded from the Passaic Valley sewage, because of its retention by screens before the sewage passes through the pumps. Nor will all the silt and heavy matters brought into the sewers by the rain washing the streets enter the bay from the Passaic Valley, because most of it will be held back prior to the pumping at Newark Bay. A third advantage of the proposed disposal over that now practiced in the metropolitan district, is the discharge of the sewage into the current instead of at the shores, and at least 40 feet below the surface instead of immediately at the surface.

The trunk sewer is located on the west side of the Passaic River. In order to intercept the sewage now entering the river from the east side, several auxiliary intercepting or trunk sewers have been located. At suitable intervals they are carried across the river through inverted siphons below the established waterway, and discharged into the main trunk sewer.

It is suggested that after the authorization of the building of the trunk sewer, no matter what method of treatment is resorted to, all sewers built within the district be designed so far as practicable on the separate plan, the foul waters to enter in one set of sewers, which would discharge into the trunk sewer, the street water to enter another set of sewers or drains discharging directly into the river; and that in order to purify the Passaic River and to maintain its purity, the rain water drains discharge their first wash, which contains the foul matter collected on the streets, into the trunk sewer, the subsequent flow being excluded by the usual automatic regulators, and discharging directly into the river.

The trunk sewer begins near the Falls at Paterson on the right bank of the Passaic River and follows it along the most practicable routes to the main pumping station, situated in the city of Newark. At two points it will be necessary to have auxiliary pumping stations to lift the sewage of low areas into the main trunk sewer. To avoid these auxiliary lifts would have required the lowering of the trunk sewer to a depth that would have made its proper construction extremely difficult and expensive. The proposed trunk sewer and its branches will be connected either directly or indirectly with the various sewers now existing in the district and discharging at present into the river, of which twenty-six are situated at Paterson, ten in Passaic, two between Passaic and Second River, and twenty-nine below Second River. To make the several local connections in a proper manner there are required seven branch sewers. For the purpose of proportioning the annual cost of maintenance it will be necessary to provide ganging stations at these and other connections, at least one for every community using the trunk sewer, so as to measure the amount of sewage delivered by each one.

From the data at hand it is estimated that the trunk sewer at the pumping station on the Newark Meadows should have a capacity of 326,000,000 gallons per 24 hours when running three-quarters full. The estimate of cost has been based on the proposition to construct the greater portion of the trunk sewer of concrete. In several aspects the concrete sewer is preferable to one lined with brick. While, if properly made, concrete will be as durable as brick, the special advantages are that it can be given a smoother surface, therefore a greater flowing capacity and cleanliness, and that it can be built at a less cost. It also offers greater security and facility for being made water-tight. An effective ventilating plant is required at a point where the sewage issues from the inverted siphon crossing Newark Bay. The diameter would range from 4 feet at the upper end to 13 feet on the Newark Meadows.

Three pumping stations are required for discharging the sewage of the district into New York Bay. The first of these has a capacity of about 20,000,000 gallons daily, and is located at Wallington at the foot of the branch sewer which conveys the sewage from the upper section on the eastern side of the river, comprising the Saddle River district, to the main trunk sewer. The maximum lift of the sewage at this point is about 15 feet. The second pumping station is located in Lyndhurst Township and is intended to collect the sewage from a narrow strip of land near the river from the townships of Rutherford, Union and North Arlington, and to discharge it into the main trunk sewer. The capacity of the station would be about 1,000,000 gallons, and the lift about 15 feet. This, however, may not be required for some time. The main pumping station is located on the Newark Meadows, as close to Newark Bay as practicable. It is conveniently situated for rail and water transportation facilities. For its first installation it should have a capacity of at least 150,000,000 gallons daily. The maximum lift is about 40 feet.

Beginning at the main pumping station on the Newark Meadows, the outfall sewer consists of two lines of steel mains operating under pressure, a section of gravity sewer, and then a single line of iron main to the outlet. The two lines of force mains, each 6 feet in diameter, pass under Newark Bay to a point on the west shore of Jersey City at the Morris and Essex Canal. The gravity sewer, 13 feet in diameter, leads from the last named point along the north shore of the canal to a point near the eastern shore of Jersey City, where a single line of steel pipe, 8 feet in diameter, leads out into the main channel of New York Bay, the point of discharge being within the State of New Jersey and about three-quarters of a mile north of Robbin's Reef Light and about 40 feet below mean low tide, where the depth of water is 70 feet.

An Unusually Large Plant for the fabrication of structural iron work and steel bridges is being built by Milliken Brothers, New York, near Arlington, on the north shore of Staten Island, facing Newark Bay. The lot has a water front of 1,800 feet and a depth of three-quarters of a mile. The building will be of special design, constructed entirely of steel and concrete. The plant will be built in two portions, the first of which is now under way, and will have a capacity of about 40,000 tons a year. It is so arranged that the columns and girders for remainder of the buildings will be constructed in it. The ultimate capacity will be 80,000 tons. The power plant will be at first installed in temporary quarters, and it will provide for the complete electric and pneumatic service for the operation of all machine tools.

The Discharge of Sewage into Dublin Harbor, Ireland.

Extracts from a paper by William K. Parry and Walter E. Adeney before the Institution of Civil Engineers.

The estuary of the River Liffey, or rather that portion of it included within the Dublin Harbor, affords, from the point of view of sewage pollution, one of the most interesting and instructive objects of study to be found around the British Isles. The estuary is confined on the south side by the South Wall, about three miles long, and on the northeast by the North Wall, which is about 9,400 feet in length; of this about 6,000 feet, from its commencement at the shore, is constructed to a height of 6 or 7 feet above high water, the remaining 3,400 feet being carried up to half-tide level only. Consequently, when the tide is at half-ebb the whole of the remaining effluent water in the estuary is concentrated and discharged through the entrance at Poolbeg, where the channel is only 1,000 feet in width, and a very rapid current, varying between 275 feet and 300 feet per minute, is set up. Unassisted by any dredging, this current has entirely swept away the bar which formerly obstructed the entrance to the harbor.

After the harbor has been emptied of tidal water, very little of the water so discharged, excepting at low neaps, returns into it with the ensuing flood-tide; the harbor being then filled, not with previously discharged water, which has passed out to a point about a mile beyond its mouth, but with clean sea-water coming up with the flood-tide from the direction of Kingstown. At low water of neap tides Dublin Harbor contains 509,280,000 cubic feet of water, and of this quantity 397,440,000 cubic feet, or 78 per cent., is contained in the deep-water channel. At low water of spring tides the harbor contains 379,920,000 cubic feet of water, and of this quantity 345,600,000 cubic feet, or 91 per cent., is contained in the deep-water channel.

The interest which the estuary of the Liffey possesses springs from the fact that the portions of the rivers Liffey and Tolka immediately above it receive the whole of the crude sewage from the population of Dublin and neighboring townships (with three exceptions), amounting in all to some 260,000 people, and that practically all the solid matters from this crude sewage are deposited along the beds of these two rivers, so that the waters and the bed of the estuary, at least below the Pigeon House Harbor, which is at about the middle of the South Wall, are but slightly affected by them.

Two of the townships which do not discharge their sewage into the river are Rathmines and Pembroke, which have a total population of 60,000. They discharge directly into the estuary, from a joint main-drainage outfall on its south side, about 1 mile above its mouth. The sewage from this outfall is discharged during the first 5 hours of the ebb-tide only, and its disposal forms a further interesting subject of study. A third township which discharges its sewage directly into the estuary is Clontarf. This town has no main drainage, but discharges its sewage from several small sewers along the foreshore on the north side of the estuary.

Analysis of samples collected in mid-channel, when the weather was both calm and very dry, seemed to show that the Dublin liquid sewage-matter becomes so much diluted with river and sea-water by the time it reaches the Pigeon House Harbor, at high water, that it scarcely affects the surface water of the estuary.

Other analyses show that the bottom waters of the estuary, at least along its less shallow portions, are fairly uniform in composition and are but slightly polluted, from opposite the Pigeon House Harbor downwards, even during a state of the tide when the volume of sea-water is at a minimum. The samples collected opposite the Pigeon House Harbor show a loss of oxygen amounting to only 13.6 per cent. after having been kept for 5 days. The figures for the surface samples, on the other hand, exhibit considerable differences in composition and in degree of pollution. Thus, opposite the harbor, the loss of oxygen amounts to 90.1 per cent. after keeping the sample for 5 days, whilst 1,122 yards lower down the loss amounts to 39.3 per cent., and 748 yards still farther down the deep-water channel it is only 10.4 per cent.

The surface water 1,870 yards below the Pigeon House Harbor is more affected by the river than is the bottom water immediately opposite the harbor, but it is not polluted quite as much. This is no doubt due to processes of purification taking place in the surface water during its flow down the estuary, evidence of which is afforded by the larger volume of carbon dioxide found in it. It should be noted that the Pigeon House Harbor is fully 2 miles below the outfalls of the principal Dublin sewers.

Particular interest attaches to the analyses of samples collected during the lower states of the ebb at neap tide, because it is generally believed by those intimately acquainted with the estuary that large quantities of sewage remain within the estuary at low neap tides, and that, in addition, considerable quantities are brought back into the estuary with the ensuing flood-tides. The samples were collected from the lower portions of the estuary and at its mouth, at low water and at the commencement of the flood-tide, with the special object of ascertaining whether there are any real grounds for this belief. The atmospheric conditions were all that could be desired for the purpose. The weather was quite calm and had been so for some time previously, and it was dry and frosty.

The results showed that the loss of oxygen sustained by the samples collected from the surface of the deep-water channel in no case exceeded 23 per cent., notwithstanding the fact that the samples were kept out of contact with the air for between 10 and 13 days. Such a loss could not have been detected had the samples been exposed to the air; and therefore the pollution of the surface water of the channel during a low neap tide is so light that it can only be ascertained when a sample of the water is subjected to the most rigorous conditions possible for the detection of pollution. If this be true of the surface water, it may be inferred that the bottom water of the deep-water channel is practically unaffected by the Dublin sewage. It is plain, also, that the incoming flood-tide does not bring back sewage-matter into the estuary.

The question of the effect of the discharge of sewage from the Rathmines and Pembroke Outfall, which is situated near the South Wall, and about a mile from its outer end, may now be considered. There are several points in connection with this outfall, and with the sewage discharged from it, which are peculiar. In the first place, the sewage from the two townships, with an aggregate population of about 60,000, has been discharged from the outfall, apparently in an untreated condition, for the past 20 years, and yet there are none of the indications which usually attend such discharge immediately around or below an outfall.

The outfall is generally submerged even at low water, except at spring tides, when it is exposed, as well as the sands below it for some distance. No permanent deposits of any kind exist either immediately around or below it. The surface of the sand is ripple-marked, and is quite free from any indication of serious pollution. About 2 or 3 inches below the surface it is black, but so it is above the outfall, and in all parts of the bed of the estuary that have been examined. The vegetation on the bank is also of the kind associated with healthy marine growth. Such a state of things was naturally surprising, and a very careful examination of the conditions attending the discharge of the sewage from the outfall, and of the composition of the sewage, has been made with a view to ascertain the causes operating to produce such exceptional results.

The sewage is impounded during the last hour of the ebb, and during the ensuing flood-tide, in a tank sewer. In the following observations the word "liquid" is used to describe the mixture of sewage and water which is delivered from the tank sewer into the Liffey channel. This liquid is not exactly crude sewage because it is much diluted, and because the heavier solids have been removed from it. But, on the other hand, it is neither purified nor clarified in the ordinary sense of the words. The result of the observations made has been to show that the total quantity discharged at each tide is in round figures 3,000,000 imperial gallons. The actual figure for each discharge is 491,100 cubic feet.

In connection with the discharge of the liquid from the Rathmines and Pembroke Outfall, the nature and direction of the tidal current in Dublin Bay must not be overlooked. For 9 out of every 12 hours the tidal current from the mouth of Dublin Harbor sets in a northeasterly direction towards the Bailey; that is to say, the current begins to flow in this direction 1½ hours after high water, and continues to flow in the same direction until 1½ hours before the next high water. As the sluices are opened immediately after high water, and as the sewage takes little more than 1 hour to travel from the outfall to the mouth of the estuary, the first portion of the liquid discharged reaches the Poolbeg Light about the time when the current begins to set towards the Bailey. The current continues to flow in this direction not only during the 5 hours that the sewage is discharged, but also for a further period of 4 hours after the sluices have been closed; consequently, when the liquid from the outfall reaches the Poolbeg Light, it must be carried out to sea by this tidal current, and cannot return. When the tide commences to flow, the water comes from the south, and therefore it does not check the current in question; on the contrary, such portion of the flood-water as cannot pass up into the Liffey constitutes the current already described, for the ensuing 4½ hours.

The liquid discharged has less than one-third of the strength of ordinary standard sewage. The actual figure is 29 per cent. of standard sewage and 71 per cent. of subsoil-water. The heavier solids are removed from the sewage by catch-pits built within the system of main sewers. About 2 tons of the heavier solids are removed daily from the various catch-pits before the sewage is delivered at the outfall. The solids consist principally of road-detritus, gravel, and sand, and the heavier constituents of the suspended matter in ordinary town sewage. In the condition in which they are removed from the catch-pits they all contain less than 33 per cent. of moisture. The quantity of dry solids removed may therefore be taken as 1⅓ tons.

There are two characters of the liquid which

demand special mention, namely, that nitrates and nitrites, derived from subsoil-water, are present in exceptionally large quantities; and that the suspended matter it contains is all of a light character. The mineral matter consists of light sand and clay, and the organic matter is of a light flocculent nature. The liquid never carries heavy road-detritus or other heavy suspended matter from the penstock-chamber even during heavy rain. The absence of heavy road-detritus explains the absence of mud-banks around and below the outfall and of permanent accumulations of putrefactive matters along the bed below the outfall. The true sewage-solids in suspension are of so light and flocculent a nature as to be easily borne for long distances by the estuary-waters. They are consequently broken up and spread over large areas, and are oxidized before they can seriously pollute any portion of the estuary.

When the valves are opened the invert of the outfall is 10 to 14 feet below the surface of the sea-water, according to the tidal season. The liquid rushes up through this depth of water with some violence to the surface, and in calm weather spreads out in a narrow stream and floats with the tide in an almost straight line to the mouth of the estuary and thence into the bay. For the first series of samples collected the path of the liquid was determined by means of three floats. Samples of water were collected vertically over the outfall and in the path of the floats, at intervals of about ½ hour, until the floats passed out from the mouth of the estuary into the bay, which they did 1 hour 15 minutes after having been placed in the water over the outfall.

From the analyses of the sewage-liquid and the estuary-waters it was observed that the former, during its passage from the outfall to the surface of the estuary immediately above it, became diluted with about five times its bulk of sea-water, and that this mixture must have flowed with the tide, in a narrow stream, to the mouth of the estuary, with but little further dilution. Perhaps it would be more accurate to say that the central portions of the stream flowed to the mouth of the estuary with little further dilution. The weather was perfectly calm. The analyses also show that even the central portions of the stream of mixed liquid and sea-water, as it flowed away from the immediate neighborhood of the outfall, were practically innocuous.

The analysis of the bottom samples indicate very slight pollution at 10 yards from the outfall, and at a depth of 2 feet only; and on comparing them with the analyses of the surface samples, and with those of the samples collected outside the path of the sewage, it becomes evident that the bottom water, even when only 2 to 4 feet below the surface, and in the path of the sewage, for a distance of at least 100 yards, is but slightly affected by the sewage from the outfall. The evidence justifies the conclusion that the slight pollution from which the bottom samples suffered was due more to the Dublin sewage than to the liquid discharged from the outfall.

In conclusion, the lessons to be drawn from the investigation were summarized as follows:

(a) That in a tidal estuary, under conditions similar to those of the Liffey, during calm weather the surface water alone is affected by the discharge of sewage into it, the bottom water of the less shallow portions of the estuary remaining practically unpolluted; and that the bed of the channel is not fouled, provided the heavy solids are intercepted before the sewage is discharged.

(b) That the sewage will become rapidly diluted with about eight to ten times its volume of clean water, but that further dilution and dispersion proceeds far less rapidly, except in stormy weather.

(c) That if sewage be discharged under conditions similar to those at the Rathmines and Pembroke outfall, the discharge can be carried on indefinitely without causing accumulation of sewage-matter within the estuary, and that the liquid discharged day by day will be carried out to sea by tidal action. But: (1) The discharge should be made into a definite deep-water channel with a current setting seaward. (2) The width of the water in the deep channel at low tides must be sufficient for the adequate dilution of the sewage. (3) The whole of the sewage should reach open water before the turn of the tide. (4) The heavy solids and the floating matter should be separated from the sewage before its discharge. This can be done efficiently by simple subsidence and screening. (5) Dilution of the sewage with subsoil- or surface-water prior to discharge is distinctly advantageous.

In the discussion which followed the reading of this paper there was much adverse criticism. Mr. G. Chatterton stated he had taken samples of the sewage at the Rathmines and Pembroke outfall, and could hardly agree with the character the authors gave it. It was quite evident to him that in addition to the bad odors emanating from the sewer, about 50 tons of mud were discharged daily at the Rathmines outfall. He thought that the conclusions set forth at the end of the paper were not fully justified, and he disagreed entirely with conclusions 4 and 5.

Dr. S. Rideal stated that although not possessing the local knowledge of Mr. Chatterton, he also thought that the evidence brought forth in the paper did not justify the final conclusions. He criticised somewhat the methods of analysis employed by the authors. Mr. G. B. Latham thought that the value of the results would have been increased if more samples had been taken. He considered that where there was such a good position for a sea outfall as that for the Rathmines and Pembroke sewer, there was no necessity whatever to remove solids, either in suspension or in solution, from the sewage before it was discharged at the outfall. Mr. R. Hassard, the engineer who designed and carried out the works which were the subject of the paper endorsed the statements made therein, and added an explanation of the arrangement of the system.

Mr. James Mansergh observed that he was acquainted with the situation, and thought that the conclusions of the authors could not all be accepted as universally applicable, as an engineer rarely had to do with circumstances equally favorable. In regard to conclusion 4, he doubted whether the separation of heavy solids and floating matter from the sewage could be thoroughly effected by simple subsidence and screening. He thought that conclusion 5 was wanting in precision, and might be misleading, because it put as alternatives two things the efficiencies of which were not properly comparable. Surface water could not take the place of subsoil water as a diluent because it was not constantly available, coming at uncertain intervals and in vastly varying quantities. Moreover, he thought that it would not be a wise thing to construct sewers in such a way as to deliberately admit of the leakage into them of subsoil water.

Numbers of The Engineering Record are wanted by Librarian of Norwich University, Northfield, Vt. Anyone who has No. 17 of Volume 39 and No. 5 of Volume 41 and is willing to part with them is requested to write.

A Steam Roller of Wide Adaptability.

A machine known as the Universal steam roller, although never having been described at length in technical journals, has been used by contractors and municipal officers for several years, and has given good satisfaction. Several photographs are reproduced herewith illustrating the various uses to which the machine can be put. This type of roller was the outcome of the demand for a wide-tire roller of high power and efficiency. The features in which it differs from the three-wheeled roller are claimed to be entirely original and to be distinctly advantageous. It is built in all sizes, from 3 to 12 tons inclusive, and this range of sizes makes it possible for a selection to be made of the roller best adapted to the work to be accomplished. It is a general-purpose road roller, and has been used to advantage not only in rolling macadam, but in rolling the subgrade and brick, asphalt, and gravel wearing surfaces.

It has been found that with the use of the Universal roller and with proper sprinkling of the road during the process of construction, a seven or even a five-ton roller is heavy enough to permanently bond the various courses of a



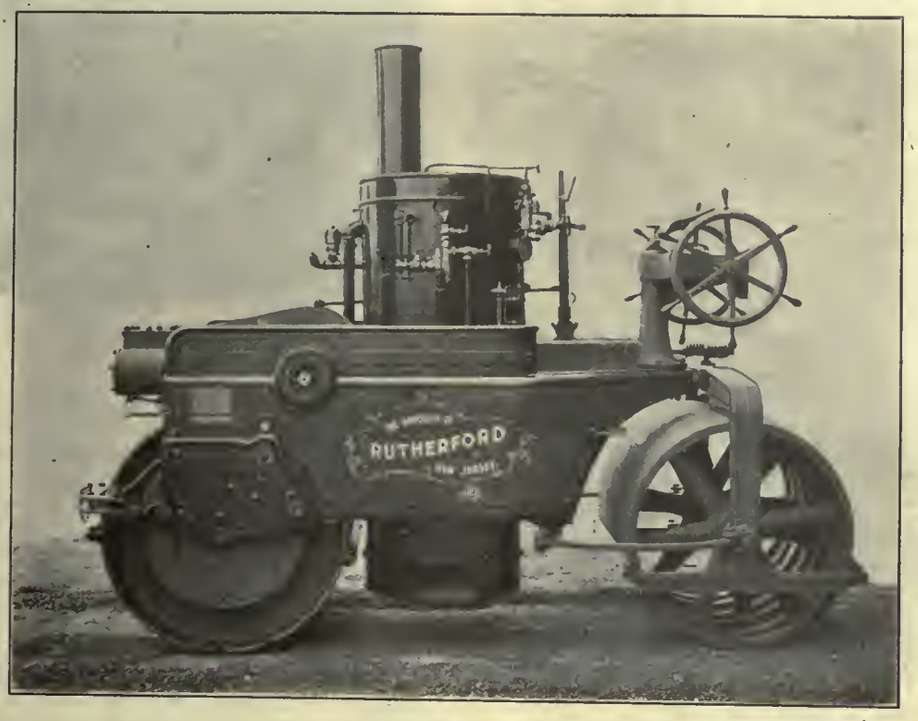
On a Country Estate.

macadam road together, giving results equal to those obtained by the use of a 10-ton machine. The advantage of being able to use a light roller appeals very strongly to road builders in many parts of the country, where it is impossible to use the heavier machines on account of light bridges and narrow roads. As regards the operation of these rollers, it is stated that one man can operate and entirely control any of the various sizes from his seat on the front of the machine. Several time and labor saving devices which have been incorporated in this roller make it easy to handle in rough or difficult work.

The boiler is of the vertical type, is placed independently in the frame of the roller and is entirely free of all machinery; neither the engines nor any other moving parts are fastened to it, hence there can be no transmission or other strains upon the boiler causing leaks and so weakening and shortening the life of this most important part of a steam roller. The use of a vertical boiler obviates another difficulty, as it makes it impossible to burn out the crown sheet or tubes, or melt the soft boiler plugs while working on steep grades.

Double engines are used for driving the Uni-

versal roller, rendering dead centers impossible and reducing to a minimum all strains and shocks upon the gearing, resulting from frequent stopping and starting in going backward and forward while rolling a road. The engines are self-contained and are mounted horizontally over the rear roll, on a separate engine frame, and not, as has been pointed out, upon the boiler. The engines are well away from the ground and out of the dust and dirt, and as a further protection against dust and foreign substances they, as well as all driving gears, are carefully encased.



The Universal Road Roller.

The horse-power of the engines of the Universal roller is very high compared with that of other rollers of equal size, giving the roller the advantage of great power on rough work and for the climbing of steep grades. This large available power is also of essential value if the owner desires to drive a stone crusher or similar machinery with the engine of the roller. An 18 horse-power engine is used on the 5-ton roller, a 25 horse-power engine on the 7-ton roller, and a 35 horse-power engine on the 10-ton roller.

At once a road roller, a portable engine and a traction engine, the Universal roller derives its name from its universal adaptability to all conditions, requirements and uses in connection with the road work of a city or contractor. Any size of the roller can be fitted with a belt-wheel, so that the engines can be used to drive a stone crusher, concrete mixer, small sawmill or other machinery. This is a valuable feature as at any time a portable engine may become a necessary addition to a road building plant. A draw bar is extended across the rear roll and attached to the sides of the main frame of the roller, so that at any time the machine is available for use as a traction engine for pulling a portable crusher or other heavy machinery from place to place or for drawing a road plow, harrow or a road scarifier.

The water and coal carrying capacities of the various sizes of Universal rollers are rated higher than those of other rollers of equal weight. By providing large capacities for these requisites much of the engineer's time is saved while the roller is in actual operation. Unique features of this machine are the coal hopper on top of the boiler and the central firing tube. A metal fender is extended above the boiler shell to form a receptacle for several hundred pounds of coal, the capacity varying in the different sizes. Extending through the center of the boiler from the fire-box to the coal-hopper is a firing tube, the top of which can be opened and closed at will by the operator, who can thus feed his fires without leaving his seat. This arrangement will be recognized as a practical time- and labor-saving device. The fires can also be fed through a door at the bottom of the boiler in the usual way. Furthermore, the engineer can, without leaving his seat, clear the fire of ashes by the use of the shaking grates, and open or close the fire-door for the regulation of the draft.

The tendency to "root" when rolling soft material or when turning a corner, so frequently exhibited in rollers having a small front roll is corrected in the Universal roller by the use of large rolls. The forward and rear roll being of nearly the same diameter and large in proportion to the weight placed upon them, allow the roller to surmount obstructions easily and roll the road material down, instead of pushing it forward or "waving" it as often occurs when rollers with a small front roll are used. The large sizes are fitted with an efficient power steering gear in addition to an auxiliary hand steering arrangement. The smaller sizes are provided with adequate hand steering device. As regards the use of this roller on steep grades, it may be stated that it has been used in rolling roads having grades up to 20 per cent.

This roller can be used in a different form for work of another character than that of building roads. The high power of the boiler and engines of the Universal roller has enabled it to be used for compacting reservoir and other embankments, in the form of the Universal steam puddling roller. Engineers and contractors have often found difficulty in securing a self-propelling machine which will properly meet the requirements of this kind of work. The object in view in this class of rolling is to consolidate layer by layer the loose filled earth so that it binds together. In the past, grooved horse rollers have been used, but they have been found to have some unsatisfactory features in the proper performance of the work. Besides, the expense of operation was sometimes too great in comparison with the results obtained.

The various features peculiar to the Universal roller have made it possible to construct upon its rolls special forms of grooving and cleats which are suited to the nature of this work. These cleats are shown in one of the accompanying illustrations. The idea that has been followed is to provide a roller which would meet the requirements of the specifications for embankment and similar work, and which would travel over the soft layers of filled earth at the proper speed and do its work with a minimum amount of attention and repairs. The manufacturers of the Universal roller are Messrs. Julian Scholl & Company, of 126 Liberty Street, New York City.



The Universal Roller Drawing a Road Scarifier.

Letters to the Editor.

Two-Hinged Arches.

Sir: A short method which appeals to the mind on account of its clearness and absolute correctness in determining stresses in a framework under any possible conditions of support and loading is the following:

For a certain system of loading the reactions of supports are estimated. Thus, for an assumed system of stresses the areas are determined and from the change of length in every member the deflection, horizontal and vertical in every triangle, laid off to increased scale and the total deformation of the frame easily summed up with due regard to the leverage. Another, closer and, possibly, a third or fourth still nearer estimate of the support-reactions (by an expert), and repetition of above proceeding will inevitably bring the supports of the deformed frame into the intended position.

In view of the rare application of the elastic theory and the risk in making the least assumptions, it would seem advisable to use above method at least as a final proof. Any result which will not stand this proof must be incorrect. Very respectfully, C. S.

Washington, D. C., December 30, 1902.

A Laboratory Locomotive for Sibley College, Cornell University.

Sir: You will be glad to learn that the Baldwin Locomotive Works have recently offered to present to the railway school of Sibley College, a laboratory locomotive of the Vauclain-de Glehn type, especially built to plans to be agreed upon by the Baldwin Works and myself. The gift will not be consummated until a building and a testing machine are provided for. I did not intend to have the matter get to the public until we saw our way definitely clear for providing necessary equipment on which to mount the locomotive, but the knowledge of the offer from the Baldwin Works leaked out to the daily papers, and to prevent any misinformation is the purpose of the present letter.

The locomotive will be a 4-cylinder balanced compound, like the engine built for the Plant system, but with four truck wheels and four driving wheels. The boiler will be designed to carry pressures up to 300 pounds gauge pressure. When the locomotive is run at this pressure, the entire weight of the locomotive can be thrown upon the driving wheels by means of a pneumatic cylinder at the rear, connected to an anchor in the foundation. When this traction increaser is not used, the engine will run at 200 pounds gauge pressure. It is intended to be very easily convertible into a perfectly balanced two-cylinder simple engine by the removal of the two high pressure cylinder bushings and a change in the valves. The details of the engine have not as yet been worked out, but are being figured. No work at all has as yet been done on the designing of a testing machine, awaiting the development of the design of the locomotive, its weight, power, wheel base, etc. When the plans of testing machine and building are completed and estimates available, we shall call upon the friends of Cornell for assistance.

I would add that every fall a series of locomotive tests is regularly carried on for our railway seniors through the kindness of the Delaware, Lackawanna & Western Railroad upon that portion of the road which comes into Ithaca. I have named these "Instruction Tests," as they are primarily intended to instruct our railway students in the methods of locomotive testing on the road. Each cylinder has two indicators with short, straight pipes, the indicator reducing rig is of the pendulum or similar triangle type, geometrically perfect, practically rigid and light, and entirely satisfactory. The coal is weighed into bags, water is metered between tank and injector, hydraulic dynamometer draw bar used, and steam chest diagrams taken. We use steam-dryness calorimeters in dome and steam chest, and smoke box, vacuum gauge, take the smoke box temperature, use the Boyer speed recorder, driver stroke counter and recorder, and air pump stroke counter and recorder and we make the various calibrations of dynamometer, tank, water meter, boiler, blower, safety valve, air pump, valve setting, cylinder clearances, etc. The students themselves do the work of rigging up the locomotive for test and stripping it ready for replacing in its regular service. It is not intended that these annual instruction tests should be omitted after we have a laboratory locomotive. Towards the end of the senior year a number of our railway seniors and graduates usually make thesis tests of locomotives for different railroads in the East. The students are in full responsible charge without assistance from the faculty.

Yours very truly,

H. Wade Hibbard,

Prof. of Mechanical Engineering of Railways.

Ithaca, N. Y., Feb. 2, 1903.



The Universal Roller Running a Stone Crusher.



Running a Portable Saw.



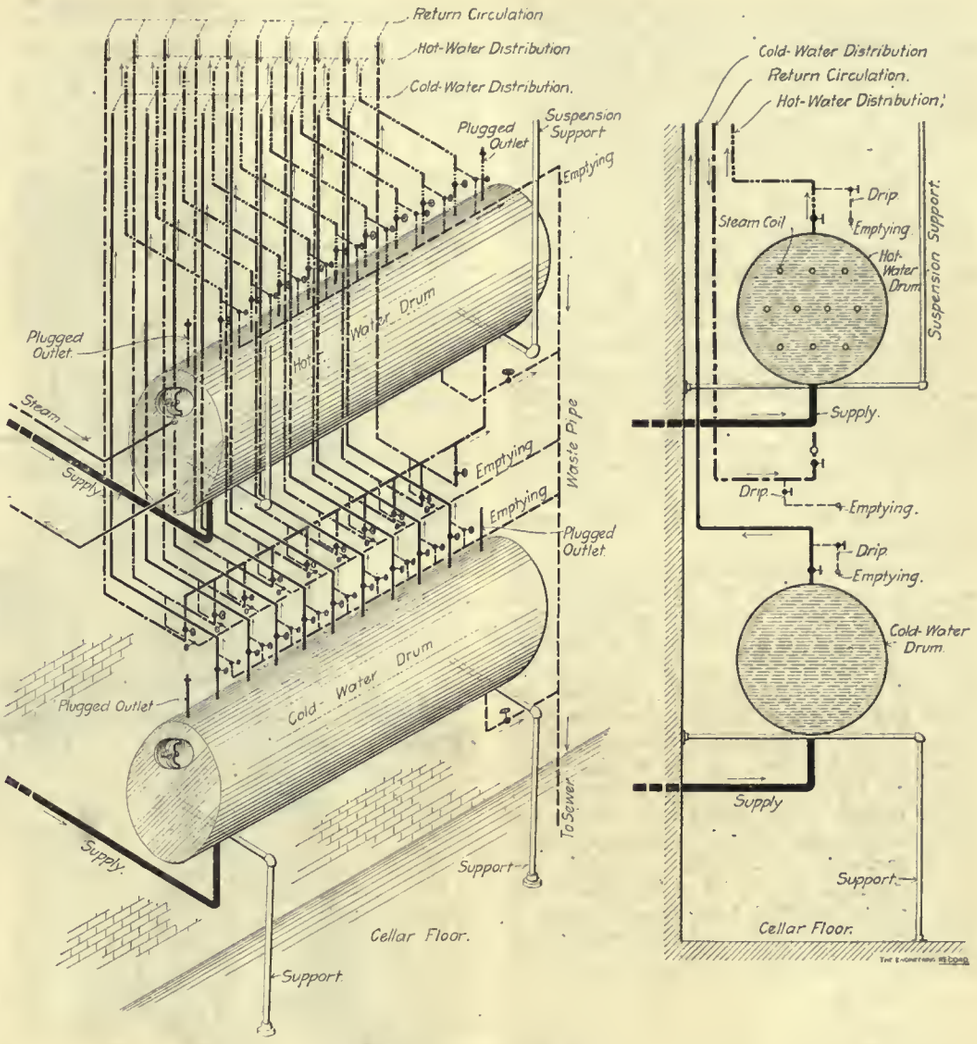
Rolling the Puddle for the Torresdale Filters, Philadelphia.

Water Purification and, indeed, purification of all kinds of liquids is to be accomplished hereafter by the magic of electricity. No more controversies about slow sand filters and mechanical filters! The new process, it is claimed, will destroy germs of all kinds, and thus prevent the spread of typhoid fever; and drinking water taken from polluted streams will be rendered harmless. The secrets of this beneficial process are the property of the National Electric Purification Company recently incorporated in New Jersey with a capital of $1,000,000.

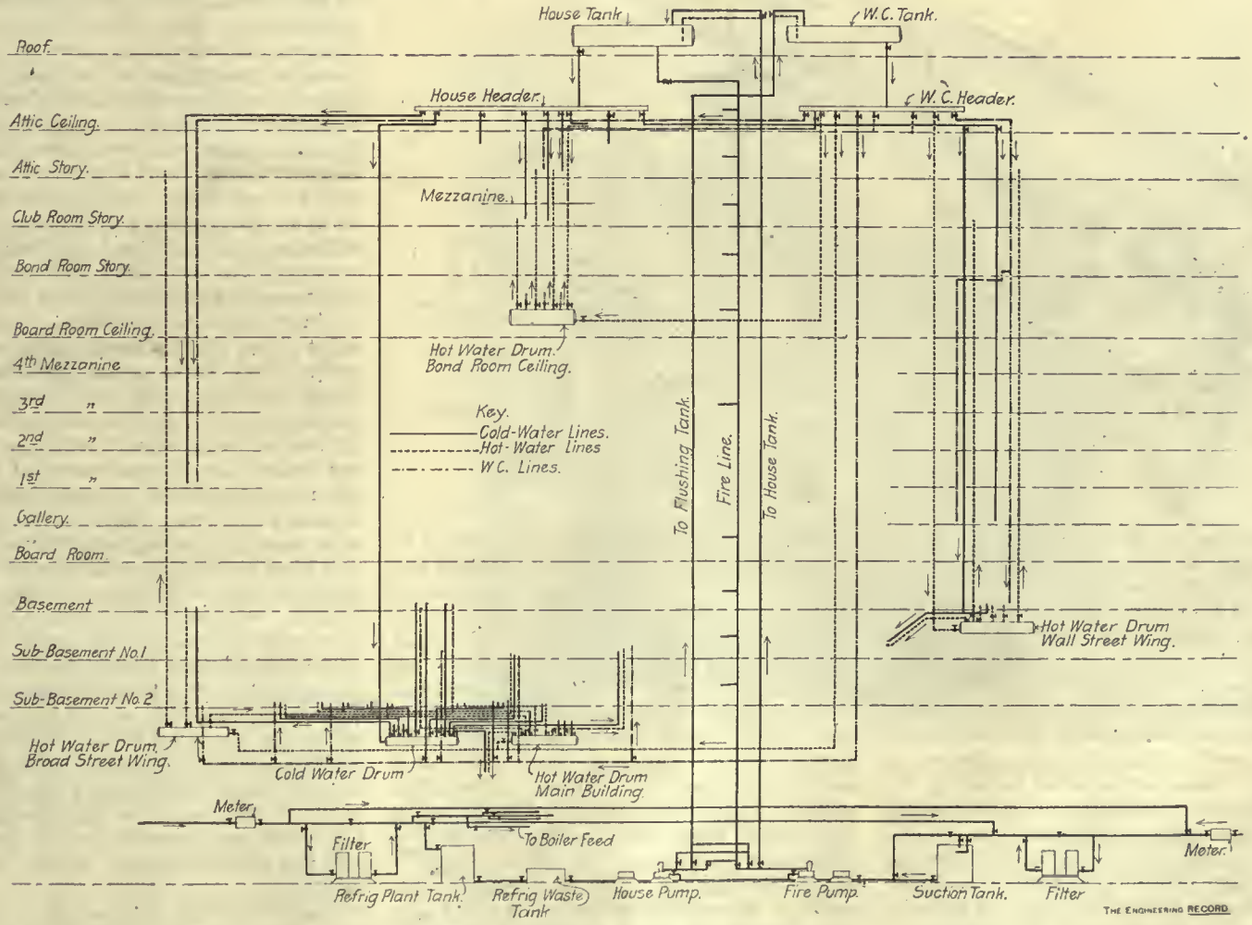
Water Supply and Distribution in the New York Stock Exchange.

The New York Stock Exchange building, on Wall Street, is a large, tall steel building, remarkable for the height and width of the board room which occupies most of the area of the building through several lower stories, and for the great depth of the cellar excavation, which gives four full stories below the curb. Machinery, storage rooms, safe deposit vaults and some offices are located below the street level, and there are offices above the board room, 100 feet above the street. There is also a long and narrow wing with offices almost isolated from the main building.

The water supply is drawn through two 2-inch service pipes from different street mains, and, after being metered and filtered, all except that which is used cold below street level, is pumped to two horizontal cylindrical steel tanks in an attic house about 200 feet above the street, or 250 feet above the pumps. One of these tanks, called the flushing tank, is marked "W. C. Tank" in the general diagram, and furnishes the supply for all flushing valves and for hot water service. This arrangement is made because the water pumped to this tank is first run through the refrigerating plant for cooling purposes and is warm when pumped to the W. C. tank. All the other water used above the street level is supplied from the second or house tank. Distribution lines from these tanks are run above the attic ceiling and from them vertical lines are dropped, with branches to the different groups of fixtures. The hot water system is divided in four parts serving different portions of the building independently; but all of them being operated under roof tank pressure. Each division has a horizontal cylindrical steel drum containing a steam coil and provided with from six to ten outlets, through which the hot water is distributed to the risers for the different groups



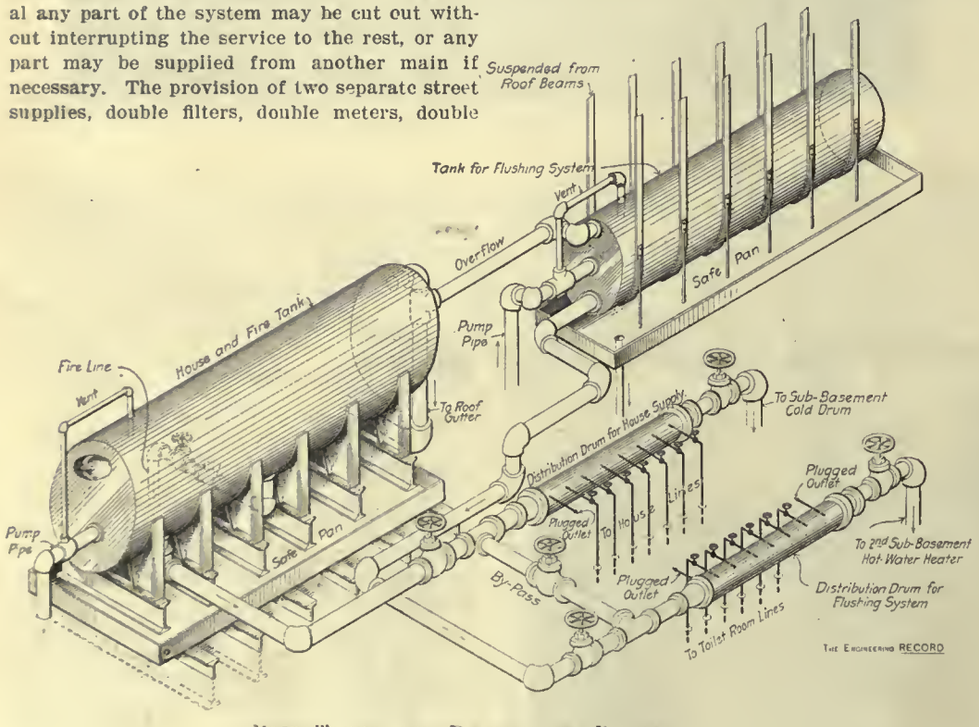
CELLAR DISTRIBUTION DRUM.



CONVENTIONAL DIAGRAM OF WATER SUPPLY.

of fixtures served. One drum is located in the cellar and supplies all fixtures below street level. Another drum, also located in the cellar, supplies all fixtures in every story of the Broad Street wing. A third drum is located in sub-basement No. 1, two stories, or about 25 feet, above the drums already described, and supplies all fixtures in the narrow Wall Street wing, which is chiefly devoted to small offices. The fourth drum is located over the board room ceiling about 100 feet above the street level, and supplies the remaining hot water fixtures in the building, which include those in the main part between the two wings. The general plan of operation and typical arrangement is indicated on the conventional plan which does not show scale or exact positions, and in which only the principal connections, tanks and drums are drawn, omitting most of the risers, all of the branches, several of the fire lines and many of the valves. A few of the most essential valves which control the general operation are shown.

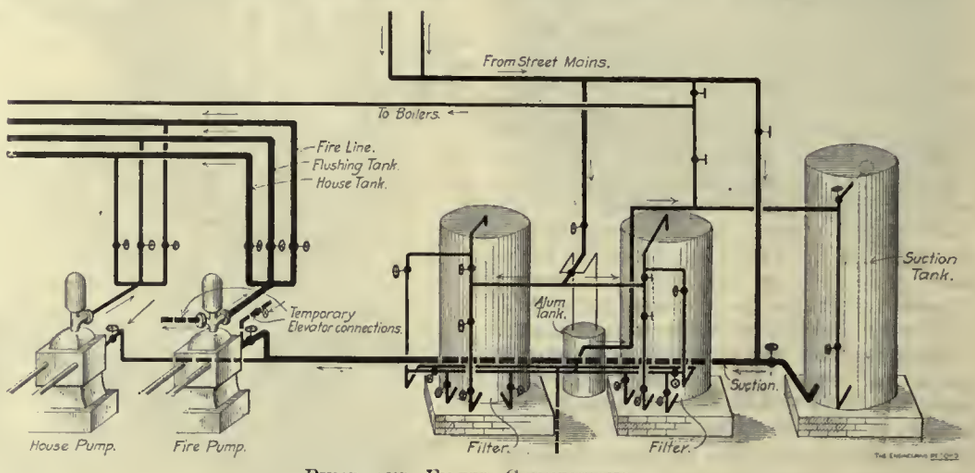
The principal features of this installation are: The supply to all fixtures under gravity pressure, the control and distribution of main cold supply lines above street level at the attic ceiling, the control and distribution of all hot and cold water below the street level from the drums and headers in the cellar, and the separate provision for independent supplies of hot water to different parts of the building. The main lines and their connections to the meters, filters, pumps, tanks, drums and headers are cross-connected and by-passed, so that in general any part of the system may be cut out without interrupting the service to the rest, or any part may be supplied from another main if necessary. The provision of two separate street supplies, double filters, double meters, double pumps, two roof tanks and several hot water heating drums with their multiple connections make the system essentially a duplicate one and provides for uninterrupted service, even if almost any portion of the plant should be disabled.



Roof Tanks and Distribution Drums.

Between the meter and the filter, one of the street service pipes is branched to the steam boilers and has several 1-inch branches to sill cocks and hose washers, and to some fixtures in the cellar. It also has an outlet to supply the refrigerating plant, which is not shown on the diagram. The lines from the street mains unite in a 5-inch branch which supplies the filters as shown in their elevation, and is by-passed to connect with the filtered water pipe to the suction tank. The filters are of the Continental make with a capacity of about 150 gallons per minute, and discharge through two 2-inch ball cocks in the suction tank. This tank is a vertical cylinder 6½ feet in diameter and 10 feet high, made with ¼-inch steel and ⅜-inch domed ends, painted inside and out with two coats of Eureka paint. It is not operated under pressure; but is accessible through a manhole, and is provided with overflow and emptying pipes. From the bottom of this tank a 5-inch suction pipe also direct-connected with the street pressure, is run to a pair of Worthington duplex pumps, one of which is intended to be used for fire service exclusively, and the other for the continuous house service. Each of them has three outlets which are valved to three main risers as shown in the diagram and serve respectively the house tank, the flushing tank and the fire system. The outlets are valved outside these mains so that either pump can be used on any main; but ordinarily the fire pump is connected to the fire line only, and the house pump to the house and flushing tank only. Both pumps are automatically controlled by Ford regulating valves set to stop them when the tanks are full, and to start them when the water falls below the required levels.

The main house tank, in the roof of the house, is a horizontal steel cylinder about 6 feet in diameter and 25 feet long, which is supported on six cast iron saddles on 15-inch transverse I-beams, which are seated in a steel safe pan. The pan itself rests on the top flanges of corresponding transverse girders, which have their lower flanges and part of the webs enclosed in the concrete of the roof surface, as indicated in the general diagram. The 4-inch supply pipe enters the end of the tank near the bottom, but rises inside to the upper part where it discharges through two ball cocks accessible through a manhole. The tank outlet is from the lowest part, and consists of an 8-inch pipe valved to a 10-inch header 5 feet long, which is made of extra heavy steel pipe with cast steel reducing ends. Its thickness is such that the distribution lines from it are tapped through the sides of the header without reinforcement. The header is supported horizontally a few inches above the floor of the roof house, without saddles or standards, by the stiffness of its vertical pipe connections.



Pump and Filter Connections.

The other gravity tank which is devoted to the service of the flushing valves and the hot water drums is about 3 feet in diameter and 25 feet long, and is suspended from the horizontal roof beams of the tank house by means of twisted flat U-bars, which have their upper ends riveted between the webs of the double channels forming part of the framework of the house. These suspenders have vertical screw rod extensions by which the steel safe pan is suspended under the tank. The center of the flushing tank is about 3 feet higher than that of the house tank; but the ends of both the tanks are in the same vertical planes as shown in the isometric drawing. The flushing tank is apparently located beyond the house tank, this displacement having been made to avoid confusion in the connected pipes. The inlet and outlet to the flushing tank correspond to those of the house tank, except that the latter is taken, as shown, from the end instead of the side of the tank. It also terminates in a supply header like that for the house tank, and the two headers are cross-connected so that either one may be supplied by either tank; but the by-pass is generally closed so that the tanks work separately. Both tanks have 5-inch overflow pipes discharging into the roof gutter and receiving the emptying pipes and the drips from the safe pans. The tanks are also fitted with tell-tale pipes, not here shown, which indicate in the engine room if the tanks are filled to overflowing. The branches from the headers, or distribution drums, as they are called in the engraving, are connected to horizontal pipes which are run in the space between the roof and the furred ceiling of the attic and there distribute to the riser lines throughout the building, which are generally carried down alongside the columns and are enclosed in fireproof casings.

The arrangement of headers for the main hot and cold supplies in the cellar is very neat

and symmetrical, and they are simple in operation, although apparently complicated on account of the large number of pipes concentrated in a small space. The operation can be readily followed in the detail drawing which shows the cold water drum below the hot water drum with its outlets connected to pipes run on the wall between those of the hot water drum. Both drums are supplied from the roof tanks by means of pipes entering them at their lowest points and which are controlled by valves in the roof house and do not have valves at the drums. The outlets are all valved and provided with emptying and drip pipes so as to enable any riser line to be cut out and emptied independently of the rest. Each hot water riser has according to its length, from one to three horizontal expansion loops, 2 feet long and terminates at the upper end with a ¾-inch return circulation pipe that is brought back parallel with it, and is connected under the drum to a header as shown in the diagram through which the water is discharged to the drum. Each drum is provided with plugged outlets to allow for additional connections in the future. The other three drums correspond essentially to this one and are of the same size, namely, 30 inches in diameter and 72 inches long, made with 5/16 inch shells and ¾-inch welded heads and tested to 200 pounds pressure. Each contains a coil with ten lines of 3-inch seamless drawn brass tubing for the special supply which is regulated with thermostats. The drum over the board room ceiling is provided with a 16-ounce copper safe pan 4 inches deep which drips into the cellar sink through a brass flap cover. This safe pan also receives the drip from an open copper gutter laid under the water and drain pipes which cross the board room ceiling.

From the fire pump five 6-inch vertical stand pipes are run to the attic ceiling where one of them is connected with the check valve to the house tank so that when the fire engines are connected in the street to the stand pipe system, they cannot pump into the tank; but the tank supply is rendered available for fire purposes. Two anti-freezing fire hydrants and valves are connected to these stand pipes through the roof, and each stand pipe is connected at every story with a 2½-inch Kennedy gate valve to 75-feet of 2½-inch white linen hose in three 25-foot lengths with ⅝-inch nozzle and stop cock. The feet of the stand pipes are drained through 1-inch drip pipes and valves to the plumbers' waste tank. The branches from the stand pipe to the street are brought up to the under side of the sidewalk and extend through it with a 4-inch seamless drawn brass tube, having a 90-degree bend facing upward 12 inches above the sidewalk line and 6 inches from the wall. These outlets have cast brass Siamese couplings with checks, and are fitted below the bend with a check valve, set so as to be kept closed by tank pressure and opened by street pressure from the fire engine. The fire system was tested to 300 pounds pressure after all connections had been made, and the same pressure was successfully applied to all water pipes throughout the building.

All valves throughout the building are of the Ludlow or Chapman make. Those 2 inches or less in diameter are made entirely of steam metal, and larger sizes have iron bodies and steam metal mountings. The service pipes outside the walls have screwed joints packed with red lead and are covered with three coats of hot Trinidad asphalt.

Mr. George B. Post is the architect of the building, Mr. H. A. Hottenroth designed the work, and Mr. John Tucker is the contractor for the plumbing of which Mr. J. J. Herlihy was foreman in charge.

The Woodward Water Wheel Governor.

The accompanying illustrations show the Woodward friction water wheel governor, made by the Woodward Governor Company, of Rockford, Ill. The governor shown in Figure 1, is fitted with two shafts, shaft A being connected to the turbine shaft and B to the gate moving mechanism. On shaft A is mounted two pans of a friction clutch each attached to a separate sleeve on the shaft. The sleeves are in turn connected to shaft B by two gears. Between the two pans is a compressed paper friction so adjusted that when it is pressed against one pan, shaft B will be turned in one direction, and when it is moved against the other pan shaft B will be turned in the opposite direction.

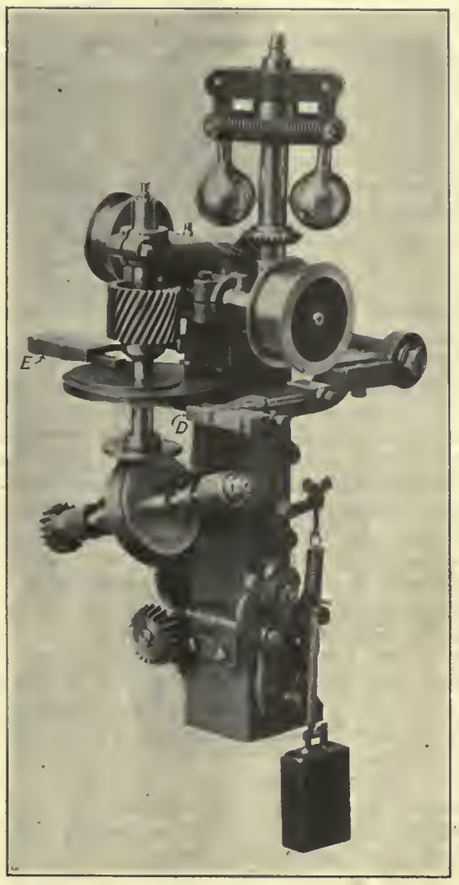


Figure 2.

The fly-ball governor is driven from the turbine shaft and shaft C in the manner shown. Shaft C, by means of a spiral gear, drives a cam shown in Figure 2. The tappets D and E are moved up and down vertically by the stem of the fly-ball governor. When the speed is normal the cam revolves between the upper and lower tappet. When it engages one or the other, the friction engages one or the other of the pans and transmits motion to shaft B in the direction corresponding to the pan that is engaged, thus opening or closing the gate until the change in the speed of the turbine disengages the tappet and stops the motion of the gate. The cam action is capable of very close adjustment, enabling the governor to act on so small a change of speed, that for ordinary conditions of electric service no perceptible variation of speed will occur. When the load is steady the governor will not act upon the gate; consequently there is less wear on the mechanism than with a governor that keeps the gate in continuous motion. To prevent racing of the governor, a device is used that is described by the builders as follows: "Just below the cam and fastened to the same shaft is a concave disk, shown in Figure 2. Below this disk will be seen the compensating wheel which travels loosely upon an oblique shaft. This oblique shaft is geared to the intermediate shaft so that it revolves only when there is a movement of the gates. It is further provided with a square thread as is also the compensating wheel. When the speed is normal the compensating wheel seeks the center of the disk which is supported upon it because this disk is constantly revolving with the cam. When a movement of the gate occurs the compensating shaft is revolved, and the wheel will travel along its shaft in such a direction that it will separate the cam from the tappet when the gate has been moved to that point which will give the correct speed, after the momentum of the machinery has been overcome. During this interval the disk will return the compensating wheel

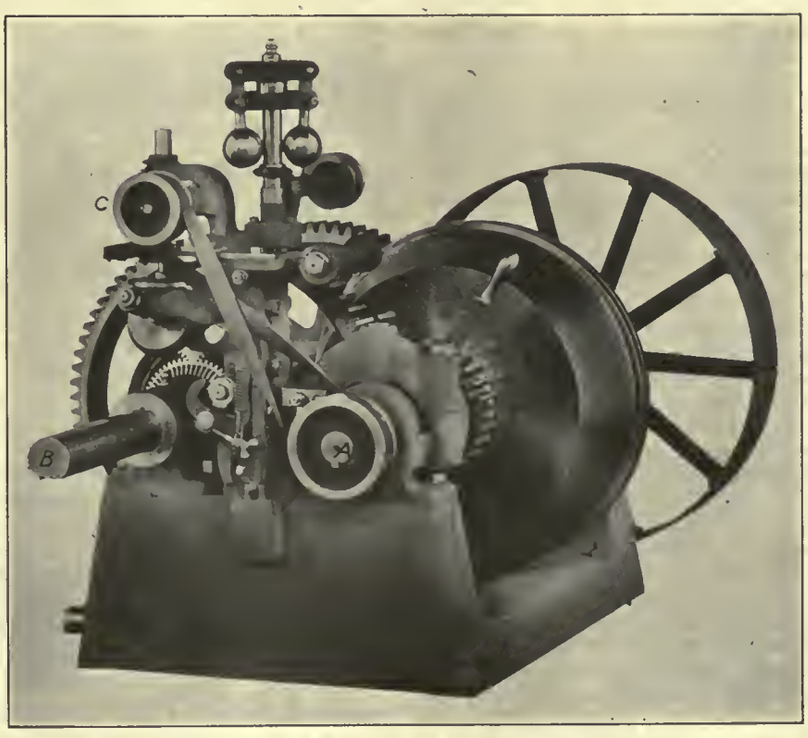


Figure 1. The Woodward Water Wheel Governor.

to the central position. This device can be designed to properly compensate for any condition as the time element can be varied, not only by varying the pitch of the screw, but also by varying the speed of the oblique shaft with a change of gears."

The governor shown is the largest furnished by the makers. The friction wheel, 24 inches in diameter and 12 inches wide, is made with sufficient surface to transmit, if necessary, 5,000 foot pounds per second to the turbine gates. All gears are cut from the solid and are wide face and coarse pitch. The shafts are of ample size and are well supported in large bearings. The friction shaft, which is the only shaft that runs continuously, has ring oiling bearings and from them there is a continuous supply of oil carried to the hubs of the pans which are loose on the shafts. These pans are so constructed that it is impossible for oil which may work out of the bearing to get on to the friction surface. All parts are made to be interchangeable. Governors of the type described have been in successful use for some time at the three phase plant of the U. S. Arsenal, Rock Island, Ill., at the Ottawa & Hull Power & Manufacturing Company, Hull, Quebec, at the Rochester (N. Y.) Gas & Electric Company's plant, and in other places.

New Books Received.

Kinematics of Machines. An Elementary Text-Book. By R. J. Durley, B.Sc., Ma.E., McGill University, Montreal. New York: John Wiley & Sons. 379 pages, illustrated. Price $4.

Steam Power Plants, Their Design and Construction. By Henry C. Meyer, Jr., M.E. New York: McGraw Publishing Co. 150 pages, illustrated. Price, $2.

Engineering for Land Drainage. A Manual for Laying Out and Constructing Drains for the Improvement of Agricultural Lands. By Charles G. Elliott, M. Am. Soc. C. E. New York: John Wiley & Sons. 232 pages, illustrated. Price, $1.50.

Book Notes.

Surveying as Practiced by Civil Engineers and Surveyors. By John Whitelaw, Jr., Assoc. M.I.C.E., New York: D. Van Nostrand Company, 516 pages, illustrated. Price, $4.

It is the author's opinion that many works on surveying devote too much attention to the elementary part of the subject and leave the reader almost entirely in ignorance of much of the actual practice of civil engineers and surveyors, and that in other works the elementary part of the subject is entirely omitted. It is the aim of the author to give the student sufficiently full details of the work which he may be called upon to carry out in actual practice, and also to fully treat the elementary part of the subject. It is exceedingly difficult to cover the subject of surveying, in the manner outlined, in the space of 500 pages, and the principal criticism of the treatise would be as to the judgment of the author in proportioning the space given to the various parts of the subject. Some 50 pages are devoted to the field and office work of making surveys with the chain alone, and of these pages 19 are taken up with the notes of a sample area survey. It would not seem that the importance or difficulty of such a form of surveying merited so much valuable space. The chapter on surveying with the aid of angular instruments describes various forms of instruments used, methods of conducting field work, plotting and computation of areas. Nothing is given as to the forms of notes to be used on such surveys. The chapter on leveling is very satisfactory in every respect. Barometric, ordinary spirit, trigonometrical, and precise leveling, are all well set forth and the instruments are well described and illustrated. Stadia surveying is also quite fully explained in a well written chapter. The adjustment of instruments receives good treatment, but might be much improved by the addition of sectional views of the important instruments.

It is doubtful if the space devoted to railroad surveying by textbooks on surveying is of much value. No adequate treatment of railroad surveying and location can be given in 35 pages and this text is no exception to the rule. The chapter on tunnel alignment is of much interest and gives, with some detail, the methods used when the line can be ranged on the surface directly over the tunnel. Chapters on surveying for water works and on hydrographical surveying contain matter of interest, but are too brief to be of much value. Astronomical observations for meridian, latitude and time which may be made with the engineer's transit or theodolite are very clearly described and form a valuable portion of the text. Geodetic surveying receives a rather brief treatment, most of which is descriptive; but little is done with actual methods of making such surveys or of adjusting results. Many valuable hints and suggestions are contained in a chapter on surveying in jungles, dense forest and in open unmapped country. Tables to be used in connection with barometrical leveling and stadia reduction tables are given. The book is well printed and has good illustrations, but is made unnecessarily bulky by the use of thick paper.

Manual for Resident Engineers. By F. A. Molitor, Chief Engineer, and E. J. Beard, Principal Assistant Engineer, Choctaw, Oklahoma & Gulf R. R. New York: John Wiley & Sons, 118 pages, illustrated. Price, $1.

The matter in this book was originally published by the engineering department of the Choctaw, Oklahoma & Gulf Railroad, for the use of its resident engineers. Three years' successful use of the manual has prompted the authors to make the book available to the public. Instructions are given to the resident engineers as to their duties, lists of supplies and equipment and care of the same, personnel of the parties, note books to be kept, reports and estimates to be made, details of alignment, staking out of work, inspection and record of work on all structures built. The text, with figure and tables, clearly sets forth the easement curve used and the method of laying out. Sample pages show form of records for bridge work, estimates of quantities in cuts and fills, and progress and final profile. The book closes with standard general specifications for graduation, masonry and timber, and abstracts from a general form of contract. Tables of level cuttings for various widths of road-bed and side slopes of 1 to 1 and 1½ to 1 are appended. The book is of great value to students and young engineers interested in railroad construction and possesses much of worth to all engineers connected with the organization of field parties for such work.

Irrigation Institutions. By Elwood Mead, C.E., M.S. New York: The Macmillan Company, 392 pages, illustrated. Price, $1.25 net.

This timely and able work by the Chief of Irrigation Investigations, United States Department of Agriculture, will be appreciated by engineers and the many irrigators who are studying the vital agricultural problem of the arid West. The changes wrought by irrigation in the last fifty years are little less than marvelious. Our best farms are found in areas formerly regarded as desert and worthless, and cities have been built in former dreary solitudes. The book as a study of engineering and agricultural problems of irrigation is broad and inviting, and the chapters treating of The Duty and Measurement of Water are extremely valuable to the hydraulic engineer. The Doctrine of Appropriation, Riparian and Interstate Rights and Contract Water Rights are ably discussed. The paramount need of the West is relief from the evils of the haphazard irrigation development of the past. The author, in his chapter on Methods for Future Development, has set out in an admirable manner the conditions which will furnish an adequate foundation for future growth. A well arranged index gives the volume the advantage of easy reference.

A Treatise on Roads and Pavements. By Ira Osborn Baker, Professor of Civil Engineering, University of Illinois. New York: John Wiley & Sons, 655 pages, illustrated. Price, $5.

Professor Baker has divided the book into two parts, the first relating more particularly to earth, gravel and broken stone roads, such as are constructed in more or less rural localities, the second pertaining exclusively to the several kinds of city pavements. He has followed closely the arrangement adopted by him in his Treatise on Masonry Construction, the volume being divided into parts, chapters, articles and sections, thus making it easy to refer to any particular subject. The topics treated are as follows and in the order given:

Part 1. Road Economics, Road Location, Earth Roads, Gravel Roads, Broken Stone Roads, Miscellaneous Roads, Equestrian Roads, Horse Tracks; Part 2. Pavement Economics, Street Design, Street Drainage, Curbs and Gutters, Pavement Foundations, Asphalt Pavements, Brick Pavements, Cobblestone Pavements, Stone Block Pavements, Wood Block Pavements, Comparison of Pavements, Sidewalks, Bicycle Paths, Race Tracks.

The author's conclusions on the financial advantages of road improvement and the losses due to bad roads as discussed by him in his chapter on Road Economics are particularly interesting. He says, "Any considerable expenditure for the improvement of rural highways cannot be justified on financial grounds alone. Good roads are chiefly desirable for the same reason that a man buys a carriage or builds a fine house, i. e., because they are a comfort and a pleasure. Good roads are to be urged principally for the same reason that good schools are maintained, namely because they increase the intelligence and value of the citizen to society." It was the evident intention of the author to include in this book all the latest methods and processes used in modern road building. Thus, in the chapter on Asphalt Pavements he discusses at some length under the head "Asphalt Macadam" the bituminous macadam pavements which have been laid in many cities and towns during the last year or two. He also gives some very interesting information concerning Steel Trackways which have been much advocated of late. In concluding his discussion on this subject he says, "they are more expensive and less effective than good macadam roads, and that for a country road when an ordinary macadam surface does not suffice, a first class pavement or a railroad should be built." The book is well illustrated and has many specifications and tables of costs. It is clear and comprehensive and will without doubt prove to be of much value to engineers having to do with the laying-out and construction of ways as well as to highway surveyors and superintendents of streets. Like the other books of Professor Baker, it will prob-

ably be used as a text book, especially in such of the technical schools of the country as include road building in their list of studies.

A New President at Stevens Institute of Technology.

On the afternoon of February 5 Mr. Alexander C. Humphreys was formally inaugurated as president of the Stevens Institute of Technology at Hoboken. He is the second president, his only predecessor having been Henry Morton, who guided the affairs of the Institute from its founding in 1870 until his death on May 9, 1902. Mr. Humphreys accepted the election to the presidency last spring. On the evening of February 5 the Alumni Association gave a dinner at Sherry's, in New York, in honor of the new president, to which some 400 alumni, guests and members of the faculty sat down. There was a long list of after dinner speakers, most of whom were representatives of other technical schools, and brought expressions of good will.

Mr. Humphreys was born in Edinburgh, Scotland, March 30, 1851, but received his education principally in Boston. As a young man he was engaged in the insurance business in Boston and New York until 1872, when he was appointed secretary of the Bayonne & Greenville Gas Light Company. While in the service of this company he was given leave of absence two mornings each week to attend lectures at Stevens Institute, which he entered in 1877. By close application night and day he succeeded in winning his diploma in June, 1881. Following graduation he became chief engineer of the Pintsch Lighting Company and in 1885 superintendent of construction of the United Gas Improvement Company, of Philadelphia. Later he became general superintendent of the latter company and continued with it until 1894, when he resigned to devote his attention more completely to the business of the firm of Humphreys & Glasgow. As a gas engineer and manager of works Mr. Humphreys is recognized as a leader, having been chief executive officer of more than 50 gas and electric companies, having built up the present system of management of controlled companies, and having been concerned in the construction of works in widely scattered countries. Stevens Institute is a special school of mechanical engineering and has graduated nearly a thousand men. Under the energetic guidance of the new president continued progress is confidently expected.

Meeting of the Connecticut Society of Civil Engineers.

The nineteenth annual meeting of the Connecticut Society of Civil Engineers was held in Hartford on February 10, and was in every way a success. Matters were brought up which point to a broadening of the field of usefulness of this already firmly established society. The morning session in the council chamber of the City Hall was devoted to business, about sixty-five members being present. As showing the growth of the society's influence it was stated that the 1,000 copies of the eighteenth annual report were not enough to supply the demand, applications having been received for them from as far away as Honolulu and South Australia. The total membership of the society, not including those elected at this meeting, was: Honorary, 8; active, 202; associate, 2. The treasurer reported a balance on hand of $466.26, a considerable gain over the previous year. The list of officers elected is given in another column.

The address of the retiring president, Mr. Clarence B. Vorce, was devoted mainly to the previous meeting of the society at Bridgeport, where the members made the most of the opportunity to inspect the work of track elevation costing about $4,000,000. Mr. Vorce referred to the fact that with only one day devoted to the meeting of the society there was very little time available for the discussion of the technical papers, and recommended a two-day session. This suggestion was acted upon later, it being decided to hold a two-day session at the next annual meeting, the first to be devoted to business, with perhaps some social gathering in the evening, and the second day to be devoted to the reading and discussion of papers. In addition to this, it was provided that hereafter the reports of the special committees (on sewerage, railways, masonry and bridges, highway construction, and law) be handed to the secretary in time to be printed and distributed to the members before the annual meeting, so that an intelligent discussion of them can be had at the meeting. Heretofore these reports have been simply handed to the secretary at the meetings without being read, and have only come to the attention of the members when printed in the proceedings of the meeting, by which time the interest which would have gone with them at first is no longer felt.

After the business meeting the members of the society visited the power station of the Hartford Street Railway Company on Commerce Street, where some very interesting foundation, retaining wall and tunnel work in concrete is just being completed. The afternoon session was held at the Hartford Golf Club. After a very enjoyable dinner, Prof. Alfred E. Burton, of the Massachusetts Institute of Technology, gave an illustrated lecture on "An Eclipse Expedition to the Island of Sumatra." In this lecture views were shown illustrating some of the primitive engineering works of Sumatra, such as a large water wheel of bamboo, with buckets arranged on the perimeter to raise the water to troughs, through which it flowed off to irrigate rice fields. The main part of the lecture described the operations which resulted in obtaining some exceedingly valuable photographs of a total eclipse of the sun. Mr. Charles M. Crawford, of the Hartford Paving & Construction Co., read a paper on "The Constituent Parts of Concrete." An abstract of this paper, together with extracts from the interesting discussion which it elicited will be given in a succeeding issue of The Engineering Record.

Personal Notes.

Mr. Arthur L. Gifford has been appointed city engineer of Elgin, Ill.

Mr. Bertram Brewer has been re-elected city engineer of Waltham, Mass.

Mr. Charles M. Slocum has been re-elected city engineer of Springfield, Mass.

Mr. William F. Keene has been reappointed city engineer of Central Falls, R. I.

Mr. John F. Sprenkle has been elected general manager of the York (Pa.) Water Co.

Mr. R. P. Rader has been elected superintendent of the Lehigh Water Co., Easton, Pa.

Mr. William A. Sweet has been elected highway commissioner of North Providence, R. I.

Mr. Edward Dillon has been elected superintendent of the New Haven (Conn.) Water Co.

Mr. R. E. Smith has been reappointed commissioner of public works of Providence, R. I.

Mr. Brainard Rorison has been elected vice-president of the Federal Asphalt Co., of Chicago.

Mr. Alex. Mead has been elected superintendent of the Windsor Reservoir & Canal Co., at Greeley, Colo.

Mr. George A. Ralph has been appointed engineer of the ditch construction of Polk county, Crookston, Minn.

Mr. L. C. Stubbins has opened an office for the practice of civil engineering in the Demaree Building, Mattoon, Ill.

Mr. C. B. Cooke has been appointed city engineer and Mr. Charles Hamilton, assistant city engineer, of Wheeling, W. Va.

Prof. Florian Cajori has been appointed dean of the engineering department of the Colorado College at Colorado Springs, Colo.

Mr. William A. Barclay and Mr. George A. Carpenter have been re-elected commissioner of public works and city engineer, respectively, of Pawtucket, R. I.

Lieut.-Col. W. R. Livermore, Corps of Engineers, U. S. A., has been appointed engineer officer of the Department of the East, to relieve Capt. W. V. Judson.

Naval Constructor Richmond P. Hobson, who was recently ordered to take station in the Puget Sound navy yard, has resigned from the Navy Department.

Mr. C. C. Edwards has been appointed acting master mechanic of the Chicago Great Western Railway at Red Wing, Minn., succeeding Mr. George Gregory, resigned.

Mr. Charles H. Smith is to be reappointed city engineer of Middletown, N. Y., Mr. J. Carl Thayer, whose appointment to the position was noted last week, having resigned.

Mr. M. E. Stark has resigned his position as superintendent of the Albany & Hudson Railway & Power Co. to become superintendent of of the Waterbury (Conn.) Street Railway Co.

Mr. W. E. Dauchy has resigned his position as chief engineer of the Chicago, Rock Island & Pacific Railway. He entered the service of the company in 1892 and became chief engineer in 1899.

Mr. Charles D. Seeberger, the originator of the escalator system, sailed for Europe on February 11, to complete arrangements for installing escalators in the stations of the new London underground railroad.

Mr. C. W. Murray has been appointed city engineer of Americus, Ga., succeeding Mr. J. B. Ansley, whose recent appointment in connection with the municipal work in New Orleans was announced in this column January 31.

Mr. Daniel W. Pike, of Messrs. Tuttle & Pike, civil engineers, has been appointed city engineer of Kansas City, Mo., succeeding Mr. R. W. Waddell, M. Am. Soc. C. E., who has resigned to join the Stewart-Peck Construction Co.

Major Thomas W. Symons, Corps of Engineers, U. S. A., is to take charge on June 1 of the public buildings and grounds in the District of Columbia, succeeding Col. Theodore A. Bingham, who will take up Major Symons' work at Buffalo.

Capt. Charles Keller, Corps of Engineers, U. S. A., has been ordered to transfer works in his charge at Grand Rapids, Mich., to Major James G. Warren, Corps of Engineers, and to take command of Company K, Third Battalion of Engineers, at Washington, D. C.

Mr. John M. Farley, M. Am. Soc. C. E., M. Am. W.-W. Asso., has opened offices in the Barnum Building, White Plains, N. Y., to engage in municipal engineering work, including water supply, sewerage and sewage disposal and railway location and construction.

Following the appointment of Mr. Lincoln

Bush to the position of chief engineer of the Delaware, Lackawanna & Western Railroad. Mr. Andrew J. Neafie has been made principal assistant engineer, and Mr. Alvin E. Deal, bridge engineer, with headquarters at Hoboken, N. J.

Mr. Fred F. Moore has resigned from the Metropolitan Water & Sewerage Board at Boston to accept a position with the New York commission for the investigation of additional water supplies.

Lieut.-Col. Charles W.. Raymond, Corps of Engineers, U. S. A., and Messrs. George S. Morison, Charles C. Schnelder, Henry W. Hodge, and Prof. Mansfield Merriman, have been appointed a commission to pass upon the plans for the Manhattan Bridge, New York City.

The Engineers' Club, of Philadelphia, visited New York on February 7. The party, numbering about 250, was escorted through the asphalt mastic works of the Vulcanite Paving Co., in Long Island City, in the morning and through the New York rapid transit subway in the afternoon. In connection with the excursion, Mr. Henry Wiederhold read a paper before the club the week previous on rock asphalt and asphalt mastic.

Mr. W. J. Wilgus, fifth vice-president of the New York Central & Hudson River Railroad, and Messrs. Bion J. Arnold, Frank J. Sprague, George Gibbs and Arthur M. Waitt have been appointed a commission to direct the electrification of the road in New York City; and the electrical and mechanical corps for this work has been placed under the general charge of Mr. Edwin B. Katte, as electrical engineer. Mr. Arthur J. Slade succeeds Mr. Katte as mechanical engineer, with office in New York, and will have charge of the designing and construction of heat, light and power plants and water and fuel stations.

At the nineteenth annual meeting of the Connecticut Society of Civil Engineers held at Hartford, February 10, the following officers were elected: President, Frederick L. Ford, Hartford; first vice-president, John K. Punderford, New Haven; second vice-president, Theodore B. Ford, Bridgeport; secretary and treasurer, J. Frederick Jackson, New Haven; directors, Edwin D. Graves and Henry J. Kellogg. The following were admitted to membership in the society: Honorary—Edgar Clark, Putnam, and Bradley H. Hull, Bridgeport. Active—Frederick S. Chapman, New London; William R. C. Corson, Hartford; Aubrey D. Fuller, New Haven; Percy T. W. Hale, Portland; Adrian C. Heltman, Jr., West Haven; Frank B. Jaynes, Bridgeport; Walter A. Jones, New Haven; Edwin M. Lee, New Haven; R. Q. Macmahon, New London; Major Charles F. Powell, Corps of Engineers, U. S. A., New London; George E. Smith, Derby; Joseph P. Wadhams, Torrington; Frederick S. Wardell, Stamford. Associate—F. B. Hastings, Bridgeport.

An Estimate of the Water Powers developed in several countries was given by Mr. A. Gradenwitz in a paper before the Frankfort Congress of German Naturalists and Doctors. His figures are as follows: Germany and Austria, 180,000 horse-power; Switzerland, 160,000 horse-power; Sweden, 200,000 horse-power; the United States, 400,000 horse-power. He estimates the total power available in several countries to be: Sweden, 2,000,000 horse-power; France, 10,000,000 horse-power; Germany, Austria, Switzerland, and Italy, about 10,000,000 horse-power, while in the United States the Niagara Falls alone could furnish 10,000,000 horse-power.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages 21, 22, 24 and 26.

WATER.

Lexington, Mass.—E. S. Locke, Water Comr., writes that contracts will be let about Mar. 15 for 9,000 ft. of 12-in. cast iron water pipe.

New Bedford, Mass.—See "Government Work."

New London, Conn.—The Water Works Dept. is reported to have purchased land in the annexed district, and will soon begin the construction of a reservoir pumping station and the laying of new pipe.

Lawrence, Mass.—W. F. Rutter & Co., of Lawrence, are stated to have secured the contract for 7,000 ft. of 6 and 8-in. iron pipe, for $4,373.

New Britain, Conn.—A press report states that contracts will soon be let by the Water Comrs. for building the retaining reservoir in Wolcott mountain. The main work will consist of the construction of two dams. The necessary excavating has already been done by the department. The department will also soon arrange for the sale of $75,000 bond issue to pay for the reservoir.

Yonkers, N. Y.—Bids will be received by the Water Comrs. Mar. 5 for pipe and castings, as advertised in The Engineering Record.

Schenectady, N. Y.—Alex. Fenwick, City Clk., writes in regard to the extension of the water supply to the 9th and 10th Wards that the work will probably cost $300,000. Chas. W. Trumbull, City Engr.

Smyrna, Del.—See "Power Plants, Gas and Electricity."

Newark, N. J.—The Bd. of Wks. is stated to have ordered 6-in. mains laid in 4 streets.

Washington, Pa.—The Dirs. of the Citizens' Water Co. are stated to have authorized improvements to the water plant, at a cost of about $100,000.

Esplen, Pa.—An application has been made for charters for two companies to be called the West Park Water Co. and the Ross Water Co. The former will supply water to Esplen and the latter to Ross Township. The companies have the same incorporators, among whom are W. J. Horgan and W. G. Stern.

Washington, D. C.—Local press reports state that Gen. Gillespie, Ch. of Engrs., has approved the recommendation of Lieut. Col. Miller, Corps of Engrs., U. S. A., the engineer in charge of the District water supply system, for the rejection of all bids received by him Jan. 28 for the construction of a slow sand filtration plant. It was also decided to secure new bids. (For list of bids opened see issue of Feb. 7.)

Allentown, Pa.—Bids will be received by the Water Comrs. Feb. 24 for furnishing material and constructing an extension to water works, as advertised in The Engineering Record.

St. Paul, Minn.—The following bids were tendered Jan. 31 for cast-iron pipe: Dimmick Pipe Co., $35 per ton; R. D. Wood & Co., $39.40 per ton for 4-in., $38.90 for 6-in., and $36.90 for rest; M. J. Drummond, $37.60 for 4-in., $36.60 for 6-in., and $35.50 for rest; U. S. Cast Iron Pipe & Fdy. Co. (awarded contract), all sizes, $32.30; Jas. B. Clow & Sons, all sizes, $34.60.

Watertown, N. Y.—The Water Bd. is reported to have decided to adopt a mechanical filtration system instead of a sand or slow system. A 6,000,000 gal. mechanical filtering plant will be installed. Specifications will be prepared and contracts let, and work will probably be begun in early spring; estimated cost, $100,000.

Buffalo, N. Y.—Local press reports state that contracts will soon be let by Com. Ward for ten 300-H.-P. boilers for the pumping station.

Gallitzin, Pa.—Frank U. Ferguson and Wm. P. Bracken are reported interested in a company just formed to construct water works in Gallitzin.

McKees Rocks, Pa.—The Council is stated to have granted the Fleming Park Water Co. a franchise to pipe the borough.

Wilmington, Del.—T. A. Leisen, the Park Engr. is reported to have completed the survey for the Porter reservoir at McKee's Hill.

Concord, N. C.—Bids will be received by the Bd. of Water Comrs. Mar. 3 for constructing water works, as advertised in The Engineering Record.

Greensboro, N. C.—The Senate has passed the bill authorizing the city to use $18,000 remainder of $25,000 bonds issued for electric plant, for the improvement of the water works.

Douglas, Ga.—The question of constructing water works and an electric light plant is reported under consideration. C. T. Roan, Mayor.

Bainbridge, O.—It is reported that bids are wanted Feb. 24 for building water works, including boiler and stack, pumping engine, water tower and tank. N. H. High, Village Clk.

Bird Island, Minn.—It is reported that the citizens have voted to construct water works.

Ft. Snelling, Minn.—Contracts for constructing water works at Ft. Snelling are stated to have been awarded as follows: Pump house, F. G. McMillan, of Minneapolis, $6,250; supply tank and trestle work, W. I. Gray & Co., Minneapolis, $5,325; pumping engines and equipment, Dwyer Htg. & Plumbing Co., St. Paul, $13,324, and extensions to present water main system. Allen Black Co., St. Paul, $13,000.

Madison, Wis.—See "Power Plants, Gas and Electricity."

Marquette, Mich.—The Water Bd. is reported to be considering the extensions of mains and intake pipe.

Flint, Mich.—The Council is reported to have directed the City Engr. to prepare an estimate of the probable cost of municipal water works.

Mt. Clemens, Mich.—Prof. Cooley estimates the cost of a new pump, with 2 new boilers, for the water works, at $10,000.

Moundsville, W. Va.—The Water Bd. is reported to be looking for a location for the construction of a new reservoir.

Pontiac, Mich.—Water bonds amounting to $15,000 are reported sold.

Holdenville, Ind. Ter.—Bids will be received on Feb. 25 by T. E. Neal, Recorder, for constructing water works, as advertised in The Engineering Record.

Chattanooga, Tenn.—Local press reports state that a water works plant is to be constructed to furnish the water supply for the new army post at Cloud Springs, Chickamauga Park. It will probably be located on the banks of the Chickamauga Creek, about 3 miles from the new post site.

Tuscumbia, Ala.—See "Power Plants, Gas and Electricity."

Wessington Springs, S. D.—Geo. R. Bateman, Town Clk., writes that the Stratton & Gilborne Mfg. Co., of Aberdeen, has received the contract for sinking an artesian well (bids opened Feb. 2) for $2,000.

Omaha, Neb.—The Senate and House are reported to have passed the bill granting the city of Omaha power to acquire municipal water works.

Great Falls, Mont.—Bd. of Water Comrs. on Jan. 31 awarded the contract for 18,120 ft. 6-in c. i. water pipe, 4,000 ft. 8-in. c. i. water pipe, and 9,810 specials, to Crane, Ordway Co., of St. Paul, Minn. Probably cost of of work, $29,000. C. W. Swearingen, City Engr.

Egan, S. D.—The citizens are stated to have voted to issue $5,000 bonds for water works.

Havre, Mont.—A syndicate, composed of J. W. Clark, T. F. Raymond, and others, are stated to have employed Co. Surveyor A. N. Merrifield, to prepare plans for a reservoir for water storage, from which to irrigate a large area of land s. w. of Havre and extending to the Ft. Assinniboine military reservation.

Colorado Springs, Colo.—The Fairley site is stated to have been chosen for the new reservoir to be built by the city. The reservoir and site will cost approximately $300,000; it will have a capacity of 17,500,000 gals. and be used to supply the entire north and east portions of the city.

Lakeview, Cal.—The Lakeview Water Co. will expend about $65,000 to enlarge and increase its water supply, according to press reports.

Ashland, Ore.—The City Council is stated to have adopted plans for water works improvements. It is proposed to replace 10-in. mains with 18-in. mains; estimated cost of improvement, $8,000.

Hotchkiss, Colo.—The Dog Fish Lake Reservoir Co. has been incorporated with a capital of $4,200, for the purpose of building canals and reservoirs in Delta County. The first to be built will be near Bald Peak. Directors, Jas. L. Cribb, W. S. Reynolds, and J. B. McGinty. The water will be used for irrigation purposes.

Tacoma, Wash.—The Special City Bd. consisting of Mayor Campbell, Comr. of Pub. Wks. Clark, and others having under consideration the establishment of a water plant for Tacoma, is reported to have directed City Engineer Taylor to prepare plans and estimates for a pumping plant, with necessary main and stand pipe connections suitable for the necessary high and low pressure service, utilizing the air lift wells as the source of water supply.

Salt Lake City, Utah.—In his annual report, City Engr. Kelsey recommends the construction of a storage reservoir at the forks of Parley's canyon, the acquisition of at least part of the primary water rights in big Cottonwood Creek, and the construction of a reservoir of at least 5,000,000 gals. capacity near the high line intake in City Creek canyon; an intercepting sewer in the western part of the city, and a pumping plant at 9th and N. for pumping the sewage into the gravity outlet sewer; the construction of a bulkhead across City Creek; the construction of a conduit to take the place of the present wooden flume from the screens to the brick tank in City Creek canyon; the extension of dead ends in the present water works system; the construction of automatic flush tanks at all dead ends of the present system; the extension of water mains through the blocks in the business district and the placing of hydrants for fire protection.

Claremont, Cal.—L. T. Gillett, Secy. Citizens' Water Co., writes that contracts will be let in about 30 days for improvements, to cost about $15,000.

Suisun, Cal.—F. W. Gabriel, Town Clk., writes that it is proposed to construct a 5-in. pipe line, at a probable cost of $25,000. Engr. H. N. Tracy, 151 Sansome St., San Francisco. An election on question will be held Mar. 25.

Winnipeg, Man.—Bids are wanted Feb. 17, for furnishing 1 simplex feed pump, 2 horizontal tubular boilers with smokestack and smoke box; also for 1 No. 7½ stone crusher, including belting, pulleys, coupling, etc. C. J. Brown, City Clk.

SEWERAGE AND SEWAGE DISPOSAL.

Portland, Me.—Rudolph Hering, of New York, N. Y., is stated to have submitted to City Council a report on the best method for the collection and disposal of the sewage of the West Side district, comprising a portion of Wards 8 and 9, west of Stevens Ave. He estimates the cost of sewer to Fore River at $66,671 and if extended to the permanent outfall it would cost $79,250.

Meriden, Conn.—Bids will be received by the Bd. of Pub. Wks., Mar. 5, for furnishing vitrified pipe, brick, cement, etc., as advertised in The Engineering Record.

Hartford, Conn.—The Bd. of Street Comrs. is stated to have authorized the City Engr. to prepare plans for a system of sewers to relieve the Franklin Ave. sewer.

Cape May, N. J.—The City Council is reported to have agreed to build a beach boulevard and a new sewer system, both improvements to cost $285,000. The city is to pay $125,000 toward the improvements and the syndicate headed by ex-Senator Wm. B. Flinn, of Pittsburg, to expend the balance. In addition the syndicate is to be bound to develop its 4 square miles of land, at an approximate cost of $2,000,000.

Newark, N. J.—Representatives of the South Side Improv. Assoc. have presented a petition to the Bd. of Wks. asking for the enlargement of the Peddie St. sewer. City Engr. Adam estimates the cost of the improvement at $92,000. He reports that the enlargement of the sewer should consist of building another one of about the same dimensions alongside of it, and recommended that this section be constructed first.

Corning, N. Y.—The Council is reported to have voted to issue $40,000 bonds for sewer construction and repair, principally in the 1st, 2d, and 5th Wards.

New York, N. Y.—Bids were opened Feb. 9 by L. F. Haffen, Pres. Bronx Boro., for constructing sewer in Mosholu Parkway North, from Webster to Perry Aves., and elsewhere, only the main items being given—*a*, F. Thilemann, Jr.; *b*, W. E. Welch; *c*, Peter Handebolt, Jr.; *d*, Thos. Murray; *e*, M. J. Leahy; *f*, Jos. M. Stanton; *g*, John T. Brady; *h*, J. H. Kerrigan; *i*, E. F. Brennan; *j*, Briggs & McLoughlin; *k*, John J. McQuade; *l*, Joseph Burns:

Bidders.	2' 9" sewer, 900 ft.	15" pipe, 665 ft.	12" pipe, 1,280 ft.	Spurs, 640.	Manholes, 29.	Rec. basins, 6.	Rock exc., 1,400 cu. yds.
a....	$9.50	$4.50	$4.00	$0.50	$50	$150	$3.00
b....	9.00	4.00	3.50	1.00	60	150	2.75
e....	9.00	4.00	3.50	...	85	175	...
d....	6.00	3.45	2.85	.50	50	130	2.25
c....	8.00	4.00	3.00	...	60	175	.60
f.....	10.00	3.50	3.00	...	50	150	...
g....	7.40	4.00	5.45	...	60	150	.01
h....	7.50	3.00	3.00	1.00	67	150	3.00
i.....	9.00	3.00	2.70	...	60	150	3.50
j.....	11.00	4.00	2.00	...	50	150	...
k....	10.00	3.00	3.00	1.00	60	150	2.90
l....	9.00	4.25	4.00	.50	40	150	3.00

Bids were also opened, at same time and place, for constructing temporary sewer, etc., in 4th Ave., bet. 15th and 18th Sts., White Plains Road, and elsewhere, only the main items being given—*a*, Robt. L. Christie; *b*, S. M. Castgolli; *c*, Wm. E. Welch; *d*, F. Thilemann, Jr.; *e*, M. J. Leahy; *f*, John J. McQuade; *g*, J. H. Kerrigan; *h*, J. C. Rodgers, Jr.:

Bidders.	15" pipe, 280 ft.	12" pipe, 3,770 ft.	8" pipe, 1,170 ft.	Spurs, 400	Manholes, 41	Rock exc., 250 cu. yds.
a.....	$5.00	$2.50	$2.00	....	$30	$2.00
b.....	3.00	2.00	.55	$0.10	33	.01
c.....	3.00	3.00	2.00	1.00	50	3.00
d.....	4.50	4.00	3.00	.50	60	4.00
e.....	2.25	1.90	1.00	.25	50	4.00
f.....	4.00	3.00	3.00	1.00	70	3.00
g.....	3.00	2.30	1.50	1.00	55	3.00
h.....	3.25	2.75	2.00	.40	50	5.00

New York, N. Y.—Bids were opened Feb. 9 by L. F. Haffen, Pres. Bronx Boro., for constructing temporary sewers in Van Buren and other streets, as follows, only main items being given:

Bidders.	18" pipe, 620 ft.	15" pipe, 1,580 ft.	12" pipe, 9,950 ft.	Spurs, 925	Manholes, 122.	Rock exc., 1,000 cu. yds.	Timber, 100,000 ft.	12" drain, 150 ft.	3" vit. pipe, 140 ft.	Catch bsns. and traps, 6.
Robt. L. Christie	$5.00	$3.00	$3.00	....	$25.00	$1.00	$20.00	$1.00	$0.50	$100.00
W. E. Welch	3.00	2.50	2.50	$1.00	50.00	3.00	....	1.00	1.00	50.00
John J. McQuade	3.00	3.00	3.00	1.00	60.00	3.00	30.00	1.00	1.00	60.00
E. F. Brennan	4.50	3.60	2.00	....	55.00	3.50	....	1.50	.40	150.00
F. Thilemann, Jr.	5.00	4.50	4.00	.50	60.00	3.50	20.00	1.00	.30	60.00
M. J. Leahy	3.10	2.10	1.95	.25	55.00	1.00	25.00	1.50	.20	100.00
Briggs & McLoughlin	4.00	3.00	2.00	....	60.00	3.00	....	....	....	150.00
J. C. Rodgers, Jr.	3.25	3.00	2.50	.30	50.00	3.00	25.00	1.00	.50	100.00

Binghamton, N. Y.—The Council has adopted a resolution directing the City Engr. to make a survey for a trunk sewer system in the western part of the city.

Atlanta, Ga.—Rudolph Hering, of New York, N. Y., in his report to Council on the sewerage system, recommends 3 septic tanks and purification plants for each tank, at a total cost of $135,000.

The Council is reported to have passed an ordinance appropriating $20,000 for the extension of the Wells trunk sewer to the city limits.

Pensacola, Fla.—It is stated that an election will soon be held to vote on issuing $75,000 bonds for a sewerage system, street paving and other public improvements.

Cincinnati, O.—Bids are wanted Feb. 17 for improving portions of Woodburn Ave. by constructing sewers and drains, with necessary appurtenances. Robt. Allison, Pres. Bd. of Pub. Service.

A. J. Henkel & Bro. are stated to have secured the contract for sewering Roeder St., Liston Ave. and Portland Ave., for $28,943.

Columbus, O.—An ordinance has been recommended to Council by the Bd. of Pub. Wks. for the construction of the Russell St. relief sewer, estimated to cost $33,839.

Valparaiso, Ind.—The contract for constructing the Sandy Hook ditch and the Cobb branch ditch is reported to have been awarded by Auditor Corboy to Trough Bros. and L. H. Carr; total amount of contract, $31,129.

Marshfield, Wis.—The Council is reported to be considering the question of issuing bonds for the construction of a sewerage system.

Winona, Minn.—Local press reports state that it is proposed to install a system of surface drainage in Winona this year.

Slayton, Minn.—John Knutson, Village Recorder, writes that the following bids were opened Feb. 2 for sewer work, consisting of 6,781 ft. of 8 to 15-in. pipe sewers, 12 manholes, 2 catch basins basins and 3 flush tanks: W. D. Lovell, Des Moines, Ia., $7,624; Fraser & Elliott, Rochester, Minn., $6,600; C. F. Lytle, Sioux City, Ia., $5,672; E. J. P. Staede, Mankato, Minn., $6,830; Ilstrup & Olson, Minneapolis, $4,772 (awarded contract).

Jacksonville, Ill.—Sewers will be constructed on Kosciusko St. and South Clay Ave. of vitrified pipe from 12 to 20 inches in diameter. C. H. Brown, City Engr.

Rock Island, Ill.—Engineer Wallace Treichler writes that bids will be received Mar. 3 for the construction of the Hampton Drainage Ditch, excavation 91,000 cu. yds.

Edgerton, Wis.—Edw. Ruger is stated to have completed plans for a sewerage system. The citizens will probably vote on the question of construction at the spring election.

Council Bluffs, Ia.—County Surveyor E. E. Cook, appointed by the Bd. of Superv. to investigate the construction of a drainage ditch in Rockford, Crescent and Garner Townships as continuations of the proposed Harrison County ditches, recommends that 3 ditches be constructed, at a cost of about $39,752.

Toledo, O.—Bids are wanted Feb. 23 for furnishing material for constructing 24-in. circular brick sewer and 4-in. shell, also 8, 10 and 15-in. circular pipe sewer in portions of Palmer St. and 2 alleys; bids will also be received Mar. 9 for constructing 24-in. circular brick sewer 4-in shell and 8, 10 and 12-in. circular pipe sewer in portions of 2 alleys. Chas. H. Nauts, City Clk.

Muncie, Ind.—Bids will be received Feb. 16 by the Common Council for constructing an 8 to 20-in. vitrified pipe sewer No. 1 in portions of Gharkey St.; bids will also be received Mar. 2 for constructing an 8 and 12-in. vitrified pipe sewer No. 2 in portions of 2d St., including manholes, catch basins, inlets and flush-tanks. R. G. Hickok, City Clk.

Racine, Wis.—At a meeting of the Council Feb. 2 plans were submitted for sewers in the district south of Washington Ave., west of Asylum Ave., to the city limits and north of the St. Paul R. R. track, at an estimated cost of $29,796. The Bd. of Pub. Wks. was instructed to prepare plans for a brick sewer in Blue River, from the 6th St. viaduct to Root River, and the time for receiving bids for the sale of the $55,000 sewer bonds was set for about Feb. 22.

Jackson, Mich.—At a meeting of Council Feb. 2 a communication from the joint meeting of the Bd. of Pub. Wks., the Mayor and the Ways and Means Com. regarding the sewer system of the city which included the bonding of the city for sufficient money to build certain trunk lines in the city. It was proposed that the people be allowed to vote on the project this spring; it is roughly estimated that the city's proportion of the expenses would be $76,000.

Burlington, Kan.—Burns & McDonnell, Postal Telegraph Bldg., Kansas City, Mo., have been engaged to make surveys and plans for sanitary sewers. Contracts will be let as soon as plans are completed.

Paducah, Ky.—Ancil E. Ratliff is stated to have secured the contract for constructing the Prairie branch drain in Fairmount Township, for $7,880.

Davenport, Wash.—The Council is stated to have selected Otto Welle, of Spokane, to prepare plans for a sewerage system.

Pasadena, Cal.—The Fairchild-Gilmore-Wilton Co. is stated to have secured the contract for a sewer in Lake Ave. and adjacent streets, for $11,434.

Mayfield, Cal.—There is reported to be a movement on foot here for the construction of a sewerage system.

Fairville, N. B.—The question of constructing a sewerage system here, at a cost of $10,000, is reported under consideration. The Legislature will be asked for authority to carry out the proposed plan.

BRIDGES.

Stamford, Conn.—It is stated that the Stamford St. Ry. Co. is having surveys made for a trestle which the Company intends building across Rippowan River at Main St.

Woonsocket, R. I.—The Finance Com. is reported to have under consideration the appropriating of $36,000 for repairing and widening the Globe Bridge at So. Main St.

Hartford, Conn.—The Senate has passed a bill authorizing the construction of a drawbridge across Connecticut River, at Hartford, by the Bd. of Comrs. of the Conn. Bridge & Highway Dist.

New Haven, Conn.—Press reports state that the N. Y., N. H. & Hartford R. R. officials are having plans prepared for several bridges to be built in connection with the grade crossings in Derby. The work is reported to include 2 and 3 span bridges across the river, and several canal bridges. C. M. Ingersoll, Jr., Ch. Engr., New Haven, Conn.

Corning, N. Y.—Mayor Miller recommends to the City Council the issuing of $15,000 bonds for Gibson bridge.

Massena, N. Y.—The St. Lawrence Power Co. is said to be contemplating the building of a bridge across the canal to replace present pontoon structure.

Allentown, Pa.—The Highway and Railroad Com. and the Mayor have been requested to confer with the Lehigh Valley and Jersey Central Railroads, the Lehigh Valley Traction Co., and the Co. Comrs. to ascertain what they will pay toward the erection of the proposed $35,000 bridge at Allen St.

Erie, Pa.—A resolution has been approved by Mayor Wm. Hardwick directing the City Engr. to prepare plans and specifications and estimate the cost of a bridge over Mill Creek at 3d St.

Pittsburg, Pa.—A bill has passed the House granting the Eastern R. R. Co., of Pittsburg, the right to build a bridge across the Monongahela River between Hazelwood and the south side of the river.

The Senate has passed a bill authorizing the Pittsburg Carnegie and Western R. R. Co. to construct a bridge across the Alleghany River at Pittsburg.

Hagerstown, Md.—The Co. Comrs. have decided to build an iron bridge across Beaver Creek, at McCauley's Mill.

Washington, D. C.—President Roosevelt has signed the bill providing for the strengthening of the Aqueduct bridge, and for the laying of a single electric car track across said structure for the accommodation of the Gt. Falls & Old Dominion R. R. Co.

Le Roy, N. Y.—See "Electric Railways."

Schenectady, N. Y.—Alex. Fenwick, City Clk., writes that it is proposed to construct a bridge across Cotton Factory Hollow, at a probable cost of $35,000. Chas. W. Trumbull, City Engr.

Newark, N. J.—Press reports state that the Hudson Co. Freeholders have agreed to co-operate with Essex Co. in the building of a bridge across Passaic River, from Delevan St., Newark, to Halstead St., Kearny.

Harrisburg, Pa.—The Secretary of the Commonwealth has granted a charter to the West Fairview and Harrisburg Bridge Co. for the purpose of constructing a bridge, two miles in length, across the Susquehanna River from Maclay St., this city, to North St., in the village of West Fairview. Capital, $10,000. Incorporators: Frank Martain, of West Fairview; J. W. Wetzel, and Conrad Hambleton, of Carlisle, and others.

Reading, Pa.—The Highway Com. has approved the plans submitted by the United Traction Co. for the proposed south approach to Front St. bridge. Plans for the abutments and superstructure, which are to be built by the Reading Ry. Co., have been approved. S. D. Missimer, Ch. Engr., U. Traction Co., 12 S. 5th St.

Scranton, Pa.—The building of a bridge at Race St., at a probable cost of $31,000, is being considered.

Port Perry, Pa.—See "Railroads."

Wheeling, W. Va.—Press reports state that specifications have been prepared for a 9-arch cut stone and concrete bridge to be built on the Shepherdtown cut-off of the B. & O. R. R. E. R. Curtis, Asst. Engr., Fairmount, W. Va.

Cincinnati, O.—The Bd. of Pub. Service has directed the City Engr. to prepare plans and specifications for repairing Liberty St. viaduct so as to accommodate pedestrians and wagons. The City Engr. estimates the cost of this repairing at $29,757.

Coshocton, O.—Press reports state that the 200-ft. iron bridge across Tuscarawas River, between Coshocton and Newcomerstown, has collapsed.

Lockland, O.—The Brackett Bridge Co., of Cincinnati, has, according to local press reports, secured the contract for the superstructure of the Clarke and Davis St. bridge between Lockland and Reading, at $7,140.

Elwood, Ind.—The Union Traction Co. is said to be contemplating the building of a bridge across Lake Erie tracks west of Elwood. A. J. Black, Ch. Engr., Anderson, Ind.

Ft. Wayne, Ind.—It is stated that the building of a dozen or more steel and stone bridges, on the eastern division of the Wabash, between Danville, Ill., and Toledo, O., and Ft. Wayne and Detroit, Mich., is contemplated. W. S. Danes, Supt. Bldgs. & Bridges, Peru, Ind.

Terre Haute, Ind.—The Comrs. of Vigo County are again considering the construction of a new bridge across the Wabash at Terre Haute. Probable cost, $200,000.

Lewiston, Wis.—It is stated that a steel bridge is to be built across Big Slough, at Menominee House, to cost from $3,000 to $5,000. O. C. Cushman, Lewiston, Chmn. Bd. of Superv. C. E. Corning, County Surv., Portage.

Cedar Rapids, Ia.—See "Electric Railways."

Lorenzo, Ill.—The Superv. of Will and Grundy Counties are considering the building of a bridge at Lorenzo, at a cost of from $18,000 to $30,000. Joliet, County Seat of Will Co.

Allegan, Mich.—The Co. Bd. of Superv. has authorized the building of a bridge across Kalamazoo River.

Faribault, Minn.—It is stated that the City Council has employed an engineer to prepare an estimate of the cost of building an overhead bridge, about ¼ mile long, across the Rock Island & Gt. Western Ry. tracks.

St. Paul, Minn.—Local press reports state that Jas. Forrestal Co. submitted the only bid, Feb. 3, for removing the piers of the Bway. bridge, at $18,000, if contractor retains the stone, or $18,500 if the stone is turned over to the city.

Milwaukee, Wis.—Bids will be received Mar. 6 by the Comrs. of Pub. Wks. for constructing a highway bridge across the North Menomenee canal at Muskego Ave. Chas. J. Poetsch, Chmn.

Plymouth, Wis.—Bids will be received Mar. 25 by the Town Bd. for constructing 4 stone and steel bridges. Elias Salsbury, Chmn.

Birmingham, Ala.—The Bd. of Revenue of Jefferson Co. will erect 3 small steel bridges.

Sherbrook, N. D.—Bids will be received Mar. 2 by the Bd. of Co. Comrs. for constructing several small combination steel and pile bridges. T. S. Hunt, Co. Aud.

Kearney, Neb.—Bids will be received Mar. 17 by the Bd. of Co. Superv. for furnishing material to construct a bridge over Wood River; bridge to be a 40-ft. under truss, with 20-ft. approach at north end and 16-ft. roadway.

Salina, Kan.—Bids are wanted Feb. 25 for constructing 2 steel bridges, each 70 ft. in length. G. J. Duncan, Co. Clk.

Topeka, Kan.—It is reported that the officials of the Union Pacific R. R. will build a bridge across Kansas River, east of Topeka. J. B. Berry, Ch. Engr., Omaha, Neb.

Carthage, Tenn.—Press reports state that the citizens of Smith Co. are considering the building of a bridge across Cumberland River, at Carthage, at a probable cost of $60,000, the town of Carthage to pay ¼ and the County to pay the remaining ¾.

Memphis, Tenn.—George E. Kessler has submitted to the Park Comn. plans for the development of walks and driveways through Riverside Park. These plans contemplate the construction of a steel bridge over a ravine 225 ft. or more in length.

Madison, Ark.—It is stated that a bill has passed the House and Senate authorizing the building of a bridge, by the Memphis, Helena & Louisiana Ry. Co., across St. Francis River, Ark.

Zona, La.—A bill has passed the House authorizing the building of a bridge across Bogue Chitto, La.

Oklahoma City, Okla. Ter.—An agreement has been reached by the Rock Island and City Officials to have plans prepared for a viaduct over the company's tracks east of the Santa Fe to cost $10,000.

Grandbury, Tex.—Press reports state that at the election held Jan. 27, it was voted to build a bridge across Brazos River, north of Grandbury.

Windsor, Ont.—It is stated that the City Officials are about to request the Michigan Central Ry. Co. to construct a steel bridge across its tracks at London St. W. S. Kinnear, Ch. Engr., Detroit, Mich.

PAVING AND ROADMAKING.

Fall River, Mass.—The Fin. Com. recommends a loan of $200,000 for beginning the construction of a roadway around North Watuppa Lake, in charge of Water Works Comn.

Hartford, Conn.—Local press reports state that the St. Bd. has voted to recommend the macadamizing of Laurel St. extension, to the junction of Wilson St., during the season of 1903.

Mattapoisett, Mass.—Press reports state that at a recent Town Meeting the citizens voted to purchase a stone crusher.

Holyoke, Mass.—The City Engr. and the Bd. of Pub. Wks. of Holyoke are reported to be considering the replacing of the present plank floor on 8 spans of the South Hadley Falls bridge with wood block paving, at a probable cost of $16,000. This structure consists of 10 spans, 8 of which are under the care of the city of Holyoke.

New York, N. Y.—The following bids were opened Feb. 9 by L. F. Huffen, Pres. Bronx Boro., for grading, flagging, etc., in Carter Ave., from E. 173d St. to Tremont Ave—A, F. V. Smith Contr. Co.; B, W. F. Murray; C, F. Thiemann, Jr.; D, D. W. Moran; E, Uvalde Asph. Pavg. Co.; F, Peter Handeboit, Jr.:

Bidders.	Exc., all kinds, 1,100 cu. yds.	Fill, 10,500 cu. yds.	New curb, 3,430 ft.	New flag, 13,500 sq. ft	New bridge-stone, 1,130 sq. ft.	Dry rubble, 1,430 cu. yds.	Lumber, 1,000 ft.
A...	$0.40	$0.40	$0.75	$0.23	$0.60	$1.50	...
B...	1.50	.45	.79	.29	.65	2.90	$39
C...	.50	.50	.65	.24	.55	1.50	25
D...	.29	.50	.70	.24	.60	2.00	30
E...	.01	.44	.70	.24	.55	1.50	1
F...	.65	.25	.65	.20	.50	2.90	...

New York, N. Y.—The following bids were opened Feb. 9 by L. F. Huffen, Pres. Bronx Boro., for asphalt paving on concrete foundation on Prospect Ave., from Southern Boule. to Crotona Park South—A, Continental Asphalt Paving Co.; B, Century Constr. Co.; C, Asphalt Constr. Co.; D, Barber Asphalt Paving Co.:

	A	B	C	D
Asphalt, 40,000 sq. yds...	$2.25	$1.30	$1.40	$1.24
Concrete, 7,200 cu. yds...	6.60	5.00	5.50	4.88
New curb (5x20-in.), 2,000 ft.	1.00	.82	.85	.82
Old curb reset, 13,500 ft..	.50	.25	.20	.18
New curb (4x14-in.), 13,-550 ft.	1.00	.51	.60	.61

Bids for asphalt block paving on E. 153d St., from Melrose to Morris Aves., were as follows:

Bidders.	Asph. blk. 3,620 sq. yds.	Concrete, 620 cu. yds.	New curb, 1,990 ft.	Old curb, 720 ft.
Continental Asphalt Paving Co.	$1.74	$6.60	$0.95	$0.50
Hastings Pavt. Co.....	1.68	6.00	1.00	.55

Syracuse, N. Y.—The Council has adopted a resolution to pave with Trinidad or Bermudez asphalt or with vitrified brick on a portion of Tracy St.

Cape May, N. J.—See "Sewerage and Sewage Disposal."

Millville, N. J.—T. H. Hogate, City Clk., writes that an ordinance has been passed by City Council providing for the paving of High, Main and Broad Sts. and Columbia Ave. Shale block or vitrified brick will probably be used.

Albany, N. Y.—Mayor Gaus has approved the ordinance authorizing the paving of Bway. from State to Steuben Sts., with asphalt.

Little Valley, N. Y.—It is stated that the Co. Bd. proposes to purchase a road machine.

St. George, S. I., N. Y.—Local press reports state that the Local Bd. has decided to pave portions of sveral streets, using macadam and brick.

Waynesboro, Pa.—The Town Council has decided to macadamize a portion of Cleveland Ave.

Somerville, N. J.—Bids will be received Mar. 4 by the Co. Bd. of Chosen Freeholders for macadamizing a road in Bridgewater Township, a distance of about ¾ of a mile; the bids to be for 8-in macadam for whole road complete, or 10-in. rock bottom for road complete. Wm. J. Logan, Dir.

McKees Rocks, Pa.—Press reports state that about 1½ miles of sidewalks are to be paved at once, on Highland Ave. and on Chartiers Ave.

Front Royal, Va.—The question of issuing $50,000 bonds for the purpose of macadamizing the main thoroughfares throughout Warren Co. is being agitated.

Roanoke, Va.—Bids will be received Mar. 5 by W. E. Thomas, Clk. of Council, for grading, macadamizing and guttering portions of Marshall Ave. J. H. Wingate, City Eng.

Savannah, Ga.—The City Council has decided to pave with brick on a portion of Perry Lane.

Local press reports state that an agreement has been reached between the property owners and the City Council whereby asphalt is to be used on Gaston St.

Columbus, O.—The Mayor on Jan. 29 approved the following ordinance: To improve Garfield Ave. from Mt. Vernon to Felton Aves. by grading and paving the same with asphalt, hard burned bricks or blocks, macadam or other substantial material, setting 5-in. curb and constructing the necessary subdrains and catch basins.

Toledo, O.—Garrigan Bros. are stated to have secured the contract to pave with Logan block on a portion of 11th St., at $3,413.

The paving of Millard Ave., from Jessie St. to the city line is under consideration.

Tipton, Ind.—A. W. Gott, Co. Surveyor, writes that the contract for constructing 6 miles of gravel road (bids opened Feb. 3) has been awarded to Lawrence Harlow, of Sharpsville, for $13,527.

Springfield, Ill.—The paving of N 7th St., a distance of 8 blocks, is being agitated and a petition is in circulation among the property owners.

Superior, Wis.—The paving of Ogden Ave. with asphalt is under consideration.

Grand Rapids, Mich.—The Common Council contemplates paving with asphalt block on Wealthy Ave.

Des Moines, Ia.—City Engineer John W. Budd estimates the cost of removing dirt and constructing proposed road down the river front to be used as a dyke, at about $28,000.

Boone, Ia.—Bids will be received Feb. 27 by Jesse L. Hull, City Clk., for furnishing material for grading, curbing and paving with brick on portions of several streets and alleys; 1,670 sq. yds. on 6-in., 5,915 sq. yds. on 5-in., and 1,180 sq. yds. on 4-in. concrete foundation, 1,730 lin. ft. cement curbing, etc. Chas. E. Russell, City Engr.

Marshall, Mich.—R. F. Grant, Recorder, writes that about ½ mile of brick paving will be laid. He also wants bids from engineers by Feb. 16, to take charge of the paving, at so much per month.

Alba, Ia.—Bids will be received Mar. 2, by the City Clk., for constructing 8,768 sq. yds. of brick paving with 4,902 lin. ft. stone curb.

Red Oak, Ia.—Bids will be received Feb. 25 by the City Clk. for constructing 41,000 yds. of brick paving with 21,483 ft. of curb.

Akron, O.—Local press reports state that the Street Com. has recommended the awarding of contracts for city paving as follows: High St., with Canton Metropolitan block, to James Wildes, at $19,619; North Broadway, with Canton Metropolitan block, to J. M. Davidson, at $2,932; Rose Ave., with Akron Granite block, to O. B. France, at $6,355.

Cleveland, O.—The Barber Asphalt Paving Co., according to local press reports, submitted the lowest bids for paving with brick ou portions of numerous streets (bids received Jan. 27), among which are the following, the prices given being with berea curb and concrete curb and gutter respectively: Tod St., $41,-281 and $46,422; W. Madison St., $31,615, berea curb; Walton Ave., $16,820 and $16,767; Pelton Ave., $15,-612 and $15,175; Kirtland St., $14,284 and $14,261; Rhodes Ave., $12,251 and $11,963; Edwards St., $12,-482 and $12,282; Seymour Ave., $9,609 and $9,591; Laurel St., $8,285 and $8,273; Delaware St., $8,945 and $8,632.

Local press reports state that bids received Dec. 23, Jan. 6 and Jan. 20, for paving with brick on portions of numerous streets, are to be readvertised.

Cincinnati, O.—Wm. Fogarty is reported to have secured the contract to pave with brick on a portion of Belvidere St., at a cost of $4,050.

The Bd. of Pub. Service, according to local press reports, awarded a contract for paving Westwood Ave. to Quebec Road, with brick, to H. Dieckmeier at his bid of $35,457.

Norwood, O.—Bids will be received Mar. 6 by W. E. Wichgar, Clk., for $10,143 street improvement bonds.

Muncie, Ind.—Bids will be received Feb. 16 by the Common Council for improving portions of North St. by grading, macadamizing and constructing 5 ft. cement sidewalk; bids will also be received Mar. 2 for improving portions of 2d St. by grading, macadamizing and constructing 6 ft. cement sidewalk, also 6 ft. cement sidewalk on portions of Madison St. R. G. Hickok, City Clk.

Rensselaer, Ind.—Bids are wanted Mar. 4 for improving 44,000 ft. of gravel roads. James C. Thrawes, Supt.

Milwaukee, Wis.—Bids are wanted Feb. 18 for $200,000 street improvement and $40,000 park bonds. Chas. F. P. Pulien, Chmn. Comrs. of Pub. Dept.

St. Paul, Minn.—The City Engr. estimates the cost of paving on 6th and Exchange Sts. and Central Ave. as follows: *a*, brick; *b*, sandstone; *c*, asphalt: 6th St., *a*, $24,607; *b*, $31,904; *c*, $19,164. Exchange St., *a*, $20,694; *b*, $26,814; *c*, $19,164. Central Ave., *a*, $9,769; *b*, $11,389; *c*, $8,872.

Davenport, Ia.—The City Council has authorized the paving of portions of numerous streets.

Sioux City, Ia.—Bids are wanted Feb. 17 for furnishing material for cement curbing and guttering portions of Kansas, Perry, Bluff and Market Sts. L. L. Cathcart, Chmn. Paving Com.

St. Louis, Mo.—Local press reports state that the Municipal Assembly has passed ordinances providing for the expenditure of over $2,000,000 for street work, the greater part for reconstruction.

Louisville, Ky.—Local press reports state that the Bd. Pub. Wks. will soon receive bids for improving 2,000 ft. of Von Borries Ave. with asphalt paving.

Tullahoma, Tenn.—The citizens of Coffee Co. are contemplating the issuing of $200,000 bonds for constructing good roads throughout the county.

Ogden, Utah.—Bids are wanted Mar. 2 for 7,500 lin. ft. of sandstone curbing, 7,000 sq. yds. sandstone block paving, and 9,000 sq. yds. asphaltum on concrete base. To be let in separate contracts. A. F. Parker, City Engr.

Salt Lake City, Utah.—City Engr. Kelsey estimates the cost of paving Second South St., at $97,216, and Third South St., at $30,689.

Seattle, Wash.—C. J. Erickson is reported to have submitted the lowest bid for grading Galer St., at $48,912.

Boise, Idaho.—Plans and specifications have been filed for paving with brick on portions of Main and 8th Sts.

Winnipeg, Man.—The City Council has decided to pave with asphalt and construct cut stone curbing, on a portion of Spence St., at an estimated cost of $10,700.

Montreal, Que.—The Road Com. is reported to have under consideration considerable street improvements, including the paving with asphalt on Victoria and Chabollez Squares.

Winnipeg, Man.—See "Water."

POWER PLANTS, GAS AND ELECTRICITY.

Mansfield, Mass.—It is stated it is proposed to organize the Mansfield Gas & Electric Co. to provide electric lights for streets, factories and business places. F. M. Cobb and Chas. C. Hagerty are reported interested.

Schenectady, N. Y.—The Mohawk Gas Co. writes that it is proposed to construct complete water gas works. C. F. Coffin, Engr. in Charge.

Waterville, N. Y.—The Waterville Electric Light & Power Co. is reported to have under consideration the plan to increase its steam plant so as to furnish steam to Marshall and Augusta as well as this town; also to increase its plant in other ways. H. P. Sweet, of Utica, Pres.; M. W. Terry, of Waterville, Secy.

Cambridge Springs, Pa.—The Council has granted W. B. Ross a franchise to establish an electric light plant.

Smyrna, Del.—The House has passed the bill authorizing the Town Council to borrow $6,000 for the improvement of the electric light and water plants.

Salem, N. Y.—Fay McFadden, of Granville, writes that the question of constructing a gas plant at Salem is under consideration.

New York, N. Y.—The following bids were opened by C. B. J. Snyder, Supt. School Bldgs., Feb. 9, for installing electric light wiring and electric bell system in Public School No. 145, Bronx Boro.: T. Fred. Jackson, $7,870; Fred. Pearce, $7,542; Peet, McAnerney & Powers, $8,350; Commercial Constr. Co., $8,278; C. E. Hewitt & Co., 13 Park Row, $7,424 (awarded contract).

Baldwins, L. I., N. Y.—The Nassau Gas Co. is about to petition the Highway Comrs. for a franchise to lay mains through Baldwins. Martin V. Wood, Pres.

Washington, D. C.—The Potomac River Power Co. is reported organized, with J. F. McLaughlin, of Toronto, Ont., as president, to erect buildings necessary for the establishment of a large water power plant near Washington.

Plattsburgh, N. Y.—It is stated the Delaware & Hudson R. R. Co. is to install an electric light plant at Plattsburgh.

Douglas, Ga.—See "Water."

Atlanta, Ga.—A definite proposition for the construction of a crematory and an electric lighting station, to be operated jointly, each to partially operate the other, will soon be made the city by Messrs. Collier & Brown.

Alton, Ill.—It is stated that the Alton Ry. Gas & Electric Co. will renew about 6 miles of gas mains in the near future. J. F. Porter, Pres.

Aurora, Ill.—It is stated that plans are being prepared for an electric light plant to be erected on Stone Ave. for the Fox River Light, Heat & Power Co.

Morrice, Mich.—The Shiawassee Light & Power Co. is reported to have in contemplation the extension of its lines to Morrice, a distance of 9 miles.

Benton Harbor, Mich.—The City Council is stated to have appointed a committee to investigate the question of constructing a municipal electric light plant.

Crystal Falls, Mich.—The Westinghouse Electric Mfg. Co., of Chicago, Ill., has secured the contract for a 150-Kw. single-phase and a 90-Kw. generator for the electric light plant, at $3,000, bids for which were opened Jan. 10.

Monticello, Wis.—The Village Council is stated to have granted J. H. Staedtler a franchise for an electric light plant.

Fertile, Minn.—The citizens are stated to have voted to construct an electric light plant, to be operated in connection with the water works.

Muscatine, Ia.—The City Council is stated to have instructed City Engr. Lamborn to secure bids for public and private lighting, for a period of 10 years. The specifications call for 50 all night lights, and 100 moonlight lights.

Springfield, O.—The Bd. of City Affairs has granted the Citizens' Light, Heat & Power Co. a 25-year franchise for the construction of a light, heat and power plant in Springfield.

Louisville, O.—M. Coy, City Clk., writes that it is proposed to have the town lighted with electricity by some corporation. He further states that Canton, which is about 7 miles distant, will likely get the contract.

Cerrogordo, Ill.—Ell Peck, Village Clk., writes that a company composed of M. N. Mikels and W. M. Rader will construct an electric light plant, at a probable cost of $8,000.

Plymouth, Mich.—Edw. Gayde, Village Clk., writes that at the spring election the citizens will vote on the question of issuing $12,000 bonds for an electric light plant.

Madison, Wis.—Engineers F. E. Tureaure and Storm Bull, of the College of Engineering, are reported to be preparing plans for the municipal central power and lighting plant. The plans provide for a pumping station for the water works, an electric plant for the lighting of the city streets and municipal buildings, facilities for furnishing power to the sewerage disposal plant, a garbage crematory and other garbage disposal arrangements; probable cost of the improvement, $100,000.

Escanaba, Mich.—Bids are wanted Feb. 16 for $50,000 gas and electric bonds. H. J. Robertson, City Clk.

Muncie, Ind.—Local press reports state that it is proposed to remodel the present electric light plant, instead of constructing a new plant.

Benton Harbor, Mich.—The Council is stated to have appointed a committee to confer with A. T. Maltby, a consulting engineer of Chicago, Ill., in regard to the construction of a municipal electric light plant.

Newport, Ky.—The City Council is stated to have passed an ordinance, providing for the setting aside of a fund amounting to $10,000 per year, to be used for the establishment of an electric light plant.

Tuscumbia, Ala.—The Sheffield Co. has been incorporated in New Jersey, with a capital of $425,000. The company will acquire the electric light franchise and franchises for trolley line in Tuscumbia and Florence and the water works of Sheffield. Geo. Parsons, of New York, N. Y., and Col. A. P. Andrews, of Raleigh, N. C., are reported interested.

Houston, Tex.—W. H. McGaldrich, of Beaumont, Tex., is stated to have petitioned the City Council for a franchise for a gas plant.

St. Joseph, Mo.—About $25,000 will be expended this spring by the St. Joseph Ry. Light & Power Co. in improving its lighting system in the outlying districts. W. T. Van Brunt, Mgr., St. Joseph.

Nashville, Tenn.—The Bullock Electric Mfg. Co., of Cincinnati, O., is stated to have secured the contract for an engine and generator for the electric light plant, at $5,615.

Sardis, Miss.—The Council is stated to have granted D. L. Rush, of Batesville, Miss., a franchise to construct and operate an electric light plant in Sardis.

Ft. Worth, Tex.—The Traders' Investment Co. is stated to have secured a franchise for an electric light and power plant.

Denison, Tex.—The Denison Light & Power Co. has purchased a site on So. Mirick Ave. and will erect on same an electric plant, to cost about $40,000.

Aberdeen, S. D.—The City Council is stated to have granted a franchise to the Aberdeen Gas Co. The company will install a gas and electric light plant.

Kelso, Wash.—The Metcalf Shingle Co. is reported to have submitted a proposition to the city to install an electric light plant.

Big Timber, Mont.—The Council is stated to have passed the ordinance, granting a 25-year franchise to the Big Timber Electric Co.

Oroville, Wash.—C. L. Pennell, of Massillon, O., is reported to have been employed by J. M. Hagerty to examine the water power on Similkameen River, 6 miles from Oroville, which he proposes developing for electrical purposes.

Aberdeen, Wash.—The Gray's Harbor Power & Light Co. has been organized, with a capital of $250,000 by John L. Wilson and E. C. Finch, of Aberdeen, to furnish light and establish an electric railway for Gray's Harbor cities. Power for running the plants will be obtained from Little North River Falls.

Toronto, Ont.—The Ontario Government is stated to have passed the order granting to Wm. Mackenzie, Fred. Nicholls, and others, of Toronto, a franchise to develop Niagara Falls power.

Canon City, Colo.—J. D. Taylor, Jr., Secy. Canon City Gas Co., writes that it is proposed to construct a gas plant, at a cost of about $50,000, and will take bids for the construction at once.

ELECTRIC RAILWAYS.

Rockland, Me.—The State R. R. Comrs. are stated to have approved the location of the Rockland, South Thomaston & Owls Head St. Ry. The proposed line will be about 8 miles in length, extending from Rockland to Keag Village, Ash Point, Crescent Beach and Owls Head.

Vergennes, Vt.—John J. Flynn, of Burlington, is reported to have purchased water rights here, and contemplates constructing an electric railway to connect Vergennes and near-by towns.

Montville, Conn.—The Montville St. Ry. Co. proposes extending its line from the New London and Norwich turnpike to Oakdale. W. S. Adams, Supt., Norwich.

Rutland, Vt.—Leroy M. Baldwin, 88 Wall St., New York, N. Y., is reported interested in the construction of a combination electric and steam railroad from Rutland to Randolph.

Concord, Mass.—The Concord, Maynard & Hudson St. R. R. Co. is stated to have petitioned the Council for a franchise to extend its tracks to the Lincoln line. John W. Ogden, Mgr., Maynard, Mass.

Granby, Mass.—It has been decided to extend the Hampshire & Worcester St. Ry. from South Hadley Center to Granby. E. E. Hammond, Ch. Engr., Ware.

Shelburne Falls, Mass.—Herbert Newell, of Shelburne Falls, is reported interested in the construction of an electric railway from Shelburne Falls to Ashfield and Buckland.

Rockville, Conn.—The Rockville & Broad Brook St. Ry. Co. is about to be formed, to construct a line from Rockdale to Ellington and Broad Brook, a distance of about 12 miles. C. E. Harwood, of Rockville, is reported interested.

East Hampton, Conn.—Eugene W. Chaffee and N. N. Hill, of East Hampton, are reported interested in the Moodus-East Hampton Tramway Co. which proposes constructing a line through the towns of East Haddam and Chatham. As soon as the charter is granted work will commence.

Chenango Forks, N. Y.—The Binghamton Ry. Co. has filed with the County Clk. a declaration of intention to extend its line to Chenango Forks, Port Crane and Owego. J. P. E. Clark, Gen. Mgr., Binghamton.

Oswego, N. Y.—The Rapid Transit Ry. Co., of Syracuse, is reported to be considering the proposition to develop the water power at High Dam.

The Syracuse Rapid Transit Co. has secured a franchise in Oswego. E. G. Connette, Gen. Mgr., Syracuse.

Schenectady, N. Y.—It is stated that the Schenectady Ry. Co. will extend its line from Schenectady and Watervliet to Troy. C. C. Lewis, Ch. Engr.

Utica, N. Y.—The Utica & Mohawk Valley Ry. Co. is reported to be considering the erection of a new power plant. C. L. Allen, Mgr., Utica.

East Orange, N. J.—It is stated that work will soon commence on the construction of the line of the North Jersey St. Ry. Co. through East Orange. D. Young, Mgr., Jersey City.

Cumberland, Md.—The Cumberland Narrows Electric Ry. Co. has been incorporated by R. H. Koch, of Pottsville, Pa.; Benj. A. Richmond, and others, of Cumberland, with a capital of $10,000, to build an electric line from Narrows Park to the Baltimore & Ohio depot in Cumberland.

Buffalo, N. Y.—The International Ry. Co. is stated to have petitioned the Bd. of Aldermen for a franchise to construct 4 new street car lines.

Trumansburg, N. Y.—H. F. Bell, representing promoters of an electric railway between Ithaca, Seneca Falls and Waterloo is about to apply for a franchise here.

Elkton, Md.—The City Council is stated to have granted a franchise to the Kent & Cecil Electric Ry. Co.

Burlington, N. J.—The People's Traction Co. is stated to have petitioned the City Council for a franchise to lay its tracks out High St. Chas. W. Atmore, Ch. Engr., Arcade Bldg., Philadelphia, Pa.

Long Branch, N. J.—The Monmouth County Electric Co. is stated to have petitioned the Comrs. for a franchise to construct a line on Bway. and 3d Ave. Wm. F. Hogan, Gen. Mgr., 643 10th St., Brooklyn, N. Y.

Saratoga, N. Y.—The North River Ry. Co. is stated to have secured a franchise in Saratoga. It will also extend its line to Schuylerville and Corinth, a distance of about 26 miles.

Le Roy, N. Y.—The Buffalo & Depew Trolley Co. has secured a franchise through the village on its proposed route from Buffalo to Rochester. The company will construct a bridge over the Oatka at Main St., at a cost of about $8,000.

Brooklyn, N. Y.—Plans are about to be prepared for a large power house for the Brooklyn Rapid Transit Co. The location has not yet been determined. Edwin W. Winter, Pres.

Lancaster, Pa.—The City Council has granted a franchise to the Lancaster & Rocky Springs Ry. Co.

Richmond, Va.—Frank J. Gould, of New York, N. Y., owner of the plant of St. Ry. & Power & Lighting Co., is stated to have authorized the expenditure of $50,000 for the enlargement of the power plant at 12th St.

Lancaster, O.—The Lancaster Traction Co. is stated to have decided to double track Main St. and make other improvements. F. E. Glon, Supt., Lancaster.

Xenia, O.—The Xenia & Wilmington Traction Co. is stated to have decided to erect a power station at Xenia. Chas. Orr, of Cleveland, is reported interested.

East Liverpool, O.—The East Liverpool & Rock Springs Ry. Co. is stated to have petitioned the Council for a franchise to lay 2 miles of tracks in Liverpool.

It is stated that the East Liverpool St. Ry. Co. is to make a number of improvements including the double tracking of a portion of the road and the purchase of a 250-H.-P. boiler for the power station.

Canton, O.—The Canton & Dover Electric Ry. Co. has been incorporated, with a capital of $10,000, to construct a line from Canton to Dover, about 23 miles in length. A. M. McCarty and Wm. Wagner, of Canton, are among the incorporators.

Milton, Ind.—The Richmond St. & Interurban Ry. Co. is reported to be considering the extension of its lines from Milton to Connersville. John Hartmann, Ch. Engr., Richmond.

Indianapolis, Ind.—The Indianapolis & Cincinnati Traction Co. has been incorporated, with a capital of $1,500,000, by Chas. L. Henry, W. L. Taylor and others. The line in Indiana will run from Indianapolis to New Palestine, Morristown, Rushville, Connersville, and Brookville.

Portland, Ind.—The Council is stated to have granted a franchise to the Dayton, Union & Huntington Ry. Co.

Kalamazoo, Mich.—John Blair MacAfee, of Philadelphia, Pa., is stated to have secured the contract for constructing the Grand Rapids & Kalamazoo Interurban Ry.

Hillsdale, Mich.—Geo. M. Clarkson and M. C. Peterson, of Ann Arbor, are reported interested in the construction of an electric railway from Hillsdale to Bryan.

Des Moines, Ia.—A correspondent writes that the Des Moines City Ry. Co. will lay 10 miles of new track and equip the entire system with double truck cars, expending in all $500,000. J. E. Welch, Ch. Engr., Des Moines.

Cedar Rapids, Ia.—J. D. Wardle, Ch. Engr., Cedar Rapids, Iowa City & Southern Ry. Co. writes that it is proposed to construct an electric railway from Cedar Rapids to Iowa City, via Curtis, North Liberty and Coralville, a distance of 30 miles. Contracts for the work will be let about Mar. 1. The grading will require the removal of about 600,000 yds. of earth, 38,000 lin. ft. of piling, 750,000 ft. of timber, and 40,000 lbs. of bridge hardware will be used. Three bridges will be constructed, one over Cedar River at Cedar Rapids and two over Iowa River at Iowa City and Curtis. They will require four 150-ft. spans and four 125-ft. spans. Estimates are now being made on electrical equipment.

Oelwein, Ia.—The Oelwein & Northwestern Interurban & St. Ry. Co. is reported organized, with John Jamison, Pres., and Wm. A. Reed, Secy. It is the intention of the company to build its first line through Scott to Arlington or Strawberry Point.

Dixon, Ill.—The Sterling, Dixon & Eastern Electric Ry. Co. is stated to have petitioned the Council for a franchise.

Decatur, Ill.—H. W. Wright is stated to have petitioned for a franchise for an electric railway to be constructed between Bloomington and Decatur.

Depere, Wis.—The Knox Engineering Co., of Chicago, Ill., is stated to have secured a franchise in Depere for an electric railway which it proposes constructing between Kaukauna and Green Bay.

The Fox River Electric Ry. & Power Co. is stated to have secured a franchise to extend its line into Depere. Mitchell Joannes, Gen. Mgr., Green Bay.

Sidney, O.—Bids are wanted Feb. 23 for the construction and operation of street railroad route No. 3. Address H. S. Alles, City Clk.

Mansfield, O.—The Citizens' Ry. Light & Power Co. is reported to be planning to extend the Shelby-Mansfield line to Norwalk or Monroeville, to connect with the Lake Shore Electric Ry. R. Carpenter, Gen. Mgr., Mansfield.

Youngstown, O.—The Pennsylvania & Mahoning Valley Ry. Co. (John Wolf, Ch. Engr., Youngstown) will make important improvements to the city line of the New Castle Traction Co. The system will be extended throughout the city, and new rolling stock added.

John Stambaugh, Geo. Rose, and other local capitalists are reported to be forming a company to build a new city line from Central Square out Market St. to the plant of the National Steel Co.

East St. Louis, Ill.—The City Council is stated to have granted a franchise to the East St. Louis & Suburban Ry. Co. for a single track line on 3d St. It is proposed to form a loop for bridge car service and also improve city service. R. F. Clark, Ch. Engr., East St. Louis.

Terre Haute, Ind.—The City Council is stated to have granted a 50-year franchise to the Terre Haute St. Ry. Co. The company will now make extensions and construct some interurban lines.

Lebanon, Ind.—The Comrs. of Boone Co. are stated to have granted the Consolidated Traction Co. a franchise in Jackson Township. Edw. Hawkins, Gen. Mgr., Indianapolis.

Joplin, Mo.—The Mineral Cities Electric Ry. Co. is reported to be planning to begin at once the construction of its line to connect Joplin and Pittsburg; it will be about 60 miles in length.

Glasgow, Ky.—W. B. Smith and Dr. J. S. Leech, of Burkesville, are reported interested in the construction of a railway for Glasgow.

Wildman, Okla. Ter.—A company is reported incorporated, with a capital of $50,000, to construct an electric railway to connect Mountain Park and Wildman, a distance of about 15 miles.

Gainesville, Tex.—A correspondent writes that this place is considering the construction of an electric railway.

Newton, Kan.—The Union Electric Ry. & Construction Co. is stated to have petitioned the Harvey Co. Comrs. for a right of way through the county, connecting McPherson, Newton, Arkansas City, and intermediate points, with Wichita.

Clayton, Mo.—The St. Louis, Kirkwood & Manchester R. R. Co. has petitioned the Co. Comrs. for a franchise for a branch from its main line, westward from Des Peres through Valley Park to the Meramac River.

Great Falls, Mont.—E. E. Shepard, of Austin, Minn., is reported interested in the construction of an electric railway from Great Falls to Choteau, a distance of 60 miles.

San Bernardino, Cal.—The City Trus. are stated to have granted a franchise on 4th St. to Geo. M. Cooley, representing the San Bernardino Valley Traction Co.

Springville, Utah.—The Council is reported to have granted an electric railway franchise to Reed Smoot and Jesse Knight.

Bakersfield, Cal.—It is stated that arrangements have been completed for the construction of an electric railway from Ventura County to Bakersfield. John Burson is reported interested.

Monterey, Cal.—H. C. P. Smith is stated to have secured a franchise for the construction of an electric railway in Monterey.

Aberdeen, Wash.—See "Power Plants, Gas and Electricity."

Chatham, Ont.—N. H. Stevens, Pres. of the Canada Flour Mills, is reported interested in the construction of an electric railway through Kent County.

RAILROADS.

New York, N. Y.—Plans for the New York Central terminal improvements, including the abolition of steam as a motive power in the Park Ave. tunnel, are now practically completed. The company is getting ready to spend over $20,000,000 on the changes to be made after the Legislature grants the necessary authority and the city finally assents to the proposals for use of additional street space near the Grand Central Station and numerous changes in existing street grades. W. J. Wilgus, Ch. Engr., New York.

Jersey City, N. J.—The power house of the Pennsylvania R. R., at the east end of the cut in Jersey City, is reported to have been destroyed by fire Feb. 4th. The building was a frame structure, covered with corrugated iron. It contained 5 boilers, 2 engines, 3 generators and 3 compressors; loss estimated at about $70,000. F. P. Abercrombie, Div. Supt., Jersey City.

Elkton, Md.—It is reported that the Philadelphia, Baltimore & Washington R. R. Co. will expend about $300,000 in improvements. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Pittsburg, Pa.—The Pittsburg, Shawmut & Northern R. R. Co. is stated to have filed with the Secy. of State a certificate of increase of its capital from $12,000,000 to $15,000,000. The purpose of the increase is to fund the many improvements that the company is making now or has in contemplation in the near future. Among the improvements is a line from Wayland north to Macedon and a branch line to Lake Ontario. M. F. Bonzano, Ch. Engr., Olean, N. Y.

Philadelphia, Pa.—Bids are wanted Feb. 16 for furnishing material necessary to complete the grading and masonry for a double track railroad between Parkesburg and Columbia, to be let in 8 sections. Wm. H. Brown, Ch. Engr., Pennsylvania R. R. Co.

Oneida, N. Y.—A press report states that the grade crossings of the N. Y. Central R. R. at James and Williams Sts. will probably be eliminated in the near future; probable cost of work is $45,000. A. H. Smith, Gen. Supt., New York.

Hornellsville, N. Y.—The Sharon & Sears R. R. Co. of Hornellsville, has been incorporated, with a capital of $10,000, to build a steam railroad about 1/4 mile long from the Sharon & Sears R. R. of Pa. to the Pittsburg, Shawmut & Northern Ry. Directors: Wm. Cobb, of Spring Mills, and Benton McConnell, of Hornellsville.

Port Perry, Pa.—Plans for the new short line which the Baltimore & Ohio will build through Southern Pennsylvania have been completed and approved and contracts for construction will soon be let. The new line will leave the present main line at Port Perry, passing through East Pittsburg, and striking the route of the old South Penn near Gratztown, Pa. The road will rejoin the main line near Hancock, Md., where the company will build a bridge across the Potomac River. J. M. Graham, Chief Engr., Baltimore, Md.

Jacksonville, Fla.—Arthur Meigs is reported to have petitioned the Council for a franchise for a railroad in East Jacksonville.

Burnsville, N. C.—The Caney River Railway Co. has been chartered in North Carolina, with J. M. Buck, N. H. Wood and Hackney Wood, all of Johnson City, Tenn., as incorporators. The charter provides that a road may be built from Yancey County, N. C., to any point in Mitchell, Madison or Yancey Counties of North Carolina.

Niles, O.—The Baltimore & Ohio R. R. is reported to have awarded the contract for grading, masonry and construction of a road between Niles and Newton Falls, O., to F. H. Clements & Co., of Philadelphia, Pa., for $600,000.

Minneapolis, Minn.—A press report states the Soo Line is to expend $1,000,000 in improvements, consisting of the relaying of 163 miles of road with 80-pound rails, the ballasting with heavy gravel of 300 miles of road and the filling of bridge cuts with 400,000 yds. of dirt. Thos. Greene, Ch. Engr., Minneapolis.

Knoxville, Tenn.—The Tennessee & North Carolina Ry. Co. is reported to have issued $750,000 bonds to be used in making eastern connections. H. T. Wilson, Gen. Supt., Newport, Tenn.

Oneonta, Ala.—It is stated that work will soon commence on the proposed extension of the Oneonta branch of the Louisville & Nashville R. R. from Oneonta to Attala and Gadsden. R. Montfort, Ch. Engr., Louisville, Ky.

Helena, Ark.—Geo. D. Updegraff and M. E. West are reported interested in the construction of a railroad from Helena to the boundary line of Missouri, a distance of 110 miles.

New Orleans, La.—The City Council is reported to have adopted an ordinance granting a franchise to the New Orleans & San Francisco R. R. Co.

The Shreveport & Red River Valley Ry. Co. is stated to have petitioned the Council for a right of way to extend its line to New Orleans. It now operates a line from Shreveport to Mansura. J. M. Phillips, Ch. Engr., Shreveport.

Lawton, Okla. Ter.—A charter is stated to have been granted to the Lawton, Wichita & Gulf Ry. Co., of Lawton, with a capital of $1,000,000. The proposed road will be 600 miles in length, from the northern boundary of Woodward County south through the Counties of Woodward, Dewey, Custer, Washita, Caddo and Comanche, in Okla., thence southeasterly to the Gulf of Mexico. Incorporators: Robt. E. Huff, Wichita Falls, Tex.; H. E. Julian and G. W. Crosby, of Lawton.

Blackwell, Okla. Ter.—A charter has been granted to the Blackwell & Northeastern R. R. Co. to take the place of the Blackwell, Enid & Southwestern, the property of which has passed into the hands of the Frisco. The new company has a capital of $50,000, and takes up the work of the old organization in constructing a line 105 miles long from Blackwell to Coffeyville, Kan., thence to a point below Kansas City, Mo., on the east Kansas State border, a distance of 150 miles. Incorporators: Ed. L. Peekman and J. G. Blanchard, of Blackwell; Frank Dale, Guthrie, and others.

Oklahoma City, Okla.—A press report states that the contract for the construction of the Oklahoma City & Southwestern R. R., to be built from Oklahoma City to Coalgate by the 'Frisco (C. D. Purdon, Ch. Engr., St. Louis, Mo.) would be let about Mar. 1.

St. Louis, Mo.—The 'Frisco is stated to have completed the survey for its new line from St. Louis to Chicago. The line will cross the Wabash at Sidney, the Lake Erie & Western at Rankin, the Illinois Central near Penfield, and the Big Four at Ogden. C. D. Purdon, Ch. Engr., St. Louis.

Ashland, Ky.—The Chesapeake & Ohio R. R. Co. is reported to be making preparations to extend the double track eastward from Guyandotte and Barbourville, and work will be commenced at once. It is the intention of the company to double track its entire system. H. C. Boughton, Div. Supt., Ashland.

Mayfield, Ky.—An engineer of the construction department of the Illinois Central R. R. Co. is reported to be surveying the route from Mayfield to Gilbertsville, 28 miles, for the purpose of building an air line. H. U. Wallace, Ch. Engr., Chicago, Ill.

Bakersfield, Cal.—The Midland Pacific R. R. Co. is about to begin a survey for the construction of a line from Bakersfield to Port Harford.

South Bend, Wash.—The Northern Pacific R. R. Co. is stated to have decided to survey for an extension of its South Bend branch to some point on the Columbia, a distance of about 30 miles. W. L. Darling, Ch. Engr., St. Paul, Minn.

PUBLIC BUILDINGS.

Fall River, Mass.—It is proposed to erect a municipal building to accommodate certain city departments, at a cost of $100,000.

The city proposes erecting a contagious disease hospital, at a cost of $25,000; also to purchase a site and erect buildings to be used for a city poor farm.

Taunton, Mass.—Plans are reported to have been prepared for the 152x312-ft 2-story Carnegie Library, to be erected on Pleasant St., at a cost of $59,750. Architect, Albert R. Ross.

Providence, R. I.—Bids will be received Mar. 4 by the Providence Armory Comn. for erecting an armory. Wm. R. Walker & Son, Archts., 17 Custom House St. D. Russell Brown, Chmn.

Concord, N. H.—A bill has been introduced in Legislature providing for an appropriation of $60,000 for additional buildings at the State Hospital for Insane. Dr. Chas. P. Bancroft is Supt.

New York, N. Y.—The following bids were opened Feb. 9 by Thos. Sturgis, Fire Comr., for the erection of an engine house on Chambers St., near Park Row: Thos. B. Leahy, 9 E. 42d St., $98,985; Tolmie & Kerr, 205 W. 30th St., $102,459; Peter J. Ryan, $105,513; Alfred Nugent & Son, $106,000; Thos. Cockerill & Son, $108,900; Murphy Bros., $109,630; Herman Probst, $111,400; Herman F. Lippe & Bro., $111,795; Wm. Horne Co., $114,477; Johnson, Kahn & Co., $119,900.

Braddock, Pa.—The Congregation of the Sacred Heart Polish Catholic Church are reported to be considering the erection of an edifice at Talbot Ave. and 6th St.; probable cost, $50,000.

Perkasie, Pa.—Saml. Stone, of Perkasie, is reported to have received the contract for the erection of the St. Stephen's Reformed Church, at a cost of $20,000.

Philadelphia, Pa.—The Senate has passed a bill providing for an appropriation of $500,000 for a State Institution for feeble minded and epileptics in Eastern Pennsylvania.

Philip H. Johnson is stated to have prepared plans for the Municipal Hospital for Contagious Diseases to be erected in the 39th Ward; probable cost, $300,000.

Washington, D. C.—The Senate ordered a favorable report on the proposed amendments to the District Bill appropriating $100,000 for improvements to Providence Hospital, and $50,000 for improvements to the Homeopathic Hospital.

A. O. Von Herbulis, of Washington, is stated to have prepared plans for a 182x210-ft. stone building to be erected opposite the Catholic Univ. for the Dominican Fathers.

The House is stated to have passed a bill authorizing the erection of a building for the Dept. of Agriculture, at a cost of $1,500,000.

Baltimore, Md.—It is stated that the St. Paul's Reformed Society will erect a church here to cost $30,000.

Long Island City, N. Y.—Bids will be received Feb. 20 by Thos. Sturgis, Fire Comr., for furnishing material for erecting a building for Hook and Ladder Co. No. 66, on Jackson Ave.

Randall's Island, N. Y.—The following bids were opened Jan. 16 by A. E. Orr, Pres. Bd. Mgrs., for plumbing improvements, Girls' Dept. and Shop, House of Refuge for Juvenile Delinquents: Howe & Bassett, Rochester, $4,500; Richard T. Ford, Rochester, $4,700; Edw. Joy, Syracuse, $6,179.

Johnson City, Tenn.—Bids will be received at the office of the Natl. Home for D. V. S., 346 Bway., New York, N. Y., Mar. 12, for furnishing material, labor, etc., for the equipment of the Hospital near Johnson City, as advertised in The Engineering Record.

Cleveland, O.—Lehman & Schmitt, Hickox Bldg., are reported to be preparing plans for the 4-story court house to be erected at Ontario and Lake Sts. The structure will be 520x250 ft. and cost $7,000,000.

Minneapolis, Minn.—The Senate has passed a bill authorizing the issue of bonds for the erection of a court house and city hall.

Centerville, Ia.—W. M. Peatman is reported to have received the contract for the erection of the Appanoose County Court House for $69,900.

Xenia, O.—Bids will be received Feb. 25 by the Trus. of Ohio Soldiers' & Sailors' Home for furnishing and erecting boilers, foundations and ash tunnel and ash conveying machinery, feed water connections, cement floors, etc. Also for removing old boilers. Orin C. Baker, Financial Officer.

Chicago, Ill.—Bids are wanted Feb. 16 for furnishing material and erecting the 2-story and basement brick fire engine house at No. 6843 Jefferson Ave. F. W. Blocki, Comr. Pub. Wks.

Portsmouth, O.—The date of receiving bids for erecting the Carnegie Library has been extended to Mar. 16. Architects, Richards, McCarty & Bulford, Columbus. E. D. Poffenberger, Secy. Library Bd.

Decorah, Ia.—Bids are wanted Mar. 3 for erecting a court house according to plans prepared by Kenney & Detweiler, Archts., Minneapolis, Minn. F. A. Masters, Co. Aud.

Elba, Ala.—It is stated that the Coffee County Court House will be erected here, to cost $20,000.

St. Louis, Mo.—The American Bridge Co., of New York City, is reported to have received the contract for the erection of the power house to adjoin the Machinery Building, for $100,000. The structure will be a steel building, 220x300 ft.

Houston, Tex.—The following bids for erecting a city hall and market house were received by the City Council (D. D. Bryan, City Secy.), Feb. 2: A. T. Lucas, Houston, $85,256, and C. C. Wenzel, Houston, $83,085. Bids were referred to Board of Pub. Wks.

New Decatur, Ala.—It is stated that Mayor Turner suggested that the city issue $25,000 worth of bonds for the erection of a city building.

Winnipeg, Man.—Bids are wanted Feb. 23 for erecting the Carnegie library. H. S. Griffiths, Archt.; C. J. Brown, City Clk.

Libraries.—Andrew Carnegie is stated to have made the following cities offers for libraries: Atlantic City, N. J., $60,000; Auburn, Me., $25,000; Colorado Springs, Colo., $50,000.

BUSINESS BUILDINGS.

Providence, R. I.—The American Ship Windlass Co. contemplates adding a foundry about 125 ft. long and about 105 ft. wide to its plant. The company also contemplates building a dock. A 10-ton electric traveling crane, one or two smaller cranes and traveling trolleys for rapid distribution of metal will probably be installed.

Jersey City, N. J.—Plans are stated to have been filed by the Erie Land & Improvement Co. for the 2-story brick freight house to be erected at 28th St. and 11th Ave., to cost $30,000.

Braddock, Pa.—It is stated that Benj. Braznell will erect a 4-story stone and brick addition to the building at Braddock Ave. and Library St. at a cost of $75,000.

Turtle Creek, Pa.—It is stated that the East Pittsburg Const. Co. will erect a 5-story brick building in Penn Ave., to cost $35,000.

McKeesport, Pa.—H. J. Lohman, National Bank of McKeesport Bldg., is stated to be preparing plans for a 2-story brick building to be erected at Ringold and Sinclair Sts., for Jas. E. White; approximate cost, $25,000.

Pittsburg, Pa.—A. & S. Wilson, 541 3d Ave., are reported to have received the contract for the alterations to the Park Bldg., to cost $20,000. Rieger & Currier, Archts.

Frankford, Pa.—W. B. Allen, Pres. Colonial Lumber Co., is reported interested in the erection of a theatre on the site of the Empire Music Hall; estimated cost, $100,000.

Homestead, Pa.—It is stated that the Monongahela Trust Co. will erect a 3-story stone and brick office building at 8th Ave. and Ann St., at a cost of $50,000.

Hagerstown, Md.—The Elks of this city are reported to be considering the erection of a $25,000 hall.

Altoona, Pa.—It is stated that the Elks of this city will erect a 4-story brick building at 12th St. and 12th Ave.

Philadelphia, Pa.—The Rapid Transit Co. (W. S. Twining, Ch. Engr.) is reported to be having plans prepared for a car barn to be erected at Frankford Ave. and Bridge St., Frankford.

Plans are reported as having been approved for the erection of a car barn at Broad and Hoyt Sts.

Charlottesville, Va.—Paul J. Pelz, of Washington, D. C., is reported to have submitted plans for the 2-story 106x128 ft. athletic club house to be erected on the grounds of the Univ. of Virginia; estimated cost from $40,000 to $50,000.

Richmond, Va.—It is stated that the Virginia Passenger & Power Co. (Calvin Whiteley, Jr., Ch. Engr.) is considering the erection of a car barn in Manchester.

Cincinnati, O.—It is stated that the Methodist Episcopal Home for the Aged of Ohio at Yellow Springs, which was recently destroyed by fire will be rebuilt. Saml. Hanaford & Sons, Hulbert Blk., are reported to have prepared plans for a 5-story structure to cost $150,000, to be erected south of College Hill.

Saml. Hannaford & Son are stated to have prepared plans for a 10-story, 90x97-ft. office building, to be erected at 8th and Race Sts. for M. M. Robertson, President of the Robertson Sewing Machine Co.; probable cost from $150,000 to $200,000.

It is stated that the Lackman Brewing Co. will remodel the Aetna building at Vine and 5th Sts., at a cost of about $100,000.

Alton, Ill.—The Alton Banking & Trust Co. will receive plans from architects for a 3-story building, to cost about $20,000. S. W. Wyss, Pres.

The Bluff City Brewery will expend $20,000 for a new building and machinery.

La Crosse, Wis.—Hands & Cady, Chicago, Ill., have been selected to prepare plans for a $100,000 hotel for La Crosse.

Newark, O.—The Columbus, Buckeye Lake & Newark Traction Co., in conjunction with the Newark & Granville St. R. R. Co. and the Newark & Zanesville Traction Co., contemplate the construction of a car barn, including repair shop and substation at Newark; size of building, 225x142 ft. E. H. Kitfield, Archt., 53 State St., Boston, Mass.

New Castle, Ind.—It is stated that the Panhandle Ry. Co. and the Lake Erie & Western R. R. (F. T. Bowles, Div. Supt., Muncie.) will erect a $20,000 union depot here.

Prairie City, Ill.—It is stated that the O. T. Johnson Co., of Galesburg, will erect a 4-story business building on Main St.; estimated cost, $20,000.

Ottumwa, Ia.—Bids will be received by G. M. Kerns, Archt., Mar. 2, for erecting a 2-story brick office building for the Courier Printing Co. A. W. Lee, Pres.

Sioux City, Ia.—It is stated that J. T. Northwall & Co., of Council Bluffs, will erect a 4-story brick ware house; estimated cost, $80,000. John T. Goodwin, Local Mgr.

Des Moines, Ia.—D. S. Chamberlain will erect a 6-story hotel, 88x132 ft. Proudfoot & Bird, Archts., Crocker Bldg.

The Continental Biscuit Co. will erect a 6-atory factory building, 132x100 ft.

The State Insurance Co. will erect a 6-story hotel, 66x132 ft., at a cost of $80,000. Yauger & Bushnell, Contractors.

Baton Rouge, La.—The Istrouma Hotel Co. is reported to be having plans prepared for a 4-story brick hotel to be erected here, to cost $85,000. Architect, Col. W. L. Stevens.

Meridian, Miss.—C. M. Pinbush, of Meridian, is reported to have received the contract for the erection of the depot in this city for the South Ry. and Mobile & Ohio R. R. Cos., at a cost of $50,000.

Vicksburg, Miss.—It is stated that plans are being prepared for a 5-story office building and hotel to be erected at Washington and Clay Sts. for the First National Bank.

Kansas City, Mo.—Geo. Mathewa, 415 Lyceum Bldg., has prepared plans for a $200,000 store building to be erected on 8th and May Sts.

Beaumont, Tex.—W. D. Appleton is reported to have received the contract for the erection of the Y. M. C. A. building for $41,400, and J. E. Grubbs and the Otis Elevator Co., of New York City, are stated to have received the contracts for the plumbing and installing an electric elevator for $5,850 and $3,250 respectively.

Seattle, Wash.—I. N. Bigelow is reported to be considering the erection of a 4-story brick hotel to be erected at Yesler Way and 3d Ave., at a cost of $40,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; m, mason; cr, carpenter; and b, builder.

Broad and Front Sts, 8-story br and atone office and stores bldg, c, $70,000; o, Balthasar Diehl; a, Max Muller.

264 E 2d St, 6-story br and stone tenemts and stores, c, $35,000; o, Max Weinstein; a, Horenburger & Straub.

230 E 3d St, 2 6-story br tenemts and stores, c, total, $70,000; o, Baum & Lapin; a, Bernstein & Bernstein.

17th St and 8th Ave, 5-atory br stable, c, $45,000; o, David W Stein; a, Chas T Mott.

29th St and 10th Ave, 6-atory br loft and stable, c, $50,000; o, Chas P Rogers; a, John A Hamilton.

604 W 48th St, 5-story br atable, c, $25,000; o, Joseph Mack; a, Fred Jacobson.

68th St and Ave A, 6-atory br stable and loft, c, $50,000; o, Mrs Emma Lowe; a, Waldemar H Mortesen.

155 Leonard St, 6-story extension to 6-story br factory and store, c, $60,000; o, Mrs Mary M Simmons; a, De Lemos & Cordes.

Bway and Liberty St, improvements in 4-story br office bldg, c, $20,000; o, Mutual Life Ins Co; a, Chas F Wood.

BROOKLYN, N. Y.

Nassau Ave and Guernsey St, 2-story br telephone exchange, c, $60,000; o, New York & New Jersey Telephone Co; a, W B Claflin.

DWELLINGS.

Pittsburg, Pa.—Geo. P. Black is reported to be considering the erection of a residence at Wilkins and 5th Aves., to cost $60,000.

It is stated that Lawrence Dilworth will erect a residence at Shady St., and 5th Ave., to cost $40,000.

Avalon, Pa.—It is stated that the contract will soon be let for the erection of a stone residence at California Ave. and Middle St. for M. O. Coggin, to cost $20,000. Architect, S. C. Irwin.

Washington, D. C.—F. G. Atkinson, 1423 F St., N. W., is reported to have prepared plans for a 5-story 82x96 ft. apartment house, to be erected at 11th and M Sts. for Dr. Farnham.

Cleveland, O.—J. M. Dyer, Cuyahoga Bldg., is reported to be preparing plans for a residence for Lyman J. Treadway, at a cost of $40,000.

Chicago, Ill.—Plans are stated to have been prepared by Nimmons & Fellowa, 204 Dearborn St., for a residence to be erected at Ellis Ave. and 49th St. for J. Rosenwald, to cost $50,000.

SCHOOLS.

Fall River, Mass.—The city proposes erecting 3 new schools this spring, at a probable cost of $150,000.

Hartford, Conn.—It is reported that the high school was destroyed by fire Feb. 6.

Watertown, N. Y.—Peet, McAnerney & Powers, 225 4th Ave., N. Y. City, are stated to have received the contract for the electric wiring of the high school for $3,362, and W. W. Conde is reported to have received the contract for the steel ceiling work for $4,183.

Lancaster, Pa.—The Bd. of Educ. is reported to have authorized the issue of $100,000 bonds for the erection of a Girls' High School at W. Chestnut and Charlotte Sts.

Pittsburg, Pa.—Plans are stated to have been approved for the 2 schools to be erected at Braddock Ave. and Waverly St., and Sheridan Ave. and Fair Oaks St., at a cost of $100,000 each.

York, Pa.—The Bd. of Educ. is stated to have rejected all bids opened Jan. 29 for the erection of the 9th Ward School, as they were in excess of the $40,000 appropriation. The lowest bid, $42,000, is reported to have been submitted by J. L. Menough.

Baltimore, Md.—It is stated that plans are being prepared for a 3-story school to be erected at Mount and Saratoga Sts., at a cost of $50,000.

The Bd. of Estimates is stated to have reported favorably on the appropriation of $100,000 for a site, for the erection of the Eastern Female High School.

Brooklyn, N. Y.—Bids will be received Feb. 24 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for erecting an addition to school No. 84.

New York, N. Y.—Bids will be received Feb. 24 by C. B. J. Snyder, Supt. of School Bldgs., for installing ventilating and heating apparatus in school No. 145.

Contracts for the new college buildings are reported to have been awarded as follows: Terra cotta work, consisting of ornamentation on the different buildings, The Perth Amboy Terra Cotta Co., Perth Amboy, N. J., for $246,300, and excavation and foundation work to V. J. Hedden & Sons Co., 41 E. 23d St., for $141,424.

Oakdale, Pa.—Preliminary plans are stated to have been submitted for the erection of two 2-story buildings for a college for the Boys' Industrial Home, to cost about $40,000 and $12,000 each.

Gainesville, Ga.—Architect Wilson, of Columbia, S. C., is reported to be preparing plans for a school to be erected here to cost $20,000.

Bowling Green, O.—The Citizens are stated to have voted to issue $15,000 school bonds.

Oberlin, O.—The Oberlin College Chapel is reported to have been destroyed by fire Jan. 25.

Upper Alton, Ill.—The Western Military Academy is reported to have been destroyed by fire.

Minneapolis, Minn.—The Senate has passed a bill authorizing the issue of $200,000 bonds for public schools.

Oxford, O.—Bids will be received Feb. 23 by the Bd. of Trus. of Miami Univ. for erecting a woman's dormitory. Paton & Miller, Archts., 153 La Salle St., Chicago, Ill.

Springfield, Ill.—The plans of Geo. H. Helmle, 430 S. 5th St., are stated to have been accepted by the Bd. of Educ. for the school to be erected at S. 2d and Laurel Sts., at a cost of $40,000.

Eau Claire, Wis.—The Bd. of School Comrs. are reported to have decided to erect an addition to the high school, to cost $25,000.

Audubon, Ia.—Bids will be received Feb. 21 by G. W. Cossan, Secy. Bd. of Educ., for erecting a high school. Liebbe, Nourse & Rassmussen, Archts., Des Moines.

Columbus, O.—Alexis Cope, Secy. Bd. Trus. Ohio State Univ., writes that all bids received Feb. 3 for erecting the Engineering Building have been rejected, and new bids will be received Mar. 11.

Versailles, Ind.—Bids are wanted Mar. 2 for erecting a 6-room brick school, according to plans and specifications prepared by W. S. Kaufman, Archt. of Richmond. F. M. Thompson, Secy. School Bd.

Columbia, Mo.—John S. Bicknell, City Clk., writes that it was voted Feb. 6 to issue $20,000 bonds for the erection of a ward school. John L. Henry, Secy School Bd.

Junction City, Kan.—The Bd. of Educ. is stated to have decided to erect a $30,000 high school.

STREET CLEANING AND GARBAGE DISPOSAL.

Poughkeepsie, N. Y.—Chas. F. Sink, of Poughkeepsie, is stated to have secured the contract for removing the garbage for the ensuing year at $1,800.

Atlanta, Ga.—See "Power Plants, Gas and Electricity."

St. Paul, Minn.—The Com. on Sts. is reported to have recommended that the contract for new equipment of the sprinkling plant be awarded to the Austin & Western Co., of Harvey, Ill. This company will furnish 53 wagons and tanks complete, and Fielding & Shepley will supply 7 more, making an outfit of 60 wagons to start with. For ten of the wagons, which are of 600 gals. capacity, the city is to pay $232 ea., and for the other 43, which will be of 700 gals. capacity, $247 ea. The wagons to be taken from Fielding & Shepley are second hand, 5 will cost $230 ea., and 2 $160 ea.

Kalamazoo, Mich.—The question of purchasing a garbage crematory is reported under consideration in Kalamazoo. E. W. Buckley, City Engr.

Sandusky, O.—Local press reports state that Chas. Schneider, of Boston, Mass., will soon visit this city and confer with the City Council regarding the construction of a garbage plant for Sandusky, at a probable cost of $40,000. Wm. F. Seitz, Jr., of Sandusky, is local representative of the company.

Cleveland, O.—Bids are wanted Feb. 18 for furnishing and delivering f. o. b. cars 18 street machine sweepers; bids are to include 1 broom with each machine and 2 extra brooms for each machine within 60 days after receipt of order; bids will also be received for furnishing and delivering f. o. b. cars 6 street sprinkling wagons. Chas. P. Salen, Dir. of Pub. Wks.

Madison, Wis.—See "Power Plants, Gas and Electricity."

GOVERNMENT WORK.

Boston, Mass.—The following bids for dredging Plymouth Harbor were received by Lieut.-Col. W. S. Stanton, Corps Engrs., U. S. A., price given per cu. yd., scow measurement: Bay State Dredging Co., 19 High St., 29.75 cts.; Simon J. Donovan, 77 Mountfort St., 32 cts.

New Bedford, Mass.—Bids will be received at Newport, R. I., Feb. 28, for extending water main, etc., at Ft. Rodman, New Bedford, Mass., as advertised in The Engineering Record.

Portland, Me.—Bids are wanted Mar. 12 for dredging and rock excavation in Carvers Harbor, Me., as advertised in The Engineering Record.

Philadelphia, Pa.—The following bids were opened at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., Feb. 7 for a sewerage and drainage system at the Navy Yard, League Island, Pa. Appropriation, $11,000: Patterson & Bryson, Baltimore, Md., $10,726; Latta & Terry Co., Camden, N. J., $15,000; M. J. Hogan, Philadelphia, $17,129; Amer. Paving & Const. Co., Philadelphia, $10,974; E. F. Fonder, Philadelphia, $11,000.

Wilmington, Del.—Bids will be received at the U. S. Engr. Office, Wilmington, Mar. 9, for dredging in Mantua, Raccoon and Alloway Creek, N. J., as advertised in The Engineering Record

Buffalo, N. Y.—Bids are wanted Mar. 5 for extending pier at Little Sodus Bay and extending breakwater at Cape Vincent. Maj. T. W. Symons, Corps Engr., U. S. A.

Local press reports state that the Buffalo Dredging Co. submitted the lowest bid (opened Feb. 6 by Col. Ward) for the work of deepening Buffalo River from Evans Slip to the Indian Reservation Line and the City Ship Canal; its bid for the entire work was $442,807. As the city is only authorized to bond itself for $350,000, only a part of the work can be done this year.

Wilkesbarre, Pa.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., Mar. 16 for a conduit and electric wiring system for U. S. Post Office, at Wilkesbarre, as advertised in The Engineering Record.

St. Augustine, Fla.—Bids will be received at the U. S. Engr. Office, Mar. 10, for constructing training walls in St. Johns River, Fla., as advertised in The Engineering Record.

Cincinnati, O.—Bids will be received at U. S. Engr. Office, Cincinnati, Mar. 17, for building Dam No. 1, Sandy River, W. Va. and Ky., as advertised in The Engineering Record.

Duluth, Minn.—Bids are wanted Mar. 9 for building the concrete south pier at Superior Entry, Wis., as advertised in The Engineering Record.

St. Paul, Minn.—Bids are wanted Mar. 7 for sluice gates and steel hinges, as advertised in The Engineering Record.

Michigan City, Ind.—The following bids were opened at Grand Rapids Feb. 5 by Capt. Chas. Keller, Corps of Engrs., U. S. A., for repair of piers and closing entrance to outer basin at Michigan City, Ind.—*a*, Robt. Millen & Co., Muskegon; *b*, Burk, Smith & Nelson, Muskegon; *c*, Nelson J. Gaylord, Ludington; *d*, Hansler & Lutz Towing & Dock Co., Chicago, Ill.:

	a	*b*	*c*	*d*
To cut down and remove old work.	$3.00	$2.00	$1.50	$6.00
To furnish material and secure it in the work:				
White oak piles.	$0.33	$0.32	$0.36	$0.30
White oak timber	40.00	50.00	45.00	50.00
White pine, L. L. yellow pine or Douglas fir	33.00	34.00	32.00	35.00
White pine, L. L. yellow pine or Douglas fir plank for sheet piles	39.00	40.00	43.00	40.00
White pine or L. L. yellow pine plank for decking	30.00	30.00	27.00	35.00
Drift bolts	.025	.035	.035	.04
Screw bolts	.03	.04	.035	.04
Carriage bolts	.04	.04	.04	.04
Tie rods	.03	.04	.035	.04
Spikes	.04	.04	.04	.04
Stone	6.50	7.00	7.50	7.50
Totals	$45,778	$46,646	$46,980	$51,942

Minneapolis, Minn.—Bids are wanted Feb. 16 for new floor construction in the U. S. Post Office. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Grand Haven, Mich.—The following bids were opened Feb. 5 at Grand Rapids by Capt. Chas. Keller, Corps of Engrs., U. S. A., for repair of North Pier at Grand Haven, Mich.: Robt. Millen & Co., Muskegon, $8,496; Archibald J. Beauvais, Muskegon, $8,761; Nelson J. Gaylord, Ludington, $9,050; Burk, Smith & Nelson, Muskegon, $9,628.

Fort Townsend, Wash.—Capt. Geo. H. Penrose, Q. M., U. S. A., writes that the contract for the construction, including plumbing, heating and electric wiring, of several buildings at Ft. Worden, Wash., has been awarded to Hastie & Dougan, of Spokane, for $157,538.

Ft. Morgan, Ala.—Bids will be received by A. D. Raymond, Q. M., on Mar. 10 for sinking an artesian well, and on Mar. 14 for constructing an extension to, and alterations in guard house, as advertised in The Engineering Record.

Algiers, La.—Bids are wanted Feb. 23 for constructing marine barracks and officers' quarters at the naval station, Algiers. R. E. De Buys, Archt., 421 Carondelet St., New Orleans. Col. F. L. Denny, Q. M., U. S. Marine Corps.

Chattanooga, Tenn.—Bids are wanted Mar. 11 (readvertisement) for constructing, including heating, plumbing and gas piping, brick hospital building at new Military Post, in Chickamauga Park. Address Capt. H. J. Slocum, Cavalry Q. M.

MISCELLANEOUS.

Gloucester, Mass.—An order has been introduced in the Massachusetts Legislature to appropriate $1,500 for a survey and report by the Harbor & Land Comrs. on the cost of dredging, widening and improving the Gloucester Canal and Amusquand River. W. L. Webber, City Engr.

Providence, R. I.—See "Business Buildings."

Allentown, Pa.—A press report states that the City Council proposes expending about $500,000 to divert the water of Jordan River, which runs through the manufacturing districts of the city, so that it will flow into Lehigh River on the outskirts of the city.

Buffalo, N. Y.—Bids are wanted Feb. 24 for widening, deepening, and straightening Buffalo River, including cuts, banks, weirs, protections and other construction necessary. Francis G. Ward, Comr. Dept. Pub. Wks.

New York, N. Y.—Bids will be received Feb. 20 by Thos. Sturgis, Fire Comr., for furnishing material, constructing and delivering a steel fireboat.

Richmond, Va.—The Osgood Dredge Co., of Albany, N. Y., is stated to have secured the contract for the construction of a dredging plant, to be used in deepening Richmond Harbor; contract price reported to be $24,000.

Cincinnati, O.—An ordinance authorizing a bond issue of about $1,000,000, to be expended for the extension of the park area of Cincinnati, is reported under consideration.

Milwaukee, Wis.—See "Paving."

Chicago, Ill.—The Lydon & Drews Co., Chicago, has been awarded the contract for dredging the main Chicago River and its south branch and for docking along portions dredged at a total of $350,585. The detailed bid is as follows: 237,223 cu. yds. dredging at 24.9 cts.; 5,337 ft. dock removal at $2; 1,000 lin. ft. removal detached piles, $1.50; 3,774 lin. ft. new pile dock, $24.25; piles, 25 cts. per lin. ft.; concrete, $7.50 per cu. yd.; oak wales, 31 M. ft., $48; wet foundation excavation, 31 cts. per cu. yd.; dry foundation excav., $3 per cu. yd.; cofferdam foundation excav., $1.75 per cu. yd.; cofferdam with pile foundation, $35 per lin. ft.; cofferdam for foundations, $50 per lin. ft.; 22,360 cu. yds. excav., $1.70 per cu. yd.; 10,950 cu. yds. concrete, $7.70 per cu. yd.; 279 M. ft. triple sheeting, $48; 100,000 lin. ft. piles, delivered, 18 cts.; 100,000 lin. ft. piles driven, 18 cts.; 252 M. ft. bracing and sheeting, $58.

Shreveport, La.—Bids are wanted Feb. 18 (readvertisement) for constructing levee work in the Parish of Caddo, approximate contents about 160,000 cu. yds. W. F. Taylor, Pres. Bd. of Comrs.

Bossier City, La.—The Bossier Levee Board is reported to have awarded the contract for levee work aggregating 157,000 cu. yds., to T. R. Bobbett, of Magna Vista, Miss., at prices ranging from $15.90 to $17.80 per cu. yd.

BUSINESS NOTES.

The Reading, Pa., Iron Co. will add a 90x400-ft. main building with a lean-to 40 ft. wide and 40x80-ft. power house to its tube works department. Contracts for buildings and machinery have been let.

The injunction against the Philadelphia Pneumatic Tool Co. restraining them from making and selling Keller pneumatic drills was suspended February 4.

An electric interurban railway, 40 miles in length, from Rochester through Canandaigua to Geneva, N. Y., known as the Rochester & Eastern Rapid Ry., is being built by the Comstock-Haigh-Walker Co. The Westinghouse Electric & Mfg. Co., of Pittsburg, will furnish two 650-Kw., three-phase, 3,000 alternation alternators, which will be arranged for direct connection to cross-compound engines running at 150 r. p. m.; seven 300-Kw., three-phase rotary converters; four 500-Kw. and nine 200-Kw., oil-cooled transformers, arranged for transformation from 390 to 16,500 volts; and two 37½-Kw., direct-current, engine-type exciters operating at about 320 r. p. m., besides switchboards, high-tension switches and lightning arresters.

Some of the filter contracts awarded to Wm. B. Scaife & Sons Co., of Pittsburg, Pa., in January are the following: Secretary Hay, Stoneleigh Court, Washington, D. C., 260,000 gals. per 24 hrs.; Alan Wood Iron & Steel Co., Conshohocken, Pa., 20,000 gals. per 24 hrs.; National Steel Co., Columbus, O., gravity system, 300,000 gals. per 24 hrs.; Willard Office Bldg., Washington, D. C., 25,000 gals. per 24 hrs.; Thos. Gale's apartment house, Washington, D. C., 12,000 gals. per 24 hrs.; Duquesne Club, Pittsburg, Pa., 57,000 gals. per 24 hrs.

The C. O. Bartlett & Snow Co., Cleveland, O., has lately received orders for its special common sense conveyor for conveying clinker, capacity 1,750 bbls. per day, from the Bronson, Mich., Portland Cement Co., and Omega Portland Cement Co., Jonesville, Mich., and also an order for one of 1,000 bbls. capacity from the Egyptian Portland Cement Co., Detroit, Mich. The company also reports the receipt of a large order for fertilizing machinery from the West Rand Fertilizer Co., Krugersdorp, Transvaal, S. A.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Feb. 17.	Winnipeg, Man.	Feb. 14
Feb. 17.	Cincinnati, O. Adv., Eng. Record, Jan. 24, 31.	Jan. 24
Feb. 18.	Savannah, Ga.	Feb. 7
Feb. 18.	Dubois, Pa.	Feb. 7
Feb. 18.	St. Francisville, La. Adv., Eng. Record, Feb. 7.	Jan. 31
Feb. 20.	Pipe, etc., Washington, D. C. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Feb. 24.	Bainbridge, O.	Feb. 14
Feb. 24.	Allentown, Pa. Adv. Eng. Record.	Feb. 14
Feb. 25.	Hoidenville, Ind. Ter. Adv., Eng. Record, Feb. 14.	Feb. 14
Feb. 27.	Pipe, etc., Burlington, Ia. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Feb. 28.	Valves, Cleveland, O. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Feb. 28.	South McAlester, Ind. Ter. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 1.	Ft. Morgan, Ala.	Jan. 24
Mar. 3.	Concord, N. C. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 5.	Pipe, Yonkers, N. Y. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 14.	Dillon, Mont.	Jan. 10
Mar. 16.	Pumping Engine, Winnipeg, Man. Adv., Eng. Record, Jan. 17 to Feb. 14.	Jan. 17
May 1.	Chinook, Mont.	Feb. 7
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Feb. 16.	Muncie, Ind.	Feb. 14
Feb. 17.	Cincinnati, O.	Feb. 14
Feb. 19.	Cleveland, O.	Jan. 31
Feb. 23.	Toledo, O.	Feb. 14
Feb. 23.	Wabash, Ind.	Jan. 31
Feb. 26.	Cleveland, O.	Feb. 7
Feb. 28.	South McAlester, Ind. Ter. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 1.	Peoria, Ill.	Jan. 17
Mar. 2.	Muncie, Ind.	Feb. 14
Mar. 3.	Rock Island, Ill.	Feb. 14
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 5.	Pipe, etc., Meriden, Conn. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 9.	Toledo, O	Feb. 14
	BRIDGES.	
Feb. 10.	Arkadelphia, Ark.	Jan. 10
Feb. 10.	Castroville, Tex.	Jan. 3
Feb. 11.	Camden, N. J.	Jan. 24
Feb. 14.	Bay City, Mich. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 16.	St. Mary's, Ont.	Feb. 7
Feb. 18.	New York, N. Y.	Feb. 7
Feb. 25.	Salina, Kan.	Feb. 14
Mar. 2.	Sherbrooke, N. D.	Feb. 14
Mar. 6.	Milwaukee, Wis.	Feb. 14
Mar. 17.	Kearney, Neb.	Feb. 14
Mar. 25.	Plymouth, Wis.	Feb. 14
Mar. 27.	Washington, D. C. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
	PAVING AND ROADMAKING.	
Feb. 16.	Muncie, Ind.	Feb. 14
Feb. 17.	Sioux City, Ia.	Feb. 14
Feb. 17.	Winnipeg, Man.	Feb. 14
Feb. 17.	Three Rivers, Mich. Adv., Eng. Record, Jan. 10.	Jan. 10
Feb. 18.	Brooklyn, N. Y.	Feb. 7
Feb. 18.	Cleveland, O.	Jan. 31
Feb. 20.	Owosso, Mich. Adv., Eng. Record, Feb. 7.	Feb. 7
Feb. 20.	Iowa City, Ia.	Jan. 31
Feb. 21.	Savannah, Ga.	Feb. 7
Feb. 23.	Canton, O.	Feb. 7
Feb. 23.	Morristown, N. J.	Jan. 31
Feb. 23.	North Manchester, Ind.	Jan. 31
Feb. 23.	Fond du Lac, Wis. Adv., Eng. Record, Jan. 3 to 17.	Jan. 3
Feb. 25.	Red Oak, Ia.	Feb. 14
Feb. 27.	Boone, Ia.	Feb. 14
Mar. 2.	Ogden, Utah	Feb. 14
Mar. 2.	Muncie, Ind.	Feb. 14
Mar. 2.	Albia, Ia.	Feb. 14
Mar. 2.	Toledo, O.	Feb. 7
Mar. 2.	Newburgh, N. Y. Adv., Eng. Record, Feb. 7, 14.	Jan. 31
Mar. 3.	Winnipeg, Man. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 4.	Rensselaer, Ind.	Feb. 14
Mar. 4.	Somerville, N. J.	Feb. 14
Mar. 5.	Rosnoke, Va.	Feb. 14
Mar. 6.	Ft. De Soto, Fla. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. —	San Diego, Cal.	Jan. 31
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Feb. 18.	St. Francisville, La. Adv., Eng. Record, Feb. 7.	Jan. 31
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
Apr. 7.	Oneida, N. Y.	Feb. 7
———	Hyattsville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Feb. 16.	Minneapolis, Minn.	Feb. 14
Feb. 16.	New Bedford, Mass. Adv., Eng. Record, Jan. 31, Feb. 7.	Jan. 31
Feb. 16.	Ft. Riley, Kan. Adv., Eng. Record, Jan. 17 to 31, Feb. 14.	Jan. 17
Feb. 16.	New York, N. Y. Adv., Eng. Record, Jan. 17 to Feb. 7.	Jan. 17
Feb. 16.	Boston, Mass.	Jan. 17
Feb. 17.	Phoenix, Ariz.	Jan. 24
Feb. 18.	Boston, Mass.	Jan. 24
Feb. 18.	Dallas, Tex.	Jan. 24
Feb. 18.	San Francisco, Cal.	Jan. 17
Feb. 19.	Ft. Hancock, N. J.	Feb. 7
Feb. 19.	Ft. Dade, Fla. Adv., Eng. Record, Jan. 31 to Feb. 14.	Jan. 31
Feb. 19.	Duluth, Minn. Adv., Eng. Record, Jan. 24 to Feb. 14.	Jan. 24
Feb. 19.	Grand Rapids, Mich. Adv., Eng. Record, Jan. 24 to Feb. 14.	Jan. 24
Feb. 19.	Chilocco, Okla. Ter.	Jan. 24
Feb. 19.	Ft. D. A. Russell, Wyo.	Jan. 24
Feb. 19.	Burlington, Ia. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 20.	Burlington, Vt. Adv., Eng. Record, Jan. 24 to Feb. 14.	Jan. 24
Feb. 20.	New York, N. Y.	Jan. 24
Feb. 20.	Boston, Mass.	Jan. 24
Feb. 21.	Boston, Mass.	Jan. 24
Feb. 21.	Bldg., Philadelphia, Pa.	Jan. 17
Feb. 23.	Algiers, La.	Feb. 14
Feb. 24.	San Francisco, Cal.	Feb. 7
Feb. 24.	Ashland, Wis. Adv., Eng. Record, Feb. 7, 14.	Jan. 31
Feb. 24.	Chicago, Ill.	Jan. 24
Feb. 25.	Creston, Ia. Adv., Eng. Record, Jan. 17, 24.	Jan. 17
Feb. 27.	Ft. Sheridan, Ill.	Feb. 7
Feb. 28.	New Bedford, Mass. Adv., Eng. Record, Feb. 14.	Feb. 14
Feb. 28.	Nashville, Tenn. Adv., Eng. Record, Jan. 31 to Feb. 14.	Jan. 31
Feb. 28.	Ft. Terry, N. Y. Adv., Eng. Record, Jan. 31 to Feb. 14.	Jan. 31
Feb. 28.	Mobile, Ala. Adv., Eng. Record, Jan. 31 to Feb. 14.	Jan. 31
Mar. 2.	Milwaukee, Wis. (5 advs.) Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 2.	Detroit, Mich. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 2.	Ft. McKinley, Me. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 2.	Cheyenne, Wyo.	Feb. 7
Mar. 2.	Ft. Douglas, Utah	Feb. 7
Mar. 2.	Jamestown, N. Y. Adv., Eng. Record, Jan. 31, Feb. 7.	Jan. 31
Mar. 3.	Ft. Riley, Kan. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 3.	Helena, Mont. Adv., Eng. Record, Jan. 24, 31.	Jan. 24
Mar. 4.	New York, N. Y. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 4.	Alexandria, Va. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 4.	Grand Rapids, Mich. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 5.	Ft. Myer, Va. Adv., Engine Record, Feb. 14.	Feb. 14
Mar. 5.	Buffalo, N. Y.	Feb. 14
Mar. 5.	Cincinnati, O. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 5.	Haines, Alaska	Jan. 24
Mar. 5.	Janesville, Wis.	Jan. 24
Mar. 7.	St. Paul, Minn. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 9.	Duluth, Minn. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 9.	Wilmington, Del. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 9.	Jamestown, N. Y.	Feb. 7
Mar. 10.	St. Augustine, Fla. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 10.	Well, Ft. Morgan, Ala. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 10.	Ft. Smith, Ark. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. 11.	Chattanooga, Tenn.	Feb. 14
Mar. 11.	Wilkesbarre, Pa. Adv., Eng. Record, Jan. 31, Feb. 7.	Jan. 31
Mar. 12.	Portland, Me. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 12.	Janesville, Wis.	Feb. 7
Mar. 14.	Bldg., Ft. Morgan, Ala. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
Mar. 16.	Wiring, P. O., Wilkesbarre, Pa. Adv., Eng. Record, Feb. 14.	Feb. 14
Mar. 17.	Cincinnati, O. Adv., Eng. Record, Feb. 14.	Feb. 14
	BUILDINGS.	
Feb. 16.	Engine house, Chicago, Ill.	Feb. 14
Feb. 17.	City Hall, Shelbyville, Ind.	Feb. 7
Feb. 17.	Church, Carrollton, Ky.	Jan. 17
Feb. 18.	Court house, Lawrence, Kan.	Jan. 24
Feb. 18.	Church, Selma, Ala.	Jan. 17
Feb. 20.	Engine house, Long Island City, N. Y.	Feb. 14
Feb. 20.	Court House, Newport, Ind.	Jan. 24
Feb. 21.	School, Audubon, Ia.	Feb. 14
Feb. 21.	School, Hespeler, Ont.	Feb. 7
Feb. 23.	Dormitory, Oxford, O.	Feb. 14
Feb. 23.	Library, Winnipeg, Man.	Feb. 14
Feb. 23.	Court house, Hamburg, Ark.	Feb. 7
Feb. 23.	School, Cleveland, O.	Feb. 7
Feb. 24.	School, Brooklyn, N. Y.	Feb. 14
Feb. 24.	School, New York, N. Y.	Feb. 14
Feb. 24.	School, Marietta, O.	Feb. 7
Feb. 25.	Pub. Bldg., Xenia, O.	Feb. 14
Feb. 25.	School, Jackson Center, O.	Feb. 7
Feb. 25.	Pub. Bldg., Des Moines, Ia.	Jan. 31
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
Mar. 2.	School, Versailles, Ind.	Feb. 14
Mar. 2.	Office Bldg., Ottumwa, Ia.	Feb. 14
Mar. 3.	Courthouse, Decorah, Ia.	Feb. 14
Mar. 4.	Armory, Providence, R. I.	Feb. 14
Mar. 5.	Hospital, Springfield, O.	Jan. 31
Mar. 11.	School, Columbus, O.	Feb. 14
Mar. 12.	Pub. Bldg., Johnson City, Tenn. Adv. Eng. Record, Feb. 14.	Feb. 14
Mar. 16.	Library, Portsmouth, O.	Feb. 14
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
	MISCELLANEOUS.	
Feb. 16.	R. R., Philadelphia, Pa.	Feb. 14
Feb. 18.	Sweepers, etc., Cleveland, O.	Feb. 14
Feb. 18.	Levee Work, Shreveport, Pa.	Feb. 14
Feb. 20.	Fireboat, New York, N. Y.	Feb. 14
Feb. 20.	Garb. Disp., Kansas City, Mo.	Jan. 31
Feb. 23.	St. Ry., Sidney, O.	Feb. 14
Feb. 24.	River Work, Buffalo, N. Y.	Feb. 14
Mar. 1.	El. Rys., Cedar Rapids, Ia.	Feb. 14
Mar. 1.	Grading, Beaumont, Tex.	Jan. 24
Mar. 3.	Cement, Winnipeg, Man. Adv., Eng. Record, Jan. 17 to 31.	Jan. 17
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. 7.	Cement, Marietta, O. Adv., Eng. Record, Feb. 7, 14.	Feb. 7
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	R. R. work, Cincinnati, O.	Dec. 20

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Contracting News.

It is our constant aim to attain completeness and the highest possible degree of accuracy in the preparation of our Contracting News. To this end, the large staff especially engaged upon this work has recently been increased. We are likewise adding to our list of correspondents, of whom there are already several hundreds distributed over all parts of the country. It is also our endeavor to present information thus gathered in the most convenient form for the large number of readers who consult our pages. As an advanced step in this line, we have begun this week an improved arrangement. The system is so simple that it will be readily comprehended. The matter will be classified as formerly by departments of which there are fourteen, and the items in each department will be arranged alphabetically according to the names of the States. Our readers can assist us in maintaining the high standard of these pages by promptly sending us information relating to any of the departments, and advising us of any errors which they may detect.

Atlanta, Ga., is proposing to extend its sewerage system and provide for partial treatment of the sewage. Mr. Rudolph Hering, of New York, in a report recently submitted, recommends septic tanks followed by roughing filters and spraying filters at the outlets of each of the three principal sewers, at a total cost estimated at $135,000. The plants will have capacities of about 3,500,000 gallons, 2,000,000 gallons and 750,000 gallons per day, according to abstracts of the reports printed in local papers.

Precedents in Hydraulic Power Development.

In the design of works for the development of water-power, experience in similar construction and a thorough appreciation of the properties of the materials at the site should be possessed in a marked degree by the engineer entrusted with the undertaking. In few branches of professional work is theory worth so little, and judgment ripened by practical judgment worth so much. The selection of the mechanical plant is generally of relatively little difficulty compared with the solution of the problems presented by the construction of the building, forebay, tail race and canal. Where one accident takes place through faulty machinery probably a dozen occur through defects in the hydraulic works. The better acquainted an engineer becomes with such plants in different parts of the country, the more thoroughly he appreciates the value of the precedents set by successful plants and the less likely he is to introduce untried constructions without a thorough investigation of their safety and advantage. It is consequently of interest to notice particularly a few of the features of hydraulic power development, and compare them with similar work in other branches of engineering.

In many cases the power plant is located away from the dam on firm rock, and water is brought to it in one or more penstocks. Such construction is usually very simple. In other cases, however, which are becoming more numerous with the development of water-powers of low head but large volume, the power-house itself becomes essentially a dam, with numerous outlets through it to accommodate the wheels, draft-tubes and discharge culverts. The water extends along one side of the building at a high elevation in a forebay, and on the other side its surface is at a much lower elevation, usually that of the river or lake on whose bank the structure is always located in works of this nature. A consideration of these elementary facts will convince any engineer that such a structure depends for its safety on the same factors as any masonry dam, namely, its foundation must be firm and impermeable, the currents at the outlets of the wheels must not erode the stream bottom so as to undermine the structure, and the wall itself against which the water presses must satisfy the conditions of security against slipping, overturning and crushing. These last conditions are so well recognized that they are never violated, yet it must have been apparent to the designers of dams that some of the power-houses recently built are seemingly open to criticism as regards the protection of the foundations and the prevention of scour at the wheel outlets.

It is an axiom among designers of dams that no percolation must take place below them. Even when the foundation is rock, a trench filled with concrete or other masonry is carried down until its bottom is below every little seam and patch of soft rock and its ends extend so far into the slope on either side that seepage around the sides is impossible. In the case of an earth bottom, the foundations are carried down to clay, hard pan or an equivalent material, and often, in the case of small structures, several rows of well-made sheet-piling are driven under the dam and occasionally above its upper toe, so as to offer every possible obstruction to the percolation of water. These precautions must be taken for a power-house just as well as for a dam. In fact they are even more important, for the settlement of the foundations of a direct-coupled water-wheel and dynamo unit by a very small fraction of an inch will throw it out of service in most cases. Power-houses will have to be built on such materials as the site affords and it is rarely that they can be shifted in order to secure better foundations. Hence the problem sometimes arises in making a practically water-tight forebay in very permeable soil in order to prevent the undermining of the power-house.

The prevention of scour at the discharge outlets of the waterwheels seems to be generally overlooked. Where the building is founded on rock it is often of little moment, but where the water rushes out of these culverts at a high velocity over an earth bottom it needs no reminder of the failure of the Austin dam to convince the observant engineer that the conditions are not satisfactory. The scouring of the bottom in this way not only affects the stability of the structure against a lateral thrust, but it also has the equally undesirable result of decreasing the amount of material resisting percolation.

Another feature of these low-head developments is the construction of the power canals. The available head is generally so low that it is impossible to use any other form of conduit than an open channel, without serious friction losses during the flow of the water. These canals are often cut through very soft earth and the protection of the banks and bottoms is a matter requiring the most careful consideration. Every boat canal superintendent has interesting tales to tell of sliding banks when the water is drawn from any section of such a waterway, and in power canals, which must be built so that the water can be drained out with the utmost rapidity in case of accident, the protection of the banks is very important.

All these points may seem trivial at first, yet a recent occurrence at Sault Ste Marie, at the power-house of the Michigan Lake Superior Power Company, of which Mr. F. H. Clergue is general manager, indicates how essential they are. This power-house is a two-story masonry and steel building about 50 feet wide, and over a quarter of a mile long, built directly on the shore of St. Mary's River. The material at this point is a very fine sandy silt, which resembles in every way a jelly, quivering at the slightest touch, and transmitting the jar of a blow through astonishing distances. The building has a foundation of piles driven very close together and to great depths, for the soft silt is over 70 feet deep in places and the piles had to be driven to refusal in order to make them of value. On these piles is a grillage carrying the masonry and steelwork. The forebay is shaped like the bell of a trumpet, the flaring end against the building and the canal entering at the apex. The bottom of this basin was piled and puddled and covered with thick plank, and at the angle of the building and forebay floor there is an inclined sheathing of heavy plank.

St. Mary's River is covered with more than a foot of ice at this season, which extends up to the masonry wall of the building. Three hundred feet or so out from the structure there is a little hut used by men in spearing fish through a hole in the ice. About four o'clock Sunday morning, February 8, the fishermen found the water so muddy that it was impossible to see into it, and so reported to the watchman of the plant. Being an unusually intelligent man, he at once notified the engineers, and the latter discovered that water was rushing from the forebay under the building into the river in a stream of sufficient volume to churn up the silt bottom and produce the effect observed by the fishermen. The headgates at the inlet to the canal, more than a mile distant, were shut down as soon as possible, and the canal drained through the openings for the purpose at the power house. An examination of the extent of the undermining has been made by divers and is stated to have shown that the damage was not serious, al-

though it can be readily seen that had the fisherman not given timely warning a different result might have followed the enlargement of the original break. None of the information given out by the company indicates any revetment of the very soft bottom along the front of the structure by riprap, mattresses or other protection. As the plant has not been placed in commercial operation doubtless this feature of the construction has not yet been considered necessary. The undermining occurred at the center of the building near or at a line where there was a drain. This was puddled and it is by no means unlikely that the washout was due to some soft places in the foundation near this puddling, for such work requires the greatest care and thoroughness in order to warrant the engineer in even hoping for its success. The forebay not being watertight, the water found its way to the soft places and washed them out.

The rapid emptying of the canal had one or two noticeable but trivial results which have led to some unwarranted and wholly misleading reports that this enterprise was seriously affected by the accident. A very light screening rack was practically wrecked by the weight of ice left upon it by the falling water, but this was in no way a matter of any moment. A more interesting feature of the incident to the engineer was the effect of the sudden fall of the water on some parts of the timber lining of the canal banks. The banks are about 20 feet high and this lining sloped at an angle of about 45 degrees. It consisted of heavy plank laid on inclined pieces of rough-hewn logs spaced about 5 feet apart. These logs were drift-bolted to piles, one row of piles at the top and one half way down the slope, and the bottom planks butted against the timber bottom. The sudden withdrawal of the water in the canal, and the pressure of the wet earth behind the timber, tore the lining with the inclined pieces away from piles and lifted it up toward a vertical position, the bottom remaining fixed. The cost of repairing these places will be small, and the total cost of repairing all that will ever occur in twenty years operation will probably be far under the additional expense of a more secure lining.

The incident as a whole is a striking proof of the old-fashioned and sometimes derided precedents of hydraulic engineering. The facts of the incident have been unfortunately magnified, as the above statement shows. The power-house structure has been carefully examined by the engineers, who have stated that precise leveling has failed to indicate any settlement whatever. The results, therefore, are of no serious consequence, as the temporary shut-down occurs before any commercial use is made of the current supplied by the station. In fact, it must be considered a fortunate thing that the washout took place at this time, and not at a later period when numerous industries would be stopped by the failure of their power supply.

The Engineering Association of the South will hold its next meeting at Berry Block, Nashville, Tenn., on March 12. At the meeting held February 12, Mr. Granberry Jackson described the water-works and electric lighting system of Tullahoma, Tenn. Power for this system is obtained from a fall in Elk River, 10 miles from town, is transmitted at 10,000 volts, and reduced for use on series arc system, incandescent system, and for induction motors driving triplex power pump. Water is obtained from wells by use of air lift, and pressure for fire purposes from tank on tower 100 feet high. Prof. John Daniel, of Vanderbilt University, explained the theory of wireless telegraphy.

Sub-Structure at the New Schlesinger & Mayer Store Building, Chicago.

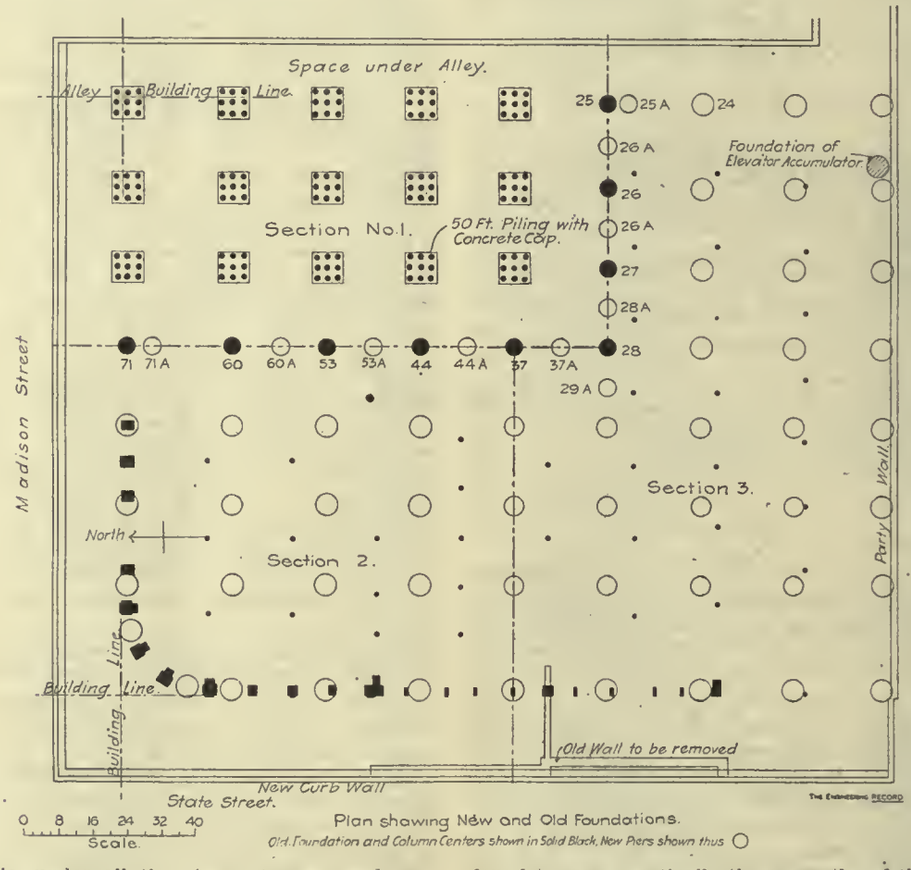
By Louis H. Sullivan.

The erection of a new department store building for the corporation of Schlesinger & Mayer, northeast corner of State and Madison streets, Chicago, for which the writer was engaged as architect, presented at the outset a problem of peculiar and unusual nature. The site, 140x180 feet, is at the very heart of Chicago's congested retail district, with street car lines and heavy team traffic on the two bounding streets. Time was the element of prime importance; and available working space and an efficient working method were of almost equal importance. It was desired to have the new building completed on or about October 1, 1903. Active operations could not be begun until October 6, 1902, leaving thus only substantially twelve months in which to carry out the project. Further, the business of the house must continue uninterruptedly in the premises with as little interference as possible, under all the circumstances; and, on a part of the ground, about 60x115 feet at the northeast corner of the property, stood a nine-story modern fire proof store building, built three years ago with the end in view that this building should be extended, nine stories in height, over the remainder of the property. It was determined, however, that this extension should be built twelve stories in height instead of nine, and that the existing nine-story building should subsequently be raised to a height of twelve stories to correspond.

The remainder of the property was occupied by an old fashioned building, or rather a collection of buildings erected shortly after the great fire and which, originally four stories in height, had been raised to a height of six stories. Their general construction was essentially of a flimsy nature, they had various widths, depths and floor levels; and the arrangement of columns was such that in the different sections there was no definite alignment Further, during previous reconstructions, internal walls had been removed and many modifications made in columns, spacing, and in foundations.

The underlying soil was filled with a motley assortment of discarded foundations, discarded sewers and water pipes, and operating sewers, water pipes, underground sprinkler system pipes, etc.

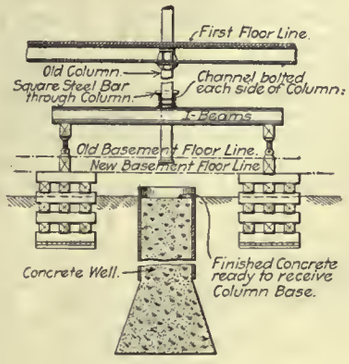
Experience has shown that a modern fire proof building ten or twelve stories in height can be built and equipped complete in twelve months' time, including the demolition of such buildings as might be on the site and the installation of complete new foundations, provided that time has been taken by the forelock and working drawings made and material manufactured and stored well in advance. In this instance, no such prior allowance of time for preparatory work was possible; drawings for the building were begun about the middle of August. Furthermore, conditions determined that the building must be erected not as a whole but in two sections; which caused the limiting conditions to become so much the more strenuous. Some way, therefore, must be found to save practically three months of time, as it was out of the question that Schlesinger & Mayer should abandon an important part of their premises during the fall and holiday seasons; operation would, therefore, if postponed, be thrown into severe weather, or say until after January 1. It was determined, therefore, as a radical measure, to abandon entirely the basement of the premises, promptly begin the foundation work and confine all operations to the basement. This meant logically a scheme to support the old building upon jackscrews and to sink caisson foundations. The conditions were difficult but by no means insuperable.



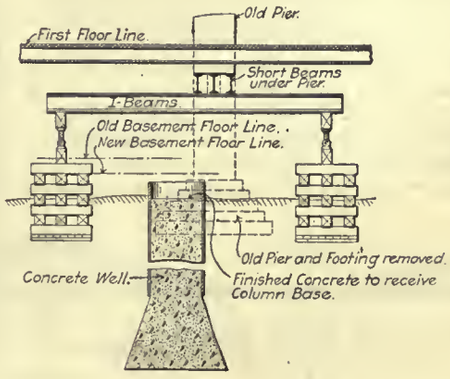
The general plan shows the relative locations of the new caisson foundations and the dimension stone footings, piers, columns and walls of the old building as well as the existing foundations of section 1, which consist of combinations of concrete piers and fifty-foot piling. The use of caisson foundations is not new, and shoring operations are not new; but the combination of caisson founda-

tions and shoring operations on an extensive scale in connection with a going business is, in so far as the writer is informed, something of a novelty. It was evident that, owing to the peculiar complexity of the relations between old and new work, great loss of time would accrue if drawings must be made showing with particularity the scheme of operations in each case. The general plan of operations was, therefore, matured, and it was determined to handle each case individually, wall, column or pier by itself, and treat it as circumstances required in harmony with the general scheme. None of the operations thus carried out is of remarkable difficulty, but all of them required the extreme of painstaking care combined with all possible celerity.

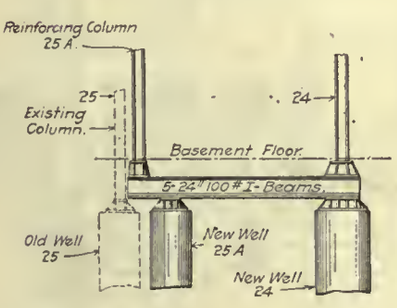
The original basement was but 8 feet high, and, as caisson sinking would require head room for the sheer legs of windlass, etc., it was determined to at once excavate the soil generally to the bottom of the old foundations; meanwhile the shoring operations were



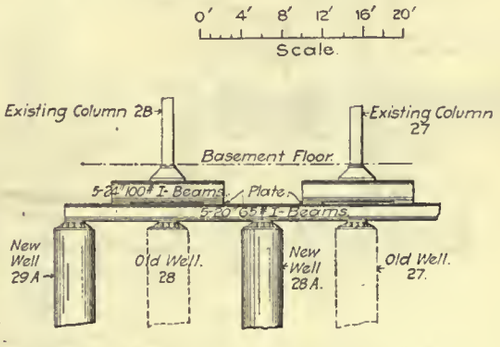
Support for Old Column while sinking Concrete Well under for New Column.



Support for Old Masonry Pier while sinking Concrete Well under, for New Column.



Method of Reinforcing Column in Alley Wall to carry Three Additional Stories.



Method of Reinforcing Foundation under Existing Columns for Three Additional Stories to Building.

Underpinning Old and Building New Substructure.

put under way by prompt excavation of trenches for the cribbing and putting in place the distributing work necessary for the underpinning of piers and columns, as shown by the typical sketches. The sinking of caissons was promptly begun in section 2, section 3 being reserved as general storage and working space. Caissons in the available free space between internal columns of section 2 were begun first, and were regularly followed by those required for the support of external columns, beginning at the northwest corner of section 2 and following consecutively south and east. It was not considered expedient to sink more than five or six caissons at one time, as the operation of a greater number would require a larger gang of men than could effectively be used. Work on both shoring and the caissons was pushed night and day with three eight-hour shifts, and was suspended only between the hours of midnight of Saturday night and midnight of Sunday.

For handling and removing excavated materials and for receiving new materials, two towers of moderate dimensions were erected on the State street sidewalk. In one was installed a double counterbalanced wheelbarrow hoist, with platform extending over receiving wagon on the street level; in the other were installed chutes for receiving cement, sand, gravel and other materials. The excavated earth was removed at approximately the rate of 300 cubic yards per day. The full and undisturbed use of about 17,000 square feet of basement floor space, combined with an excellent system of electric lighting and the protection afforded by the existing building against all inclemencies of weather were highly favorable to the progress of the work, which, when once well inaugurated, was kept steadily under way until January 1, 1903, at which date fifty-three out of the fifty-nine caisson foundations required were in place. After due consideration it was determined to postpone the sinking of the six remaining caissons which would come under operating passenger elevators, freight elevators, package conveyor and smoke stack, until the time should come for the demolition of section 3, as their prior installation would inevitably cripple the business of the house, while their subsequent installation would in no wise interfere with the general progress of the work.

The support of certain parts of the work by means of shoring was of a nature so complicated as to be almost indescribable, and resulted in effect in a maze of beams, blocks, screws, etc. In several instances it required a full month, working day and night, to provide the necessary supports prior to the sinking of an individual well. In many instances the wells had to be sunk half way under existing foundations, or immediately under old columns and piers, or directly between existing foundations. Yet so systematically was the work undertaken and carried out that the additional cost of the installation of the sub-structure work complete, including all shoring, was within $8,000 in excess of what it would have cost had the work been carried on in an open field.

The caissons were sunk in the manner now in practice in Chicago, commencing with a circular hole dug about 6 feet below the excavated basement. This was lined with 2x6-inch tongued and grooved pine vertical lagging; a heavy iron ring being expanded near the top and bottom. The excavation was then continued in 5-foot sections, lagging inserted as before, and so on until the required depth was reached. When each well had been sunk to the proper depth for belling an auger boring was taken to make sure that the shale, which was assumed to be a satisfactory support for the foundations, extended to a further depth of at least 16 feet; the auger hole was filled with sand and the wells immediately filled with concrete dumped from wheelbarrows at the top. The upper 10 feet being packed with rammers. Concrete, in proportions of 1:3:5, was mixed in a machine conveniently located, washed pebbles in sizes ranging from a hen's egg to a pea being used in place of broken stone. The upper foot of the concrete filling of the wells was made extra rich to serve as a suitable support for the circular cast iron bed plates. The pebble concrete has proved of superior quality, all voids being completely filled and broken samples showing a clean fracture through both pebbles and concrete.

The operation of sinking a well is very simple. It required one digger at the bottom, a bucket, rope and windlass and two men at the top; but the work was found to be laborious, owing to the actual toughness and stickiness of the clay despite the presumable softness of the plastic clay as shown by the borings. At a depth of about 50 feet below the general excavation this clay began rapidly to stiffen, and so continued until the stratum of shale was reached at a depth of about 60 feet below general level of excavation, or about 75 feet below sidewalk level. Generally speaking water was not found in the wells during sinking operations; on the contrary, it was necessary to send water to the diggers. In one instance a sudden gush of water occurred at a depth of about 40 feet, was shortly over and was quickly bailed out. The origin of this water pocket has not been traced. The shale upon which it was determined to base the concrete piers is a stratum of the glacial drift. It is exceedingly tough, almost dry, and is permeated with a very fine black gravel; it can be cut, or rather chipped, only with a mattock. To excavate it is very laborious, so that it required nearly as much time to shape the bell as to sink the shaft of the well. It was found that well sinking progressed at an average of about one well per day, or, in other words, it required about six days to sink and fill one well. This rate of progress was maintained with a fair degree of uniformity, slacking up or gaining in accordance with the delivery of material. The shorers kept suitably in advance of the diggers.

As operations progressed, a part only of the shoring was allowed to remain. Wherever possible, the piers or columns of the old buildings were reset upon the new concrete piers. Incidental to the general operations, the old curb wall, which was found to be in good condition, was underpinned to the depth required by the new basement floor; the dimension stones from old foundations being split up and used for this purpose. The south line-wall was put on drums, a small section at a time, and the new foundation inserted at a lower level; after allowing proper time for the setting of cement the wall was again underpinned and allowed to rest upon the new foundation. The handling of this wall was an extremely delicate operation owing to the fact that the rubble masonry

above the old foundation was found to be of an almost unbelievably inferior quality.

The south wall of the new building is to be built within the lot lines of the property. The south row of new steel columns will therefore be cantilevered according to the method that now prevails. In order that the bells of the south line of wells shall not project into the neighboring property they were made substantially elliptical in form instead of round. All of the operations connected with the substructure work were carried out with great intelligence and care by those who had them in hand, and were brought to a conclusion without the slightest mishap of any kind.

It was found necessary, during the progress of the work, to support the existing sidewalk, not only as a measure of public safety, but to insure sufficient working space. Many difficulties were encountered in shifting and readjusting the various sewer pipes, underground pipes of the sprinkler system, water supply pipes, electric wires, cash conveyer tubes, etc., and in adjusting the shoring supports accordingly. It was found that a well could be sunk in close proximity to an old foundation, indeed partly under it, provided that foundation had been carried originally to the blue clay, without supporting such pier, column or wall by means of shoring. In such cases, however, it was not deemed advisable to sink two contiguous wells at the same time.

The greater part of the old foundations rested upon a treacherous mixture of sand and clay permeated by water.

Inasmuch as it had been determined to make the new building twelve stories in height, whilst the existing section 1 is but nine stories in height, and the steel columns and the foundations of same were designed accurately for their loads, it was obvious that the steel columns for the west and south row bounding this section and their supporting concrete piers must be reinforced. This work is now under way, and will be accomplished by a system of intermediate concrete piers sunk to the same depth as the old ones and a distributing system of foundation beams. The two columns, one within the masonry of the alley wall and one within the Madison Street wall are to be reinforced by an especially designed new column with cantilever foundation-supports. The floor system of section 1 adjoining these columns is now carried upon a system of drums, screws and cribbing, reaching from blue clay to the roof beams. Column connections will be cut, columns removed, sent to the shop, cut and fitted for new lengths and replaced at a height three stories above the original position, new columns being inserted for the three lower stories.

On January 6, by careful prearrangement, the wrecking of the corner building, occupying the site of new section 2, was begun, and was completed in nine days of sixteen working hours each; operations at night being conducted by the aid of electric light. At the date of this writing, February 2, the third tier of beams for section 2 is in place. Prior to the demolition of the corner building, the usual dust and weatherproof partitions were built, housing in the adjoining parts. It is the present intention to begin wrecking section 3 about May 15. Owing to the impossibility of getting steel columns in time, it was determined to use cast iron columns of round section for section 2 of the building; a special form of connection to the floor system being devised to insure rigidity against wind strains. For section 3 it was found feasible to obtain steel columns. The metal framework of the building will therefore present a curious feature, for there will be three different types of columns in its construction, namely: Gray columns for section 1, round cast iron columns for section 2 and Z bar columns for section 3. It was considered advisable, as a matter of business policy, to proceed with the sub-structure operations as quietly as possible. The general public, therefore, had no knowledge of what was going on until the beginning of the erection of the steel work of section 2 revealed the fact that the foundation work had been completed.

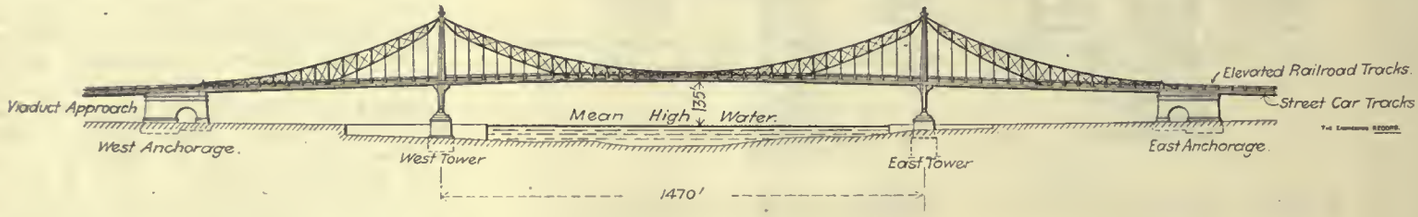
Four test borings, in the basement, near the outer walls, were made to a depth of about 64 feet below the basement floor, and in general indicated a thin upper stratum of wet, sandy clay underlaid by plastic clay varying from very soft to stiff for a thickness of about 50 feet, beyond which there was a stratum 10 or 12 feet deep of dry clay with gravel and shale overlying the hardpan. At one boring the successive depths of the different strata were as follows: Concrete and cinder filling to a depth of 1½ feet below the basement floor; wet, sandy clay to 4½ feet; plastic clay to 26½ feet; stiff clay to 30 feet; soft to very soft clay to 38½ feet; stiffer to plastic clay to 53 feet; very hard, dry clay with gravel and shale to 64 feet, hardpan below. The other three borings corresponded essentially to this with different locations for the intermediate stratum of stiff clay. At another boring there was a 2-foot layer of stiff, blue clay above the plastic clay and a 1-foot layer of water bearing black sand over the hard clay 6 feet above the hardpan.

It may be noted in closing that the system of caisson foundations now coming into general use in Chicago admits of the excavation of a sub-basement at a future time. This will be presently demonstrated in Schlesinger & Mayer's building, where it had been determined to sink a sub-basement about 50x140 feet with a clear head room of 20 feet to receive boiler and machinery plant. The operation of excavating for a sub-basement is greatly simplified by the presence of the stout concrete piers which will serve as a strong and suitable support for cross bracing, should such be required. It is probable, however, that the method of operations to be followed will consist of sinking trenches to the full depth, building the retaining walls of concrete therein, and then excavating the full enclosed area; or, perhaps, to begin by excavating the full area to a reasonable and easily managed depth, and then to proceed with the trenches, retaining walls, etc., as above set forth. These matters are now under consideration.

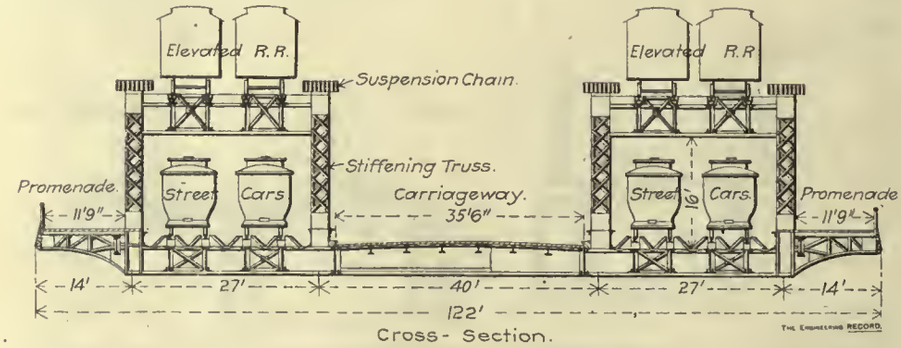
The Manhattan Bridge, New York.

Bridge No. 3 across the East River between the Brooklyn Bridge, or No. 1, and the nearly completed Williamsburg Bridge, or No. 2, is officially known as the Manhattan Bridge. Its termini will be near the intersection of the Bowery and Canal Street, Borough of Manhattan, and on Fulton Street in the Borough of Brooklyn, crossing the respective shore lines at Pike Slip and Washington Street. The original design has been radically modified by Commissioner Lindenthal and the associated architects, and the general features and dimensions having been adopted, have recently been described and illustrated, more or less accurately, in several press accounts. Details of design are not yet made public by the bridge department, but some of the main features of construction and arrangement have been determined as follows: The main roadway will be 122 feet wide over all, and starting from the street levels at both ends will rise with 3 1/10 per cent. grades to a center height of 135 feet above high tide over the navigable channel, as required by the War Department of the United States Government. It will, with its approaches, have a total length of about 9,900 feet, making it the longest city bridge in the world.

The main or center span and the two symmetrical side spans will be suspension structures with center lengths of 1,470 feet and 725 feet respectively, and will be supported from two steel towers, 1,470 feet apart on centers, on comparatively low masonry piers, and rising to a height of 400 feet above high water. The superstructure of the main spans will be suspended from four lines of eye-bar chains with fixed connections at the tops of the towers and at the shore anchorages. The eye-bars will form chords of catenary curves and will be the top chords of stiffening trusses in vertical planes which are calculated to prevent the distortion of



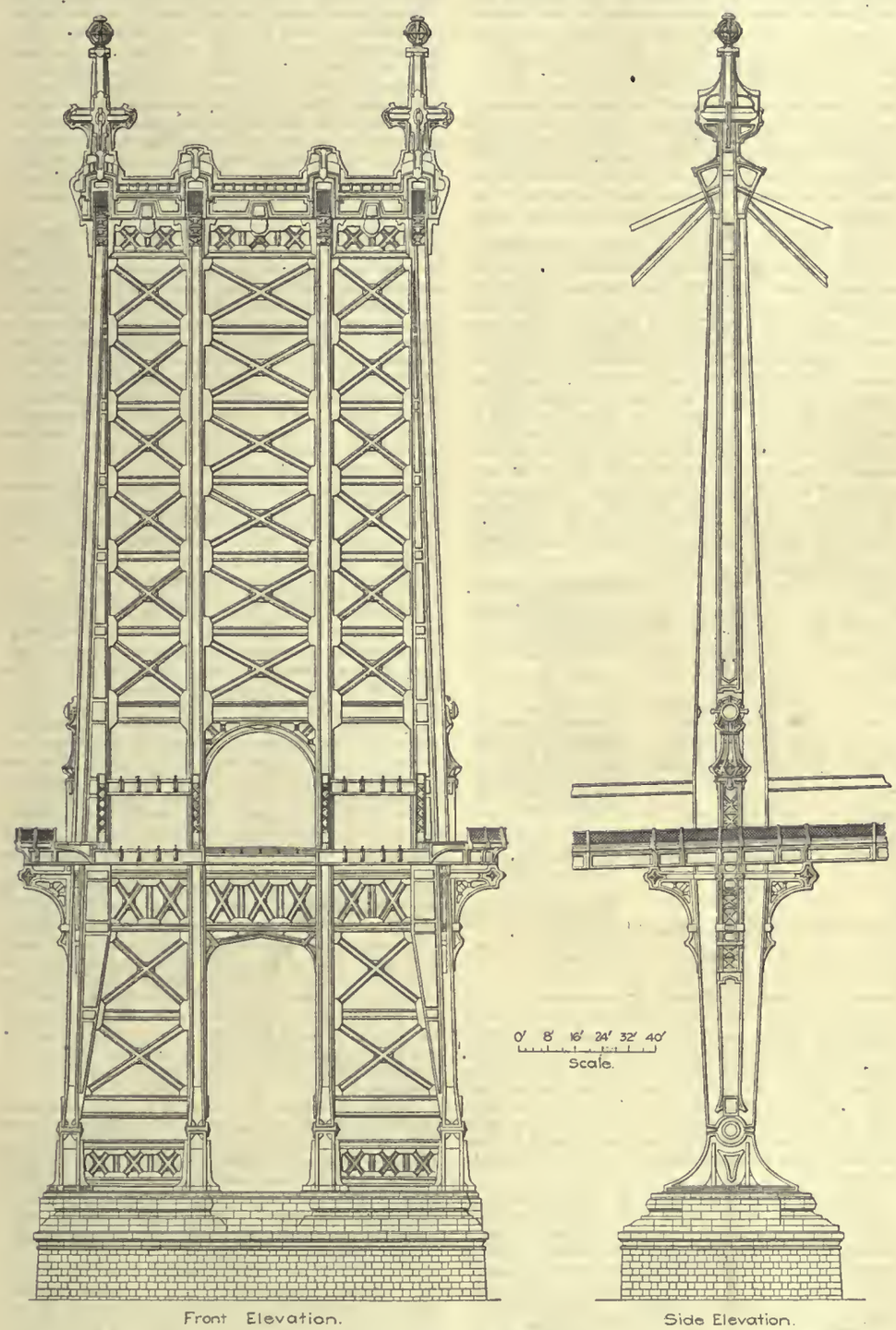
Main Spans of Manhattan Bridge.



Typical Section of Roadway.

the superstructure by unsymmetrical or moving loads. The trusses will have curved bottom chords which, at the anchorage ends and at mid-channel, will lie in the floor plane. As they are designed to have the greatest resistance at the quarters, where the moment of flexure is greatest, and to be shallow at the center so as to cause small temperature and deflection stresses, their construction will effect a considerable economy of weight. They will have panels of about 45 feet in length, will be pin-connected and will support the main roadway platform by vertical suspension members.

The main chains will be in vertical planes 20 and 47 feet each side of the axis of the bridge, and at the shore ends will be deflected over steel vertical posts to enter the anchorage piers at an angle of less than 45 degrees with the horizontal. The main platform will have plate girder floor beams 87 feet long, each supported at the ends and at two intermediate points from the suspension chains, and each having end cantilevers 14 feet long to carry the promenades 11¾ feet wide in the clear, from which there will be an unobstructed view of the river. Adjacent to each promenade there will be two street car tracks between the planes of the inner and outer main chains, and between these two sets of street car tracks there will be, in the center of the platform, a 35½-foot roadway with a capacity of four three-horse teams abreast. The four tracks for the elevated roadways will be carried on two separate upper decks above the street car tracks and there will be no structures of any sort above the promenades or the driveway, thus eliminating all danger from drippings or of falling objects to injure pedestrians or carriages.



Main Tower, 400 Feet High.

The towers are of novel construction, each consisting of a single transverse vertical bent of four massive columns on the center lines of the chains. The two inner columns are vertical and the outer ones are only slightly battered, all being thoroughly united by heavy transverse girders and by rigid X-bracing with portal openings left to accommodate the different kinds of service. The tops of the towers will terminate with ornamental finial construction, and the posts will taper toward both ends in the longitudinal plane. The lower end of each post will be extended to afford a base distributing the pressure on the masonry, and provision for the longitudinal motion of the chains fixed to the tower can either be made at the foot of the tower or, as it will be very small relative to the height of the tower, may be permitted to be absorbed by flexure within the elastic limit.

The tower piers will have foundations carried to bed rock in pneumatic caissons. The anchorage piers are very high and massive and will be pierced with large transverse arches to allow street traffic through them. They will probably be built by cofferdam methods in sandy soil which is 80 or 90 feet deep to the rock. They will have large interior cavities crossed by the upper parts of the anchor chains and, like the tower piers, will be built of concrete with ashlar facing, and will have heavy cornices and mouldings. The design of both superstructure and substructure is intended to combine architectural beauty of outline and detail with engineering merit to afford great rigidity and independence of friction devices and to secure the maximum utility, economy, strength and permanence. The structure will be fireproof throughout and the roadways will have solid buckle plate floors.

Emergency stairs will be provided at several points to connect the elevated roadways with the promenades in case of accident. The promenades will be accessible from the surface of the ground at the corner of Pike and Cherry Streets, New York, and at the corner of Water and Adams Streets, Brooklyn, by means of two stairways and four passenger elevators in each of the anchorage piers. The large amount of space in these great piers will be partly utilized by the construction there of halls available for public meetings. It is estimated that the eight street car and elevated railroad tracks on the bridge will have a capacity of 200,000,000 passengers a year under ordinary conditions.

The estimated cost of the superstructure, including approaches, is ten million dollars and that of the tower and anchorage piers is about three million dollars. The contracts have been awarded for the tower piers, one of which is now nearly completed and the other one will probably be finished during the present season. Enough funds are now in hand to pay for the substructure and an additional amount of five million two hundred and fifty thousand dollars is promised by Mayor Low to be available for the superstructure after July next. It is therefore expected that the principal remaining contracts for the other portions of the bridge will be awarded this fall, so that the erection of the towers can be completed within two years. During this time the chains and superstructure can be manufactured, and as the chains admit of much faster erection than is possible in weaving wire cables, it will be practicable to complete the erection of the bridge in four years.

The design and construction of the bridge is under the supervision of Mr. Gustav Lindenthal, C. E., commissioner of bridges, Mr. Henry A. La Chicotte engineer in charge, and Mr. Henry H. Hornbostel, consulting architect. Mr. John C. Rodgers is the contractor for the caisson foundations of the tower piers.

The American Water-Works Association will hold its twenty-third annual convention at Detroit, Mich., June 23 to 26, with headquarters in Hotel Cadillac.

The Methods of Choosing City Engineers.

By A. Marston and G. W. Miller.

Abstract of a paper read at the annual meeting of the Iowa Engineering Society.

In the course of the preparation of a paper for the "Iowa Engineer," the authors of this paper have recently carried on a correspondence with the city engineers of some twenty-five cities, scattered over this country, on the subject of the methods of choosing city engineers. To a very great extent the purity of the public water supply, the sanitary condition of the sewer system, the comfort of the public in using the streets, the aesthetic appearance of the streets, the economical expenditures of public money in city improvements, and even peace between neighbors over property lines, depend upon the ability and honesty of the city engineer. Certainly all must admit the great importance of choosing the very best man for the place in each case. Just as certainly all must admit that in very many cases, under present conditions, merit is very far from being the only thing which determines the choice of the city engineer.

The desirability of improvement in this matter is universally admitted by those qualified to speak with authority, but the question is, what else can be done? We have asked the questions of what is being done and what should be done of the men we think best qualified to answer them, the city engineer. Some of their answers are presented in the accompanying table and below are given some quotations from letters received:

Methods of Appointing City Engineers in Twenty-five Cities.

City.	Population.	Method of selection.	Term.	Method of selecting assistants.
Baltimore	508,900	Appointed by Mayor	4 years	Appointed by Engr.
Buffalo	352,400	Appointed by Comr. of Pub. Wks.	Pleasure of Comr.	Civil Service
Burlington, Ia.	23,200	Elected by people	2 years	Appointed by Engr.
Chicago	1,698,600	Civil Service	Good behavior	Civil Service
Charleston	55,800	Elected by City Council	4 years	.....
Clinton, Ia.	22,700	Elected by people	2 years	Appointed by Engr.
Colorado Springs	22,500	Elected by people	2 years	.....
Columbus	125,600	Appointed by Mayor	Good behavior	Civil Service
Council Bluffs	25,800	Elected by people	2 years	Appointed by Engr.
Des Moines	62,100	Elected by people	2 years	Appointed by Engr.
Detroit	285,700	Appointed by Comr. of Pub. Wks	Pleasure of Comr.	Appointed by Comr.
Kansas City	163,800	Appointed by Board of Pub. Wks.	Pleasure of Board	Appointed by Board
Lincoln	40,200	Elected by people	2 years	Appointed by Engr.
Memphis	102,300	Appointed by Mayor	3 years	Appointed by Engr.
Milwaukee	285,300	Appointed by Mayor	3 years	Civil Service
Minneapolis	202,700	Elected by Council	2 years	.....
New Orleans	287,100	Elected by people	4 years	.....
Philadelphia	1,293,300	Civil Service	Good behavior	Civil Service
Salt Lake City	53,500	Appointed by Mayor	2 years	Appointed by Engr.
Omaha	102,600	Appointed by Mayor	3 years	Appointed by Engr.
Rochester	162,600	Appointed by Mayor	2 years	.....
St. Paul	163,100	Appointed by Mayor	3 years	Appointed by Engr.
St. Louis	575,200	Appointed by Mayor	4 years	Appointed by Board
San Francisco	342,800	Appointed by Board of Pub. Wks.	Pleasure of Board	Civil service
Sioux City	33,100	Elected by people	2 years	Appointed by Engr.

Summary—Appointed by Mayor, 9; elected by people, 8; appointed by Comr. of Public Works, 4; elected by City Council, 2; Civil Service, 2.

Burlington, Iowa.—"Our office is elective; term, two years. The present method was established in 1897. In practice it works as well as could be desired—that is we think so, as long as we hold the office at least; a little selfish, but highly flavored with human nature. I will say to you that I have found in actual practice that the office of city engineer when elective gives the holder a freedom of action impossible in a position appointed by the council or the mayor, with the attendant evils of dictation. It must be remembered that the ability of the average mayor or councilman is not above that of the average delegate to a convention, hence is superior to him in no way. This may appear strong, but is in line with my observation. To get the best service I would have the civil engineer appointed for a term of ten years after passing a creditable examination. Moral character, integrity, etc., should be considered and have weight in determining the fitness of the applicant as well as a technical education. By technical education should not necessarily mean that the applicant should be the possessor of a diploma. His diploma should be carried entirely in his head and be displayed only through answers to questions. The customary allowance of two years' experience in line of collegiate education, or vice versa, I think equitable. I advise the term of office to be ten years, for that I think is long enough to permit one to hold office without proving that he has improved or deteriorated. A re-examination in competition with others will go far to enlighten the public as to his fitness for another term. If the applicant has studied hard, as all engineers should do, and has no physical disability, he will almost surely be reappointed. Emmet Steece, City Engineer."

Colorado Springs, Colo.—"In a city where politics enters into the administration, we do not know whether we will serve more than one term or not; as a consequence, I do not know whether I shall succeed myself next April or whether some new man may be put in the position. . . . While the people will not do so at all times, yet in my judgment the people, as a whole, are better able to select engineers than a board, clique, or any other set of men, few in numbers, which must be appointed, elected or obtain their position through influence and necessarily, for self-protection, exert their influence to retain their position. E. W. Case, City Engineer."

Lincoln, Neb.—"The city engineer of Lincoln, Neb., has been an elective office since the spring of 1892. Under the system now in vogue, the city engineer and all other city officers are nominated by the primary system. By this system he is under no obligations to any one man or set of men, but to the whole population for his office, and in that way I think that, as practiced here, the engineer is farther removed from political entanglements than by the old system of appointment. The city engineer has the whole say as to who his help shall be. The people here, by their votes, have practically made the office of city engineer non-political. The term of office is two years and nearly all of the engineers have held the office more than two terms. Geo. L. Campon, City Engineer."

Sioux City, Iowa.—"The office of city engineer is a political one and is filled by nomination and election the same as any other city office and requires the furnishing of an acceptable bond in the sum of $10,000 before qualifying. This system has been in use since 1886. The length of term is two years. The assistant is appointed by the city engineer. In a city of this size it would be extremely difficult to remove the office out of the sphere of political influence, and I am not sure that it would be an improvement to do so, for, as a rule, appointing bodies are subject to influence, sometimes political, sometimes financial, and the engineer at best is subject to the will of the leading spirits of that body. The question of merit is not the only one that arises in the filling of an appointive office and in some cases it is entirely overlooked. While the elective system has its objectionable features, yet I think, as a whole, it is preferable, as in it the incumbent is not only responsible to his party leaders, but to the whole people, as he should be under our system of government, and biennially they have the opportunity to either ratify or reject their former choice. If the candidate for the city engineer is alive, a man of ability, integrity and tact, the baleful influence of party politics should not prevent him from discharging the duties of the office with honor to himself and credit to the profession. J. M. Lewis, City Engineer."

Clinton, Iowa.—"The office of city engineer is elective and the system from a merit standpoint is a failure. Any one who gets out and hustles can get a nomination, and if nominated by the winning party is elected. From a close examination of election returns it does not look as if merit made any appreciable difference in the vote for engineer. During the past ten years there have been five different candidates for the office without any experience. Of these two were elected, one from a tailor shop (who had rodded one year on a railroad), and the other from a sash and blind factory, who had taken a course in land surveying ten years previously in Germany, but had never worked at it. We believe the office should be under Civil Service rules with only State licensed engineers eligible to office. Assistants should be appointed by the engineer under civil service rules. I write from thirteen years' experience under both systems. C. P. Chase, City Engineer."

Baltimore, Md.—"I can best answer your question by quoting from the city charter: 'The city engineer, who shall be the head of the first sub-department of public improvements, shall be appointed by the mayor and approved by the second branch of the city council; if they fail to approve, the mayor must send in other names.' The city engineer may be removed by the mayor during the first six months. After six months he cannot be removed except for cause, after trial. The term of office is four years. The city engineer has absolute control of the appointments of all assistants and others in his department, from the highest to the lowest, and hence if he does not get good men it is his own fault. B. T. Fendall, City Engineer."

Memphis, Tenn.—"The city engineer is appointed by the mayor. There is no way that I know of by which merit alone can place a man in this position. J. A. Omberg, Jr., City Engineer."

Milwaukee, Wis.—"The city engineer, who is ex officio president of the board of public works, is appointed by the mayor and confirmed by a majority of the common council for a term of three years. This has been in vogue since 1874. The assistant city engineer is appointed by the city engineer. The rest of the force in this department are under civil service commission. The civil service commission was established in 1896 and has given general satisfaction. Previous to the establishment of the civil service system, all appointments were made by the city engineer and there has never been much political influence used in any appointment in this department. Charles J. Poetsch, City Engineer."

Omaha, Neb.—"The city engineer is appointed by the mayor and confirmed by the city council. This has been in vogue here for twenty-two years. In the past six years the engineer was appointed for three years and previously for two years. The engineer appoints his principal assistant subject to approval of city council. I think to insure best results the appointment should be in the middle of the mayor's term, in place of the beginning, to enable the mayor and council to better familiarize themselves with the competency of the incumbent and to remove the engineer from immediate effect of campaign promises. The employees should be retained on civil service rules. Andrew Rosewater, City Engineer."

Minneapolis, Minn.—"The city engineer is chosen by the council for a term of two years. This method is not to be recommended, but in my opinion the city engineer should be elected by the voters at large. G. W. Sublette, City Engineer."

Buffalo, N. Y.—"The department of public works has been since January 1, 1902, under the control of one commissioner of public works, elected by the people. Under said commissioner are four bureaus, designated engineering, water, buildings and streets. The head of each bureau is a deputy commissioner, who is appointed by and serves at the pleasure of the commissioner. One deputy, designated deputy engineer commissioner, has charge of the bureau of engineering. All other appointments in the bureau are in the competitive class under civil service law. There are under the deputy engineer commissioner nine assistant engineers appointed from the civil service eligible list, and the present incumbents have served varying terms, the longest, I think, eighteen years. There is little effort to fill the position of assistant engineer, except by promotion from a lower grade, except when it requires special expert knowledge not in possession of any one in line of promotion. The rules of the civil service commission do not allow the taking in of outside men, and, in any case, the applicant for the position must qualify by examination conducted by the local civil service commission, whose actions are governed by the State civil service commission. The system is apparently satisfactory. My conclusion is that the system is good and will be good so long as we are able to have proper men in office as civil service commissioners. C. M. Morse, Deputy Engineer Commissioner."

Columbus, Ohio.—"My theory is that the employees in the department of civil engineering should be under civil service rules and appointed after competitive examination; the chief engineer and his assistants should not be limited in any manner as to residence. The citizens are entitled to the best service which it is able to obtain, and the most skilful man or men, wherever found, should be available for such service. Julian Griggs, Chief Engineer."

St. Louis, Mo.—"The engineering work of this city is under the control of a board of public improvements, consisting of six members, representing the various branches of municipal work. The president of said board is elected by the people every four years, the members are appointed by the mayor for a term of four years, the assistant engineers are appointed by the members of the board for a term of four years. Up to the present time politics have not been considered to any great extent in the appointments; merit and not political influence are considered. I would say the only way for an engineer to succeed in a municipal office is not to affiliate with any of the party organizations, but to attend strictly to his duties, and in time the question of politics of an engineer will not enter into the appointment. Jas. C. Travilla, Office Superintendent."

San Francisco, Cal.—"Under the charter, which went into effect January, 1900, the city engineer is appointed by the board of public works and holds office at the pleasure of the board. The board members are appointed

by the mayor, who holds office for two years. 'Said five years' practical experience as such, who shall be board shall appoint a civil engineer of not less than designated city engineer. He shall hold his office at the pleasure of the board. He shall serve the board exclusively, and shall not be engaged in any other business while he is in service.' C. E. GRUNSKY, City Engineer."

Chicago, Ill.—"Since 1897 the city engineer of Chicago has been appointed under the civil service law after having passed a competitive examination. The assistant engineers are appointed in the same manner. Removal can be made only by preferring charges, and the accused has the right to defend himself before the civil service commission before the discharge can become effective. Should the commission consider the charges not well founded it orders a reinstatement. JOHN ERICSON, City Engineer."

Philadelphia, Pa.—"Since April, 1887, the office of chief engineer and surveyor, and all assistant engineers and subordinate officers of the bureau of surveys, have been filled by appointment of the director of the department of public works, after competitive civil service examinations. These examinations have proved satisfactory and resulted in raising the standard of public service in this bureau to a high degree of efficiency. Appointees hold office during good behavior, and may be removed by written order of the director, giving reasons therefor, provided it is not done for political reasons. As a result of the system of competitive examinations there were upon the list of employees of this bureau, engaged on public works, during this spring and summer, seventy-five college graduates, representing most of the colleges and universities in the eastern part of the United States, and rendering most efficient service. G. S. WEBSTER, Chief Engineer."

We have called attention to the ills, and in addition we wish merely to lay down a few principles which we think should help guide the steps of progress in this matter. First of all every one can agree to the principle that the city engineer should be selected and retained in office for merit alone. Political affinity should not be taken into account in the slightest degree. The only question at all debatable is how to bring this about. To place the office under civil service regulations will naturally occur, but it seems evident that this method in its usual form can only be adopted by those cities large enough to maintain a competent civil service commission without finding the expense a serious draft. Moreover there are so many qualifications for a city engineer which can not be properly taken into account in any examinations, that there is room for serious doubt whether such responsible positions can not be filled by direct appointment by some intelligent and honest appointing power. Even where civil service regulations are adopted for selecting the city engineer, the appointing power should be allowed to give very great weight to those qualifications which can not be determined by examinations.

In the majority of cities, and especially not of very large size, it seems probable that the city engineer must, at least for a long time to come, continue to be selected by means very similar to those now in use. Any of these means, whether by election or by appointment by mayor, council, or board of public works, is capable of giving most excellent results if administered on the basis of appointment for merit alone, and does in some cases give excellent results. Any of these means, on the other hand, is subject to most deplorable abuses when not administered on the basis of merit. The question is, then, how to make the consideration of merit the important thing, no matter what method of appointment is adopted. It would seem, in the first place, that the law ought to carefully specify the qualifications for the office. Of course it would doubtless be possible to evade legal requirements, but the fact that such requirements existed would help. The law should specify that the appointee should be a civil engineer of a certain training (not necessarily school training), and of a certain number of years experience, and that he should have a recognized high professional standing. If we ever succeed in getting our State license law for engineers, a State license should be one of the requirements. Could not the law require that the professional standing of the appointee be certified by a temporary board, one at least to be a civil engineer selected by the president of this society?

In the second place, the tenure of office ought to be during good behavior. Of course, this would carry with it that either the Board of Public Works, the Mayor or the Council, should have the power of removal for cause, and they ought not to be so hampered in this respect as to enable an incompetent man to hold on to his position, but the engineer should be given the right to a public hearing before removal, and should have redress in the courts against injustice. Making the tenure of office during good behavior would go very far toward rendering it impossible for men to obtain the office merely as a reward for political services. Moreover, it takes about one of the present terms of office to enable a man to become thoroughly acquainted with the local conditions and requirements of his work, and it is absurd to dispense with his services just as they become most valuable.

In the third place, the appointment of subordinates in the city engineer's department, ought, in all cases, to be on a civil service basis. In cities too small to maintain a civil service commission, the examinations could be conducted by the engineer, assisted by other members of an examination board appointed temporarily or permanently by the Mayor. The engineer should have the right to select from the eligible list, and should also have the power of making removals for cause, after a public hearing given the person removed. Putting the engineer's force on a merit basis will help remove the city engineer's office from politics, for it would then be impossible for any one to demand from him promises of appointments in payment for votes and other assistance. Also it will help the quality of the city engineer's work to have his force permanent, so that when a new city engineer is appointed he may at once have the benefit of the advice and experience of subordinates thoroughly familiar with the local conditions and the routine of the department's work.

Technolexicon.

The technical dictionary in English, French and German, comprising a complete vocabulary of terms of all industries, now in course of preparation by the Society of German Engineers was described in some detail in The Engineering Record of May 25, 1901, and September 6, 1902. The collecting of words was begun a year and a half ago, but it is expected that this part of the task will not be completed before the end of next year. Then the compilation of the contributions will begin, and will occupy about two years, so that the manuscript will be ready to go to the press by the end of 1906. Not only contributions of technical terms with the translation for them are valued, but also those which, in giving merely the technical term, give, at the same time, an explanation thereof, viz.:— in which sense or in which connection the term is used; and also contributions regarding customary phrases used in the technical language of the country are highly appreciated. If a very uncommon term is communicated, the source where the term may be found should be stated.

The principal sources for the "Technolexicon" are these contributions, but of great value are also catalogues, price lists and other printed matter of industrial firms, from which technical terms can be gathered by the editorial staff in Berlin. It is highly desirable, therefore, that all the manufacturing firms publishing catalogues, price lists, etc., send a copy of their printed matters to the Editor of the Technolexicon, Dr. Hubert Jansen, Berlin, N. W. (7), Dorotheenstrasse 49. It is thought to be also in the interest of such firms, for the "Technolexicon," once completed, will undoubtedly prove a valuable help in the work of translating catalogues from one language into another.

All those who may desire to contribute through collecting terms and phrases, may apply for note-books, especially arranged for that purpose, and for letters of information directly to Dr. Jansen or to Dr. Alfred Mueller, 150 Nassau Street, New York City, N. Y.

Meeting of New England Water Works Association.

The February meeting was held on Wednesday, February 11, at the Hotel Brunswick, Boston, with President Charles K. Walker in the chair, Willard Kent, secretary, and present also about 80 members and guests. Five new members were elected.

Mr. Robert Spurr Weston, of Boston, read a paper on The Water Supply of New Orleans and Its Improvement. Mr. Weston was in charge of the experiments on purification which were completed a few months ago, and his paper was a brief statement of the present condition of the water supply, followed by a description of the principal investigations carried on and their results. He showed a sample of the Mississippi river water at about its average condition, which was a revelation to most of the members, and followed it with a sample of water which had passed one of the experimental purification plants; on account of its freedom from color this was almost as much of a surprise as the other.

Mr. Caleb Mills Saville, division engineer on the Metropolitan water works, read a paper on Pipes and Pipe Laying of the Metropolitan Water Works, profusely illustrated by lantern slides. Among the points brought out, there may be noted: Although there are many miles of 48-inch and 60-inch pipe, there are in the lines no gates larger than 36 inches, long reducers being used on each side to give a taper something like that of a Venturi meter; changes in direction are made by opening joints on straight pipe as far as possible with joint opening not exceeding 1 inch; when special curves are used, they are backed with concrete to take the thrust, and the joints run solid with lead; the pipes laid very carefully to line and grade, with their axes usually about 5 feet below the surface of the ground; water is used for settling material in backfilling trenches whenever the material is proper, but it is necessary to be careful not to float the empty pipe line; before acceptance from the contractor, all pipe lines are tested under hydrostatic pressure. The slides illustrated many interesting details of the work described, most of which related to pipe lines 20 inches or larger in diameter.

It was announced that a sub-committee consisting of Past-Presidents Holden and Merrill had been appointed to consider the place for holding the annual convention, and that they would be glad to receive any suggestions from the members.

The Water Board of Cambridge, Mass., in its last annual report, unanimously recommends the immediate installation of a complete meter system, and to that end advises the appropriation of $25,000, to be charged to the water works construction account, and met by an issue of bonds to be paid out of the water works receipts. This sum will probably provide for all the meters that the board can set during the year.

The Septic Tank at LaGrange, Ill.

By William B. Ewing, Chicago.

LaGrange has a population of 3,500, and covers an area of one and one-half square miles. The ground is undulating, rising to the south, excepting a triangular strip along the east side, which is almost level and is about 16 feet lower than the main portion of the town. A combined system of sewerage carries not only the sewage and storm water of the town, but also the drainage from a tract equally as large, outside of the town. This circumstance compelled the town to construct a larger outlet than is usual in towns of its area and population. The system consists of laterals on the north and south streets connecting into the main sewer, which extends east and west through the center, to the outlet, which discharges into an open ditch about 4,000 feet east of the town.



General View of LaGrange Septic Tank.



Outlets of Septic Tank.

This ditch empties into Salt Creek about 300 feet above its junction with the Des Plaines River. The diameter of the main sewer where it joins the outlet is 5½ feet. In the storm water area of the La Grange sewers there are over 25 miles of paved streets which afford the storm water a rapid and easy flow to the sewers, so that a comparatively light rainfall quickly increases the flow in the sewers and produces a marked increase in the flow in the main sewer.

To avoid passing all the storm water through the septic tank and to intercept the sewage and the first flood wave of storm water, a weir was built at a high point in the main and a 12-inch sewer pipe laid from the weir to the septic tank, a distance of about 1,000 feet. That portion of the sewage below the top of the weir passes through the 12-inch conduit into a settling chamber, where any sand or mud washed from the streets is prevented from entering the tanks. These chambers are constructed in duplicate, each being 12x14 feet and 6 feet deep. Each chamber has a valve at the inlet and outlet and also a valve through which its contents can be drained into the main sewer, when it is necessary to empty it.

The sewage flows from the settling chambers into the septic tank, which consists of three separate compartments, side by side, each 100 feet long, 10 feet wide and 10 feet deep, covered with a roof of concrete 6 inches thick. The depth of the sewage in each tank is 7 feet. The sewage is stored from twelve to eighteen hours and flows from the tanks over three weirs in thin transparent sheets, dropping 18 inches into a shallow basin, from which it discharges back into the main sewer. Each compartment is provided with a valve at the inlet by which the flow may be regulated or cut off, and a separate weir, over which the effluent flows. Three feet from the outlet there are baffle boards extending from the roof of the tank to 2 feet below the flow line, which prevent the gas in the tanks from escaping, or any portion of the scum from passing out over the weirs. Each compartment slopes toward the outlet and can be drawn off into the main sewer if desired. An accompanying illustration shows the sewage flowing from the tank. The discharge pipe leading to the main sewer is inserted in the bottom of the basin just in front of the middle weir. Another illustration is a view of the tank looking west. The main sewer lies in the street outside the fence, and the effluent from the tank flows from the basin in the foreground back into the main sewer, from which the sewage was intercepted.

All the masonry is constructed of concrete consisting of 1 part Portland cement, 3 parts torpedo sand and 5 parts crushed limestone, thoroughly tamped into forms. The roof has clear spans of 10 feet and is built of concrete 6 inches thick reinforced by heavy woven wire netting embedded in the lower quarter. The top is covered with 1 inch of cement mortar, floated to a smooth surface. The work was designed by the writer and constructed under his direction by the contractor, Mr. R. J. Nash, of Chicago. It was completed and the sewage turned in on November 15, 1901, and has been in continuous operation since.

The developments following the beginning of use of the tank were somewhat interesting. In a few days the entire surface of the sewage was covered with large bubbles of gas and a little later by the basis of a scum, in a curdling or clotting at the surface, which gradually thickened into isolated patches of a leathery scum of black decomposed matter covered with a tough crust, puffed up with gas. These patches, enlarging, later extended over the entire surface. The roof being exposed to the changes in temperature, the contents of the tank were susceptible to extreme changes. During the winter the scum was very slow in forming, and no heavy coating grew until the middle of May, at which time it was a foot thick and so remained, the surface drying and cracking, as shown in one of the photographs which is a view in one of the manholes. The apparently slow growth of the scum during the winter seemed to have no bad effect on the effluent of the tanks; upon the fifth day it cleared up, was free from odor and color and no further decomposition was apparent in the samples that were taken from time to time during the year.

The object of the plant was to remove the cause of offensive odors produced by decomposing sewage in the open ditch. This has been successfully accomplished, and no complaints have been made since the plant has been in operation. The design of the plant provided for filtration of the effluent, if necessary; but at the present time there has been no occasion for further treatment. Usually no odor is perceptible at or near the tank, and except at rare intervals on windy days, the tank cannot be located by the sense of smell. The beneficial effects of mechanical action on the sewage in assisting the action of the tank, as noted in a recent report of the State Board of Health of Massachusetts is apparent in the La Grange tank, the sewage varies in character from a strong domestic sewage during a period of dry weather to a weak solution of storm water following heavy rain storms, which flowing through several hundred feet of sewers and a thousand feet of the conduit leading to the tank, breaks up the solids into small particles which more readily yield to the action of the tank and prevent the accumulation of deposits. The writer is of the opinion that the location of a septic tank is one of the important considerations in its design and operation.

The variation in the quality of the sewage, as noted before, has produced no apparent effect on the character of the effluent, the difference in strength of the sewage is counteracted by a corresponding variation in the time of storage in the tank; the strong sewage being at a time of minimum flow, remains longer under the septic action, while the storm water flow, a maximum, passes through the tank in a correspondingly shorter time. During a period of heavy storms, the effluent is at times turbid. A large number of soundings were made during the year without detecting any deposit on the bottom of the tank. At the end of continuous operation for one year, a compartment was drawn off. Its sides were slimy, and on the bottom there remained a thick slime about 1 inch deep, which, on the removal of its water, left a dry scum less than ⅛ of an inch thick.



Scum in Septic Tank.
Viewed through a manhole.

"Science Abstracts" hereafter will be published in two sections, Section A,—physics embracing light, including photography; heat; sound; electricity and magnetism; chemical physics and electro-chemistry; general physics; meteorology and terrestrial physics; physical astronomy. Section B, embracing steam plant, gas and oil engines; automobiles; oil engine driven ships and launches; balloons and airships; general electrical engineering; including industrial electro chemistry; electric generators, motors and transformers; electrical distribution, traction and lighting; telegraphy and telephony. The American Physical Society is now joined with the Institution of Electrical Engineers and the Physical Society of London in the direction of the publication and has elected Professor E. H. Hall, of Harvard University as its representative on the publishing Committee. In consequence of this arrangement, Section A will in future be received by all members of the American Physical Society. The American Institute of Electrical Engineers is also co-operating with the Committee.

A Proposed Subway System for Chicago.

There has recently been made public a very comprehensive report entitled "The Engineering and Operating Features of the Chicago Transportation Problem," submitted to the committee of local transportation of the Chicago City Council by Mr. Bion J. Arnold, consulting electrical engineer, Nov. 19, 1902. The report is made in fulfilment of a contract between the city of Chicago and Mr. Arnold for the preparation of estimates, designs, plans, appraisals, and opinions concerning the existing or possible traction companies; their cost of operation and earnings; capitalization and general statistics, which was to include an estimate of the cost of an adequate new system and its net earnings, designs and estimates for construction and operation of an underground conduit system; for the re-arrangement of present surface lines outside the business district; plans of subways in the business district and reports on wages, rules and regulations for employes with recommendations for changes thereof; a design for rails to protect the street pavements; maps of the present and re-arranged terminal facilities and reports on the practicability of operating single cars instead of car trains; of universal transfers; of through routes versus down town terminals and joint use of tracks; on the transformation of cable to underground electric lines; on the re-arrangement of the Union loop; on the prevention of electrolysis; estimates of franchises and of the cost and advisability of cement roadbeds for street car tracks. Mr. Arnold was also to serve as consulting engineer to the committee, and was to receive a compensation of $10,000, plus expenses.

All of the above data is included in the report which comprises about three hundred pages of text, including appendices, fifteen folded plates showing subway construction and stations and details of tracks and conduits, and a case of fourteen large maps of present and re-arranged surface tracks, subway routes, terminal loops, etc. The whole is an elaborate and comprehensive treatment showing thorough study and skill in the consideration of the problem and giving valuable statistics, plans and designs which embrace a large amount of detailed information clearly stated and conveniently arranged. It is, of course, impossible to give even an adequate summary of this data in the limited space available, and we therefore present merely an abstract of Mr. Arnold's conclusions and recommendations, together with some explanation of the principal structural features of the proposed subway system.

The report is divided into six parts, namely: Discussion of Street Railway Systems and Conduits; Inadequacy of Present Terminals and Service, with Recommendations for Improvement under Divisional Ownership; Growth of Population, Development of Transportation, Probable Future Increase; Capitalization and Official Results of the Past; Through Routes, Universal Transfers and "One-City-One-Fare;" Discussion of New Unified System of Street Railways, Technical Problems, Valuations and Estimates. The ten appendices give tabulated data on the length and time of round trip, the maximum number of cars operated on the present routes, recommend routes for operation under unification and divisional ownership, and give schedules of transfer points, the streets occupied by different railways and the streets on which it is recommended to construct new tracks.

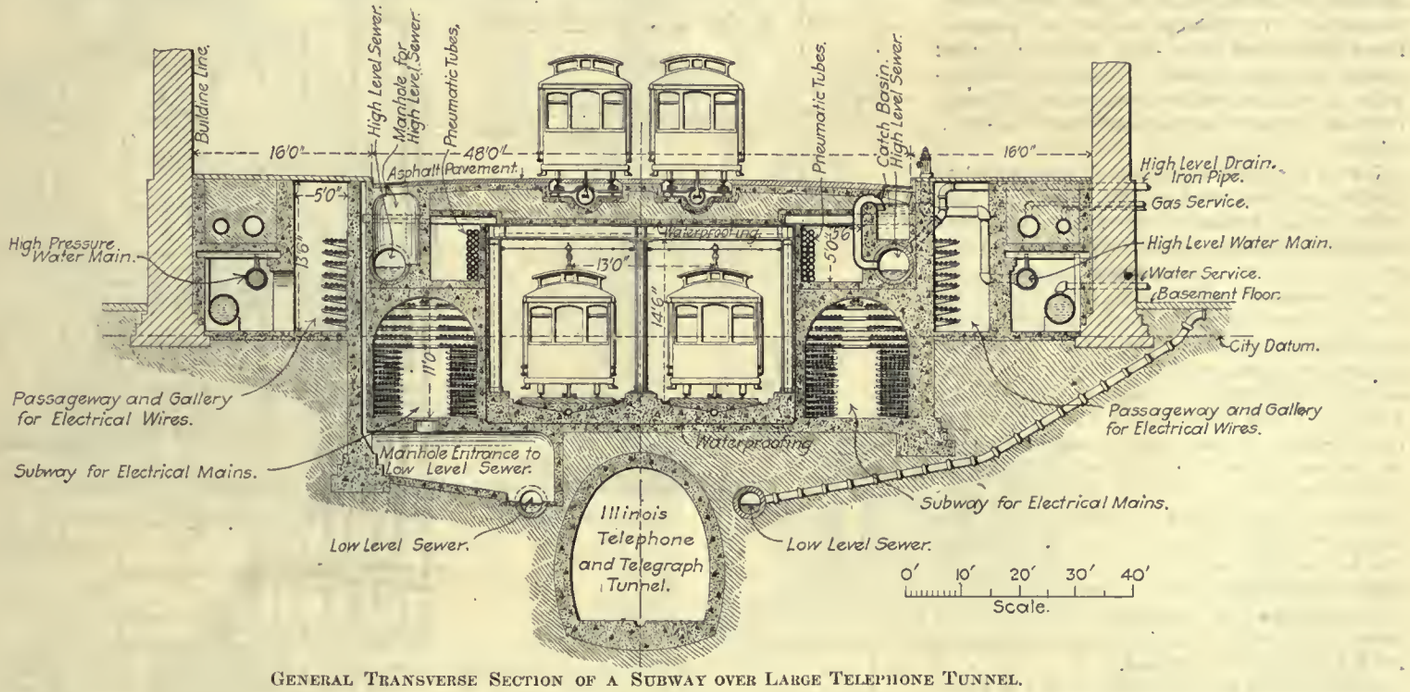
Mr. Arnold acknowledges the co-operation of the railway companies in Chicago and other cities and the valuable assistance received by him from Messrs. Charles V. Weston, C. E., Augustine W. Wright, Oren Root, Jr., and George C. Sikes. He refers to a consideration of elevated sidewalks, movable sidewalks, subsidewalks, railways and other schemes, and to the question of utilizing the water power from the Sanitary District for generating electricity to operate the street railways; but submits no recommendations or data concerning them, his endeavor having been to outline several plans for the eventual securing of the best surface railway transportation facilities. Immediate relief is only possible with a plan of surface tracks designed to ultimately become a part of a combined system which will provide for present needs, through traffic and the abandonment of the river tunnels for street car purposes and their retention for future subway uses. In conclusion he recommends that a street car passenger should be carried over a route between any two points within the city limits for a single fare; that routes through the business district ought to be substituted for down town terminals wherever possible; and outside the business district that the detached lines should be connected and cars operated over them on the through route principle.

A system of street car subways must eventually be built in the business district and should be provided with galleries for present and future underground utilities. Alternative plans are presented, one for a single level system costing $16,000,000 and the other with both high and low level subways to cost $20,000,000, either of which could be constructed in successive portions. A unified system of combined surface and subway street railway tracks having a total of 745 miles of single track, is proposed at an estimated cost of $90,000,000 for the two-level subway systems. Immediate improvements of the local transportation facilities may be effected by substituting electric for cable power and routing the cars according to accompanying plans, so as to enter the city from the north and west sides over bridges until the subways shall be constructed.

An underground electric conduit system at $100,000 per mile, exclusive of paving, is recommended for the business district; elsewhere the cost is estimated at $70,000 per mile. Special grooved girder rails are recommended for well-paved streets and the girder type on poorly paved streets. Single fares could be afforded by a unified company, or transfers could be given between divisional companies. A reasonable regulation of traffic is considered essential to the improvement of the street car service and to prevent its present unwarrantable interference with it. It is recommended to increase the length of the station platforms of the Union elevated loop now, and later to provide stub end terminals just outside the loop.

The development of the subway plans has had in view the ultimate unification of all street railway facilities; the operation of cars between the various divisions of the city through the business district, or the divisional operation of the cars using the subway system as a loop terminal or a combination of these methods of operation; the construction of the system as close as possible to the street level; this arrangement to provide maximum efficiency with a minimum length and the disposition of all underground utilities, so as to be easily accessible without destroying the street surface and without direct connection with the transportation subway.

It is assumed that the entire width of the street between building lines is available for public use and that all pipes and conduits, especially in business districts, should be placed



GENERAL TRANSVERSE SECTION OF A SUBWAY OVER LARGE TELEPHONE TUNNEL.

in properly constructed galleries built, wherever practicable, underneath the sidewalks. The length of proposed subways is 20,825 linear feet of double track and 20,000 linear feet of single track structure, exclusive of river tunnels. Typical cross sections are given of the double track subway over large and small telephone tunnels, through the station, through the intersection with the low level subway, and through the single track subway and the elevated railroad on Wabash Avenue. Plans and cross sections are also given of double and single track stations, and there are details of electric conduits.

The normal sections are rectangular with a steel framework of transverse bents of I-beam columns and roof beams with concrete floor sidewalks and roof arches. Where center columns are used they are built up of plates and angles and the structure is protected by a waterproof coating.

In order to provide for the present maximum dimensions of 8½ feet wide, 11 feet high and 47 feet long of the 50,000-pound trolley cars, the subway would have interior dimensions of 14½ feet in height and 25 feet in width, allowing clearances of 20½ inches on the sides of the cars, which would be maintained on curves and would allow safe passage for employes between the tracks. The minimum depth of platform floors is assumed to be 18½ feet below street grade, and it is proposed to construct the subways chiefly in trenches covered with plank roofs on which the street traffic could be maintained.

Within the subway district it is proposed to provide, on each side of the subway, a high level gravity system of sewers for all house drainage at and above the first floor level and for storm water. This would pass over the subway entrance and discharge directly into the river. A low level sewer would be provided for the basement drainage of buildings and for the subway drainage, and would discharge into receiving wells emptied by pumps. These sewers would be single lines, except when parallel to the telephone tunnels, where there would be one on each side. It is proposed to install in the subway district a 36-inch belt water main connected to the various pumping stations. This will have feeders to lateral supply mains, which will be connected with such of the present pipes as are not disturbed by the subway construction, and so provide for complete circulation of water. A similar arrangement would be made for a gas circulating system.

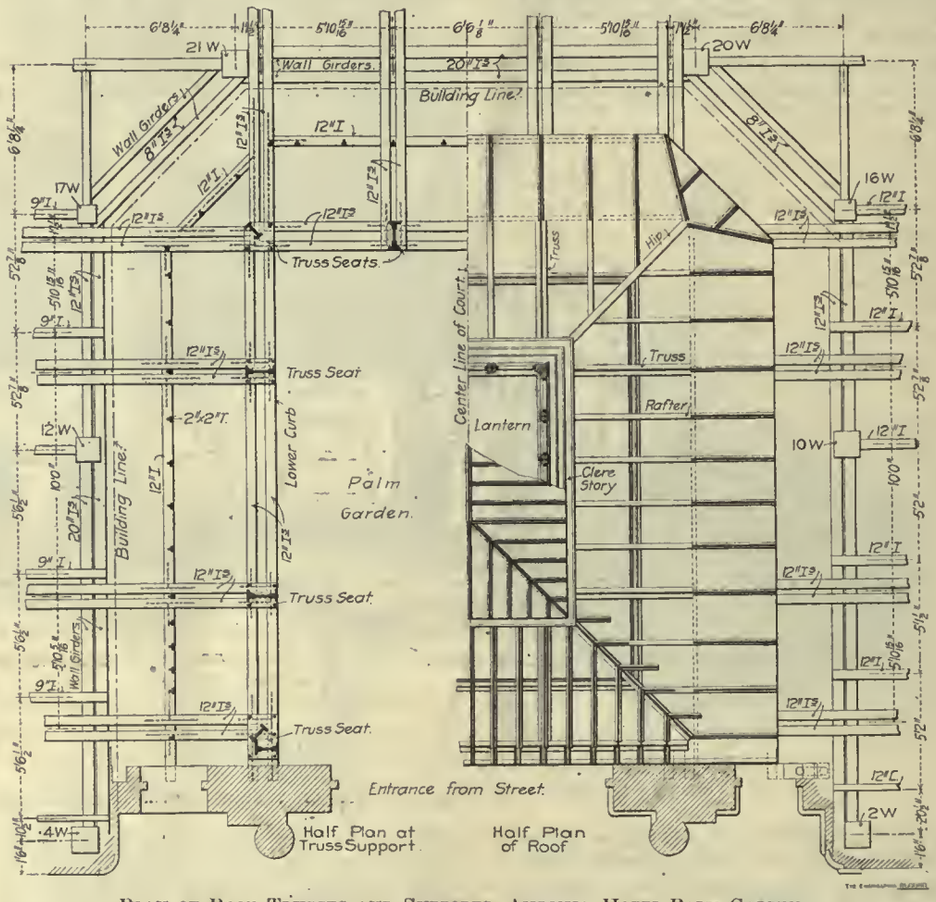
Electric wires and cables would be run parallel to the subway in galleries approximately 9½ feet wide and 11 feet high in the clear with an arched-roof, which would also serve as the floor for a gallery just below street level to contain the high level sewer and pneumatic tubes. The electric gallery would be continuous between subway stations and would occupy the space between the subway wall and curb wall at the outer edge of the sidewalks. Electric wires and cables would be carried on racks and would pass underneath the station platforms in tile conduits terminating in manholes outside the subway walls at the ends of the platforms. Service mains for each block are to be carried in a gallery occupying the first 5 feet inside the curb wall, and having its roof formed by the concrete sidewalk. Between this gallery and the building line there would be another gallery for water pipes, with gas mains packed in sand above its roof. Service ducts 20 feet apart would be provided for connecting the buildings on both sides of the street with the electric main galleries.

By the construction of three or more north and south subways, and three or more low level east and west loops with double deck stations, it is believed that the entire street car traffic of the business center of Chicago, except what would be handled by the surface loops, could be kept underground for several years to come.

The typical cross section for a double-track subway in a 66-foot street over a small telephone tunnel differs chiefly from the cross section here shown in that the lateral galleries are smaller and narrower and the main electrical galleries are proportionately higher, with flat instead of arched roofs, and that there is only one low-level sewer which is located over the crown of the telephone tunnel. The single track subway structure is shown located between the elevated railroad and the existing sidewalk vaults, the outer wall of the latter forming part of the wall of a three-story manhole. The opposite wall of this manhole forms one wall of the subway. The upper story of the manhole gives access to the high level sewer, the middle story to the continuous water service subway and the lower story as a lateral extension a short distance under the subway to the low level sewer. This arrangement does not show any provision for electric mains or gas or service pipes.

The section through the intersecting subways at a double deck station shows the upper tracks parallel to and on the center line of the street with narrow entrance stairways just inside each curb and the platforms between them and the upper tracks. The stairways are continued in the same plane to the lower subway. The spaces over the upper platforms form galleries for the high level sewers, and outside the stairways there are three-story galleries reaching from the pavement to the level of the upper tracks and containing in the lower part electric cables, in the upper part gas mains with sand filling and between them and high and low pressure water mains, the whole construction occupying all the space between building lines. The platforms have a ticket office at each end and exit turnstiles in the center. For the single track subway a platform 125 feet long and 19 feet wide is shown extending to the building line on one side of the subway and having beyond it, in the middle, a waiting room about 37 feet square on the center line of an intersecting street with ticket office and exit turnstiles between it and the platform. The entrance to this waiting room is by two stairways in the corners opposite the subway, and there are toilet rooms and closets between the stairways and the subway.

The rail recommended is laid on a concrete beam and has a girder section and is 9 inches high with a 6-inch bottom flange and 7/16-inch web and a 5 5/32-inch grooved top flange which resembles that used in Philadelphia; but has the wheel bearing made heavier and curved. It is adapted to new asphalt, brick or dressed granite pavements, but is not advised for other streets. The interposition of a well dressed ribbon of granite between the rails and the asphaltic pavements is considered desirable. Sections of the rails used in a number of cities are given. It is considered necessary to provide cement concrete roadbeds for 25-ton electric motor cars on Chicago soil. Where the concrete longitudinal beams entirely enclose the lower part of the rails they are connected by a continuous concrete surface and the use of wood is dispensed with.

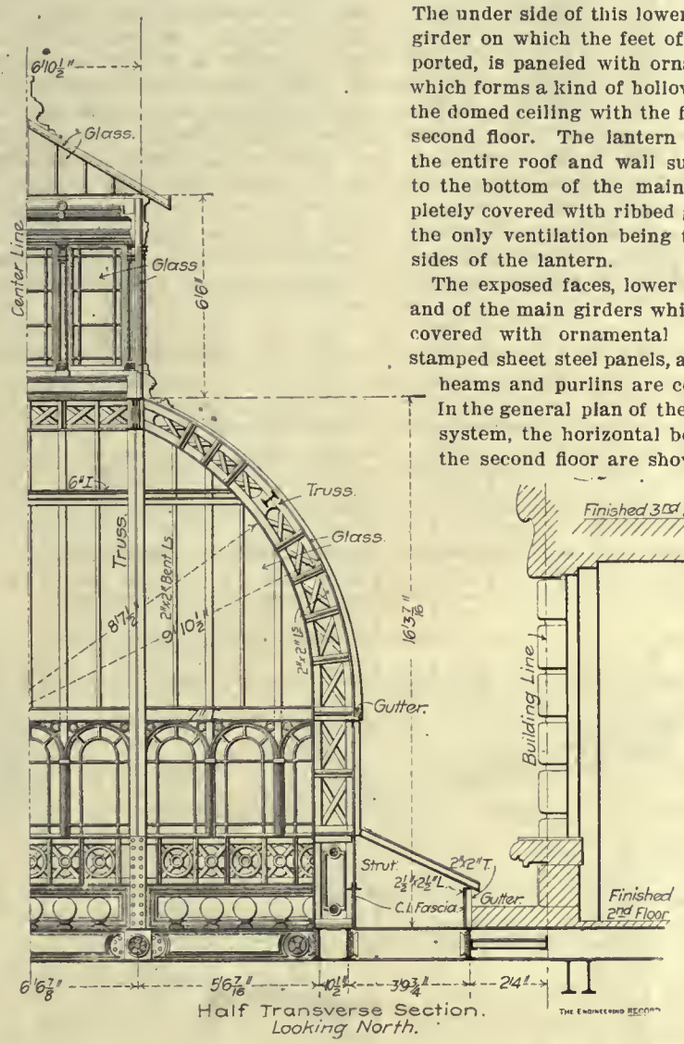


Plan of Roof Trusses and Supports, Ansonia Hotel Palm Garden.

Structural Steel Work in the Ansonia Apartment Hotel, New York.—III. Palm Garden Roof.

The lower part of 30x40 foot west court of the Ansonia building, on the 73rd street side, is designed to be used as a palm garden. It is covered with a convex steel and glass roof supported about 6 feet beyond the building line of the walls on the three sides of the court on the cantilever ends of the regular second floor girders, which have fulcrums on the top flanges of pairs of wall girders connected to the iron columns and supporting the second story wall masonry in the usual way. The ends of the cantilevers are web-connected to pairs of hori-

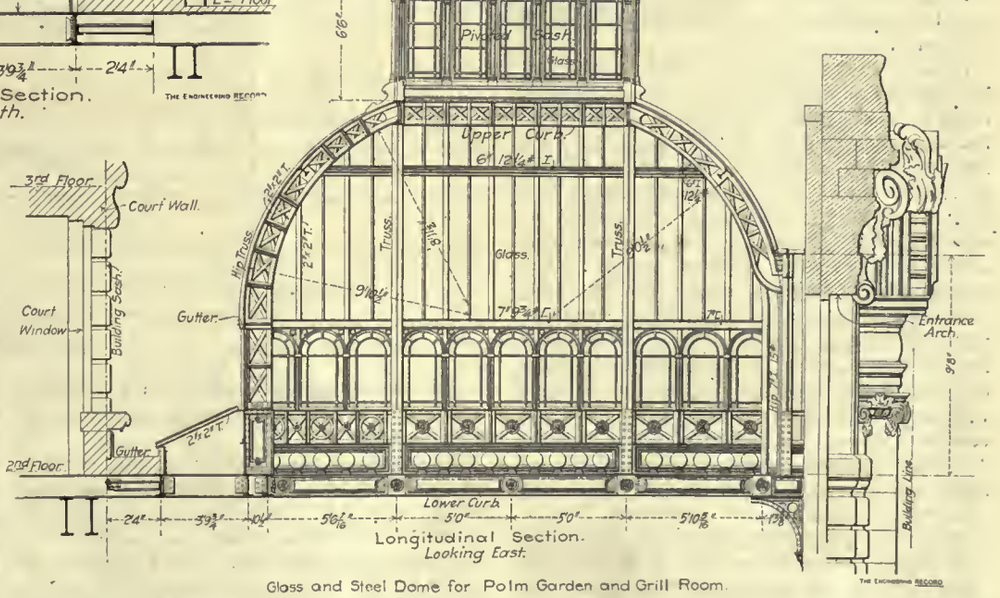
zontal 12-inch I-beams parallel with the court walls, and having on their top flauges, seats for the lower ends of the steel roof trusses, which are curved lattice girders with a lower chord radius of about 8½ feet and have their ends continued vertically about 6½ feet below the springing line, thus giving a clere-story 3½ feet high above the top of the sloping side roof which covers the outer ends of the cantilever beams.



The trusses are like dome ribs arranged at the bottom on the three sides of a 23x19-foot rectangle and abutting at the top on the sides of a rectangular 10x6½-foot curb, concentric with the base of the roof trusses. The curb is made of lattice girders, having their depth equal to that of the roof trusses at the top, and supports a lantern with its vertical sides in the planes of the curb girders. The street end of the roof is set back about 5 feet from the building line, and is carried by a special arch truss shown only in end elevation in the accompanying drawing. This arch is supported just inside the front wall on the main longitudinal girders which carry the other roof trusses. The springing line is near the level of these girders, and the crown of the arch is at the springing line of the regular roof trusses.

There are four transverse intermediate roof trusses, two on each side of the court, and four similar hip trusses seated at the corners of the rectangle and abutting against the top curb at the centers of its ends. One longitudinal truss extends from the apex of the two hip trusses, at the inner end of the roof, to the middle of the lower end beams. The trusses are connected a little above the haunches by longitudinal and transverse 6-inch I-beams with their webs in radial planes as indicated by the plan and cross sections. These beams serve as girders to give intermediate support for the 2x2-inch T-bars about 1 foot apart in vertical planes, curved to correspond with the upper chords of the lattice girder trusses. The feet of these bars rest on a belt channel just below the springing line, which divides the top of the clere-story. The latter is filled, as shown in the elevations, with a light angle-iron framework which gives a sort of arcade of narrow arches reaching to the top of the sloping side roof. The under side of this lower roof, and the fascia girder on which the feet of its rafters are supported, is paneled with ornamental sheet metal which forms a kind of hollow cornice connecting the domed ceiling with the flat ceiling under the second floor. The lantern has a hip roof and the entire roof and wall surface from its apex to the bottom of the main clere-story is completely covered with ribbed glass in fixed panels, the only ventilation being through the pivoted sides of the lantern.

The exposed faces, lower parts of the trusses and of the main girders which support them are covered with ornamental cast-iron work and stamped sheet steel panels, and all of the trusses, beams and purlins are covered with copper. In the general plan of the roof and cantilever system, the horizontal beams in the plan of the second floor are shown by broken lines.



Glass and Steel Dome for Palm Garden and Grill Room.

the cantilevers and roof members being drawn full.

Mr. Paul E. Duboy was the architect; Mr. Philip E. Raqué, the consulting engineer, and Mr. Edward Raqué, the engineer in charge for Mr. W. E. D. Stokes, the owner and builder. The structural steel work was built and erected by Messrs. J. B. & J. M. Cornell, with Mr. C. J. Wolfe, engineer in charge of the draughting department. The copper and skylight work was done by A. J. Ellis & Company.

An Electric Railway Bridge Accident.

An accident on the Berkshire Street Railway, in Lee, Mass., in which an electric car and a steel bridge were demolished, but which fortunately caused no loss of life, should be seriously considered by every person interested in the operation of electric railways. There are comparatively few wrecks on electric lines which do not teach something of value, and this accident contains an unusual amount of food for thought.

A double truck electric car weighing 48,000 pounds, while rounding a curve at the entrance to a through, riveted-truss bridge over the Housatonic River, left the rails, and, after breaking off two wooden trolley poles, struck the inclined end post of the outside truss, demolished almost every member of the bridge, and was itself so completely wrecked that the remains of the car body were burned.

A long tangent, practically level, ends near the entrance to the bridge in a curve of 50 feet radius. The curve itself ends approximately 10 or 15 feet from the bridge abutment. The floor of the bridge was provided with inside guard rails which were carried well around the curve. The motorman and conductor were the only persons on the car, which at the time of the accident, 11 P. M., was within less than a mile of the car barn where the car was to have been left for the night. The car struck the curve at a high rate of speed. The wheels of the front truck rounded the curve safely, but the rear truck wheels left the rails about 30 feet from the end of the bridge. The two trolley poles above mentioned were about 7 feet from the outside rail and were struck by the eaves of the car and broken off. As the car swung around, it struck and broke the end post of the outside truss. The rear end then fell into the river and the front end remained on the bridge. Neither the motorman nor the conducter was injured, although the latter was thrown through the car window upon the ice in the river. The motorman claims to have applied the air brake when within 150 or 200 feet of the curve and that the brake failed to work. He estimates the speed of the car at 15 miles per hour when it struck the curve. About one mile before he reached the bridge he had occasion to apply the brake and it worked satisfactorily. The officials of the company claim that the brake was in working order.

Pennsylvania's Portland Cement Industry.

The Department of Internal Affairs, of Pennsylvania, has recently issued an historical and statistical monograph on the manufacture of cements, treating especially of the Portland cement industry in that commonwealth. The report was prepared by Mr. Robert W. Lesley, Assoc. Am. Soc. C. E., president of the American Cement Company, and is illustrated with views of cement works and quarries and cuts of a number of the machines used in the working of Portland cement. The ancient and more recent history of cement and its production are reviewed at some length, analysis of a number of American and European Portland cements are given and some statistics relating to the manufacture, consumption, importation and exportation of cement are presented.

To Smeaton, the constructor of the Eddystone light house, is given the credit of the discovery of hydraulic mortars. His problem was the construction of foundations under water in a difficult place, and it was imperative that mortar to set under water should be had. Out of this necessity grew the first introduction of hydraulic cement or hydraulic limestone mortar. In the course of his work he made a number of experiments in the way of burning various limestones for the purpose of procuring lime for his construction, and the result of these tests showed that the theories of the ancients were incorrect, and that the burning of hard limestones did not give the hardest mortar, as they had supposed. He discovered that the softer limestones, namely, those limestones which contained by analysis, a fair amount of argillaceous substances or clay, would give excellent results in hydraulic construction, and he laid down, as a result of his discovery, the principle that a limestone yielding one-fifth to one-fourth per cent. residue when dissolved in hydrochloric acid, would set under water. To these limestones he gave the name of hydraulic limestones, and from the principle laid down by him come the two great definitions of what we know as the "natural" and the "artificial," or "Portland" cement of commerce.

In 1901 Pennsylvania produced more than half of the total quantity of Portland cement made in the country. In 1882, as reported by the Geological Survey, 85,000 barrels of Portland cement were made in the United States; in 1890 seventeen works produced 335,500 barrels; in 1900 fifty works had an output of nearly 8,500,000 barrels; and in 1901 the total production was over 12,700,000 barrels. The accompanying diagram shows the domestic production, importation and total consumption of Portland cement in the United States for the twelve years from 1890 to 1901. This diagram shows that the imports of cement, with some small variations, have remained constant since 1890, but the production of American Portland cement, which in that year amounted to only 335,000 barrels, or 15 per cent. of the total amount consumed, has increased in eleven years thirty-five times and now supplies about 95 per cent. of the demand.

The growth of the consumption of cement given by periods of ten years is as follows in pounds per capita:

1850	6.46
1860	10.49
1870	12.77
1880	13.04
1890	33.93
1900	91.82

Generally, therefore, it may be safely said that the cement industry is growing rapidly, but most especially is this the case with the manufacture of Portland cement, the production of which this year is expected to largely exceed all previous years.

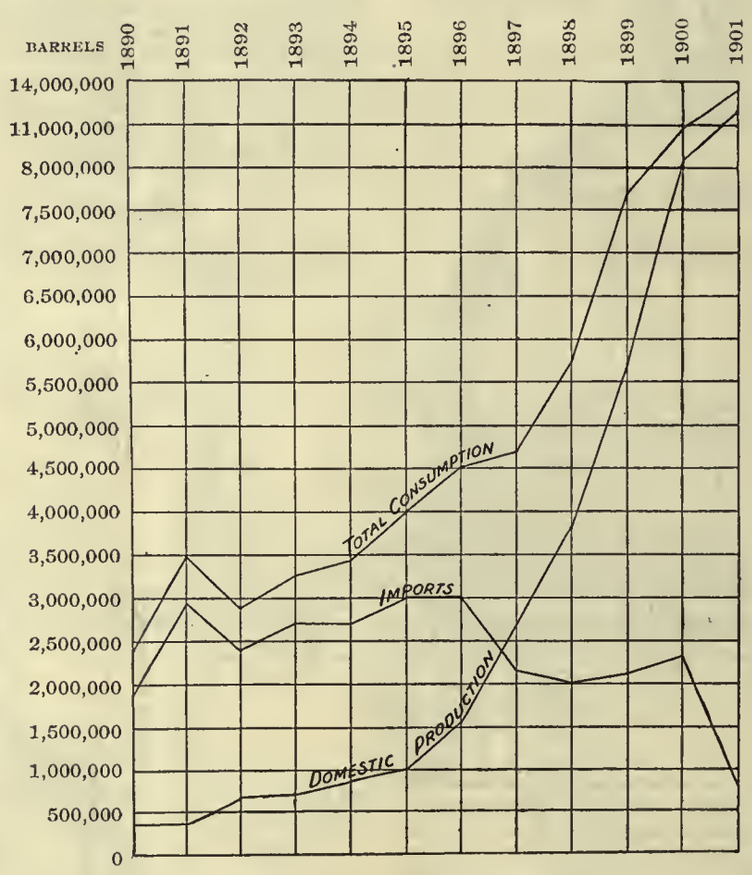
The first successful works in the United States were those of Mr. David O. Saylor, at Coplay, Lehigh County, Pa., and this plant together with the works of the Wampum

PRODUCTION OF PORTLAND CEMENT IN THE U. S., WITH INCREASES EACH YEAR, SINCE 1890.

Year.	Product, barrels.	Increase, barrels.	Percentage of increase.
1890	335,500	...	...
1891	454,813	119,313	35.6
1892	547,440	92,627	20.4
1893	590,652	43,212	7.9
1894	798,757	208,105	35.2
1895	990,324	191,567	24.0
1896	1,543,023	552,699	55.8
1897	2,677,775	1,134,752	73.5
1898	3,692,284	1,014,509	37.9
1899	5,652,266	1,959,982	53.1
1900	8,482,020	2,829,754	50.1
1901	12,711,225	4,229,205	50.0

Cement Company, in Lawrence County, were the first producers in the State of Pennsylvania. It was practically these two works that furnished the 85,000 barrels of Portland cement mentioned in the census of 1882, and during the early years of the industry, when, after the Wampum works ceased to be a large producer, it was the Saylor works that was the largest contributor to the census returns until about the year 1885.

The center of the industry in this country for years has been in the territory lying practically between Phillipsburg, N. J., and Cementon and Siegfried's Bridge, in Lehigh and Northampton counties, Pa. This field embraces nearly all the largest producing works in the United States, and within it are gathered nearly three-quarters of the total producing capacity in the country. As far back as 1890, when there were sixteen works in the country, the works located in Lehigh County and one works located near Phillipsburg, N. J., produced practically 60 per cent. of all the Portland cement made in this country. The figures for the year 1901 show that the output for the Lehigh district was 8,595,340, or over two-thirds of the total output, the number of works having increased but slightly. This district embraces the following works: In New Jersey—The Edison, Alpha and Vulcanite. In Pennsylvania—The Northampton, Phoenix, Dexter, Nazareth, Atlas, Lawrence, Reading, Bonneville, Whitehall, Hercules, Coplay, Lehigh, Martin's Creek and American Cement Companies. Most of these companies have more than one works. In addition to these works, outside of this district, but still in the State of Pennsylvania, are the Clinton Cement Works, near Pittsburg, Pa., where slag cement is made, and the Crescent Cement Company, at Wampum, Pa., where Portland cement is made from limestone and clay. Many of the larger works in the Lehigh district have more than a single plant—the Vulcanite Portland Cement Company have two large mills, the Alpha Portland Cement Works have two mills, the Atlas Portland Cement Works have two mills, the Coplay Cement Works have three mills, the Lehigh Portland Cement Works have three mills and the American Cement Company has six mills, all of them in full operation and producing more largely than ever.



GRAPHIC REPRESENTATION OF THE PRODUCTION, IMPORTATION AND TOTAL CONSUMPTION OF PORTLAND CEMENT IN THE UNITED STATES FROM 1890 TO 1901.

The following figures will help one to form an idea of the magnitude of the industry of cement making in Pennsylvania in 1901:

Number of firms having active plants in Pennsylvania in 1901	14
Capital invested	$19,271,981
Production in Pennsylvania for 1901—	
Portland (barrels)*	6,873,203
Natural (barrels)*	851,866
Improved (barrels)*	230,600
Total production in barrels	7,955,669
Market or realized value	$7,334,891
Aggregate of wages paid	$2,212,457
Average number of workmen employed	5,080
Average number of days in operation	326
Average earnings for the year	$435.52
Average daily wage	$1.34

*Based on barrels of 300 pounds.

Barbed Wire is being used by the Portland Cement Company, at Florence, Col., for the reinforcement of a reservoir with a capacity of 2,500 barrels, which, it is claimed, will only cost half as much as a steel structure.

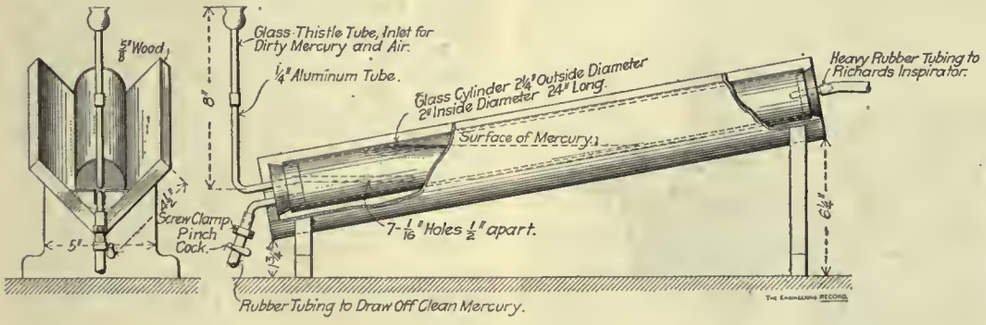
An Effective Mercury Cleaning Device.

By A. O. Doane, Division Engineer, Metropolitan Water Works, Boston.

The mercurial gage is perhaps the most reliable and accurate instrument for measuring pressures, but in practical use it sometimes develops some annoying faults. A frequent source of trouble is the clouding of the glass tubing by deposits from the mercury. It is almost sure to occur if the chemically pure metal is not used and this is both expensive and in many places difficult to obtain.

The commercial mercury which comes in large iron flasks is almost always very dirty; but is otherwise suitable for use in gages. Various methods of cleaning mercury have been tried with more or less success, such as filtering through chamois leather, washing with strong soda solution or with dilute nitric acid, or using a mixture of sulphuric acid and bichromate of potash. Probably redistillation would prove effectual, but this is an inconvenient and dangerous process.

An apparatus which originated in the laboratories of the Massachusetts Institute of Technology, and was afterwards introduced on the Boston Water Works by Mr. Charles W. Sherman, is now in use in a somewhat modified form on the Metropolitan Water Works, and furnishes a very convenient and reliable means of cleaning the mercury, giving satisfactory and permanent results. The device, as shown in the sketch, consists of a glass cylinder 2¼ inches in outside diameter and 24 inches long, supported in an inclined position by a wooden rack. Both ends of the cylinder are closed by tightly fitting rubber stoppers.



A SIMPLE MERCURY-CLEANING DEVICE.

Two ¼-inch aluminum tubes pass through the stopper at the lower end. The lower tube extends only to the inner surface of the stopper, and has a short piece of rubber tubing, with screw clamp and pinch cock attached to the outer projecting portion. The upper tube is connected by means of a short piece of rubber tubing with a glass thistle tube the top of which is about 8 inches above the center of the cylinder. The aluminum portion of this tube passes through the stopper and extends beyond it for a distance of 6 inches. It is bent downwards so as to be approximately parallel to the surface of the mercury after the apparatus is charged. The end of the tube is closed with sealing wax and 7 holes 1/16-inch in diameter spaced about ½-inch apart are drilled along the under side of the tube, starting from the closed end. An aluminum tube passes through the stopper at the upper end of the cylinder, and is connected by means of a stiff rubber tube with a Richards inspirator, which may be connected to any water tap having a ¾-inch hose thread nozzle.

The method of using the apparatus is as follows: The rubber tube on the outlet pipe at the lower end is closed by means of the screw clamp and pinch cock. The mercury to be cleaned is then poured into the cylinder through the thistle tube until the perforated tube is submerged and a small air space is left between the surface of the mercury and the top of the glass cylinder near the lower end. The tubing at the upper end is connected to the Richards inspirator attached to a water tap and the water turned on. The jet of water exhausts the air in the cylinder, the air outside rushes in through the thistle tube and through the perforations in the aluminum tube, causing a violent agitation in the mercury, gradually separating all dirt and other foreign substances, which collect at the upper end of the cylinder and adhere to the glass.

The flow of air may be regulated by varying the force of the water jet in the inspirator. The time required to clean a charge varies with the condition of the mercury; if it is very dirty three or four hours is none too long, but if only slightly dirty the operation may be completed in one or two hours. The apparatus requires no attention while working if the water pressure is fairly steady.

The clean mercury is drawn off through the lower tube by loosening the screw clamp and regulating the flow by means of the pinch cock. It is a good plan to draw the last part of the charge into a separate vessel as this portion is liable to contain any dirt which may be floating on the surface of the mercury. When it is desired to stop the operation the connection between the cylinder and inspirator should be broken before the water is entirely shut off, otherwise water is liable to be drawn back into the cylinder. It is well to vary the inclination of the cylinder to suit the amount of mercury in the charge, making it more nearly horizontal as the amount of mercury is increased. This apparatus will handle a charge of from 10 to 15 pounds of mercury successfully.

The glass tubing of the mercurial gages may be cleaned by the use of either soda solution or dilute acids. A cylindrical bristle brush attached to a long wooden rod is a convenient implement for this purpose. For small bore tubes a piece of reed such as is used in basket making or heavily insulated copper wire may be substituted for the wooden rod. Great care should be taken to avoid the contact of metal or other hard substances with the interior surface of the glass tubes as the slightest scratch will result in breaking the tube.

An Alumni Fellowship in Architecture is announced by the Trustees of the University of Pennsylvania for annual award during a term of five years and of the value of one thousand dollars, open to competition among graduates of the School of Architecture, wherever resident. The holder of the fellowship is required to spend not less than one year in foreign travel and study upon a programme approved by the professor of architecture and the provost of the university, to make reports of his work at appointed periods and, upon his return, to exhibit at the School of Architecture work completed.

The Grand Central Terminal, New York.

In accordance with the plans, which have for a long time been in preparation, for improving the entrance of the New York Central & Hudson River Railroad and the New York, New Haven & Hartford Railroad to New York City and their terminal at Forty-Second Street, general plans relative to the modification of the track system have been completed and submitted to the Board of Estimate and Apportionment of New York City. These have been modified by them and the changes having been accepted by the railroad company, three bills have been prepared for presentation to the New York legislature, and it is expected that these will be promptly passed, providing for and requiring the immediate construction of the proposed improvements, which are grouped under three heads corresponding to the respective bills.

The first provides for improvements north of Mott Haven by which the tracks of the Spuyten Duyvil and Port Morris Railroad will be shortened nearly a mile and eleven grade crossings at Kingsbridge will be abolished. The new alignment close to the north side of the Harlem ship canal will require the construction of a new draw bridge. Grade crossings in the Bronx will be removed and the Port Morris branch will be transferred from open cut to a tunnel under St. Mary's Park.

The changes on Manhattan Island include the depression of all tracks between Fifty-seventh Street and Forty-second Street, and the extension of Park Avenue south from Forty-ninth Street to the Grand Central Station by a wide viaduct so that carriages will have unobstructed passage on it at grade to the concourse, thus virtually creating a new portion of the street and restoring it to the city, besides improving the conditions for the remainder of that street and effecting the concealment of all train service there. The intersecting streets between Forty-fourth and Fifty-seventh streets will be carried across Park Avenue at a maximum grade of 4 per cent. by bridges or viaducts 50 feet wide.

The Railroad Company will pay an annual rental of $25,000 for the use of the sub-surface of streets south of Fifty-seventh Street, and will pay all expenses of the changes and new construction, except the sum of $600,000 determined to be the cost to the city for acquiring equivalent street space. The city will also pay $60,000 for ground abandoned by the railroad and annexed to St. Mary's Park.

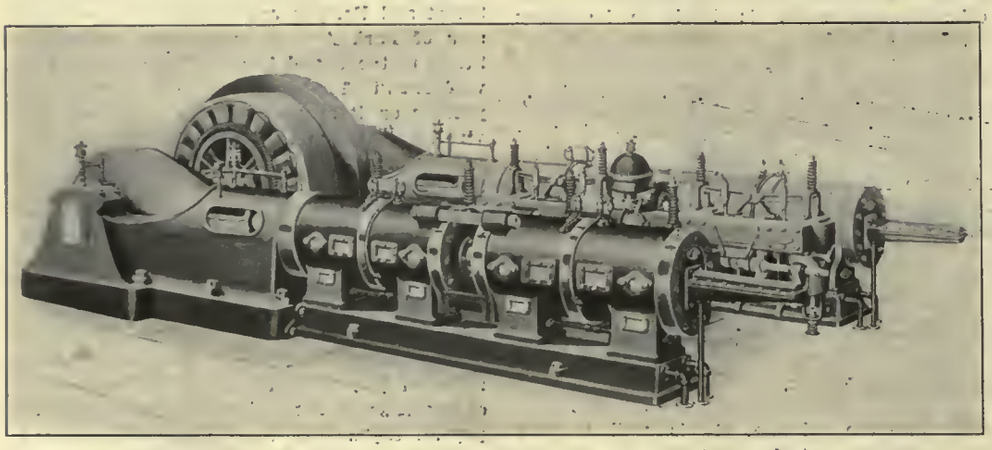
It is provided that steam locomotives shall not be used south of the Harlem River, except in case of emergency, when a fine of $500 a day would be incurred for their use after the third day. No power house other than stations for the transformation of electric current shall be placed on Manhattan Island more than two blocks from the water front, except with the consent of the Board of Estimate and Apportionment. Besides the changes in track, the railroad company contemplates radical improvements in the Grand Central Station which will involve either great extensions or complete reconstruction and may include some unusual features. These are expected to be definitely settled in the near future, and the total expenditure of from $25,000,000 to $35,000,000 in New York City and vicinity is provided for.

An Engineer of Surface Construction is to be employed by the department of water supply, gas and electricity of New York City. He will have control over the arrangement of the 46,000 lamp posts owned by the city. His attention will also be given to the many buildings and other structures controlled by the department.

A New Double-Acting Tandem-Internal-Combustion Engine.

The accompanying illustration is a view of a 1,500-horse-power, double-acting, tandem-cylinder gas engine which the Westinghouse Machine Company has been developing for some time and has planned to build in sizes as large as 3,000 horse-power. The engines have, according to sizes, two cylinders driving the one crank, or four cylinders with two cranks, as shown. They work under the four-stroke cycle and the periods of admission are distributed so that there is an impulse imparted at every stroke, or two every revolution, in the single-crank engine, and four impulses every revolution in the double-crank engine. As regards the supply of combustible, they employ, instead of an explosive mixture varying in richness according to the load, a mixture which is initially proportioned according to the nature of the gas used, and maintained constant under all conditions of load. As the load on the engine increases or decreases, a corresponding greater or less quantity of the mixture is admitted to the cylinders, the scheme being that at all times an explosive mixture of maximum strength is utilized, thereby effecting high thermal efficiency and economy of fuel.

The design of cylinders, pistons and valves departs materially from steam engine practice. The cylinders are double walled, with the outer



The Westinghouse Double-Acting Double-Crank Tandem Gas Engine.

walls split peripherally to allow expansion and contraction without placing the cylinder casting under stress. The tandem cylinders are united at the top by heavy tie rods engaging peripheral bosses, and at the bottom by a stout cast-iron distance piece. The rear section of the bed-plate which supports the two cylinders is cored hollow with a central dividing wall, and serves as a reservoir for incoming and outgoing circulating water. All connections are piped directly to these reservoirs, thus avoiding a large amount of piping about the engine. Through the bed-plate extend the four vertical exhaust pipes, which connect immediately below with an exhaust main. The exhaust passages leading from the valve chambers are cast with the cylinders, upon their under sides, and are water cooled.

At the ends of each cylinder are horizontal side ports, resembling straight steam ports, which communicate with removable combustion chambers. The cylinders are closed by water jacketed heads, those located between the two cylinders being split diametrically for facility in inspecting the interior, and the two halves are united with a ground fit—without packing. The combustion chambers are independent castings, with circular valve-liner seats and cored out passages for circulating water. Both admission and exhaust valves, which are of the standard poppet type, operate vertically, open by cam movement and are held to their seats by spring pressure. The central space, closed by the admission valve above, and the exhaust valve below, communicates directly with the cylinder port.

The supply pipe is a rectangular cast-iron main extending along the entire front and provided with openings opposite each admission valve. It receives its supply from the governor chamber located midway between the two ends, this in turn communicating with a mixing chamber supplied on the one hand with gas and on the other with air through suitable valves. One of these two valves can be seen beyond the cylinder in the foreground of the cut, below the governor chamber. They are provided with graduated indices, so that the proportions of gas and air is indicated at all times and under the control of the attendant. The valve gear is of the standard Westinghouse cam and roller-pattern. Pistons are constructed in two parts, with packing rings and babbitted bearing surfaces. They are secured in position on the rods by internal nuts and present plain convex surfaces to the burning gases. Piston rods are of forged steel, with bored water ducts. The packing for poth piston rod and tail rod is of metallic ring type.

Water for cooling the pistons enters a cavity on the cross-head by means of a flexible pipe connection provided with special swinging joints, flows through the hollow piston rod to the front and rear pistons, and finally emerges through a bronze tail rod extending through the rear head, there emptying into a cast-iron jacket communicating with the hot-water return pipe. Cold water conducted through the cylinder jackets passes to the jackets surrounding the exhaust valves and ports, and finally to the return pipe, emerging at a sufficiently high temperature, it is stated, for use in heating and drying coils, radiators, etc.

The engine is started by compressed air pumped into a steel reservoir during a previous run. A disengaging gear is provided to isolate the rear cylinder and allows it to operate as an air motor until the regular combustion cycle is taken up in the forward cylinder. The rear cylinder may then be thrown into normal action. The engine is governed by a flyball governor which operates a vertical piston valve supplying the fuel mixture of constant quality in quantities proportionate to the load. The single-crank engine is at present manufactured is sizes ranging from 250 to 750 horse-power, and the double crank from 750 to 1,500 horse-power. In the latter, cranks are placed at 90 degrees' angularity. The first installation of this type of engine is to be made at the works of the Consolidated Industries Company, Batavia, N. Y., employing 250 horse-power, single-crank, double-acting engines, direct connected to Westinghouse alternating-current generators, operating in parallel on a general light and power distribution system. A Lowe coke and gas process will be employed, yielding metallurgical coke, coal and water gas, the last to be used for power purposes. An installation of double-crank, double-acting engines is to be made at the works of the Atlantic Refining Company, at Philadelphia. These are of 500 horse-power each, to operate with rich oil gas of approximately 1,400 thermal units per cubic foot. At Hillburn, N. Y., the Rockland Electric Company will operate with producer gas, employing 350 horse-power single-crank engines. The Potosina Electric Company, of San Luis Potosina, Mexico, will employ three 160-horse-power single-crank machines.

Some Applications of Machinery in an American Steel Mill.

The high state of development of American industrial methods is a subject which has frequently raised invidious comparisons with the conditions existing in other countries, and has many times taken the form of self-laudation. It was, however, referred to in an interesting way by Mr. George Westinghouse at a dinner which he tendered in London on January 9 to railway managers, financiers and engineers. His remarks were made in response to a toast offered by Lord Kelvin, who said the present development of the electrical industry in the United Kingdom owed its growth largely to him. "We owe to him," he said, "the bringing to England, and causing to be appreciated in England, American methods." Mr. Westinghouse replied that America has always been shorthanded with regard to labor. "As a result we see the splendid mills at Homestead, where they produce with about 4,000 men three times as much steel as the Krupp works produce with 15,000 men. I took some English friends to Homestead. Mr. Schwab, after guiding us through several departments, said: 'I will now show you where we turn out 750 tons of plates per day.' The mill was in the shape of an L. We went into the short end of the L where the furnaces were fed by natural gas, of course requiring no stokers. The end at which we entered had a rather low roof; and there was in sight a contrivance like a battering ram in front of the furnaces; two workmen were sitting down eating their dinners near by; no one else was present. I thought: 'Mr. Schwab has made a mistake, he has asked us to see a mill that is not in operation.' But we went through the mill, which was about 200 feet long; and suddenly we heard a rattle and then saw a truck approaching loaded with a big ingot. No one touched the truck or the ingot. The load came to a platform, the crane overhead dropped a pair of tongs and quickly put the ingot on the roller table, and as it moved along to the great rolls, it was automatically kept in place. The adjusting screws of the rolls were turned by little electric motors, and not a man in that house did a bit of work. We went back to the furnaces. There was a fifteen year old boy seated in a little place called the pulpit. He was able, merely by the movement of levers, to open at will any of the furnace doors and move the car along. And we saw this car come in front of a furnace and the charging machine approach, and take out of the open furnace a hot ingot which was dropped on the car and moved off to its work. There was this boy doing absolutely no hard work, and his mill was turning out 750 tons of steel plate each day. My English friends said: 'England has no chance in competition with such methods.'"

Power to Drive Machine Tools.

Some time ago some tests were made at the Du Bois shops of the Buffalo, Rochester & Pittsburg Railway, at Du Bois, Pa., which give additional data relating to the power consumption of machines and shafting in metal working industries. The tests were conducted by Messrs. H. M. Palmer and George H. Gibson, of the Westinghouse Electric & Manufacturing Company, with the permission of Mr. F. T. Hyndman, master mechanic of the road at Du Bois and with the assistance of Mr. C. D. McArthur, chief draftsman. The shops and the power plant from which they are served with compressed air and electric current for power and lighting were described in this journal September 6, last year. The locomotive-erecting, boiler and machine shop consists of a middle aisle for erecting and two shed bays equipped with shafting for driving the machine tools. Two 50-ton Shaw electric traveling cranes have a runway in the middle aisle. There are five lines of shafting driven by five shunt motors in the shed bays and the sections are designated as wheel section and boiler section in one bay, and lathe, tool and flue sections in the opposite bay.

The wheel section shaft is driven by a 40-horse-power motor, is 200 feet long, 2½ inches in diameter, and has 26 hangers. It was convenient in this instance to obtain a test of the line shaft alone. A test of the line shaft and counters only gave 1.5-horse-power. A 15-minute test was made of a group of machines comprising a 72-inch and a 66-inch wheel lathe each with two cuts, a wheel press operated at 50 tons, and an 84-inch Niles boring mill, a band saw belt, an emery wheel, a Pond radial drill, and a 60-inch planer with one tool cutting cast iron, with an average result of 4.6 horse-power, a minimum of 0.88 horse-power and a maximum of 10.43 horse-power. The speed of the line shaft was 160 revolutions per minute.

A 60-inch planer, cutting a cast-iron cylinder, which at starting took 10.3 horse-power, and running steadily, 4.2 to 7 horse-power, averaged 6.1 horse-power during the whole time. A band saw cutting 4-inch oak took 5,6 horse-power, whether the saw was cutting or not.

A 42-inch wheel lathe with one tool cutting took on starting 4.6 horse-power, and on steady running 0.5 horse-power. An emery wheel took 0.7 horse-power. A 79-inch wheel lathe with two tools making roughing cuts on a pair of drivers took 4 horse-power. An 84-inch boring mill boring an 8-inch cylinder took 2 horse-power. A 60-inch planner cutting a cast-iron cylinder took 2 horse-power, and a maximum at reversal of 8.5. An 18-inch slotter with tools of ¾-inch face cutting steel took 0.3 horse-power, and a maximum at reversal of 1.2. A band saw starting up took 6.3 horse-power and running light or cutting 4-inch oak, 4 horse-power.

The boiler section shaft is driven by a 30 horse-power motor; with all the counter-belts thrown off and the line shaft tested alone, it took 0.3 horse-power. It is 170 feet long, 2½ inches in diameter and has 19 hangers; the speed was 158 revolutions per minute. A test of the shaft and countershafts gave an average of 2 horse-power.

A stay-bolt cutter and a bolt cutter, a No. 4 Hilles & Jones punch and shear, the last punching 13/32-inch holes in 3/16-inch steel plate, took an average of 1 horse-power, with a minimum of 0.2 and a maximum of 3.5. The No. 4 Hilles & Jones punch and shear starting light took 6.9 horse-power, settling down to 0.4 horse-power; shearing 5/16-inch steel plate, it required 3 horse-power.

A 6-foot radial drill starting up light took 3.6 horse-power, settling down to 1.1. A 1½-inch drill cutting in steel gave 1.5 horse-power. A 6-foot radial drill and bolt cutter required 1.1 horse-power. A 12-foot bending roll starting light showed 7.3 horse-power, settling down to 4.75 horse-power; rolling steel plates, ½x8-inch required 5.3 horse-power. A test of line shaft and counters with the 6-foot radial drill cutting steel with 1½-inch drill, and a punch and shear running light showed 2 horse-power. A 1-inch stay-bolt cutter added to the above took on starting up 4.5 horse-power, and cutting 12 threads per inch gave 2.1.

The lathe section shaft is driven by a 30 horse-power motor and with counters gave 4.1 horse-power. With counterbelts off it gave 0.7 horse-power. The speed was 155 revolutions per minute. It is 180 feet long, 2½-inch in diameter, and has 22 hangers. A single 26-inch planer cutting cast-iron took 1 horse-power, and at reversal 3.5. A 16-inch shaper cutting 1/32-inch steel at 12-inch stroke took 0.9 horse-power, with a minimum of 0.2 and a maximum of 1.4. A 24-inch turret lathe cutting required 0.3 horse-power. A 24-inch lathe boring brass took 0.03.

The tool section shaft is driven by a 20 horse-power motor, and with counters required 2.8 horse-power. It is 140 feet long, 2½-inch in diameter, and has 20 hangers. The speed was 155 revolutions per minute. A single grinder took in starting 9.7 horse-power, and grinding 1.95 horse-power. A 28-inch lathe took on starting 4.7 horse-power and cutting steel 2.5.

The flue section shaft is driven by 10 horse-power motor and with all counters gave 0.6 horse-power. Alone it gave 0.035 horse-power. It is 90 feet long, 2½-inch in diameter, and has 12 hangers. A single flue welder with blowing fan attached required on starting 7.1 horse-power; running light it took 3.4 horse-power. The pipe cutter cutting 2½-inch pipe took 0.06 horse-power. The auto-flue cleaner, cleaning 2-inch flue, took 0.2 horse-power.

A 2½-inch line shaft in the blacksmith shop, 75 feet long with 12 hangers and counters with grindstone and two blowers constantly in operation gave 14.5 horse-power. The bolt header added gave on starting 7.8 horse-power, running light 0.5 horse-power, and heading 1-inch bolts 3.5. A No. 2 Hilles & Jones punch and shear have on starting 5.5 horse-power, running light 0.5, and shearing 1½-inch round bar 4.3.

The brake horse-power delivered by the motor at any given load was determined by means of the motor efficiency curve. This is a source of considerable error at low readings, since the actual efficiency of the motor as installed may differ from that given on the curve sheet.

A 100-Ton Crane.

It is rather unusual to see an 80-ton locomotive picked up bodily and transported from one location to another. For that reason the accompanying illustration of a traveling crane performing this act in the Collinwood shops of the Lake Shore and Michigan Southern Railway will, doubtless, be of interest. The crane is of 100 tons capacity, is equipped with five motors, and was built by the Niles-Bement-Pond Company, of New York. It is of the Niles standard design fitted with two 50-ton trolleys. The main hoist motors are each of 45 horse-power, and are capable of hoisting the full load at a speed of about 10 feet per minute.

The bridge motors traverse the bridge up or down the shop, which is about 530 feet long, at the rate of 150 feet per minute with the full load, and 200 feet per minute with light load. The bridge, which has a span of 65 feet 6 inches, is of the company's standard box girder construction used on all of its cranes, and is fitted with eight truck wheels running in heavy steel truck frames, which are securely riveted to the box girders.



A NILES 100-TON CRANE IN OPERATION.

All gears on this crane are cut from the solid and run submerged in oil. Each trolley is equipped with the Niles improved automatic safety mechanical brake, which controls the load at all times, and an electrical brake mounted on the armature shaft which is "on" when the current is thrown off. The motors are designed especially for crane work, and are wound for 220 volts direct current. Each motor has its reversible controller and rheostat.

The Sanitary Condition of Havana, Cuba, is undergoing a gradual relaxation from the standard set during the American control of the city, according to "Consular Reports" for February. This is no doubt due in part to the financial conditions prevailing throughout the island. It is stated that the cleaning of streets in the residential and business portions of the city, and the removal of garbage at night is carried on with the same efficiency as during the American occupation; but that the house to house inspections by the sanitary department are not pushed with the same vigor as prevailed prior to May 20, 1902, and that violations of the sanitary and plumbing laws are allowed to exist and even to be built in new structures.

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers.. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Personal Notes.

Mr. William Mulholland has been re-elected superintendent of the Los Angeles, Cal., water board.

Mr. O. T. Smith has been re-elected secretary and superintendent of the Freeport (Ill.) Water Company.

Mr. William H. Ulrich has been elected superintendent of the Fredericksburg (Pa.) Water Company.

Mr. R. I. D. Ashbridge has resigned his position as first assistant engineer, Bureau of Filtration, Philadelphia.

Mr. Warren Briggs, of Bridgeport, Conn., has been appointed architect for the New York, New Haven & Hartford Railroad station in that city.

Mr. F. S. Donterville has been appointed engineer-in-chief of the Fort Wayne, Ind., waterworks system, succeeding Mr. Thomas Baxter, who held the position for thirteen years.

Mr. J. D. Keiley has been appointed assistant electrical engineer and Mr. E. L. Broome, assistant steam engineer of the New York Central & Hudson River Railroad, with offices in New York City.

Mr. A. H. Olmsted, town engineer of Bloomfield, N. J., has been appointed assistant engineer in connection with filtration work for the commission on additional water supply of New York City.

Mr. B. C. Milner has been appointed superintendent of the St. Louis-Louisville lines of the Southern Railway, with office in St. Louis, and is succeeded as engineer of maintenance of way by Mr. C. C. Coffee.

Messrs. Chambers & Hone, civil engineers of New York, have been chosen by the Department of Public Works of Scranton, Pa., to inspect the iron and steel work in the West Lackawanna Avenue viaduct in that city.

Capt. Charles Whiteside Rae, U. S. N., has been announced as the successor of Rear Admiral George W. Melville, chief of the Bureau of Steam Engineering at Washington, whose term of office will expire early in August.

Captain William E. Craighill, Corps of Engineers, U. S. A., has been assigned as engineer of the Seventh and Eighth Lighthouse Districts, taking up the work recently given to Captain Spencer Cosby, who relieved Lieut.-Col. Andrew N. Damrell.

Mr. M. H. Gerry, Jr., M. Inst. E. E. Assoc. M. Am. C. E., chief engineer and general manager of the Missouri River Power Company, at Helena, Mont., has been retained as consulting electrical engineer of the Great Northern Power Company, of Duluth, Minn.

Prof. Louis G. Carpenter has been appointed state engineer of Colorado, succeeding Mr. Addison J. McCune, whose term has expired. He has devoted his attention largely to irrigation matters and for several years has had charge of the state experimental station at Fort Collins.

Mr. John F. Stevens, M. Am. Soc. C. E., has resigned his position as chief engineer and general manager of the Great Northern Railway, and will be succeeded at St. Paul by Mr. A. H. Hogeland, assistant chief engineer. Mr. Max Toltz, Assoc. M. Am. Soc. C. E., has resigned as mechanical engineer to accept a similar position with the Minneapolis, St. Paul & Sault Ste. Marie Railway, and Mr. R. D. Hawkins has been promoted to that position.

Mr. William B. Causey, chief engineer of the Elgin, Joliet & Eastern Railway, and of the Chicago, Lake Shore & Eastern Railway, has been appointed general superintendent of construction of the new line being built by the Mason City & Fort Dodge Railroad from Fort Dodge, Ia., to Council Bluffs. He is succeeded by Mr. Arthur Montzheimer, as chief engineer in charge of maintenance of way, and of bridges and buildings, with headquarters at Joliet, Ill.

The Board of Works of Newark, N. J., has voted to separate the departments of streets and sewers on March 1. Mr. Ernest Adam, for 38 years head of the combined department, has been made city surveyor and engineer of the Department of Streets and Highways, and Mr. Edward S. Rankin, for the past five years principal assistant in the sewer department and 16 years assistant to Mr. Adam, has been made engineer of sewers and drainage.

Colonel Samuel M. Mansfield, Corps of Engineers, U. S. A., will probably be retired in a short time with the rank of brigadier general, and his duties, including those of engineer of the Eastern Division, in charge of river and harbor improvements at New York City, are to be assumed by Col. Amos Stickney, who is stationed at St. Louis. By the retirement of Col. Mansfield, Lieut.-Col. Oswald H. Ernst, at Chicago, will become colonel; Major Daniel W. Lockwood, engineer secretary of the lighthouse board at Washington, lieutenant colonel; Capt. Lansing H. Beach, at Fort Wayne, Mich., major; First Lieut. Robert P. Johnston, secretary of the California debris commission, captain; Second Lieut. Clarence O. Sherrill, in Manila, first lieutenant.

Col. Henry G. Prout, for sixteen years editor of "The Railroad Gazette," has been appointed vice-president and general manager of the Union Switch & Signal Company, of Swissvale, Pa. His withdrawal from active journalism gives The Engineering Record an opportunity to record its appreciation of the able manner in which he has conducted its esteemed contemporary, and it is with pleasure that it may recall the early, interesting career that has preceded his better known works. Soon after his graduation from the University of Michigan, which followed his service in the Civil War, he became a major of engineers in the service of the Khedive of Egypt. At the request of General Gordon, he became general governor of the Provinces of the Equator, where he was, according to the order, "supreme over finance, civil and military affairs." At one time he had to transport a 80-foot screw steamer about 60 miles through the woods over broken country, to prepare it for navigation in the lake Albert Nyanza. The beasts of burden were naked savage negroes, who carried all parts except the boiler, which was hauled on runners. It was this steamer in which Emin effected the rescue of the explorer, Henry M. Stanley.

Obituary Notes.

William R. Trigg, founder and president of the shipbuilding establishment of William R. Trigg Company, at Richmond, Va., and president of the Richmond Locomotive Works, died in that city on February 16, aged 54 years.

William A. Mundell, a well-known architect of Brooklyn, died February 10 in that city, where he was born in 1844. He was the designer of a large number of public and prominent buildings in Brooklyn, including the Hall of Records, the Pouch Mansion, most of the National Guard armories and a number of hospitals.

Rear Admiral Lewis W. Robinson, U. S. N., retired, died February 16 at his home in Philadelphia from pneumonia after an illness of two days. He was born in 1840 and entered the navy when 21 years of age. He served through the Civil War and received various assignments in an engineering capacity, becoming chief engineer in 1883, with the rank of lieutenant-commander. The departments of machinery at the Centennial Exposition and the World's Fair at Chicago were under his supervision.

A New Bridge Span Injured by a Flood.

On the night of February 7, one of the partially completed spans of the Fourteenth Street highway bridge now being built across the Chattahoochee River, at Columbus, Ga., fell into the river because the false-work was carried away by a heavy flood. The bridge consists of five equal spans, 140 feet 10½ inches long, resting on two abutments and four piers, all of concrete masonry. At the time of the accident two of the five spans had been erected, and the false-work removed. The third span, however, was not connected, although all but one panel had been erected and bolted up. Consequently nearly the entire span, excepting some of the stringers and the lateral members, was lost. The total rise in the river at the bridge was about 15 feet, 12 of which occurred in the twenty-four hours immediately preceding the failure. The rainfall at Columbus, as reported by the government observer, was 3.25 inches for the twenty-four hours ending on the morning of the 8th. All of the sub-structure was completed about two months ago, and at this writing it does not appear to have been injured in the least. The bridge superstructure is being built by the American Bridge Co., of New York, and the erection is being done by Messrs. George H. Crafts & Co., of Atlanta, Ga., under a sub-contract with the bridge company. The sub-structure was built, under a separate contract, by Mr. B. H. Hardaway, of Columbus, Ga. It will be possible to recover nearly, if not all, of the steel, but to what extent it will be damaged cannot now be ascertained. These notes were sent by Mr. Robert L. Johnson, superintendent of public works, of Columbus.

Typhoid Fever in Massachusetts has, for a long series of years, shown a gradual and steady diminution in its prevalence, according to the latest report of the State Board of Health. Since the general introduction of public water supplies, widespread epidemics have been practically unknown. Statistics were compiled for 33 cities in the State by 5-year periods since 1871 and it appears that the mean death rate of these cities for 1901 was but little more than one-fourth as great as in the five years from 1871 to 1875.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 216, 21, 22, 24 and 26.

WATER.

Phoenix, Ariz.—T. A. Jobs, City Recorder, writes that active efforts are in progress to have an election called on the question of issuing $300,000 bonds for water works to be owned by the city.

Augusta, Ark.—See "Power Plants, Gas and Electricity."

Gentry, Ark.—A. Tallman, City Clk., writes that P. E. Miller has secured the franchise for water works; probable cost of work, $5,000. Part of equipment already purchased.

Vallejo, Cal.—The City Trns. are stated to have accepted the plans prepared by City Engr. Noyes for the new high level distributing water system, and work will be commenced at once.

Sausalito, Cal.—The Town Trns. are reported to have appointed an advisory committee to assist the board in securing a water supply. J. Thomas, Pres. Bd. Trns. L. C. Pistolesi, 606 Montgomery St., is City Attorney and one of the advisory committee.

Vallejo, Cal.—It is stated that bids are wanted Mar. 2 for the following water works supplies: 100 tons of 12-in., 75 tons of 10-in. and 110 tons of 6-in. cast iron pipe; also 5 tons of specials, valves, etc. A P. Noyes, City Engr.

Fresno, Cal.—The Consolidated Canal Co. will issue bonds to the amount of $150,000. The purpose of the issue is to make extensions and to improve its water system.

Ft. Collins, Colo.—Mayor Baker and Aldermen Brown and Whitton are reported to have been appointed as a committee to investigate the question of increasing the water supply and to change its source by extending the line about the north fork of the Pondre; the probable cost will be about $300,000.

Del Norte, Colo.—A party of Denver capitalists, headed by Hal Sayer and J. B. Andrews, are reported to be here for the purpose of directing preliminary work on the first of the series of dams and reservoirs to be built on the south fork of the Rio Grande.

Boulder, Colo.—The City Council is reported to be considering a proposition from Jas. P. Maxwell, owner of Silver Lake, and from the owners of Goose Lake for the construction of a dam on top of the present dam at Silver Lake for storage purposes for the city of Boulder. The proposition contemplates a dam 25 ft. high. The city needs water for University and Chautauqua Heights, and it is for this purpose mainly that a new source of supply is sought.

Colorado Springs, Colo.—The City Council is stated to have voted a bond issue of $459,000 for the extension of the water system. Two reservoirs and a tunnel will be constructed and a reservoir site purchased.

New Britain, Conn.—The Water Comrs. on Feb. 9 are stated to have awarded to the Warren Foundry & Machine Co., of Phillipsburg, N. J., the contract for about 300 tons of 12-in. pipe for about $6,000. They have also decided to lay a 12-in. main from Vine St. to Curtis, to Myrtle to Main, a distance of about 1 mile; also a 12-in. main from E. Main up Main to Lee; this extra work will cost about $15,000.

Manning, Ia.—R. Wohlers, City Clk., writes that it was voted Feb. 11 to issue $8,000 bonds for constructing water works.

Boone, Ia.—C. E. Russell, City Engr., writes that contracts will soon be awarded for 12 blocks of brick paving and ½ mile of water main.

Boone, Ia.—See "Paving and Roadmaking."

Ruthven, Ia.—The town is reported to have voted for water works.

Clarion, Ia.—The City Council is reported to have decided to construct water works.

Dedham, Ia.—H. W. Bruce, Recorder, writes that the citizens voted Feb. 9 to issue $2,000 bonds for constructing water works.

Silver City, Ia.—The business men are reported to be agitating the question of constructing water works.

Lewiston, Idaho.—Bids are wanted Mar. 4 for furnishing about 41,000 ft. 6, 8, 12 and 16-in. wood or steel water pipe. Chas. S. McDonald, City Clk.

Nampa, Idaho.—Bids are wanted Feb. 25 for furnishing supplies to be used in the construction of the water works system consisting of 14 fire hydrants complete, 4-in. main, 12,360 ft. 4 and 6-in. pipe, etc. W. J. McClelland, Mayor.

Joliet, Ill.—The City Council has appropriated $15,000 for a stand tower for the water works. H. A. Stevens, City Engr.

Chicago, Ill.—Bids will be received Feb. 26 by Bd. of Local Improv. for water service pipes in numerous streets. John A. May, Secy.

Elgin, Ill.—R. R. Parkin, Water Works Supt., writes that it is proposed to construct a reservoir of 1,000,000 gal. capacity to cost from $10,000 to $12,000; it is also proposed to install two 150-H.-P. boilers at once.

Cayuga, Ind.—See "Power Plants, Gas and Electricity."

Pauls Valley, Ind. Ter.—The citizens are stated to have voted Feb. 7 to issue $15,000 additional water works bonds.

Pikesville, Ky.—Geo. Pinson, Jr., City Clk., writes that W. B. Cox, of Williamson, W. Va., has secured a franchise for constructing water works; probable cost of plant is $5,000.

Madisonville, Ky.—The Spring Lake Ice & Water Co., of Madisonville, has been incorporated, with a capital of $80,000, by E. C., H. K. and E. H. Anderson.

Rayne, La.—See "Power Plants, Gas and Electricity."

Tewksbury, Mass.—It is stated that the question of municipal water works, to cost $100,000, will come up at the annual town meeting.

South Grovcland, Mass.—Benj. Peabody is the engineer in charge of securing a water supply from Johnson's Pond.

Lakepark, Minn.—See "Power Plants, Gas and Electricity."

Natchez, Miss.—Bids will be received Mar. 2 by the City Clk. for $150,000 municipal water works bonds.

Kansas City, Mo.—Bids are wanted Mar. 5 for furnishing material and laying a 36-in. cast-iron water main, weight, 475 lbs. per lin. ft., from Quindaro pumping station to Kaw Point pumping station, a distance of about 18,320 ft. Baxter Brown, Secy. Bd. of Pub. Wks.

Cameron, Mo.—The City Council is reported to have authorized a preliminary survey for water works.

Havre, Mont.—G. T. Sanderson, City Clk., writes that all bids received on Jan. 30 for water works and an electric light plant have been rejected. New plans will be prepared and work readvertised.

Dillon, Mont.—Edwin Norris, City Clk., writes that it was voted Feb. 7 to issue $65,000 bonds for the construction of water works.

Charlotte, N. C.—The Bd. of Aldermen have endorsed a proposition which empowers the Bd. of Water Comrs. to mortgage the municipal water plant for $200,000. The new amendment authorizes the Water Comrs. to issue bonds to the amount of $200,000 for the general purpose of operating and maintaining a system of water works for this city, and for making improvements thereto.

Bottineau, N. D.—Bids will be received Mar. 4 by N. P. Nordin, Co. Aud., for boring a deep well, including casing pipe and pump complete.

Jersey City, N. J.—Local press reports state that the following bids were opened Feb. 16 by the Jersey City Water Co. for all the cement conduits required to bring the city's new water supply from the dam at Boonton: *a*, Boonton dam section; *b*, Hook section; *c*, Singap section; *d*, section east of Watchung: Eastern Construction Co., *a*, $75,431; *b*, $42,008; *c*, $137,888; *d*, $53,340. Quailey & Co., *a*, $79,695. New York Filler Co., *a*, $79,370; *b*, $45,023; *c*, $171,100; *d*, $64,225. Harold Bouton, *b*, $44,156. Metropolitan Construction Co., *c*, $163,012. Hudson County Tunneling Co., *d*, $55,532. United Engineering & Contracting Co., *d*, $71,350. The Eastern Constr. Co. is reported to have secured the contract for the work at a total of $308,666.

Elmer, N. J.—C. Van Meter, Boro. Clk., writes that there is some talk of water works and an electric light plant, but nothing definite yet.

Asbury Park, N. J.—Supt. Coffin, of the Water Dept., in his report to Council Feb. 9 recommended the construction of an elevated storage reservoir.

Pennyrove, N. J.—Jonah H. Smith, Boro. Clk., writes that it is proposed to construct water works, at a cost of $35,000. T. Chalkley Hatton, of Wilmington, Del., is the Engineer.

Avon-by-the-Sea, N. J.—The citizens voted on Feb. 9 to issue $34,000 bonds for water works.

Albuquerque, N. M.—It is reported that W. W. Jones, of San Marcial, N. M., is making survey of lands in San Andreas mountain region for the San Andreas Irrigation Co. through Dr. C. G. Cruickshank. The company is ready to begin work as soon as the land is turned over by the government. The first labor will be on the construction of a dam of solid masonry, 90 ft. high, to cost $200,000. The water will be conveyed over the land by system of pipes and ditches. Sub-irrigation will be used.

Dunkirk, N. Y.—The Bd. of Water Comrs. have voted to purchase additional generators for the electric light station, new boilers for the pumping station, and to extend and enlarge water mains throughout the city. A bond issue of $50,000 is proposed to cover the cost of the improvements.

Batavia, N. Y.—Capt. Lina Beecher is reported interested in the construction of water works. He estimates the entire cost of the plant, including the land, pumping station and standpipes, at $92,000.

Cincinnati, O.—Bids are wanted Mar. 17 for constructing coal storage houses, trestle approaches, inclines and tracks, for the Eastern Pumping Station, near California, O., and for the Western Pumping Station, in Cincinnati, as advertised in The Engineering Record.

Cleveland, O.—Bids will be received by the Clerk Bd. of Control Mar. 12 for furnishing and delivering water pipe and special castings, as advertised in The Engineering Record.

Bids are wanted Mar. 7 for the superstructure of a side track for the coal storage house at Kirtland St. pumping station. Chas. P. Salen, Dir. of Pub. Wks.

Springfield, O.—It is proposed to equip the new water plant with gas engines and a power pump.

Brooklyn, O.—Bids will be received Feb. 23 by the Village Clk., for $24,000 water works bonds.

Cleveland, O.—Bids are wanted Mar. 16 for $200,000 water works bonds, also $25,000 sewer bonds. H. D. Coffinberry, City Treas.

Findlay, O.—John W. Riegle, City Engr., writes that the American Sewer Pipe Co. bid $1.30 per ft. for vitrified pipe and $5,851 for vitrified specials, for a conduit about 10 miles long, for delivering water to pumping station. Bids on three kinds of materials were asked for, 20-in. cast iron pipe, 24-in. vitrified pipe and 30-in. brick conduit. The U. S. Cast Iron Pipe & Fdy. Co. was lowest on cast iron pipe, bidding $30.50 per ton on pipe and $55 on specials. E. M. Campfield, Findlay, was lowest on brick work, bidding $1.60 per ft. for two-ring conduit, $1.20 per ft. for two-ring conduit and $1.50 per cu. yd for rock excavation.

Columbus, O.—Supt. J. O'Shaughnessy, of the Water Dept., in his annual report recommends a line of pipe for the northeastern part of city, east of High St. and north of the R. R. tracks, at an estimated cost of $66,850.

Wilmington C. H., O.—See "Power Plants, Gas and Electricity."

Allentown, Pa.—Bids will be received by the Bd. of Water Comrs. on Mar. 3 for furnishing materials and constructing proposed extension to water works, and on Mar. 6 for one 8,000,000 gal. pumping engine, both advertised in The Engineering Record of Feb. 21.

West Fairview, Pa.—A charter has been granted to the Enola Water Co., of West Fairview, with a capital of $10,000, by Frank Martin, West Fairview; Arthur R. Rupley and Caleb S. Brinton, of Carlisle.

The Riverside Water Co., of West Fairview, is also reported incorporated, with a capital of $10,000, by Geo. K. Billmyer, Edwin K. McConkey, and others, of York.

Stroudsburg, Pa.—A charter has been granted to the Monroe County Water Power & Supply Co., of Stroudsburg, with a capital of $10,000.

Alexandria, S. D.—The Council is reported to be considering the question of constructing water works.

Alcester, S. D.—D. K. Williams, Town Clerk, writes that bids will be received in March for water works, to cost $4,000.

Lawrenceburg, Tenn.—See "Power Plants, Gas and Electricity."

Port Arthur, Tex.—See "Power Plants, Gas and Electricity."

Beaumont, Tex.—The Beaumont Water Co., of which Col. I. D. Polk is Pres., is reported to have awarded a contract to A. B. Sanders, of Louisville, Ky., for laying about 15 miles of mains and laterals, and the installation of a pumping and filtration station; contract price reported to be about $200,000.

Salt Lake City, Utah.—Louis C. Kelsey, City Engr., writes that plans are being prepared for a storage reservoir in Parleys Canyon.

Milwaukee, Wis.—The only bid received Feb. 6 by the Comrs. of Pub. Wks. for 135½ tons cast-iron water pipe and 30 3/10 tons of special castings was that of the U. S. Cast Iron Pipe & Foundry Co., of Chicago, Ill., at $34.40 and $78.00 per ton, respectively.

Cuba, Wis.—The Chicago Bridge & Iron Co. is stated to have secured the contract to extend the water works, for $4,100.

Marinette, Wis.—The City Water Co., of Marinette, has awarded the contract for the new intake pipe (bids opened Feb. 9) to Rainboldt & Walters, of Sturgeon Bay.

Moundsville, W. Va.—The Monndsville Water Co. is stated to have purchased a site N. E. of the Camp grounds, and will erect on same a reservoir having a capacity of 2,000,000 gals. The improvements will necessitate the laying of 5,000 ft. of 12-in. main.

Bluefield, W. Va.—See "Electric Railways."

Saratoga, Wyo.—R. W. Dyer, Town Clk., writes that the citizens voted Feb. 4 to issue $20,000 bonds for the construction of water works.

Ottawa, Ont.—It is reported that about $50,000 for main extensions are recommended among the estimates for the current year.

Toronto Junction, Ont.—W. J. Conron, Town Clk., writes that the question of extending the intake pipe into Humber Bay is not yet settled by Council. John Haggas, Water Works Supt.

SEWERAGE AND SEWAGE DISPOSAL.

Ft. Apache, Ariz.—Col. J. W. Pope, Ch. Q. M., Denver, Colo., writes that new bids will be received Feb. 26 for the construction of a sewerage system at Ft. Apache, Ariz.

Long Beach, Cal.—Sewer bonds amounting to $35,000 are reported sold.

Vallejo, Cal.—It is stated that bids are wanted Apr. 6 for constructing 2,500 ft. of 8-in. sewer; average cut, 6 ft.; estimated cost, $3,000. A. P. Noyes, City Engr.

New Britain, Conn.—Engr. Wm. H. Cadwell writes that 5 miles of trunk sewers and 10 to 15 miles of small laterals are contemplated; vitrified salt glazed pipe to be used.

Clarion, Ia.—A drainage ditch 26 miles in length, costing about $60,000, will be constructed to facilitate the drainage of the farms in Blairsburg and Williams Townships, Hamilton County (Webster, C. H.), and portions of Wright (Clarion, C. H.) and Hardin (Eldora, C. H.) Counties. The ditch will vary in depth from 6 to 12 ft., and in width from 4 to 8 ft. The Bds. of Hamilton, Wright and Hardin Counties will probably soon hold a joint session to complete all arrangements and receive bids on the work.

Burlington, Ia.—City Engr. Emmett Steece is reported to be preparing plans for the Stony Lonesome sewer; it will be about 4,000 ft. in length and cost about $35,000.

Algona, Ia.—L. E. Potter, Auditor, writes that it is proposed to construct drainage ditches in Kossuth County. A. J. Lilly, Engr. in charge; probable cost, $6,000.

Chicago, Ill.—Bids are wanted Feb. 26 for constructing sewers, etc. F. W. Blocki is Comr. of Pub. Wks.

Waukegan, Ill.—It is reported that R. J. Smith, Supt. of Pub. Wks., has about completed plans and estimates for Sewer District Number 2. The estimate is about $27,000.

Danville, Ill.—See "Paving and Roadmaking."

Peru, Ind.—It is stated that bids are wanted Feb. 24 for constructing 3,000 ft. 20-in. tile sewer, with an 8 to 20-in. cut. Wm. O'Hara, City Clk.

Auburn, Ind.—The Auditor of De Kalb County will soon receive bids for the construction of a large ditch.

Indianapolis, Ind.—City Engr. Nelson has presented plans for the contemplated Pogues Run sewer and places the cost for its entire construction at $1,083,500.

Evansville, Ind.—The city authorities contemplate constructing a sewer in Kentucky Ave., estimated to cost from $25,000 to $50,000.

Muncie, Ind.—R. G. Hickok, City Clk., writes that Lyons & Delaney, of Muncie, have secured the contract for the Perkins Ave. sewer, 3,945 ft. (bids opened Feb. 9), for $9,655, and W. M. Birch, of Muncie, secured the contract for the Gharkey St. sewer, 2,242 ft. (bids opened Feb. 17), for $4,089.

Bridgewater, Mass.—Snow & Barbour, Tremont Bldg., Boston, are stated to have completed the preliminary survey for a sewerage system. The matter will probably be submitted at the annual town meeting in March.

Hudson, Mass.—It is estimated that the proposed new sewerage system for Hudson can be installed for $150,000.

Baltimore, Md.—Bids are wanted Feb. 25 for general purposes in the City Engrs. Dept. during year 1903 the following supplies: vitrified sewer brick, vitrified sewer pipe, vitrified paving brick or blocks, asphalt blocks, cement, granite paving blocks, etc.; also for sheet asphalt repairs. R. T. Fendall, City Engr.; Thos. G. Hayes, Pres. Bd. of Awards.

Van Buren, Me.—A public hearing will be given at the State House, Augusta, Me., on Feb. 25 on an act to incorporate the Van Buren Sewerage Co.

Jackson, Mich.—This city contemplates constructing a purification plant and intercepting sewer. Expect aid from State to care for sewerage from State prison. A. R. Stevens, City Engr., Jackson.

Crookston, Minn.—Geo. A. Ralph, Engr. for State Drainage Comn., writes that it is proposed to construct drainage ditches in Red River Valley, at a probable cost of $200,000. Contracts will probably be let in April.

Kansas City, Mo.—Plans have been prepared for the following sewers: Sewer District No. 102, 1,100 ft. pipe sewers, cost $4,400; Sewer District No. 235, 3,700 ft. pipe sewers, cost $6,000; and Sewer District No. 193, 9,800 ft. pipe sewers, 3,000 ft. brick sewers, 25 manholes, 27 catch-basins, at a cost of $32,000.

Avon-by-the-Sea, N. J.—The citizens voted Feb. 10 to issue $32,000 bonds for a sewerage system.

Asbury Park, N. J.—The beach sewer purchase and improvement bonds, amounting to $175,000, are reported sold.

Weehawken, N. J.—Thos. Cavanagh is stated to have secured the contract for constructing the sewer and pumping station in lower Weehawken, for about $40,000.

Penn Yan, N. Y.—The Bd. of Water Comrs. of Penn Yan are stated to have accepted the proposition of Knight & Hopkins, Engrs., of Rome. They will come to Penn Yan within a few days and make plans for the preliminary survey for a complete system of sewers and a reduction plant.

Brooklyn, N. Y.—Bids will be received Mar. 4 by J. Edw. Swanstrom, Boro. Pres., for furnishing material for constructing 2,464 lin. ft. 12 to 24-in. vitrified stoneware pipe, 15 manholes, and 5 receiving basins in portions of 3 streets.

New York, N. Y.—Bids will be received Mar. 3 by Jacob A. Cantor, Pres. Boro. Manhattan, for furnishing material for constructing sewer in portions of Exchange Place.

Dayton, O.—The Bd. of City Affairs is stated to have adopted the resolution providing for the construction of sanitary sewers in South Park, at a cost of $24,000.

Bids are wanted Mar. 17 for constructing northwestern stormwater sewer in a portion of Coate Ave. and Orchard St., estimated quantities 1,480 lin. ft. 4, 4½ and 36-in. brick or concrete sewer, 1.0 lin. ft. 12 and 24-in. pipe sewer, 4 catch-basins, 6 manholes and 40 perches stone masonry. F. M. Turner, City Engr.; Robt. H. Ferguson, City Compt.

Cincinnati, O.—G. P. Walker is stated to have secured the contract for constructing a sewer in Observatory Ave., for $12,380.

City Engr. Stanley is reported to have been directed by the Bd. of Pub. Service to prepare plans and specifications for the construction of a trunk sewer in the Millcreek Valley from Glendale to Ohio River, in accordance with the request of the Millcreek Sewer Com.

Norwood, O.—City Engr. J. A. Stewart is stated to have submitted plans for the disposal of sewage to the Comrs. of Sewers. He advocates conveying all the sewage to Bloody Run instead of dividing it between that stream and Duck Creek, as was originally contemplated. The size of the pipe to be used would vary from 8 to 24 in. It will be necessary to construct a receiving basin of 100,000 gals. capacity in East Norwood, so that the sewage can be raised by compressed air to the gravity sewer at Forest Ave. and the B. & O. S. W. R. R.; estimated cost, $50,000.

Bowling Green, O.—Bids are wanted Mar. 14 for furnishing material and constructing circular pipe sewers. Alex. Williamson, Clk.

Cleveland, O.—See "Water."

Ardmore, Pa.—G. C. Anderson, Secy. Comrs. of Lower Merion Twp., writes that it was voted Feb. 17 to issue $250,000 bonds for the construction of a sewerage system.

Erie, Pa.—A correspondent writes that contracts will soon be let for 2,860 ft. of 30 in., 1,750 ft. of 27 in. and 1,826 ft. 20 in. tile sewers. Separate bids to be received on each section.

York, Pa.—The citizens voted Feb. 17 to issue $400,000 bonds for a sewerage syatem. Chas. P. Shreiner, City Clk.

Houston, Tex.—City Engr. Dormant is stated to have completed plans for a sewer system for the 3d and 4th Wards and the Fair Grounds Addition.

Beaumont, Tex.—The City Council is stated to have adopted a resolution authorizing City Engr. Merritt W. Yeater to prepare plans and specifications for expending $180,000 on sewerage and paving and the advertising of bids on same, the payment for which is to be made with the 4 per cent. bonds.

Marshfield, Wis.—It is stated that bids are wanted by the Bd. of Pub. Wks. until Mar. 30 for constructing about 6 miles of storm sewers, septic tank, filter beds, etc. C. S. Vedder, City Clk.

Sheboygan, Wis.—Plans are being prepared for about 2,500 lin. ft. of sewers, sizes 48 in. to 10 in. C. F. Boley, City Engr.

BRIDGES.

Arkadelphia, Ark.—Joe Hardage, County Judge, writes that Stupp Bros. Bridge Co., of St. Louis, Mo., has secured the contract for constructing a steel bridge, 514 ft. long, across Ouachita River (bids opened Feb. 10) for $29,975.

Hot Springs, Ark.—A correspondent writes that plans are being prepared, and contracts will soon be let for a bridge across Ouachita River, 4 miles south of Hot Springs.

Hartford, Conn.—A bill has passed the House, and is now ready for the signature of the President, for the building of a drawbridge across Connecticut River at Hartford.

Des Moines, Ia.—Press reports state that the officials of the Wabash R. R. are contemplating the reconstruction of the road from Des Moines to Moberly. It is stated that about $1,000,000 will be expended in building steel and cement culverts, steel bridges, reducing grades, eliminating grade crossings, etc. W. S. Newhall, Ch. Engr., St. Louis, Mo.

Cedar Rapids, Ia.—The Pub. Improv. Com. has recommended to the City Council the building of a concrete bridge across Cedar River, preferably at 2d Ave.

Marseilles, Ill.—It is stated that Wm. Pease has secured the contract to construct a bridge across the canal for $7,618.

Pekin, Ill.—Press reports state that Prof. Wells, of Armour Institute, Chicago, has been engaged to prepare plans for the steel superstructure for the wagon bridge.

Joliet, Ill.—Will and Grundy Counties are about to let the contract for a bridge over Kankakee River, on the county line, estimated to cost $25,000. H. H. Stassen, of Joliet, Chmn. of Com.

Delavan, Ill.—It is stated that the City Council has ordered plans and specifications prepared for a steel bridge to be built across Illinois River.

Hazleton, Ind.—The building of a drawbridge across White River, at or near Hazleton, at an estimated cost of $50,000, is reported to be under consideration.

South Bend, Ind.—The American Bridge Co., of Toledo, O., has awarded the contract for a concrete and steel undergrade crossing on the M. C. Ry. in South Bend, to C. H. Defrees, of South Bend, for $8,440.

Tell City, Ind.—The Comrs. of Perry and Spencer Counties have jointly let a contract to Henry W. Eigeman to build a bridge over Anderson River. The structure is to be of iron. The contract price, $14,200. Cannelton, County Seat of Perry County.

Bluffton, Ind.—The Comrs. of Wells Co. have made appropriation for 15 new bridges, some of which are to be steel structures. Plans and specifications are being made and the contracts will be let in March.

Frankfort, Ind.—Bids will be received Mar. 4 by the Co. Aud. for constructing several steel and stone bridges.

Salem, Mass.—Press reports state that the building of a bridge, at a probable cost of $60,000, across Danvers River, between Kernwood Dist., Salem, and Ryal Side, Beverly, is being considered.

Boston, Mass.—Bids are wanted Mar. 2 for constructing a steel retractile draw for Wellington bridge, Middlesex Falls Parkway, Somerville and Medford. Wm. B. De Las Casas, Chmn. Metropolitan Park Comn.

Niles, Mich.—The American Bridge Co., of Toledo, has been awarded the contract for a viaduct over the M. C. Ry., south of Niles, Mich., by the South Bend & Southern Michigan Ry. Co., for $5,200.

Jackson, Mich.—This city will probably construct a steel-concrete bridge, two 20-ft. arches, or span, about 108 ft. from property line to property line on the skew across Grand River. A. B. Stevens, City Engr.

Portland, Mich.—It is stated that bids are wanted by J. T. Argell, of Belding, until Feb. 26 for constructing a 2-span bridge across Grand River at Portland. Each of the spans are to be 112 ft. long, and are to rest on tubular piers.

Grand Rapids, Mich.—City Engr. Anderson has completed plans and specifications for the Wealthy Ave. bridge.

Stillwater, Minn.—Press reports state that the officials of the Wisconsin Central R. R. are contemplating the building of a bridge across St. Croix River, at the northern end of the city. Chas. N. Kalk, Ch. Engr., Milwaukee, Wis.

Vicksburg, Miss.—Press reports state that the Comrs. of the National Park have awarded contracts for constructing bridges in the Park (12 in all) to Geo. H. Crafts, of Atlanta, Ga.; King Bridge Co., of Cleveland, O.; A. M. Blodgett, of Kansas City, Mo., and the American Bridge Co., of N. Y. City. The contracts are stated to amount in all to about $85,000.

St. Joseph, Mo.—The American Bridge Co., N. Y. City, is reported to have secured the contract for rebuilding the bridge across Missouri River, this city, for the St. Joseph & Grand Island R. R. Probable cost, $400,000.

Omaha, Neb.—Local press reports state that the Union Pacific R. R., the Burlington and the Omaha R. R. Companies are interested in the building of a viaduct, of steel and wood, from 9th St. and Capitol Ave. to 8th and Davenport Sts. Probable cost, $75,000. J. B. Berry, Ch. Engr., Union Pacific R. R., Omaha.

Camden, N. J.—Aaron Ward, Camden, N. J., has secured the contract for the Baird Ave. drawbridge, 136-ft. span with foundations, for $26,900. J. J. Albertson, Co. Engr.

Atlantic City, N. J.—Bids will be opened in Atlantic City, Mar. 4, by the Bd. of Freeholders, at Odd Fellows Hall, for the construction of 2 steel highway draw bridges. J. J Albertson, Co. Engr.

Newark, N. J.—The Bridge Emergency Com. of the Joint Free Bridge Com. of Essex and Hudson Counties has decided to put an improved draw in the Bridge St. bridge, at a probable cost of $40,000.

The Senate has passed a bill authorizing Essex and Hudson Counties to repair the joint bridges.

New York, N. Y.—According to the "Journal of Commerce" official announcement has been made by Jos. U. Crawford, Engr. of the Branch Lines of Penn. R. R., regarding the building of the bridge across East River at Hell Gate. It is estimated that the cost will be over $8,000,000, and the length of the bridge, including approaches, will be 2 miles, the center span to be 840 ft. long. The bridge is to be 135 ft. above the water, and is to extend from Port Morris, Harlem, to Randall's Island, thence to Ward's Island, and from that point to Long Island, where the Penn. lines will be connected with the N. Y., N. H. & Hartford R. R. W. H. Brown, Ch. Engr., Philadelphia, Pa.

New York, N. Y.—In a letter to Bridge Comr. Lindenthal, Mayor Low recommends the fireproofing of the driveways and footways of the new Williamsburg bridge.

Yonkers, N. Y.—Local press reports state that the N. Y. C. & Hudson R. R. R. is contemplating the building of a bridge from Yark St. to Glenwood. H. Fernstrom, Ch. Engr., N. Y. City.

Rensselaer, N. Y.—Press reports state that the N. Y. C. & Hudson River R. R. Co has submitted to the State R. R. Comrs., plans for a carriage bridge to be built at 3d Ave.

Napoleon, O.—Local press reports state that the Co. Comrs. have awarded the contract to construct an iron bridge at Perry St. to the Brackett Bridge Co., Cincinnati, for $7,179.

Salem, O.—It is stated that in connection with the Youngstown & Ohio Electric Ry. in this city, a viaduct will be built across the Ft. Wayne & Salem R. R. tracks at Lisbon crossing.

Dayton, O.—Local press reports state than an agreement has been reached between the Bd. of City Affairs and the City Ry. Co. whereby the construction of a bridge at 3d St. is assured. The cost of the bridge will be, according to reports, about $175,000, the Ry. Co. to contribute $55,000 toward the cost.

Delaware, O.—Bids will be received until Mar. 9 by Frank Warren, Co. Aud., for furnishing material and constructing a 3-span, deck plate girder bridge, across Big Walnut Creek, at Sunbury, Berkshire Township.

Steubenville, O.—Press reports state that Col. Garrett J. Lydecker, of Cincinnati, is the Senior member of the Bd. of Engrs., appointed to prepare plans for a bridge which the Government proposes to construct across Ohio River at Steubenville.

Pittsburg, Pa.—A bill has passed both the House and Senate authorizing the Pittsburg, Carnegie & Western R. R. Co. to construct a bridge across Allegheny River.

Lancaster, Pa.—See "Electric Railways."

Stroudsburg, Pa.—Press reports state that the Stroudsburg Passenger Ry. Co. has decided to construct an iron bridge, for the use of said road, across Pecono Creek. Chas. B. Staples, Secy.

McKees Rocks, Pa.—See "Railroads."

Altoona, Pa.—A correspondent writes that it is proposed to construct a bridge over the Pa. R. R., main line, between 16th and 17th Sts., 87-ft. span, to carry 2 street railway tracks. A. C. Shand, Supt. Altoona Division, P. R. R., in charge.

Philadelphia, Pa.—Mayor Ashbridge has signed a bill granting permission to the American Flour Mills Co. to build a steel and glass bridge, 12 ft. wide and 200 ft. long, across Delaware Ave., between Green and Noble Sts.

Local press reports state that the Secy. of War has approved the plans of the Philadelphia Rapid Transit Co. for bridge which said Co. proposes to build across the Schuylkill River at Market St.

Sharon, Pa.—The Co. Comrs. are reported to be considering the building of a bridge across Shenandoah River from Dock to Main Sts., in this city.

Pittsburg, Pa.—Local press reports state that the Pennsylvania R. R. Co. is about to submit to the Secy. of War plans for the proposed bridge which is to be constructed by said Company across Allegheny River at Brilliant. H. R. Leonard, Engr. of Bridges, Philadelphia.

Chamberlain, S. D.—The Senate has passed a bill authorizing the construction of a bridge across Missouri River, between Brule and Lyman Counties.

Knoxville, Tenn.—F. J. Moreland, City Engr., writes that the city and the K. L. F. and J. R. R. are interested in the construction of the proposed $80,000 bridge.

Tonkawa, Okla. Ter.—See "Railroads."

Ft. Worth, Tex.—It is stated that the construction of 6 iron bridges on the Rio Grande division of the Texas & Pacific R. R. Co. is contemplated. B. S. Wathen, Ch. Engr., Dallas.

Castroville, Tex.—H. E. Haass, of Hondo, Co. Judge, writes that the contract for a bridge across Medina River, Castroville (bids opened Feb. 10), has been awarded to E. P. Alsbury & Son, of Houston, for $13,890. It will be a 3-span bridge, 1 252-ft., 2 100-ft. each, on 2 stone abutments and 2 stone piers, earth-fill approaches, 16-ft. roadway.

Front Royal, Va.—Press reports state that a $12,000 bridge is to be built across Shenandoah River at Carson's Ford.

Colville, Wash.—It is stated that bids are wanted by the Co. Clk. until Mar. 9 for constructing a drawbridge across Calispel River.

Tacoma, Wash.—Local press reports state that the plans for the 21st St. bridge have been approved by the Ch. Engr. of the Government, and have been submitted to the Secy. of War for his approval.

Grand Rapids, Wis.—Press reports state that the wagon bridge across the Wisconsin River is to be rebuilt at a cost of about $16,000.

Appleton, Wis.—The City Engr. has been instructed to prepare plans and specifications for a concrete or stone bridge to be built at Pacific St.

Kenosha, Wis.—The City Engr. has been directed to prepare plans for a steel or iron bridge which is to replace present structure at Middle St. Probable cost, $12,000.

La Crosse, Wis.—See "Railroads."

Chatham, Ont.—It is stated that bids are wanted Mar. 26 for constructing a steel swing bridge across River Sydenham at Tupperville. A. McArthur, Township Clk.

PAVING AND ROADMAKING.

Mobile, Ala.—The following bids were opened Feb. 10 by Bd. Pub. Wks., J. N. Hazlehurst, Ch. Engr., for paving: 37,000 sq. yds. asphalt, Southern Pav'g & Const. Co., Chattanooga, Tenn. (awarded contract), 40 cts. per cu. yd., 4-in. concrete foundation; $1.34 per sq. yd., 1½-in. wearing surface and 1-in. binder; 42 cts. per ft. granite curb; 90 cts. for 24-in. combined curb and gutter; 35 cts., 24-in. cement gutter; total, $75,056. Louisiana Improvement Co., New Orleans; 10 cts., foundation; $1.70, asphalt; 45 cts., granite curb; 90 cts., combined curb and gutter; 20 cts., cement gutter; total, $77,188; 19,000 sq. yds. vitrified brick: Southern Pavg. & Constr. Co. (awarded contract), 40, 42 and 90 cts., respectively, for foundation, granite curb and combined curb and gutter; $1.42 per sq. yd. brick, sand foundation and filler; $1.35 per sq. yd., brick and cement filler; total, $38,906; Cook & Laurie, Mobile, bid on these items as follows: 40, 46 and 90 cts., $1.42 and $1.40; total, $40,194.

Vallejo, Cal.—It is stated that bids are wanted Apr. 6 for paving 6,000 sq. yds. with asphalt, at an estimated cost of $13,000. A. P. Noyes, City Engr.

Riverside, Cal.—C. R. Stibbens, City Clk., writes that it is proposed to pave Main St. for about 15 blocks with asphalt. A. P. Campbell, Engr. in Charge.

Los Angeles, Cal.—Press reports state that Chas. Stansburg has secured the contract to grade a portion of Sunset Boulevard; probable cost, $10,000.

Pasadena, Cal.—It is stated that City Council has adopted a resolution to pave with asphaltum on concrete on a portion of Fair Oaks Ave., and to curb with cement and gutter with granite block.

Augusta, Ga.—Bids will be received by Jacoby Phinizy, Mayor, Mar. 2, for 52,000 yds. of asphalt, brick or bituminous macadam, to be laid on the old concrete foundation.

Atlanta, Ga.—Bids will be received Mar. 2 by the Mayor and Gen. Council for paving approximately 30,000 sq. yds. of asphalt on Peachtree and Peters Sts. R. M. Clayton, City Engr.

Louisville, Ky.—Local press reports state that the American Standard Asphalt Co., 1st and A Sts., submitted the lowest bids for resurfacing a number of streets, at 71 cts. per sq. yd.; probable total cost, $50,000.

Washington, Ia.—D. C. Kyle, City Engr., writes that all bids received Jan. 15 for 32,000 sq. yds. brick paving have been rejected, and the matter is postponed indefinitely.

Boone, Ia.—See "Water."

Keokuk, Ia.—J. R. Robertaon, City Engr., writes that bids will be received Feb. 26 for 2,314 sq. yds. brick paving, 1,400 cu. yds. earth excavation, and 700 lin. ft. of stone curb.

Des Moines, Ia.—Local press reports state that the Bd. of Pub. Wks. will soon ask bids for paving with brick on portions of Southeast 9th St. and E. 6th St.

Danville, Ill.—The City Council has passed ordinances for about 15,000 yds. of brick pavement, 5,000 lin. ft. of stone curbing, and 3,300 ft. of 8-in. sanitary sewer. W. H. Martin, City Engr.

Decatur, Ill.—The Bd. of Local Improv. has authorized the resurfacing of portions of E. Main and Water Sts. with asphalt. There are 31,260 sq. yds. to be resurfaced, and the total cost is estimated at $39,375.

Chicago, Ill.—The Board of Local Improv. has decided to pave with asphalt West Huron St., cost $72,500; South Campbell Ave., cost $18,000; Cleaver St., cost $31,000, and West Dunning St., cost $14,000.

Evansville, Ind.—The question of constructing 4 miles of brick and asphalt pavements, and 5 miles of artificial stone sidewalks, is under consideration. Aug. Pfafflin, City Engr.

Lafayette, Ind.—The following bids have been received by the Comrs. of Tippecanoe County for paving the Main Street Levee: Standard Paving Co., of Chicago, $29,000; Barber Asphalt Co., $21,208; Western Paving & Constr. Co., of Lafayette, $19,910 (awarded contract). M. W. Miller, Co. Engr.

Madison, Ind.—The city authorities have decided to pave Main St. this season. A committee from the City Council will decide the kind of pavement to be laid.

Connersville, Ind.—Specifications are being prepared for paving with asphalt, Central Ave., the principal street in this city. Address City Clerk.

Baltimore, Md.—The following ordinances were reported favorably by the Highways Com. in the First Branch of the Councils: Paving Patterson Park Ave., from Baltimore to Jefferson St., with asphalt blocks, $16,000; paving Hollins St., from Fremont Ave. to Poppleton St., with asphalt blocks, $13,000; paving North Ave., from Washington St. to Belair Ave., with asphalt blocks, $36,000.

Baltimore, Md.—See "Sewers."

Baltimore, Md.—Bids are wanted Feb. 25 for grading, paving, curbing or recurbing portions of Stockholm St. B. T. Fendall, City Engr. Thos. G. Hayes, Pres. Bd. of Awards.

St. Paul, Minn.—Local press reports state that the Bd. of Pub. Wks. has approved the paving of portions of Exchange St. and Central Ave. with asphalt, at an estimated cost of $19,164 and $8,872, respectively.

Pontiac, Mich.—Wm. J. Fisher, City Engr., writes that it is proposed to pave Huron St. at a cost of about $26,507. Material not yet decided upon.

Duluth, Minn.—It is stated that the paving of a portion E. Michigan St. with sandstone block, is under consideration. Probable cost, $8,996. W. P. Patton. City Engr.

Jefferson Barracks, Mo.—See "Government Work."

St. Joseph, Mo.—Ordinances have been passed in the Lower House authorizing the grading, curbing and paving with macadam and brick on portions of several streets.

According to local press reports about $20,000 will be needed to maintain St. Joseph parks during the coming year and to make needed improvements. Among the improvements contemplated by the Park Comrs. is the curbing, guttering and macadamizing of the driveway through the park, at an estimated cost of $6,000.

Trenton, N. J.—Bids will be received Mar. 3 by the Common Council for paving Barnes St. with asphaltum, on a 6-in. concrete base, and Kersey alley with vitrified brick. C. Edward Murray, City Clk.

Hoboken, N. J.—Bids will be received Feb. 25 by the Mayor and Council for improving portions of 5th St. by grading, curbing, flagging and paving the roadway with Belgian block. Jas. H. Lonergan, City Clk.

Brooklyn, N. Y.—Bids will be received Mar. 4 by J. Edw. Swanstrom, Boro. Pres., for regulating, grading, paving, curbing and flagging sidewalks on portions of numerous streets. Engineer's estimate of quantities as follows: 20,603 sq. yds. asphalt pavement, 3,345 cu. yds. concrete, 37,120 sq. yds. granite pavement, with sand joints, 114,128 sq. ft. cement sidewalk, 28,899 lin. ft. new curb, etc.

Buffalo, N. Y.—The lowest bid received Feb. 10 for paving on a portion of Lord St., was submitted, according to local press reports, by the Barber Asphalt Paving Co., with asphalt, at $14,042, and by L. H. Gipp, with brick, at $14,170.

Oyster Bay, L. I., N. Y.—It is reported that a macadam road, 1½ miles long, is to be built from Locust Valley R. R. depot to Lattington.

Niagara Falls, N. Y.—Local press reports state that the City Engr. has been instructed to prepare specifications for paving with asphalt and brick on a portion of Niagara Ave.

New York, N. Y.—Bids will be received Mar. 3 by Jacob A. Cantor, Boro. Pres., for resurfacing and repaving with macadam on present pavement prepared as foundation, a portion of 7th Ave.

Ironton, O.—Bids are wanted Mar. 5 for improving portions of 6th St. by grading and paving with macadam on a furnace cinder or ash foundation, including setting curb, etc. Geo. H. Davies, City Clk.

Dayton, O.—Bids are wanted Feb. 24 for paving with cement on portions of several sidewalks; also for grading and graveling the roadway and sidewalks, curbing and paving the gutters of several other streets. Robt. H. Ferguson, City Compt.

Cincinnati, O.—Local press reports state that Wm. Flynn has secured the contract to pave a portion of Delaney St. at $4,503, and Evan Evans the contract to pave a portion of Oregon St. at $12,237.

The City Engr. has been directed to prepare plans for paving with brick on a portion of Cemetery St.

Bids will be received by the Bd. of Pub. Service until Mar. 3 for furnishing material and grading, setting curbs and paving with asphalt on a portion of Hamer St. Geo. F. Holmes, Clk.

The City Bd. of Legislation has adopted ordinances to pave with asphalt on a portion of St. Gregory St., and with brick on a portion of Witter St.

Cleveland, O.—It is stated that bids are wanted until Mar. 5 for paving with brick on portions of 32 streets. Chas. P. Salen, Dir. Pub. Wks.

Toledo, O.—The City Council has adopted a resolution to repave a portion of Superior St. with either sheet asphalt, vitrified or asphalt block.

Newark, O.—C. H. Wells, City Engr., writes that bids were opened as follows, Feb. 10, for 12,580 sq. yds. brick paving, and 6,246 lin. ft. curb, on Cedar St.: Baldwin Bros. & Graham, Columbus, $1.42 per sq. yd. pavg., with cement filler, $1.32 with sand filler, and 38 cts. per ft. for sandstone curb; Brennan & Nutter, Newark, $1.32 and $1.25 for paving with cement and sand filler respectively.

Tiffin, O.—Bids will be received Mar. 11 by the City Council for improving portions of South Washington St. by grading, draining, curbing and paving with brick or asphalt block. Bids will also be received Mar. 13 by the Finance Com. of City Council for $11,000 street improvement bonds. C. J. Peters, City Engr.

Portland, Ore.—The City Council has adopted resolutions to lay about 12 miles of cement sidewalks and to improve by paving with macadam on portions of numerous streets.

Erie, Pa.—A correspondent writes that the city contemplates about 25,000 yds. of brick paving and 7,000 yds. of stone. Only 440 yds. of asphalt have been provided for, but the early spring will probably bring legislation for more.

Ft. Mansfield, R. I.—Capt. E. F. Ladd, Q. M., New London, Conn., writes that the following are the lowest bids received Feb. 11 for work at this Post: For constructing roads, the Lane Constr. Co., of Meriden, Conn., at 82 cts. per sq. yd., and for sidewalks, the Hartford Paving Co., Hartford, $1.20 per sq. yd.

Beaumont, Tex.—See "Sewerage and Sewage Disposal."

Spokane, Wash.—It is stated that City Comr. Lillenthal estimates that 50 miles of sidewalks will be laid in Spokane during the coming year.

Seattle, Wash.—The City Council has decided to pave with brick and asphalt on First Ave., north of Pike St. Probable cost, $113,000. R. H. Thomson, City Engr.

The City Engr. estimates the cost of improving Railroad Ave., from University to Broad St., at $35,562.

Ballard, Wash.—The City Council has accepted the estimate of the City Engr. for paving with brick, constructing granite curbing and cement walks, on Ballard Ave., at $40,391.

Chippewa Falls, Wis.—David Kirk, City Engr., writes that P. McDonnell, Duluth, Minn., was lowest bidder for brick paving, requiring over 25,000 sq. yds. on a 6-in. concrete foundation, with cement filler and protection curb where needed, including the removal of present cedar block pavt. For Purlington block, he bid $2.19 per sq. yd.; Canton block, $2.30; for Indiana block, $2.25

Madison, Wis.—O. S. Noraman, City Clk., writes that R. F. Conway & Co., of Chicago, Ill., secured the contract for paving with asphalt Main, Carroll and Mifflin Sts. (Bids opened Feb. 9.)

Montreal, Que.—Bids are wanted Feb. 26 for furnishing and erecting an asphalt paving plant. L. O. David, City Clk.

POWER PLANTS, GAS AND ELECTRICITY.

Augusta, Ark.—P. H. Porter, of Clinton, Ky., has secured the contract for an electric light plant, and for two 6-in. wells, for a total of $11,413. Weatherford & Hildebrand, Engrs., Memphis, Tenn.

Scotia, Cal.—It is reported that the Pacific Lumber Co. will construct an electric light plant at Scotia.

Trinidad, Colo.—A press report states that the Las Animas Light, Power & Mfg. Co. is to increase the capacity of its gas and electric plants and extend the system.

Black Hawk, Colo.—The Council has granted the Seaton Mountain Electric Light & Power Co. a franchise to construct and operate an electric light plant.

New Haven, Conn.—The New Haven Gas Co. is reported to have petitioned for permission to increase its capital from $2,000,000 to $5,000,000. Extensive improvements are reported to be in contemplation.

South Norwalk, Conn.—A. E. Winchester, Gen. Supt., writes that bids will probably be received in March for an extension to the electric light plant.

Washington, D. C.—See "Government Work."

Seaford, Del.—The House has passed the bill authorizing the Town Council to borrow $10,000 for an electric light plant.

Rome, Ga.—See "Electric Railways."

Albany, Ga.—The Albany Power & Mfg. Co. has applied for a charter, with a capital of $200,000. Alex. W. Smith is reported interested.

Monroe, Ga.—L. S. Radford, City Clk., writes that an electric light plant will probably be constructed this year, but no definite arrangements have been made.

Atlanta, Ga.—O. H. Sheffield & Co., 518 Austell Bldg., Atlanta, have purchased water rights on Savannah River in Elbert County. About 5,000 H.P. will be developed and transmitted to factories in the vicinity. Improvements are roughly estimated at $300,000. Surveys and plans are being made. O. H. Sheffield is Ch. Engr.

Dayton, Ia.—A. C. Lindberg, Town Clk., writes that Allen Cox, of Linnburg, Ia., is the engineer for the proposed electric light plant.

Muscatine, Ia.—Bids will be received Mar. 10 by A. K. Ilaff, City Recorder, for lighting the streets with electricity for 10 years.

Stratford, Ia.—It is stated that Allen Cox, of Linnsburg, will construct an electric light plant to furnish light to Stratford and Dayton.

Quincy, Ill.—C. E. Mead, of Quincy, is Gen. Mgr. of a company being formed to construct an electric light plant, at a probable cost of $150,000.

Decatur, Ill.—Mayor Shilling is stated to have signed an ordinance granting R. E. Pratt, and others, the right to establish an electric light plant in Decatur.

Venice, Ill.—It is reported that plans have been prepared for a power house for the Venice & Granite City Electric Light & Power Co.

Edwardsville, Ill.—The City Council has passed an ordinance granting a 10-year franchise to the Edwardsville Electric Light Co.

Morrison, Ill.—The Morrison Electric Light Co., of Morrison, has been incorporated, with a capital of $40,000, to furnish electric current and steam. Incorporators: A. V. Viner, Luther R. Ramsey, and Saml. L. McCalmont.

Decatur, Ind.—Pres. Warring, of the Warring Glove & Mitten Factory, will purchase a large instalment of electric machinery for his plant in Decatur.

Brazil, Ind.—Local press reports state that work will soon begin on the construction of a gas plant in Brazil. Messrs. Eaton & Page, chief stockholders of the Chicago Sewer Pipe Plants, are reported interested.

Greencastle, Ind.—Plans are being prepared and bids will soon be asked for the electric light plant of the Putnam Electric Co.

Jeffersonville, Ind.—It is stated that the United Gas & Electric Co. will make extensive improvements to its plant.

Cayuga, Ind.—Mr. Barford, of Washington, is reported to have secured the contract for an electric light plant and water works for Cayuga, for about $30,000.

Bluffton, Ind.—John Mack, Mayor, writes that the Olds Construction Co., of Ft. Wayne, Ind., has secured the contract for constructing the electric light plant (bids opened Feb. 11) for $15,000. The company is to draw its own plans and submit prices for direct-connected 100 and 200-Kw. phase generators with compound engines.

Louisville, Ky.—A press report states that the holding company which plans to take over the plants of the Louisville Electric Light Co. and the Citizens' General Electric Co. will have a capital of $5,000,000. The object of so large a capital is reported to be to provide money for placing wires underground. A name for the holding company has not been decided upon.

Danville, Ky.—Engineer Reihm estimates the cost of constructing a municipal electric light plant at $17,000.

Rayne, La.—W. Mackintosh, Cons. Engr., Beaumont, Tex., writes that A. B. Sanders, Beaumont, bid $24,665 for the equipment of the municipal water works and light plant, including 90-H.-P. engine, 100-H.-P. boiler, two 30-Kw. dynamos, and 50,000 gal. water tower and tank 100 ft. high; A. L. Dabney, Memphis, Tenn., $25,700, and P. H. Porter, Louisville, Ky., $26,744.

Newburyport, Mass.—It is stated that the Newburyport Gas & Electric Light Co. will construct and equip a new electric light station. W. R. Johnson, Pres.

Baltimore, Md.—John Waters is stated to have secured the contract for building a plant at Spring Gardens for the Consolidated Gas Co.; it will cost about $40,000.

The Baltimore Refrigerating & Htg. Co. will shortly award contracts for the erection of a new power house on South Eutaw St. The work planned by the company will cost about $3,000,000. This year about $1,000,000 will be expended.

Federalsburg, Md.—John F. Disharoon, Proprietor of Idlewild Mills, is reported interested in the construction of an electric light plant.

Waterville, Me.—A public hearing will be given at the State House, Augusta, Feb. 18, on the act to incorporate the Messaloskie Electric Co. H. D. Eaton, an attorney of Waterville, is reported interested.

Fryeburg, Me.—The Fryeburg Electric Light Co. has been incorporated, with a capital of $10,000, to deal in gas and electricity for lighting, heating, manufacturing and mechanical purposes. Henry B. Cotton, of Conway, N. H., and A. R. Jenness, of Fryeburg, are among the incorporators.

Boothbay Harbor, Me.—A hearing will be given at the State House Feb. 26 on an act to incorporate the Boothbay Harbor Electric Light & Power Co.

Iron Mountain, Mich.—Local press reports state that the Iron Mountain Electric Light & Power Co. will expend about $20,000 in improvements.

St. Joseph, Mich.—Congress has reported favorably on the bill permitting the construction of a dam across St. Joseph River in Berrien County, Mich.

Niles, Mich.—It is reported that the Niles Gas Co. is about to commence the construction of a new plant.

Bessemer, Mich.—E. D. Nelson, Pres. Ironwood & Hurley Electric Ry., is reported interested in a movement to harness the water power on Black River and construct an electric plant.

Two Harbors, Minn.—Bids are wanted Mar. 2 for furnishing material and constructing a 20-in. cast iron intake pipe, 620 ft. long; also a well and a brick or stone building for a pumping and electric light station. F. E. Evans, Village Recorder.

Lakepork, Minn.—Bids are wanted Mar. 2 for $11,000 electric light and water bonds. O. Larson, Recorder.

St. Paul, Minn.—Bids are wanted Mar. 16 for a 300,000 gal. capacity Gasoline Pumping Engine for Phalen Park. Matt Jensen, Secy. Bd. of Park Comrs.

Duluth, Minn.—The Council on Feb. 9 granted a franchise to the Highland Canal & Power Co. to develop the water power of St. Louis River for electrical purposes.

Jackson, Miss.—T. McClelland, of the Jackson Bank, is reported interested in the construction of an electric light plant.

Clayton, Mo.—The Co. Comrs. are stated to have granted the King Electric Light Co. a franchise along the highways in St. Ferdinand and Central Townships.

Springfield, Mo.—It is reported that the Springfield Lighting Co. will expend about $150,000 in improvements during the year.

High Point, N. C.—The High Point Electric Power Co. has been incorporated, with a capital of $20,000, by A. N. Richardson and W. S. Thomas.

Lumberton, N. C.—The Council is reported to have under consideration the question of establishing an electric light plant.

East Orange, N. J.—The City Council on Feb. 13 decided to secure bids for street lighting by electricity and gas.

Liverpool, N. Y.—The Village Bd. is stated to have granted Fred Wyker a franchise to light the village by electricity.

Syracuse, N. Y.—Local press reports state that the Syracuse Lighting Co. want bids for the construction of 2 gas supply holders, each of 500,000 cu. ft. capacity. John J. Cummins, Gen. Mgr.

Alden, N. Y.—The Village Trus. are stated to have granted a franchise to the Alden & Batavia Gas Co. for 5 years.

Watertown, N. Y.—The People's Power & Light Co., of Watertown, has been incorporated, with a capital of $60,000. Incorporators: J. M. Carpenter and G. H. Smith, of Watertown.

Albion, N. Y.—A press report states that the Albion Power Co., which has purchased the works of the Brockport Electric Light Co., will enlarge and improve the electric works owned by the company at Waterport, and improve central station in Albion.

Wilmington C. H., O.—The United Water & Light Co. is stated to have purchased the electric light plant of the city. The bid of the company was conditional on the granting of a franchise for the construction and operation of water works. An ice plant will also be put in.

Ft. Stevens, Ore.—See "Government Work."

Pendleton, Ore.—It is reported that the Pendleton Electric Co. will double the capacity of its plant, at a cost of about $20,000.

Spring City, Pa.—See "Electric Railways."

Pittsburg, Pa.—The Standard Oil Co. is reported to have obtained an interest in the People's Natural Gas Co. A 20-in. pipe line connecting the mains of the People's Co. with great supplies of natural gas controlled by the Standard in Wetzel County, W. Va., is now being surveyed and will be completed by July 1; it will be constructed by the People's Natural Gas Co., at a cost of about $2,000,000.

West Fairview, Pa.—The Enola Illuminating Gas Co., of West Fairview, has been incorporated, with a capital of $10,000, to furnish gas near West Fairview. Directors: Frank P. Snodgrass, George Nauman, and others.

Union, S. C.—Col. T. C. Duncan, of Union, is reported interested in the harnessing of Broad River and the furnishing of electric power to Union for commercial purposes.

White Lake, S. D.—It is stated that steps are being taken to have an electric light system established. If private parties cannot be induced to construct same the citizens will urge the town to establish a plant, to cost about $4,000.

Scotland, S. D.—I. M. Dain, City Aud., writes that V. B. Diehl and Fred Becker are reported interested in the construction of a gas plant.

Scotland, S. D.—It is stated that V. B. Diehl and Fred Becker have applied for a franchise for a city gas lighting system and will put in an acetylene gas plant as soon as the weather will permit.

Knoxville, Tenn.—The House is reported to have adopted the resolution authorizing the Knoxville Power Co. to dam the Little Tennessee River.

Lawrenceburg, Tenn.—It is reported that an electric light plant and water works will be constructed here.

Pilot Point, Tex.—A company is reported organized here to construct an electric light plant and ice factory. J. E. Light, Pres.; A. W. Walker, Secy.

Port Arthur, Tex.—Among the bids for constructing a water, ice and light plant, received Feb. 7 by W. H. Lovegrove, Engr., and W. Mackintosh, Beaumont, Assoc. Engr., are the following: Two 10 and 20x14-in. compd. cond. engines, Russell Eng. Co., Massillon, O., $4,737; Watertown (N. Y.) Eng. Co., $5,411; Harrisburg (Pa.) Fdy. & Mach. Wks., $5,600; A. L. Ide & Sons, Springfield, Ill., $4,800; American Eng. Co., Bound Brook, N. J., $4,810. 40-ton ice plant: Triumph Ice Mach. Co., Cincinnati, $25,936; Vilter Mfg. Co., Milwaukee, $26,016; York Mfg. Co., York, Pa., $24,200.

Brigham, Utah.—The Council is reported to have placed contracts with the General Electric Co., of Schenectady, N. Y., for a 450-H.-P. dynamo, and with the Pelton Water Wheel Co., of San Francisco, Cal., for an 800-H.-P. water wheel.

Ogden, Utah.—City Engr. A. F. Parker and E. W. Wade are reported to have arranged to construct a power plant of 1,500 H.-P. in Weber Canyon. Work will probably be started early in the spring.

Springville, Utah.—The citizens voted Feb. 12 to issue $20,000 bonds for the construction of an electric light plant.

Alexandria, Va.—The Council is reported to have authorized the Com. on Light & Finance to employ an engineer to prepare plans for an electric light plant.

Reusens, Va.—Geo. O. Tenny is stated to have secured the contract for an electric power plant at Reusens, for the Lynchburg Water Power Co., of Lynchburg; contract price reported to be about $100,000. This will not include the electrical equipment, which will cost an additional $75,000.

Beloit, Wis.—The city is figuring on a complete electric light system, to consist of about 20 miles of wire, 250 arc lights and incandescents, according to demand. Address Robt. Caldwell, City Engr.

Milwaukee, Wis.—The lowest bid received Feb. 12 for the installation of a new electric plant at the County Hospital was that of Julius Andrae & Sons, for $7,300.

Prince Albert, N. W. Ter.—It is stated that bids are wanted Mar. 16 for electrical machinery, boiler, engine, etc., for an electric light plant for the town of Prince Albert, Saskatchewan. Wm. Knox, Chmn. of Com.

Hamilton, Ont.—The Hamilton Cataract Power, Light & Traction Co. has been incorporated, with a capital of $5,000,000, by J. M. Gibson and J. R. Moodie, of Hamilton, and J. A. Kammerer, of Toronto. It is reported to be the intention of the company to extend the existing plant 2 miles south of St. Catharines.

Toronto, Ont.—Wm. Pierson Judson, of Oswego, N. Y., Engr. of the Hamilton & Lake Erie Power Co., recently incorporated, is reported to have submitted a proposition to the Mayor, Civic Electrical Energy Com. and Toronto manufacturers regarding the supplying of electrical power to Toronto.

ELECTRIC RAILWAYS.

Redwood City, Cal.—The Bd. of Superv. has granted W. J. Martin, of the San Francisco Land Co., a franchise to construct an electric railway from Holy Cross Cemetery to South San Francisco.

New London, Conn.—The East Lynn St. Ry. Co., which has secured a special charter for an electric railway from New London to East Lynne, has organized with Richard C. Morris as Pres., and Calvin S. Davis as Secy.; capital, $100,000. Company will probably begin construction work immediately.

Delaware City, Del.—Right of way has been secured between Delaware City and Odessa for the proposed electric railway between Milford and Delaware City. H. L. Evans, Pres. of the Wilmington and New Castle Ity. Co., is reported interested.

St. Augustine, Fla.—The St. Augustine & South Beach Ry. has been sold to Judge J. W. Henderson and Dr. Horace Lindsley. It is said that the new owners plan to reconstruct the property and equip the line with electricity. It is about 5 miles in length.

Rome, Ga.—The local properties of the City Electric Ry. Co. will probably be improved and an extension of the company's lines built to Lindale. This plan contemplates an issue of $125,000 of stock and $100,000 of first mortgage bonds, to which local interests have been asked to subscribe. The railway company owns the local lighting plant.

Athens, Ga.—Chas. H. Lemon, representing an Ohio syndicate, has been in consultation with the local authorities in the interest of a scheme to build an electric railway to connect Atlanta, Decatur, Monroe, Watkinsville, Athens, Lexington, Washington, Appling and Augusta.

Augusta, Ga.—Jas. U. Jackson, Pres. of the Augusta & Aiken Ry. & Electric Co., and associates, are said to be planning to incorporate a company to build an electric railway between Augusta and Columbia.

Marshalltown, Ia.—The Marshalltown Electric St. & Interurban Ry. Co. has been organized, with a capital of $25,000, to build an electric railway in Marshalltown, and from Marshalltown to Eldora and Grundy Center. Directors: H. E. Sloan, H. P. Densel and A. G. Glick, of Marshalltown.

Pocatello, Idaho.—J. B. Perrine has applied for a franchise.

Boise, Idaho.—Howard Sebree, of Caldwell, has applied for the right of way for an electric railway from Boise to Caldwell, a distance of 30 miles.

Quincy, Ill.—Citizens of Quincy are reported to have completed subscriptions for $207,000 of stock in the Quincy & Western Electric Ry. The plan of the company is to build two lines, one running north and tapping Hancock County points, the other running east to Illinois River.

Springfield, Ill.—General Akin, of Springfield, is reported interested in the construction of an electric railway from Springfield to Riverton.

Plainfield, Ind.—The Indianapolis & Martinsville Rapid Transit Co. is said to be considering the advisability of extending its lines from Plainfield to Greencastle. Emmet M. Smith, Secy., Indianapolis.

New Harmony, Ind.—The Mt. Vernon, New Harmony & Northeastern Traction Co. is to be incorporated to build an electric railway from New Harmony through Princeton to Petersburg. Harry Kurtz is reported interested.

Indianapolis, Ind.—The Indianapolis, Danville & Rockville Traction Co. has been incorporated, with a capital of $100,000. Directors: W. B. Blair, W. C. Osborn, and others.

Goshen, Ind.—B. C. Bender, City Clk., writes that it was voted Feb. 10 to issue $30,000 subsidy to the Ft. Wayne & Goshen Electric Ry. Co.

Knox, Ind.—The Knox, Chicago & Northern Traction Co. has been organized to build electric railway 140 miles in length. One line to be built from Logansport through Winamac, Boss Lake, Knox and Laporte, and another line to be built from Rochester through Culver, Boss Lake, Knox, Wanatah, Valparaiso and Hammond. J. C. Fletcher, Pres., Knox, Ind.

French Lick, Ind.—A survey has been completed for the line of New Albany & French Lick Springs Valley Traction Co. It will run through 4 counties.

Lakeland, Ky.—The Louisville & Eastern R. R. Co., successor of the Louisville, Anchorage & Pewee Valley Electric Ry. Co., has completed permanent surveys for the extension of its lines from Lakeland to Shelbyville.

Covington, Ky.—The Dayton, Covington & Piqua Traction Co. has secured the right of way for an extension of its lines from Covington to Bradford, Versailles and Celina. R. M. Graham, Ch. Engr., West Milton, O.

Shreveport, La.—The Shreveport & Suburban Traction Co., of Camden, N. J., has been incorporated, with a capital of $400,000. Incorporators: John R. Miller, Herman Hedberg, and others.

Westport, Mass.—The South Shore St. Ry. Co., which plans to build an electric railway to Monquitt, has applied for franchises in Westport and Dartmouth.

Northboro, Mass.—The Hudson & Northboro. St. Ry. Co. has filed a petition for a location in Northboro. It is proposed to build over private land for a portion of the route.

Towson, Md.—The Towson & Cockeysville Electric Ry. Co. is to be incorporated, with a capital of $100,000, to build an electric railway to connect Towson with Cockeysville; it will be 6½ miles in length. Incorporators: Joshua F. Cockey, Wm. H. Wight, and others.

Glasgow, Mo.—A charter has been granted to the Central Missouri Electric Ry. Co., with a capital of $4,000,000, to build a line to connect Brookfield, Glasgow and St. Louis. A survey of the road has been completed.

Ann Arbor, Mich.—Fleet Smith and County Treasurer Chas. Braun are securing the right of way for an electric railway. It is said that the plan of the promoters is to build a line through to Brighton and Lansing.

Mankato, Minn.—Hord & Keator have been granted a franchise for the construction of an interurban electric railway through the county toward St. Peter.

Greenville, Miss.—The Delta Electric Light, Power & Manufacturing Company is said to be in the market for the equipment for the electric railway lines that it proposes to build here.

Prosperity, Mo.—The Southwest Electric Ry. Co. has filed for record a plat of its extension from Prosperity to Duenweg, a distance of 3½ miles.

Lincoln, Neb.—Surveys are being made for an electric railway between Lincoln and Omaha. E. C. Hurd, of Akron, O., and H. H. Wilson, of Lincoln, are reported to be interested.

Hawthorne, N. J.—The Paterson & State Line Traction Co. has secured a franchise in Hawthorne. It is proposed to build an electric railway from Paterson to Allentown and Suffern. Preston Stevenson, Pres., Paterson.

Red Bank, N. J.—The Jersey Central Traction Co. haa applied to the Council for permission to build down Front St. It is said to be the plan of the company to build through to Oceanic. Frank Vanderbilt, Ch. Engr., Keyport.

Canisteo, N. Y.—The Canisteo, Jasper & Woodhull Ry. Co. has obtained authority from the State R. R. Comrs. to construct its proposed road. The company is to operate an electric railway from Canisteo to Jasper.

Vestal, N. Y.—The Binghamton St. Ry. Co. has applied for a franchise in Vestal. J. P. E. Clark, Gen. Mgr., Binghamton.

Delaware, O.—Capitalists at Delaware and Ft. Recovery will incorporate the Delaware, Bellefontaine, Ft. Recovery & Wabash Traction Co. to build an electric railway from Delaware to Wabash, Ind. Right of way is being secured.

Steubenville, O.—Eastern parties represented by H. C. Johnson, manager of the Atlantic City & Suburban Traction Co., have purchased the Pleasant Heights St. Ry., together with a large block of real estate on Pleasant Heights. It is stated the new owners propose to extend the line in Carroll County.

Columbus, O.—Colonel Albert A. E. Boone, of Zanesville, has incorporated two companies to encircle Cleveland and Columbus with belt lines. The Cleveland line is incorporated as the Cleveland Manufacturers Belt Line & Terminal Ry. Co., and the Columbus line is to be known as the Columbus Belt Line & Terminal Ry. Co. Both have a temporary capital of $10,000. They propose a belt line surrounding the respective cities, and there are to be numerous branches radiating to surrounding towns.

Marysville, O.—The Toledo, Columbus, Springfield & Cincinnati Electric Railway Company has secured a 25-year franchise through Marysville. The road is to be in operation by Dec. 1, 1903.

Port Clinton, O.—A press report states that the Village Clk. will receive bids Mar. 9 for a franchise for an electric railway. The Lake Erie, Bowling Green & Napoleon Ry. Co. is stated to have petitioned for the franchise.

Kittanning, Pa.—A charter has been granted to the Kittanning & Mosgrove St. Ry. Co., with a capital of $18,000, to build a 3-mile line from Wickboro to Mosgrove, via Hay's Run. Directors: Frank A. Maesta, Jas. McCullaugh, Jr., and others.

Marysville, Pa.—Franchises have been granted the Perry County Electric Ry. Co. by the Councils of Marysville and Duncannon, and a majority of the rights of way between these two towns has been obtained.

Lancaster, Pa.—The Lancaster & Rocky Springs Ry. Co. has accepted the ordinance passed by the City Council, and has authorized appropriations for the erection of an extra 450-H.-P. rotary converter station for the Park line, and the construction of a double-track steel bridge over Conestoga Creek.

Allentown, Pa.—The Dirs. of the Allentown & Reading Traction Co. have decided to make improvements, including the double-tracking of the line from Dorney's Park to Allentown, a distance of several miles, the addition of a new engine and generator to the power plant at Kutztown, and the enlargement of the storage battery facilities at the Blandon station.

McKeesport, Pa.—The Pittsburg, McKeesport & Connellsville Ry. Co. (W. A. Bishop, Ch. Engr., Connellsville.) is said to have purchased from the Pittsburg Ry. Co. a franchise to operate a double track system from 5th Ave. up Walnut St. to 16th Ave.

Spring City, Pa.—The Montgomery & Chester Electric Ry. Co. and the Schuylkill Valley Illuminating Co. have authorized the expenditure of $120,000 in improvements.

Willow Grove, Pa.—The Philadelphia & Langhorne St. Ry. Co. has filed notice of a proposed extension over the turnpike from Somerton to Feasterville and Willow Grove.

American Fork, Utah.—Chas. W. Earl, in the interest of the Utah County Light & Power Co., has applied for a franchise for an electric railway from American Fork to the old smelter site in American Fork Canyon, a distance of about 20 miles.

Seattle, Wash.—P. J. Donohue has applied to the Council for a franchise for electric railway to West Seattle.

Mineral, Wash.—Fred E. Sander is reported interested in a plan to build an electric railway to connect Index and Mineral City, 14 miles distant. The line will pass through Ethel, Sunset and Nonpareil mines.

Everett, Wash.—The Everett & Snohomish Rapid Transit Co., which plans to build 10 miles of line to connect Everett, Lowell and Snohomish, has engineers at work on plans for construction. Alex. de Soto, Pres., Seattle.

Bluefield, W. Va.—The Bluefield Ry., Light & Power Co. has been incorporated to build electric railway, lighting plants, gas plants and water works. Incorporators: S. R. Bullock, C. C. Brown, and others, of New York, N. Y.

Clarksburg, W. Va.—The Clarksburg & Fairmont St. Ry. Co. has filed a map and profile of its proposed line from Clarksburg to Salem.

Wheeling, W. Va.—The Wheeling, West Liberty & Belt Ry. Co. has been incorporated to build an electric railway from Wheeling to Altenheim, Greggaville and West Liberty, a distance of about 13 miles. Incorporators: C. L. Hill, Will Chambers, and others.

Janesville, Wis.—The Southern Wisconsin Interurban Ry. Co. has been incorporated to construct an electric line from Janesville to Madison, with a capital of $25,000. Incorporators: C. S. Jackman, Dennis Hayes and Michael Hayes.

Guelph, Ont.—The by-law to assist the Puslinch Lake & Hespeler St. Ry. Co., by taking stock to the amount of $25,000, has been passed by the ratepayers of Guelph.

RAILROADS.

Boca, Cal.—Amended articles of incorporation have been filed by the Boca & Loyalton Ry. Co., to construct, equip, maintain, conduct and operate a railroad from a point in the town of Boca through the county of Sierra, to Beckwith, and along Feather River, Spring Garden Creek and Spanish Creek, to Quincy, a distance of about 85 miles; and also in a northerly direction from Beckwith, a distance of about 35 miles.

Oakland, Cal.—The Sacramento & Oakland R. R. Co. is reported incorporated, with a capital of $5,000,000. Its terminus is to be at Oakland, while the main line is to run between Oakland and Sacramento, with branches to Point Richmond and Martinez. A. J. Brown, Pres.; A. D. Wilson, Ch. Engr.

Muncie, Ind.—A press report states that about $100,000 will be expended in the improvement of the Ft. Wayne division of the Lake Erie & Western R. R. Work will be commenced about April 1 on the improvements. About 35 miles of new track will be laid between this city and Ft. Wayne. Frank T. Bowles, Div. Supt., Muncie.

Des Moines, Ia.—See "Bridges."

Chicago, Ill.—The Chicago, Riverside & La Grange R. R. Co. has been chartered to build a railroad from 40th Ave. and W. 22d St. to 46th Ave. and W. 22d St. John T. Richards, Geo. T. Pitkin and Eugene Dupee, Attorney, 140 Dearborn St., Chicago, are the directors.

Joliet, Ill.—The Joliet, Wilmington & Dwight R. R. Co. has been incorporated, with a capital of $100,000, to construct a line from Joliet to Dwight, with branches to Coal City and South Wilmington. Incorporators: F. E. Fisher, W. H. Huen, and others, of Joliet.

The City Council has passed and the Mayor has signed the ordinance providing for the elevation of all railroad tracks within the city limits of Joliet, east of the Desplaines River. The railroads affected are the Chicago & Alton, Chicago, Rock Island & Pacific, Atchison, Topeka & Santa Fe, Michigan Central, Elgin, Joliet & Eastern, and Chicago, Lake Shore & Eastern.

Indianapolis, Ind.—The absorption by the Illinois Central R. R. Co. of the Indianapolis Southern R. R. Co. will give the Illinois Central an entrance into Indianapolis. The only change in the proposed plans will be that the western terminal will be Switz City, instead of Linton, Ind. Surveyors are now in the field, and the work of construction will be pushed to completion rapidly. H. U. Wallack, Ch. Engr., Chicago, Ill.

Huntersville, Md.—The Iron Mountain & Greenbrier R. R. Co. is stated to have decided to extend its line 15 miles to Huntersville.

Wells, Mich.—The Escanaba & Lake Superior R. R. will be extended from Wells, Mich., a distance of 7 miles to Ford River. J. W. Wells, Gen. Mgr., Menominee, Mich.

Woodland, Mo.—It is stated that the contract is about to be let by the Frisco R. R. Co. for the construction of the Eastern Illinois short line to St. Louis. The proposed line will run from Woodland to Villa Grove, and will be 62 miles in length. C. D. Purdon, Ch. Engr., St. Louis.

Aurora, Mo.—Wm. Kenefick and F. S. Hammond are reported to have secured the contract from Missouri Pacific management for building a large portion of the White River extension. They will construct the road from Aurora, Mo., to the second crossing of the White River, a distance of 76 miles.

Long Island City, L. I., N. Y.—The Long Island R. R., now controlled by the Pennsylvania R. R., is reported to be planning to expend a large sum of money in improving its equipment, roadbed and stations. Wm. F. Potter, Gen. Supt., Long Island City.

New York, N. Y.—About $10,000,000 will be expended by the Erie R. R. Co. in improvements which will include the construction of new ferryhouses at Chambers and 23d Sts., N. Y. City, and at Jersey City, and the rearrangement of tracks and terminals at that point; the construction of a new line through an open cut over Bergen Hill, important improvements at stations along the suburban lines and various improvements along the line, including construction of 2d and 3d tracks; provision of tools and improvements for the shops, etc. C. W. Buchholz, Ch. Engr., N. Y. City.

Toledo, O.—The Wheeling & Lake Erie R. R. Co. is stated to have decided to double track its line east from Toledo and south from Cleveland. H. W. McMasters, Div. Supt., Toledo.

Toledo, O.—Press reports state that the Wabash R. R. Co. has decided to expend $10,000,000 in building terminals here connecting the Ann Arbor and Wheeling and Lake Erie roads, and building a 4-track line through the heart of the city. It has also been decided to build shops here and a depot. W. S. Newhall, Ch. Engr., St. Louis, Mo.

Dayton, O.—The Dayton, Springfield, Columbus, Ohio, Belt Lines and Eastern Steam Ry. Co., of Zanesville, has been incorporated, with a capital of $10,000, by Albert E. Boone, John W. Marquand, and others. The company proposes constructing a steam railway from Dayton to Newcomerstown, Springfield, Columbus, Millersport, New Salem, Somerset, New Lexington, Crooksville, Roseville, Philo, Duncan Falls, Bridgeville and Otsego, and a branch from Springfield to Deavertown and from Duncan Falls to Cumberland.

Oklahoma City, Okla. Ter.—A charter has been granted to the Oklahoma City & Northwestern R. R. Co., with Oklahoma City as the principal place of business and with $15,000,000 capital stock. The purpose is to construct a line 540 miles in length from Oklahoma City to Denver. The road passes through the counties of Oklahoma, Canadian, Kingfisher, Blaine, Dewey, Woods and Woodward, in Okla. C. G. Jones, Pres. of the Frisco lines in Oklahoma, is at the head of the new corporation.

Tonkawa, Okla. Ter.—It is stated that the Rock Island R. R. Co. will extend its line, projected from Enid to Billings, Okla., to a connection with the Santa Fe at Tonkawa. It will necessitate the bridging of the Arkansas River near Tonkawa. The extension will be begun immediately. W. E. Dauchy, Ch. Eng., Chicago, Ill.

Allegheny, Pa.—The Com. appointed by Recorder J. O. Brown to find some way of relieving the congestion of the downtown district and providing means of rapid transit, recommends that a tunnel line be built to the East End. It is claimed that if a tunnel were drilled through the hills to the East End, following the hill beneath Locust St., then curving beneath Gazzam's Hill, the route could be completed at a cost of about $6,000,000. The plan suggests a downtown terminal at Try St. The committee is composed of H. C. Frick, Col. A. J. Logan and R. B. Mellon. It would require two years to complete the road.

McKees Rocks, Pa.—A press report states that the Pittsburg & Lake Erie R. R. Co. (J. A. Atwood, Ch. Engr., Pittsburg,) has asked bids for improvements at McKees Rocks and Youngstown, O., to cost $75,000. Two large shops are to be added to the McKees Rocks layout at a cost of $60,000. There will be also a concrete bridge at Youngstown to enable the company to cross a number of industrial plants which will cost about $15,000.

Pittsburg, Pa.—The Wabash R. R. Co. is stated to have decided to construct a 10-mile branch to the Carnegie steel mills in the Pittsburg region. It is estimated that this new road can be built for about $750,000, including the cost of a tunnel about 1,000 ft. long. W. H. Newhall, Ch. Engr., St. Louis, Mo.

Ch. Engr. Brown, of the Pennsylvania R. R. Co., is stated to have awarded contracts for grading and masonry on the Brilliant Branch, in Pittsburg, and the building of the masonry piers and abutments for a bridge across Allegheny River in connection with the new line to the Columbia Contracting Co., of Pittsburg and the Drake & Stratton Co., respectively. Both contracts to be completed Dec. 31, 1903.

Plans and specifications are being prepared for an important extension of the Pittsburg, Chartiers & Youghiogheny, the line operated jointly by the Pennsylvania and the Pittsburg & Lake Erie. The plans are under the charge of J. A. Atwood, of Pittsburg, Ch. Engr. of the Pittsburg & Lake Erie, and provide for the construction of the P. C. & Y. from its present terminus around the island; probable cost of work is $100,000.

Veblen, S. D.—The Veblen & Northwestern, of Veblen, S. D., has been incorporated, with a capital of $300,000, to construct a line from Veblen, S. D., to Hankinson, N. D., a distance of about 50 miles. Directors: A. J. Kelsey and John A. Brandt, of Veblen, and Byron Abbott, of Britton.

Elizabeth, W. Va.—The Brady Construction Co., of Clarksburg, W. Va., is stated to have secured the contract to construct the Wabash R. R. connection between the Little Kanawha and the West Virginia Central, and to build all the trestle and pile work of the extension, for about $150,000. The contract for the link of 45 miles from Burnsville to Belington, the terminus of the West Virginia Central, is yet to be let. W. S. Newhall, Ch. Engr., St. Louis, Mo.

La Crosse, Wis.—A press report states that the Chicago, Burlington & Quincy Ry. Co. will expend $500,000 in improving the northern division. The improvements consist of new bridges over St. Croix and Black Rivers, and a new viaduct at La Crosse. A double track will be laid from La Crosse to Onalaska, and the canacity of the Burlington shops at Grand Crossing will be doubled. The freight yards here will also have double the trackage when the improvements are completed. D. Cunningham, Div. Supt., La Crosse.

Oodnadatta, So. Australia.—According to the New York "Tribune," Alan G. Pendleton, South Australian Rys. Comr., at Adelaide, gives notice that tenders will be received at his office, May 2, 1904, for the construction and working of a line of railroad on the land grant system, between Oodnaratta, South Australia, and Pine Creek, Northern Territory, in accordance with the provisions of the Transcontinental Ry. act of 1902. Information may be obtained at the office of the chief secretary in Adelaide, the Agent General for South Australia, 1 Crosby Square, Bishopgate St., Within, London.

PUBLIC BUILDINGS.

Little Rock, Ark.—The Senate is stated to have passed the bill providing for an appropriation of $140,000 for the erection of an annex to the State insane asylum in Little Rock.

Washington, D. C.—The Senate has passed a bill providing for an appropriation of $215,000 for the erection of an addition to the Bureau of Engraving and Printing Building.

Athens, Ga.—Engravers and purchasers of bonds are requested to write to J. F. Rhodes, Mayor, regarding the $50,000 bonds authorized for the erection of a city hall.

Abbeville, Ga.—Frank C. Milburn, of Columbia, S. C., is stated to be preparing plans for the Wilcox County Court House, to cost $50,000.

La Grange, Ga.—Plans will be received Feb. 25 by the Bd. of Co. Comrs. for erecting a court house, including steam heating and electric light wiring; probable cost, $35,000. C. H. Griffin, Chmn.

Denison, Ia.—The Bd. of Supervs. is reported to have selected the plans of G. A. Berlinghoff, of Beatrice, Neb., for the court house to be erected here, to cost $70,000.

Richmond, Ind.—The Comrs. of Wayne County have decided to erect a court house and hospital.

Muncie, Ind.—Preparations are being made to erect a City Hospital here, to cost $25,000.

Indianapolis, Ind.—A site has been purchased in this city for the Methodist Deaconess Hospital; estimated cost, $200,000. Rev. H. L. Halstead, Secy. Hospital Bd.

Green Castle, Ind.—The citizens have voted to build a $200,000 court house.

Cannelton, Ind.—It is stated that the Perry County Comrs. are about to receive plans for a court house to be erected here, to cost from $40,000 to $60,000.

Taunton, Mass.—Bids will be received Feb. 28 by the Co. Comrs. for erecting a building for the Registries of Deeds and Probate and Probate Court for the Northern Dist. Albion M. Marble, Archt., 8 and 9 Hamilton Place, Boston, Mass.

Lawrence, Mass.—Bids will be received by Archts. Chickering & O'Connell Mar. 1 for a $70,000 church for Rev. J. J. Curtin.

Marlboro, Mass.—A correspondent writes that a library and city hall will be erected this year.

Muskegon, Mich.—Fuller & Pitcher, of Albany, N. Y., are stated to have submitted to the Bd. of Trustees plans for the buildings for the Hackley Hospital; estimated cost, $130,000.

Albert Lea, Minn.—The Citizens are stated to have voted to issue $20,000 bonds for the erection of a city hall.

Gulfport, Miss.—Bids will be received Mar. 2 by the Bd. of Co. Superv., at Mississippi City, for erecting a 2-story brick court house at Gulfport. Andrew J. Bryan & Co., Archts., Hennen Bldg., New Orleans, La.

Dover, N. H.—Competitive plans will be received Mar. 9 for a $30,000 library. Mayor A. G. Whittemore, Chmn. Library Trus.

Manchester, N. H.—The Hillsboro County Comrs. are reported to have selected the site for the county building to be erected here.

Long Island City, N. Y.—Bids will be received Mar. 4 by Thos. Sturgis, Fire Comr., for furnishing material for erecting a building on E. 8th St. for Engine Co. No. 158 and Hook and Ladder Co. 65.

New York, N. Y.—Bids will be received Mar. 2 by Jacob A. Cantor, Pres. Boro. Manhattan, for furnishing material to repair and alter Ludlow St. jail.

Bids will be received Mar. 2 by John W. Brannan, Pres. of the Bd. of Trus. Bellevue and Allied Hospitals, for repairs and alterations to the plumbing system in the main building of Bellevue Hospital.

Binghamton, N. Y.—The Trus. of the Public Library are stated to have rejected all plans recently submitted for the $60,000 building. A new competition will soon be arranged.

Buffalo, N. Y.—The Superv. of Erie County are to appropriate $75,000 for improvements in the County Hospital and Engine Room.

Kings Park, N. Y.—The contract for installing air compressor in L. I. State Hospital (bids opened Jan. 28) has been awarded to Ralph R. Carter, 23 Church St., N. Y. City, for $4,190. T. E. McGarr, Secy. State Comn. in Lunacy, Albany.

Amsterdam, N. Y.—The Trustees are stated to have approved plans for the 3-story addition to the hospital, to cost $25,000.

Utica, N. Y.—Olin W. Cutter, of Boston, Mass., is stated to have been selected to prepare plans for the Oneida County Court House, to cost $350,000.

Cleveland, O.—It is stated that the City Hall Comrs. have engaged A. E. Skeel, New England Bldg., to make the measurements and estimates necessary before the opening of the competition for preparing plans of the new city hall.

Mansfield, O.—Bids are wanted Mar. 18 for furnishing material and installing ventilating and heating apparatus, electric light, fixtures and wire; plumbing material, Portland cement, ivory cement, brick, steel and iron work, etc., to be used in constructing the east cell and lateral wing of the Ohio State Reformatory. C. H. Workman, Secy. Bd. of Mgrs.

Dayton, O.—Bids will be received Mar. 12 by the Bd. of Trus. of National Military Home for D. V. S., for furnishing material and erecting a stone gateway and lodge. Peters, Burns & Pretzinger, Archts., Kuhns Bldg. John W. Byron, Commissary of Subsistence and Supt. of Pest Fund.

Brandon, Man.—It is reported that the provincial government will erect a wing to the asylum at Brandon, to cost $70,000.

BUSINESS BUILDINGS AND DWELLINGS.

San Francisco, Cal.—The Western Addition Masonic Hall Assoc. is reported incorporated, with a capital of $75,000, to erect a 6-story brick Masonic Temple at Fillmore and Sutter Sts., at a cost of $60,000. Pres., Adolph Meyer.

Washington, D. C.—It is stated that the Elks of the District of Columbia have decided to erect a building, to cost $100,000.

Council Bluffs, Ia.—The Chicago Great Western Ry. Co. (O. Cornelisen, Div. Supt., Ft. Dodge,) is stated to have had plans prepared for a 119x30 ft. brick depot, to be erected at South Main St. and 9th Ave., at a cost of $20,000.

Des Moines, Ia.—C. E. Eastman Co., Observatory Bldg., is stated to be preparing plans for a 7-story brick addition to the Wellington Hotel at W. 5th St. and Grand Ave. Owner, Henry C. Hansen.

The State Insurance Co. is stated to have awarded the contract for the erection of the Windsor Hotel, at 219 W. 4th St., to Youger & Bushnell, of Chicago, Ill., for $80,000.

Bloomington, Ill.—It is stated that the Big Four (G. W. Kittredge, Ch. Engr., Cincinnati, O.), and the Lake Erie & Western R. R. Co. (E. A. Handy, Ch. Engr., Cleveland, O.), will unite in the erection of the station here.

Springfield, Ill.—It is stated that bids are wanted Mar. 1 for a 5-story bank building for the Farmers' National Bank. S. J. Hanes, Archt.

Richmond, Ind.—A $50,000 brick union office building, union station and freight depot, will be erected by the Local and the Dayton and Western Electric Ry. Co.

Kokomo, Ind.—Geo. K. Stewart, of Marion, Ind., will erect a $75,000 brick business block here. Bids will soon be asked.

Muncie, Ind.—The Big Four and the Lake Erie & Western Ry. Co. (E. A. Handy, Ch. Engr., Cincinnati, O.), have decided to build a joint freight depot, to cost $75,000.

Elwood, Ind.—C. G. Poor is interested in the erection of a hotel here, to cost $40,000. Plans and specifications are now ready for bidders.

Indianapolis, Ind.—The Indianapolis Traction & Terminal Co. is reported to have completed arrangements for securing the property on which to erect the proposed terminal station. The contract for erecting the new building is yet to be awarded. It is said this contract will include razing the buildings now on the ground.

A bill has passed the Legislature providing for the erection of a $500,000 Coliseum building in Indianapolis. Address Secy. of Coliseum Assoc.

Spokane, Wash.—F. P. Hogan will erect a 3-story brick apartment and store building, 100x155 ft. L. L. Rand, Archt., "The Rookery."

Preusse & Zittel, Jameson Bldg., have prepared plans for an addition to St. Joseph's Orphanage, to cost about $50,000.

Detroit, Mich.—Standard Bros. are reported to be having plans prepared for a 6-story brick building. Architects, A. C. Varney & Co., 58 Newberry Bldg.

Rochester, Minn.—It is stated that the Chicago Great Western Ry. Co. (C. E. Dafoe, Div. Supt., St. Paul,) will erect a depot here, to cost $50,000.

Minneapolis, Minn.—Betrand & Chamberlain, 517 1st Ave. S., are reported to be preparing plans for alterations to the Page Hotel on Bridge Sq. for Smith & Zimmer, to cost $50,000.

St. Paul, Minn.—C. H. Johnson, 712 Manhattan Bldg., is stated to have prepared plans for a 6-story Y. M. C. A. building, to be erected at St. Peters and 5th Sts.; probable cost, $300,000.

Kansas City, Mo.—Geo. Mathews, Lyceum Bldg., has prepared plans for a brick warehouse to be erected on St. Louis Ave. for Lang Bros., to cost $30,000.

M. O'Connell, New Ridge Bldg., has prepared plans for a brick apartment house to be erected on Jefferson and 10th St. for L. M. Leslie, to cost $75,000.

St. Louis, Mo.—Dr. H. Tuholske is reported to have had plans prepared for a residence to be erected at Westminster Pl. and Taylor Ave., to cost about $25,000.

Springfield, Mo.—It is stated that the Holland Banking Co. has purchased a site and will erect a $75,000 bank building.

Kalispell, Mont.—It is stated that the Masons will erect a Masonic temple at Main and 3d Sts., to cost $25,000.

New York, N. Y.—Plans are stated to have been filed for a 9-story brick hotel, to be erected at 153 W. 47th St. for R. Brown; estimated cost, $175,000. Architect, G. F. Pelham, 503 5th Ave.

Poughkeepsie, N. Y.—Percival M. Lloyd has prepared plans for a 3-story office building, 26x60 for the Poughkeepsie Daily Eagle, to cost $15,000. Bids will be called for Mar. 1.

New York, N. Y.—See "Railroads."

Buffalo, N. Y.—It is stated that the contract will soon be let for the 4-story, 50x200 ft. brick building to be erected at Genesee and Main Sts., for Geo. E. Loverack. Architects, Green & Wicks, 110 Franklin St.

Toledo, O.—See "Railroads."

Cincinnati, O.—Bansmith & Weber, Johnston Bldg., are reported to be preparing plans for a residence for Judge Miller Outcalt, to cost $35,000.

Toledo, O.—D. L. Stine, Valentine Bldg., is reported to have prepared plans for a 6-story building for W. L. Milner; estimated cost, $175,000.

Springfield, O.—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. (G. W. Kittredge, Ch. Engr., Cincinnati, O.), is reported to be having plans prepared for a depot and freight station, to be erected here, to cost, approximately, $100,000.

Toledo, O.—Local press reports state that bids will be received Mar. 1 by Harry Wachter, Archt., for erecting a Masonic temple, to cost about $100,000, at Adams and Michigan Sts.

McKeesport, Pa.—Harry Davis, of the Grand Opera House, Pittsburg, is reported interested in the erection of a theatre here, to cost about $50,000.

Pittsburg, Pa.—M. E. F. McConegey is reported to have had plans prepared for a 4-story apartment house, to be erected at Meade St. and Lexington Ave., at a cost of $35,000. J. E. Obitz, Archt.

Charleroi, Pa.—It is stated that the Charlerol Amusement Co. will erect a theater at 6th St. and McKean Ave., at a cost of $50,000.

Philadelphia, Pa.—It is stated that John Stafford will erect a 16-story apartment house at 16th and Chandler Sts., and a 12-story addition to the St. James Hotel, at 13th and Walnut Sts.

Nashville, Tenn.—J. C. McClanahan is to erect flats on Polk Ave. and Church St., at a cost of $60,000.

Elkins, W. Va.—Mrs. S. B. Elkins is reported to be having plans prepared for a 3-story Y. M. C. A. building to be erected here, to cost $60,000.

Petersburg, Va.—Plans are stated to have been prepared by John Peebles, of Norfolk, for the 6-story hotel to be erected at Sycamore and Tabb Sts., at a cost of $75,000.

Winnipeg, Man.—The Bole Drug Co. is reported to be having plans prepared for a 5-story brick building to be erected on Princess St.; probable cost, $30,000.

SCHOOLS.

Middletown, Conn.—It is stated that $100,000 has been given toward the erection of the Scott Laboratory of Physics, for the Wesleyan Univ.

Washington, D. C.—J. M. Dunn is reported to have secured the contract for the erection of the school at 27th and K Sts., for $36,620.

The contract for the erection of the parochial school and hall at 10th and G Sts., for the St. Patrick's R. C. Church, is reported to have been awarded to J. S. Larcombe; estimated cost, $100,000.

Des Moines, Ia.—It is stated that bids will be received Mar. 10 by the Bd. of Control of State Institutions of Iowa, for erecting 16 buildings and 2 brick smokestacks.

Chicago, Ill.—Bids are wanted Feb. 27 for erecting a school on Eberly and W. Cullom Aves., including ventilating, steam heating, heat regulation, plumbing, gas fitting, sewerage, fireproofing, structural iron, etc. W. B. Mundle, Archt. of Bd. Educ. T. J. Waters, Ch. Engr.

Indianapolis, Ind.—The contracts will soon be let for the erection of 5 schools; estimated cost, $350,000.

Hartford City, Ind.—The School Bd. has decided to rebuild the high school recently destroyed by fire, at a cost of $40,000.

Indianapolis, Ind.—Wilson Bros., of Philadelphia, Pa., are reported to have prepared plans for a building for the Manual Training High School; probable cost, $90,000.

A bill has been passed in the Legislature providing for an appropriation of $150,000 to erect a Girls' Industrial School or Prison.

Cambridge, Mass.—It is stated that $76,000 has been given toward the erection of an Infants' Hospital for the Harvard Medical School.

Minneapolis, Minn.—The Bd. of Educ. is stated to have decided to erect additions to the following schools: Franklin, 15th Ave. N. and 4th St., to cost $30,000; Franklin and 23d Aves., N., to cost $35,000; Bryant, Clinton Ave. and 27th St., S., $30,000; Hawthorne, 24th Ave., N., and 6th St., $33,000.

St. Paul, Minn.—Plans are stated to have been prepared by J. W. Stevens, 502 Drake Blk., for a school to be erected here, to cost about $33,000.

Fulton, Mo.—Theo. C. Link, of St. Louis, is reported to have prepared plans for a building for the Westminster College, to cost $30,000.

Kansas City, Mo.—Bids will be received Mar. 2 by the Authorities of School Dist. for $500,000 school bonds.

Lakewood, O.—Bids will be received Mar. 3 by Maurice Welfare, Clk. of Bd. of Educ., for $75,000 school bonds.

Kensington, O.—It is stated that bids are wanted Feb. 23 for erecting a school. A. E. Swearingen, Clk.

Cleveland, O.—It is stated that bids are wanted Mar. 2 for erecting the Doan St. school. Starr Cadwallader, School Dir., Rose Bldg.

Eugene, Ore.—The Citizens are stated to have voted to issue $30,000 bonds for the erection of a high school.

Lebanon, Pa.—Plans are stated to have been prepared for a 3-story brick dormitory for the Cumberland Univ., at a cost of $20,000.

Erie, Pa.—Plans will soon be prepared for a school at 10th and Cascade Sts. It will be a 12-room structure of brick and stone, and cost about $50,000.

Tamaqua, Pa.—It is stated that bids are wanted by the School Bd. until Mar. 2 for erecting a school. A. L. Oliver, Secy.

Scranton, Pa.—M. J. Ruddy is stated to have submitted the lowest bid, $89,950, for the erection of the high school.

Pittsburg, Pa.—Andrew Carnegie is stated to have approved the site east of Schenley Park for the technical school. W. N. Frewd, Pres. Bd. of Trus.

STREET CLEANING AND GARBAGE DISPOSAL.

Rockford, Ill.—Local press reports state that the Health Com. on Jan. 31 opened the only bid sent in for the collection and care of garbage for 1903. It was submitted by J. A. Peterson at $2,400 for 6 wagons for 8 months.

Brooklyn, N. Y.—Bids will be received Feb. 27 by John McG. Woodbury, Comr. of Street Cleaning, for furnishing and delivering 200 ash carts.

GOVERNMENT WORK.

San Francisco, Cal.—Bids are wanted Mar. 5 for furnishing material for constructing a brick fog-signal building at Ft. Winfield Scott, Ft. Point Light Station. Lieut.-Col. Thos. H. Handbury, Corps Engrs., U. S. A.

Washington, D. C.—Bids will be received Mar. 10 by the Bureau of Supplies and Accounts, Washington, for furnishing at the Navy Yard, Puget Sound, a quantity of electrical supplies, 1 pump, etc. A. S. Kenny, Paymaster Gen., U. S. Navy.

Wilmington, Del.—Bids are wanted Mar. 16 for constructing wing dams on Rancocas River, N. J. Col. Jared A. Smith, Corps Engrs., U. S. A.

St. Augustine, Fla.—The following bids for furnishing material and constructing jetties at entrance to St. John's Harbor, Fla., were received by Capt. Francis R. Shunk, Corps Engrs., U. S. A., Feb. 12: *a*, 90,000 tons 1st class stone; *b*, 40,000 tons 2d class stone; *c*, 5,000 cu. yds. 3d class stone: Christie, Lowe & Heyworth, Chicago, Ill., *a*, $3.25; *b*, $3.25; *c*, $3.25. Hughes Brothers & Bangs, Syracuse, N. Y., *a*, $2.69; *b*, $2.69; *c*, $2.44. Roderick G. Ross, Jacksonville, Fla., *a*, $2.22; *b*, $2.22; *c*, $2.13. Georgia Contracting Co., Atlanta, Ga., *a*, $2.41; *b*, $2.39; *c*, $2.03.

Bids are wanted Apr. 17 for a steel hull, stern wheel, combined dredge and snagboat, as advertised in The Engineering Record.

Chicago, Ill.—The following bids for dredging in Calumet River, Ill., were received on Feb. 10 by Lieut.-Col. O. H. Ernst, Corps Engrs., U. S. A., 450,000 cu. yds., price given per cu. yd.: Griffiths, McDermott & Watt Dredging Co., Chicago, 14.5 cts., (lowest bidder); Hausler & Lutz Towing & Dock Co., Chicago, 18 cts.; The Fitz Simons & Connell Co., Chicago, 19.45 cts.; Lake Superior Contr. & Dredging Co., Duluth, Minn., 20 cts.; Saml. O. Dixon, Milwaukee, Wis., 21 cts.; Duluth Dredge & Dock Co., Duluth, Minn., 21.5 cts.; The Lydon & Drews Co., Chicago, 22.9 cts.

Creston, Ia.—The Iowa Mfg. Co. of Oskaloosa, Ia., is stated to have secured the contract for heating the Post Office for $4,865.

Rock Island, Ill.—Shop A, the principal issue storehouse at the Rock Island Arsenal, was destroyed by fire Feb. 11; it is reported to have been erected 20 years ago at a cost of $400,000.

Indiana.—It is stated that Secretary Shaw, of Washington, D. C., has decided to give private architects an opportunity to compete for smaller buildings, and has directed that they be permitted to prepare plans for buildings ordered at the first session of the present Congress to include post office buildings at Anderson, Richmond, Elkhart, Hammond, Logansport and Vincennes. Contracts for these buildings will be let this spring.

Richmond, Ky.—Bids are wanted Mar. 23 for the completion of the U. S. Post Office at Richmond. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Boston, Mass.—Bids are wanted Mar. 16 for furnishing and delivering granite for the light and fog-signal tower on Ram Island Ledge, entrance to Portland Harbor, Me. Col. W. S. Stanton, Engr. First Light House Dist., U. S. A.

Bids are wanted Mar. 16 for dredging in Little Harbor, Exeter, Lamprey and Cocheco Rivers, N. H. Capt. Harry Taylor, Corps Engrs., U. S. A.

The following bids were opened Feb. 12 by Capt. Harry Taylor, Corps Engrs., for constructing breakwater in Gloucester harbor: *a*, rubble stone in substructure and in apron; *b*, dimension stone in superstructure; *c*, rubble stone in interior superstructure; *d*, galv. steel cramps: Rockport Granite Co., Rockport, Mass., *a*, $1.07 per ton of 2,000 lbs.; *b*, $4.80 per ton; *c*, $1.97 per ton; *d*, 15 cts. per lb. Jno. Cashman, Quincy, *a*, $1.25; *b*, $5.23; *c*, $2.27; *d*, 17 cts.

Ft. Howard, Md.—Bids are wanted Mar. 20 for constructing sea wall, filling, etc., at this post. Address Capt. Wm. E. Horton, Q. M., Baltimore.

Grand Rapids, Mich.—Bids are wanted Mar. 11 for dredging harbors on east shore of Lake Michigan. Capt. Chas. Keller, Corps Engrs., U. S. A.

Duluth, Minn.—Bids are wanted Mar. 9 for dredging about 40,000 cu. yds. at Ashland, Wis., and Ontonagon, Mich. Capt. D. D. Gaillard, Corps Engrs., U. S. A.

St. Paul, Minn.—Bids are wanted Mar. 7 for alterations to the U. S. Custom House at this post. Jas. Knox Taylor, Superv. Archt., Treasury Dept., Washington, D. C.

Minneapolis, Minn.—Bids are wanted Mar. 19 for enlarging, including heating apparatus, plumbing, electric conduits and wiring, the U. S. Post Office, etc., in said city. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Jefferson Barracks, Mo.—Bids are wanted Mar. 12 for constructing roads at this post. Address Lieut.-Col. J. W. Jacobs, Depot Q. M.

Ft. Robinson, Neb.—Bids are wanted Feb. 25 for furnishing material and installing a steam heating plant in the guard house. Address John W. Pullman, Ch. Q. M., Omaha.

Ft. Mott, N. J.—Bids are wanted Mar. 10 for furnishing 1 35-H.-P. steam boiler and connections, also for material and setting and connecting same for water system. Address Quartermaster at same place.

New York, N. Y.—Bids will be received Feb. 24 by the Bureau of Supplies and Accounts for furnishing at the N. Y. Navy Yard a quantity of electrical supplies, iron, steel, asbestos, pumps, tubes, etc. A. S. Kenny, Paymaster Gen., U. S. Navy, Washington, D. C.

The following bids for dredging in Passaic River, N. J., were received by Lieut.-Col. C. W. Raymond, Corps Engrs., U. S. A., Feb. 16, price given per cu. yd.; Wm. H. Taylor, 24 Emory St., Jersey City, N. J., 40 cts.; International Contracting Co., 95 Broad St., New York, 29 cts. and 34.8 cts.; P. Sanford Ross, Inc., Jersey City, N. J., 27.5 cts.; Morris & Cummings Dredging Co., 17 State St., New York, 31 cts.

Portland, Ore.—The Bd. of Engineer Officers, which has for 6 months been considering the permanent improvement of the mouth of Columbia River, has reported to General Gillespie recommending the extension of the present, or south, jetty due west for 2½ miles, or so much of this distance as the depth of water will permit. The board estimates the proposed extension of the south jetty will cost $2,260,000, and the construction of the north jetty $1,205,000, to which $250,000 is added, being the cost of operating the dredge Grant, making the total cost of the proposed improvement $3,715,000.

Portland, Ore.—Bids are wanted Mar. 16 for constructing dipper dredge, or for dredging machinery for improving Willamette, Vamhill, Upper Columbia and Snake Rivers. Capt. W. C. Langfitt, Corps Engrs., U. S. A.

Ft. Stevens, Ore.—Bids are wanted Mar. 6 for furnishing and delivering material for constructing electric light plant at this post. Address F. H. Hathaway, Ch. Q. M., Vancouver Barracks, Wash.

Burlington, Vt.—Bids are wanted Mar. 16 for repairing breakwater. Capt. Harry Taylor, Corps Engrs., U. S. A., Winthrop Bldg., Boston, Mass.

Ft. Wright, Wash.—Bids are wanted Mar. 11 for constructing, including steam heating, gas fitting and plumbing, 1 double set officers' quarters; also for constructing 1 quartermasters' and 1 ordnance storehouse. Address Capt. W. C. Wren, Constructing Q. M.

Superior, Wis.—The Lake Superior Contracting & Dredging Co., of Duluth, Minn., has secured the contract for dredging pier trench at Superior Entry, Wis., bids opened Feb. 9 at 15 cts. per cu. yd., or a total of $19,500.

Sheridan, Wyo.—Capt. Thos. Swobe, Q. M., U. S. A., writes that the following contracts were awarded Feb. 11 for constructing, plumbing, etc., buildings at this post (bids for which were opened Dec. 20): Construction of 5 buildings, B. J. Jobst, Omaha, Neb., $136,523; heating 3 buildings and plumbing 2, to J. J. Harrington, of Omaha, Neb., at $10,972 and $3,920 respectively; plumbing 3 buildings, to Shackelton & Whiteway, of Butte, $8,663, and heating 1 building, to the Dwyer Plumbing & Htg. Co., at $2,269.

NEW INDUSTRIAL PLANTS.

The Florence, Colo., Portland Cement Co. will erect a plant to have a daily capacity of 1,000 bbls. Two 600-H.-P. cross compound Reynolds-Corliss engines and six rotary kilns will be installed. Electric power will be used throughout. The Osborn Engineering Co., Cleveland, O., are the consulting engineers, and Robt. W. Hunt & Co., Chicago, the consulting chemists. J. Q. MacDonald, Gen. Mgr.

The A. H. Pugh Printing Co., 310 Walnut St., Cincinnati, O., is having plans drawn for a 68x340-ft. building of cement fireproof construction. The company expects to use its present engine, but will be in the market for 25 to 30 motors of ½ to 6-H.-P. each.

The Cambria Foundry & Machine Co., Johnstown, Pa., will erect a 120x55-ft. foundry, for which all material excepting a 10-ton crane has been ordered. The company will also erect a 125x34-ft. machine shop, for which it will require a 48-in. lathe, a 36x36x12-ft. planer, a 24-in. crank shaper, a 100-ton 36-in. hydraulic wheel press, a steam hammer and a second-hand air compressor for drilling, chipping and cleaning castings. The company will use power plant which it now has.

The Madison Cotton Oil Co., Tallulah, La., will erect a 60-ton crude cottonseed-oil mill. There will be five buildings, and the power plant will consist of two 125-H.-P. boilers and a 20x42-in. Corliss engine. F. P. Fox, Vicksburg, Miss., Pres.

N. M. Chambless, 709 S. 35th St., Birmingham, Ala., is erecting engineer for a company that will erect a brick and tile plant and mine coal. A power house will be erected at the brick plant and the mining machinery will be operated electrically. The company will be in the market for about 500-H.-P. in water-tube boilers, a 400 to 450-H.-P. Corliss engine, electric hoisting machinery, generators, steam pumps, etc.

The Imperial Furniture Mfg. Co., Statesville, N. C., is in the market for a 125-H.-P. boiler, shafting, pulleys, hangers, belting, power elevator, a 1½-in. suction deep well pump, a boiler feed pump, and manifolds and piping for dry kiln.

The Davis Cotton Mills, Augusta, Ga., are increasing their capital from $250,000 to $500,000, and will install 25,000 spindles and a corresponding number of automatic looms. The power will be steam with electric transmission and motors on short lines of shafts. W. B. Smith Whaley & Co., Columbia, S. C., are the engineers.

The Bowler Foundry Co., 14 Winter St., Cleveland, O., is having plans prepared by the Wellman-Seaver-Morgan Engineering Co., Cleveland, for a plant to cost about $300,000.

The Barry Mfg. Co., Muscatine, Ia., are building a machine shop, and have already built a foundry; the building will be 3 stories, 48x210 ft. A power plant of 150-H.-P. will probably be installed.

The Pittsburg, McKeesport & Connellsville Ry. Co. has plans for new shops at Connellsville, Pa., and is in the market for equipment.

E. Montgomery, Summerville, Ga., is interested in the organization of a company to build a 2-story, 75x150-ft. cotton mill, with engine and boiler rooms annexed, at La Fayette, Ga. A 200 or 250-H.-P. engine and boilers will probably be installed.

MISCELLANEOUS.

Chicago, Ill.—Bids will be received by the South Park Comrs. for furnishing and delivering f. o. b. cars at 38th St. and Archer Ave. 500 bbls. of Portland cement. E. G. Shumway, Secy.

Bossier City, La.—Bids are wanted Mar. 5 for constructing following levee work in the Parish of Bossier: Buckhall levee, approximate contents 20,000 cu. yds. T. N. Braden, Secy., Curtis, La.

Wilmington, N. C.—Local press reports state that bids will be received Feb. 24 by Chmn. of Street and Wharves Com. for furnishing 3,000 tons crushed rock.

New York, N. Y.—Bids will be received Feb. 27 by McDougall Hawkes, Comr. of Docks, for furnishing material for etxending pier No. 33, North River, at foot of Canal St.

Buffalo, N. Y.—Bids are wanted Feb. 24 for widening, deepening and straightening portions of Buffalo River and Casenovia Creek. Francis G. Ward, Comr. of Pub. Wks.

Bids are wanted Feb. 24 for $750,000 bonds to be used for widening and straightening Cazenovia Creek.

Lockland, O.—Bids will be received Feb. 24 by Frank Jonte, Village Clk., for furnishing and delivering f. o. b. cars 1,000 cu. yds. crushed blue limestone.

Columbus, O.—Bids will be received Feb. 23 by John A. Connor, Clk. of Bd. Pub. Wks., for furnishing material and erecting 1 176x9 ft. self-supporting steel chimney.

Bairdstown, O.—Bids will be received Feb. 27 by R. B. Fast, Clk. of Bloom Township (Bairdstown, P. O.) for quarrying, crushing and delivering approximately 11,400 cu. yds. stone on portions of 3 roads.

Philadelphia, Pa.—Bids are wanted Feb. 27 for sprinkling drives, dredging river, etc. Jesse T. Vogdes, Ch. Engr. and Supt. of Fairmount Park.

Austin, Tex.—The City Council is reported to be preparing to submit to the citizens a proposition looking to rebuilding of the great dam across the Colorado River at this place. The dam was destroyed by the flood 3 years ago. A portion of the structure is still standing, and engineers estimate that it can be rebuilt at a cost of about $500,000.

Niagara Falls, Ont.—Bids will be received Mar. 2 by Frederic Nichols, Vice-Pres. and Gen. Mgr., 14-16 King St., Toronto, for furnishing material and constructing a timber crib cofferdam in the Niagara River, near Tempest Point, Queen Victoria Niagara Falls Park. Hugh L. Cooper, Ch. Engr., 29 Broadway, N. Y.

BUSINESS NOTES.

The Kelly-Springfield Road Roller Co., Springfield, O., has opened an office at 220 Broadway, New York, to facilitate the handling of its Eastern business.

The Struthers-Wells Co., Warren, Pa., has secured a contract from the Canadian Power Co. for a penstock 9 ft. in diameter and 450 ft. long to be erected on piers at Shawinigan Falls, Que., for conveying water under 90 ft. head to the turbines.

The steam turbine equipment of the Hartford, Conn., Elec. Light Co. is to be duplicated by machines manufactured by the builders of the original installation, The Westinghouse Machine Co., Pittsburg. The present Corliss engine equipment will be replaced by two 1,000-H.-P. turbines, direct-connected to revolving field polyphase generators. These units will operate in parallel with the 1,500-Kw. unit installed one year ago, with superheated steam at 150 lbs. pressure and a high vacuum.

The Philadelphia Pneumatic Tool Co. has arranged to double the size of its offices in the Singer Bldg., Broadway and Liberty Sts., New York. An electrically driven air compressor and a complete plant for testing and exhibiting pneumatic tools of all kinds in operation will be installed. The New York offices will continue under the management of W. A. Battey, assisted by James H. Beaubien. Orders have been recently received for complete equipments for pneumatic tools for the National Railroad of Mexico and for the Interoceanic Railroad of Mexico. In two days last week the company shipped Keller rotary drills to the amount of over $10,000.

The Weston Electrical Instrument Co., Newark, N. J., has won an infringement suit against the Keystone Electrical Instrument Co., in the United States Circuit Court of the Southern District of New York.

The Philadelphia Tapestry Mills two years ago decided to operate their plant by electric power, and purchased a 150-Kw. Westinghouse two-phase engine-type alternator, together with from 12 to 15 type C induction motors. This plant has given such satisfaction that they have now decided to duplicate it, and have recently contracted with the Westinghouse Company for another alternator of the same size. The Dodge Coal Storage Co., of Philadelphia, is building a large coal handling crane to be installed at the Maryland Steel Company's plant at Sparrow's Point. This crane will be driven by electric motors, and the Dodge Company has recently purchased for this purpose one 50-H.-P. and two 30-H.-P., direct-current motors with controllers, from the Westinghouse Electric & Mfg. Co.

The Evansville, Ind., Contracting Co. has reincorporated and increased its capital stock to $150,000. The company has many contracts in view for the season. D. P. Gittell, Pres.; Charles Lieb, Secy.

The Power Specialty Co., 126 Liberty St., New York, has been awarded a contract by the N. Y. C. & H. R. R. R. for four superheaters to be installed in four 500-H.-P. Aultman & Taylor boilers at the new Weehawken power house, and has also received an order for superheaters from the Kentucky Refining Co.

The Burt Mfg. Co., Akron, O., has received orders for shipments of 6 oil filters to Sydney, Australia; 5 oil filters to Stockholm, Sweden, and 5 for Johannesburg, South Africa.

The J. B. & J. M. Cornell Co. has been incorporated with a capital of $2,000,000. The directors are John M. and Irwin H. Cornell, of New York, and Charles R. Leffingwell, of Yonkers, N. Y.

Strauss, Eisendrath & Co., Chicago, have recently installed a 175-H.-P. direct-connected unit, consisting of an engine made by the Ball Engine Co., Erie, Pa., and a Western Electric generator, and the Woman's College, Baltimore, Md., has recently bought a 160-H.-P. self-oiling Ball engine arranged for direct connection to a 100-Kw. General Electric generator.

The Allis-Chalmers Co. will on May 1 remove its general offices to the New York Life Bldg., Chicago. The company reports that during the past two months orders for engines, mining machinery, rock crushing machinery, saw-mill machinery, or flour-mill machinery were booked from every State in the Union, and England, South Africa, Mexico, Canada, Chili, Central America, Brazil, West Australia, Turkey, Finland, Yukon Ter., Belgium, British Columbia, Bolivia, Hawaiian Islands, Peru, Alaska, China, and the Philippine Islands. The company also reports the following among its sales of Reynolds-Corliss for January: St. Louis & Suburban Ry. Co., a 30 and 50x60-in. 1890 cross compound and two 32x60-in. cylinders; Bethlehem Steel Co., So. Bethlehem, Pa., a 30x48-in. 1890 horizontal; Crystal Food Co., Jackson, Mich., a 16x36-in. girder frame; Hunter Milling Co., Wellington, Kan., a 16 and 30x42-in. 1890 cross compound horizontal; Gunther Fdy., Mch. & Supply Co., for Alamo, Tex., Cement Works, a 20x42-in. girder frame horizontal; Wm. H. Patterson, Smithville, Mo., a 12x30-in. girder frame horizontal with boiler and heater; W. S. Tyler Co., Cleveland, O., a 22 and 36x42-in. vertical cross compound; Maas, Blum & Co., New York, a 12x36-in. girder frame horizontal; Seeley, Son & Co., Fremont, Neb., a 22x42-in. 1890 horizontal; E. H. Dyer, Cleveland, O., two 10x30, two 14x36 and two 12x36-in. 1890; Georgia Iron & Coal Co., Chattanooga, Tenn., a 44 and 84x60-in. long crosshead blowing engine; United Engineering & Contracting Co., New York, two 18x42-in. 1890; Atlas Portland Cement Co., Northampton, Pa., two 14 and 28 and 20x42-in. Reynolds air compressors; Penn-Allen Portland Cement Co., Allentown, Pa., a 20 and 40x42-in. horizontal cross compound, a 14x36-in. horizontal, a 12x30-in. horizontal, and an 18 and 36x42-in. cross compound; Fraser & Co., Ottawa, Can., a 30x60 1890 horizontal.

The New York Edison Co. has placed a contract with Westinghouse, Church, Kerr & Co. for another 6,500-H.-P. Westinghouse vertical three-cylinder compound engine. The contracts include eleven units, aggregating 71,000-H.-P. normal, or 100,000-H.-P. maximum capacity. The N. Y. C. & H. R. R. R. has placed an order with the company for four Westinghouse-Corliss engines of the horizontal cross-compound type, for the power station in process of erection for the Weehawken, N. J., elevator. Two of the engines are of 1,200-H.-P. normal capacity, and the remaining two of 700-H.-P., each pair being direct-connected respectively to 750 and 400-Kw. polyphase generators of the revolving field type. They will operate with 140 lbs. of steam superheated to 500 deg. F. and with high vacuum. An isolated plant for a group of five or six office buildings in Pittsburg for Henry Phipps, including the Bessemer Building, corner Sixth and Duquesne Way, is to have machinery installed by Westinghouse, Church, Kerr & Co. The power equipment will include two 1,500-H.-P. Westinghouse-Corliss engines, of the horizontal cross-compound type, operating non-condensing, the exhaust steam being used for heating purposes. The engines will be placed on the ground floor, while the boilers will be located on the second floor, and supplemented by suitable coal and ash handling appliances.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Feb. 24.	Bainbridge, O.	Feb. 14
Feb. 24.	Allentown, Pa., Adv. Feb. 14.	Feb. 14
Feb. 25.	Nampa, Idaho	Feb. 21
Feb. 25.	Holdenville, Ind. Ter. Adv. Feb. 14.	Feb. 14
Feb. 26.	Chicago, Ill.	Feb. 21
Feb. 27.	Pipe, etc., Burlington, Ia. Adv. Feb. 7 to 21.	Feb. 7
Feb. 28.	Valves, Cleveland, O., Adv.	Feb. 7 to 21. Feb. 7
Feb. 28.	South McAlester, Ind. Ter. Adv. Feb. 7 to 21.	Feb. 7
Mar. 1.	Ft. Morgan, Ala.	Jan. 24
Mar. 2.	Vallejo, Cal.	Feb. 21
Mar. 3.	St. Martinsville, La., Adv. Feb. 21.	Feb. 21
Mar. 3.	Water Wks. Extension, Allentown, Pa. Adv. Feb. 21.	Feb. 21
Mar. 3.	Concord, N. C., Adv. Feb. 14, 21.	Feb. 14
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 4.	Bottineau, N. D.	Feb. 21
Mar. 4.	Lewiston, Idaho	Feb. 21
Mar. 5.	Kansas City, Mo.	Feb. 21
Mar. 5.	Pipe, Yonkers, N. Y., Adv. Feb. 14.	Feb. 14
Mar. 6.	Engine, Allentown, Pa., Adv. Feb. 21.	Feb. 21
Mar. 7.	Cleveland, O.	Feb. 21
Mar. 12.	Pipe, etc., Cleveland, O., Adv. Feb. 7.	Feb. 21
Mar. 14.	Dillon, Mont.	Jan. 10
Mar. 16.	Pumping Engine, Winnipeg, Man. Adv. Jan. 17 to Feb. 14.	Jan. 17
Mar. 17.	Cincinnati, O., Adv. Feb. 21.	Feb. 21
Mar. 18.	Georgetown, S. C., Adv. Feb. 21.	Feb. 21
May 1.	Chinook, Mont.	Feb. 7
Mar. —	Alcester, S. D.	Feb. 21
———	Metera, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Feb. 25.	Baltimore, Md.	Feb. 21
Feb. 26.	Ft. Apache, Ariz.	Feb. 21
Feb. 26.	Chicago, Ill.	Feb. 21
Feb. 26.	Cleveland, O.	Feb. 7
Feb. 28.	South McAlester, Ind. Ter. Adv. Feb. 7, 14.	Feb. 7
Mar. 1.	Peoria, Ill.	Jan. 17
Mar. 2.	Muncie, Ind.	Feb. 14
Mar. 3.	New York, N. Y.	Feb. 21
Mar. 3.	Rock Island, Ill.	Feb. 14
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 4.	Brooklyn, N. Y.	Feb. 21
Mar. 5.	Pipe, etc., Meriden, Conn. Adv. Feb. 14, 21.	Feb. 14
Mar. 9.	Toledo, O	Feb. 14
Mar. 14.	Bowling Green, O.	Feb. 21
Mar. 17.	Dayton, O.	Feb. 21
Mar. 18.	Georgetown, S. C., Adv. Feb. 21.	Feb. 21
Mar. 30.	Marshfield, Wis.	Feb. 21
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. —	Crookston, Minn.	Feb. 21
	BRIDGES.	
Feb. 25.	Salina, Kan.	Feb. 14
Feb. 26.	Portland, Mich.	Feb. 21
Mar. 2.	Boston, Mass.	Feb. 21
Mar. 2.	Sherbrooke, N. D.	Feb. 14
Mar. 4.	Frankfort, Ind.	Feb. 21
Mar. 4.	Atlantic City, N. J.	Feb. 21
Mar. 6.	Milwaukee, Wis.	Feb. 14
Mar. 9.	Delaware, O.	Feb. 21
Mar. 9.	Colville, Wash.	Feb. 21
Mar. 17.	Kearney, Neb.	Feb. 14
Mar. 25.	Plymouth, Wis.	Feb. 14
Mar. 26.	Chatham, Ont.	Feb. 21
Mar. 27.	Washington, D. C., Adv. Feb. 7 to 21.	Feb. 7
	PAVING AND ROADMAKING.	
Feb. 23.	Fond du Lac, Was., Adv. Jan. 3 to 17.	Jan. 3
Feb. 24.	Dayton, O.	Feb. 21
Feb. 25.	Hoboken, N. J.	Feb. 21
Feb. 25.	Baltimore, Md.	Feb. 21
Feb. 25.	Red Oak, Ia.	Feb. 14
Feb. 26.	Keokuk, Ia.	Feb. 21
Feb. 26.	Montreal, Que.	Feb. 21
Feb. 27.	Boone, Ia.	Feb. 14
Mar. 2.	Atlanta, Ga.	Feb. 21
Mar. 2.	Augusta, Ga.	Feb. 21
Mar. 2.	Ogden, Utah	Feb. 14
Mar. 2.	Muncie, Ind.	Feb. 14
Mar. 2.	Albia, Ia.	Feb. 14
Mar. 2.	Toledo, O.	Feb. 7
Mar. 2.	Newburgh, N. Y., Adv. Feb. 7 to 21.	Jan. 31
Mar. 3.	Trenton, N. J.	Feb. 21
Mar. 3.	New York, N. Y.	Feb. 21
Mar. 3.	Cincinnati, O.	Feb. 21
Mar. 3.	Winnipeg, Man., Adv. Feb. 7, 14.	Feb. 7
Mar. 4.	Brooklyn, N. Y.	Feb. 21
Mar. 4.	Rensselaer, Ind.	Feb. 14
Mar. 4.	Somerville, N. J.	Feb. 14
Mar. 5.	Ironton, O.	Feb. 21
Mar. 5.	Cleveland, O.	Feb. 21
Mar. 5.	Roanoke, Va.	Feb. 14
Mar. 6.	Ft. De Soto, Fla., Adv. Feb. 7 to 21.	Feb. 7
Mar. 11.	Tiffin, O.	Feb. 21
Mar. 16.	Menominee, Mich., Adv. Feb. 21.	Feb. 21
Mar. —	San Diego, Cal.	Jan. 31
Apr. 6.	Vallejo, Cal.	Feb. 21
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Feb. 18.	St. Francisville, La., Adv. Feb. 7.	Jan. 31
Mar. 2.	Two Harbors, Minn.	Feb. 21
Mar. 3.	St. Martinsville, La., Adv. Feb. 21.	Feb. 21
Mar. 4.	Franchise, Manila, P. I.	Nov. 15
Mar. 6.	Ft. Stevens, Ore.	Feb. 21
Mar. 10.	Muscatine, Ia.	Feb. 21
Mar. 16.	St. Paul, Minn.	Feb. 21
Mar. 16.	Prince Albert, N. W. Ter.	Feb. 21
Apr. 7.	Oneida, N. Y.	Feb. 7
———	Hyattsville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Feb. 24.	New York, N. Y.	Feb. 21
Feb. 24.	San Francisco, Cal.	Feb. 7
Feb. 24.	Ashland, Wis., Adv. Feb. 7 to 21.	Jan. 31
Feb. 24.	Chicago, Ill.	Jan. 24
Feb. 25.	Ft. Robinson, Neb.	Feb. 21
Feb. 25.	Creston, Ia., Adv. Jan. 17, 24.	Jan. 17
Feb. 27.	Ft. Sheridan, Ill.	Feb. 7
Feb. 28.	New Bedford, Mass., Adv. Feb. 14, 21.	Feb. 14
Feb. 28.	Nashville, Tenn. Adv. Jan. 31 to Feb. 21.	Jan. 31
Feb. 28.	Ft. Terry, N. Y. Adv. Jan. 31 to Feb. 21.	Jan. 31
Feb. 28.	Mobile, Ala., Adv. Jan. 31 to Feb. 21.	Jan. 31
Mar. 2.	Milwaukee, Wis. (5 advs.) Adv. Feb. 7 to 21.	Feb. 7
Mar. 2.	Detroit, Mich., Adv. Feb. 7 to 21.	Feb. 7
Mar. 2.	Ft. McKinley, Me., Adv. Feb. 7 to 21.	Feb. 7
Mar. 2.	Cheyenne, Wyo.	Feb. 7
Mar. 2.	Ft. Douglas, Utah	Feb. 7
Mar. 2.	Jamestown, N. Y., Adv. Jan. 31, Feb. 7.	Jan. 31
Mar. 3.	Ft. Riley, Kan., Adv. Feb. 7 to 21.	Feb. 7
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 3.	Helena, Mont., Adv. Jan. 24, 31.	Jan. 24
Mar. 4.	New York, N. Y., Adv. Feb. 7 to 21.	Feb. 7
Mar. 4.	Alexandria, Va., Adv. Feb. 7, 14.	Feb. 7
Mar. 4.	Grand Rapids, Mich. Adv. Feb. 7 to 21.	Feb. 7
Mar. 5.	San Francisco, Cal.	Feb. 21
Mar. 5.	Ft. Myer, Va., Adv. Feb. 14, 21.	Feb. 14
Mar. 5.	Buffalo, N. Y.	Feb. 14
Mar. 5.	Cincinnati, O., Adv. Feb. 7 to 21.	Feb. 7
Mar. 5.	Haines, Alaska	Jan. 24
Mar. 5.	Janesville, Wis.	Jan. 24
Mar. 7.	Bldg., St. Paul, Minn.	Feb. 21
Mar. 7.	St. Paul, Minn., Adv. Feb. 14, 21.	Feb. 14
Mar. 9.	Dredging, Duluth, Minn.	Feb. 21
Mar. 9.	Duluth, Minn., Adv. Feb. 14, 21.	Feb. 14
Mar. 9.	Wilmington, Del., Adv. Feb. 14, 21.	Feb. 14
Mar. 9.	Jamestown, N. Y.	Feb. 7
Mar. 10.	Washington, D. C.	Feb. 21
Mar. 10.	Ft. Mott, N. J.	Feb. 21
Mar. 10.	St. Augustine, Fla., Adv. Feb. 14, 21.	Feb. 14
Mar. 10.	Well, Ft. Morgan, Ala., Adv. Feb. 14.	Feb. 14
Mar. 10.	Ft. Smith, Ark., Adv. Feb. 7, 14.	Feb. 7
Mar. 11.	Ft. Wright, Wash.	Feb. 21
Mar. 11.	Grand Rapids, Mich.	Feb. 21
Mar. 11.	Chattanooga, Tenn.	Feb. 14
Mar. 11.	Wilkesbarre, Pa., Adv. Jan. 31, Feb. 7.	Jan. 31
Mar. 12.	Jefferson Barracks, Mo.	Feb. 21
Mar. 12.	Portland, Me., Adv. Feb. 14, 21.	Feb. 14
Mar. 12.	Janesville, Wis.	Feb. 7
Mar. 14.	Bldg., Ft. Morgan, Ala., Adv. Feb. 14.	Feb. 14
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
Mar. 16.	Portland, Ore.	Feb. 21
Mar. 16.	Burlington, Vt.	Feb. 21
Mar. 16.	Harbor Work, Boston, Mass.	Feb. 21
Mar. 16.	Wilmington, Del.	Feb. 21
Mar. 16.	Granite, Boston, Mass.	Feb. 21
Mar. 16.	Wiring, P. O., Wilkesbarre, Pa. Adv. Feb. 14, 21.	Feb. 14
Mar. 17.	Cincinnati, O., Adv. Feb. 14, 21.	Feb. 14
Mar. 18.	Buffalo, N. Y., Adv. Feb. 21.	Feb. 21
Mar. 19.	Wilmington, Del., Adv. Feb. 21.	Feb. 21
Mar. 19.	Minneapolis, Minn.	Feb. 21
Mar. 20.	Richmond, Ky.	Feb. 21
Mar. 20.	Ft. Howard, Md.	Feb. 21
Mar. 24.	Kalamazoo, Mich., Adv. Feb. 21.	Feb. 21
Apr. 17.	St. Augustine, Fla., Adv. Feb. 21.	Feb. 21
	BUILDINGS.	
Feb. 23.	School, Kensington, O.	Feb. 21
Feb. 24.	School, Brooklyn, N. Y.	Feb. 14
Feb. 24.	School, New York, N. Y.	Feb. 14
Feb. 24.	School, Marietta, O.	Feb. 7
Feb. 25.	Courthouse Plans, Lagrange, Ga.	Feb. 21
Feb. 25.	Bns. bldgs., Tacoma, Wash.	Feb. 21
Feb. 25.	Pub. Bldg., Xenia, O.	Feb. 14
Feb. 25.	School, Jackson Center, O.	Feb. 7
Feb. 25.	Pub. Bldg., Des Moines, Ia.	Jan. 31
Feb. 25.	School, Quincy, Ill.	Jan. 10
Feb. 27.	School, Chicago, Ill.	Feb. 21
Feb. 28.	Pub. Bldg., Taunton, Mass.	Feb. 21
Feb. 28.	Pub. bldg plans, Columbus, O.	Dec. 20
Mar. 1.	Church, Manchester, N. H.	Feb. 21
Mar. 1.	Bus. Bldg., Poughkeepsie, N. Y.	Feb. 21
Mar. 1.	Bank, Springfield, Ill.	Feb. 21
Mar. 1.	Masonic Temple, Toledo, O.	Feb. 21
Mar. 2.	Hospital, New York, N. Y.	Feb. 21
Mar. 2.	School, Cleveland, O.	Feb. 21
Mar. 2.	Courthouse, Gulfport, Miss.	Feb. 21
Mar. 2.	Jail, New York, N. Y.	Feb. 21
Mar. 2.	School, Tamaqua, Pa.	Feb. 21
Mar. 2.	School, Versailles, Ind.	Feb. 14
Mar. 2.	Office Bldg., Ottumwa, Ia.	Feb. 14
Mar. 3.	Pub. Bldgs., Orange City, Ia.	Feb. 21
Mar. 3.	Courthouse, Decorah, Ia.	Feb. 14
Mar. 4.	Pub. Bldg., Long Island City, N. Y.	Feb. 21
Mar. 4.	Armory, Providence, R. I.	Feb. 14
Mar. 5.	Hospital, Springfield, O.	Jan. 31
Mar. 9.	Library Plans, Dover, N. H.	Feb. 21
Mar. 10.	School, Des Moines, Ia.	Feb. 21
Mar. 11.	School, Columbus, O.	Feb. 14
Mar. 12.	Gateway & Lodge, Dayton, O.	Feb. 21
Mar. 12.	Pub. Bldg., Johnson City, Tenn. Adv. Feb. 14, 21.	Feb. 14
Mar. 16.	Library, Portsmouth, O.	Feb. 14
Mar. 18.	Pub. Bldg., Mansfield, O.	Feb. 21
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
Apr. 1.	Elevators in bus. bldgs., Tacoma, Wash.	Feb. 21
Apr. 2.	Hotel, Bemidji, Minn.	Feb. 21
	MISCELLANEOUS.	
Feb. 23.	Chimney, Columbus, O.	Feb. 21
Feb. 23.	St. Ry., Sidney, O.	Feb. 14
Feb. 24.	Crushed stone, Lockland, O.	Feb. 21
Feb. 24.	Crushed stone, Wilmington, N. C.	Feb. 21
Feb. 24.	River Work, Buffalo, N. Y.	Feb. 14
Feb. 27.	Pier, New York, N. Y.	Feb. 21
Feb. 27.	Ashcarts, Brooklyn, N. Y.	Feb. 21
Feb. 27.	Stone, Bairdstown, O.	Feb. 21
Feb. 27.	Sprinkling & Dredging, Phila., Pa.	Feb. 21
Mar. 1.	El. Rys., Cedar Rapids, Ia.	Feb. 14
Mar. 1.	Grading, Beaumont, Tex.	Jan. 24
Mar. 2.	Niagara Falls, Ont.	Feb. 21
May 2.	R. R., Oodnadatta, So. Australia	Feb. 21
Mar. 3.	Cement, Winnipeg, Man. Adv. Jan. 17 to 31.	Jan. 17
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 15
Mar. 5.	Levee Work, Bossier City, La.	Feb. 21
Mar. 7.	Cement, Marietta, O., Adv. Feb. 7 to 21.	Feb. 7
Mar. 9.	St. Ry. franchise, Port Clinton, O.	Feb. 21
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	Cement, Ill.	Feb. 21
———	R. R. work, Cincinnati, O.	Dec. 20

PROPOSALS.

Water Works.

GEORGETOWN, S. C.

Sealed proposals will be received by the Commissioners of Public Works of the City of Georgetown, S. C., until 11 A. M., Wednesday, March 18th, 1903, for constructing a system of Water Works in the City of Georgetown, S. C., and for furnishing the materials for the same.

The Works will embrace approximately 9 miles of pipe, stand pipe, air lift plant and other appurtenances.

Plans and specifications will be on file, and may be seen at the office of the Chairman of the Commissioners, and copies of specifications, forms, etc., may be obtained from the Engineer.

The right is reserved to reject any, or all, bids.

J. B. STEELE, Chairman,
Georgetown, S. C.

Engineer, J. L. LUDLOW, Winston, N. C.

TREASURY DEPARTMENT, OFFICE SUPERVISING Architect, Washington, D. C., February 14th, 1903.—Sealed proposals will be received at this office until 3 o'clock P. M., on the 18th day of March, 1903, and then opened, for repairs, painting, etc., at the U. S. P. O., Buffalo, N. Y. Copies of the specifications may be had at this office, or at the office of the Custodian of the building, Buffalo, N. Y., at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

109 THAMES ST., NEWPORT, R. I., FEB. 7, 1903.—Sealed proposals, in triplicate, will be received here until 12 M., Feb. 28, 1903, for extending 4-inch water main approximately 1,000 feet and installing 2 Fire Hydrants at Fort Rodman, New Bedford, Mass. Information furnished on application. U. S. reserves the right to reject or accept any or all proposals or any part thereof. Envelopes containing proposals to be indorsed "Proposals for Hydrants, etc., Fort Rodman, Mass." Capt. THOMAS H. SLAVENS, Qr. Mr.

PROPOSALS.

Constructing Sewers and Furnishing Sewer Pipe.

GEORGETOWN, S. C.

Sealed proposals will be received by the Commissioners of Public Works of the City of Georgetown, S. C., until 11 A. M., March 18th, 1903, for constructing Pipe Sewers and for furnishing Sewer Pipe. Extent of proposed works is approximately 5 miles of pipe sewers from 8 to 15 inches diameter.

Plans and specifications will be on file, and may be seen at the office of the Chairman of the Commissioners, and copies of specifications, forms, etc., may be obtained from the Engineer.

The right is reserved to reject any, or all, bids.

J. B. STEELE, Chairman,
Georgetown, S. C.

Engineer, J. L. LUDLOW, Winston, N. C.

U. S. ENGINEER OFFICE, WHEELING, W. Va., February 21, 1903.—Sealed proposals for furnishing and delivering about 32,000 barrels of American Portland cement for Ohio River dams will be received here until 11 A. M. (Eastern time), March 23, 1903, and then publicly opened. Information furnished on application. W. E. CRAIGHILL, Capt., Engrs.

FORT MYER, VA., FEB. 12, 1903.—Sealed proposals, in triplicate, for grading and filling, will be received until 10 A. M. March 5, 1903. The U. S. reserves the right to reject or accept any or all bids or any part thereof. Information on application. Envelopes containing bids should be endorsed "Proposals for grading," addressed Capt. W. F. CLARK, Q. M.

U. S. ENGINEER OFFICE, NASHVILLE, Tenn., Jan. 28, 1903.—Sealed proposals for the construction and delivery, etc., of four (4) pairs of Steel Lock Gates, Filling Valves, etc., for Locks A and No. 1, Cumberland River, will be received here until 11 A. M., standard time, Feb. 28, 1903, and then publicly opened. Information furnished on application. M. B. ADAMS, Lieut. Col., Engrs.

PROPOSALS.

PROPOSALS FOR TAINTER GATES, Etc.—U. S. Engineer Office, Bank of Minnesota Bldg., St. Paul, Minn., Feb. 5, 1903.—Sealed proposals for twelve steel Tainter Sluice Gates and accessories, also Steel Hinges and accessories for one Bear Trap Log Sluice Gate, will be received here until 2 P. M. (Central Standard Time), Mar. 7, 1903, and then publicly opened. Information furnished on application. Major R. L. HOXIE, Engrs.

U. S. ENGINEER OFFICE, CUSTOM-house, Cincinnati, O., February 4, 1903.—Sealed proposals for furnishing material and all labor for raising crest of Dam No. 9, Muskingum River, Ohio, with concrete, will be received here until noon, standard time, March 5, 1903, and then publicly opened. Information furnished by Assistant Engineer Edmund Moeser, Zanesville, O., or by Major ERNEST H. RUFFNER, Engineers, Cincinnati, O.

U. S. ENGINEER OFFICE, MILWAUKEE, Wis., Jan. 31, 1903.—Sealed proposals for building crib piers, crib breakwater, pile revetment, removal of portion of old pier, and dredging at Waukegan Harbor, Ill., will be received here until 3 o'clock P. M., March 2, 1903, and then publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. J. G. WARREN, Major, Engineers.

U. S. ENGINEER OFFICE, 537 CONgress St., Portland, Me., February 10, 1903.—Sealed proposals for dredging and rock excavation in Carvers Harbor, Me., will be received here until 12 M., March 12, 1903, and then publicly opened. Information furnished on application. S. W. ROESSLER, Maj., Engrs.

U. S. ENGINEER OFFICE, GRAND RAPids, Mich., February 2, 1903.—Sealed proposals for Repair of Piers at Pentwater and White Lake, Mich., and Repair of Piers and Revetment at Charlevoix, Mich., will be received here until 3 P. M., March 4, 1903, and then publicly opened. Information furnished on application. CHARLES KELLER, Capt., Engrs.

PROPOSALS.

FORT TERRY, N. Y., JAN 28, 1903.—Sealed proposals, in triplicate, for constructing, plumbing, heating and electric wiring, frame barrack building and for constructing gun shed and machine shop building here will be received until 12 M. Feb. 28, 1903. U. S. reserves right to accept or reject any or all bids or any part thereof. Information on application. Envelopes containing proposals will be endorsed "Proposals for Barrack," addressed S. Y. BRITT. Q. M.

U. S. ENGINEER OFFICE, DULUTH, Minn., Feb. 7, 1903.—Sealed proposals for building in place the concrete south pier at Superior Entry, Wis., will be received here until noon, Mar. 9, 1903, and then publicly opened. Information on application. D. D. GAILLARD, Capt., Engrs.

U. S. ENGINEER OFFICE, CINCINNATI, O., Feb. 14, 1903.—Sealed proposals for building Dam No. 1, with Abutment and Protection, Big Sandy River, W. Va. and Ky., will be received here until 10 A. M., central time, March 17, 1903, and then publicly opened. Information furnished by Maj. ERNEST H. RUFFNER, Engrs.

U. S. ENGINEER OFFICE, 2001 I ST., N. W., Washington, D. C., Feb. 6, 1903.—Sealed proposals for construction of a highway bridge across Potomac River at Washington, D. C., will be received here until 12 M., March 27, 1903, and then publicly opened. Information furnished intending bidders on application. CHAS. J. ALLEN, Lt. Col., Engrs.

U. S. ENGINEER OFFICE, ST. AUGUSTine, Fla., Feb. 10, 1903.—Sealed proposals for constructing training walls in St. Johns River, Fla., will be received here until 12 noon, Mar. 10, 1903, and then publicly opened. Information furnished on application. FRANCIS R. SHUNK, Capt., Engrs.

U. S. ENGINEER OFFICE, WILMINGTON, Del., Feb. 7, 1903.—Sealed proposals will be received at this office until 12 o'clock, noon, March 9, 1903, for dredging in Mantua, Raccoon and Alloway creeks, N. J. Particulars on application. JARED A. SMITH, Colonel, Engineers, U. S. Army.

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Annual Meeting of the American Institute of Mining Engineers.

The thirty-third annual meeting of the American Institute of Mining Engineers was held in Albany, N. Y., February 17 to 21, with headquarters at the Ten Eyck Hotel. About 100 members were present, many being accompanied by ladies, and there was a large number of guests. The business and literary sessions, over which President E. E. Olcott presided, were held in the rooms of the Albany Institute and Historical and Art Society, whose interesting historical and art collections were open to the members. At the opening session Mayor Gaus welcomed the Institute to the city, and several tributes were paid to the memory of the late Abram S. Hewitt, who was the president of the Institute in 1876 and 1890. On Thursday morning Governor Odell gave a reception in the executive chambers of the Capitol and on Thursday evening an elaborate banquet was spread at the Ten Eyck. Many technical papers were presented. One of the most interesting entitled "Reconnaissance Along the Rockies of British Columbia," was presented by Mr. Howard W. DuBois, of Philadelphia, who exhibited some admirable lantern views.

Wednesday morning a large party visited the great plant of the General Electric Company at Schenectady and the company entertained its guests at luncheon in the restaurant connected with the works. The afternoon was spent in the extensive works of the American Locomotive Company. On Friday afternoon a trip was made to the Watervliet Arsenal where a large variety of cannon and the processes and machinery employed in their manufacture were exhibited by the army officers in charge. The Albany Chamber of Commerce arranged for this excursion. On Saturday there were two excursions. One party visited the plant of the Helderberg Cement Company at Howe's Cave. The quarries, mines and works, said to have a capacity of 600,000 barrels of cement per annum, were inspected. The second party went to the water-power plant at Spier Falls, where a large masonry dam and power house are being constructed for the Hudson River Power Company.

An Alternative Panama Canal Plan.

The probable early completion of the preliminaries of taking title to the new Panama Canal Company's property on the Isthmus centers extraordinary interest on that route for an Isthmian Ship Canal. It is highly probable that before the fourth of March, the date of expiration of the option given by the new Panama Canal Company, the Senate will have placed the seal of its approval upon the canal treaty with the Republic of Colombia. It is equally probable, indeed practically certain, that that republic will also ratify the canal treaty on its part. This culmination of all the steps preliminary to the actual construction of the canal has already stimulated suggestions or propositions, bearing upon plans for the finished construction.

The general plans elaborated by the Isthmian Canal Commission under the provisions of the law which created it, and under the instructions received from the Secretary of State, are admirable both for their comprehensiveness and for the large way in which were treated those features, such as the locks and dimensions of prism, on which the real accommodation of navigation depends. The law required that the commission should find a route for, and plan a canal to accommodate the largest ships afloat, presumably at any time they may desire to pass through the Isthmian waterway. Among the alternative plans proposed for this ship canal is that of a member of the Isthmian Canal Commission itself, Mr. George S. Morison, M. Am. Soc. C. E. His paper is published in full in the January "Proceedings" of the Society for the current year and it indicates that there was some diversity of opinion among the members of the commission upon a number of the larger features of the project, although the report of the commission was unanimous.

The principal feature of Mr. Morison's alternative proposition is a different location of canal line from that of the commission, which was identical with the New Panama Canal Company's route from Colon harbor to the Bohio locks (a distance of about 15½ miles), easterly of the latter and closely as laid down by Commander Lull in 1875. Lull's idea was to place this part of the canal line as far as possible from the Chagres River, and Mr. Morison apparently follows his lead. At Tiger Hill, nearly 10 miles from the deep water of Colon harbor, the latter places a lock with a lift of about 26 feet necessitating the carrying of the canal prism between Tiger Hill and the Bohio locks largely between embankments, in some cases nearly or quite 25 feet high. About 1¼ miles in distance is saved by this location, and less than $1,500,000 in cost. As, however, the Isthmian Canal Commission made only partial examination along this alternative route the estimated saving in cost of the shorter line might either disappear or turn into added cost on the completion of those examinations. Again, as was brought out in the discussion of Mr. Morison's paper, at the recent meeting of the American Society of Civil Engineers, the increased time required for a ship to pass through the canal on the alternative route in consequence of the additional lock would several times overbalance the time gained by the shortened distance alone. Nor is that all. The enhanced cost of maintenance consequent upon the presence of another lock would be an item of serious magnitude. On the whole, therefore, it is far from being clear that the disadvantages of the alternative proposition can be nearly balanced by the mere shortness of line or its removal to a greater distance from the Chagres River.

Under the modified plan suggested by Mr. Morison the bottom of the canal prism between the Bohio and the Pedro Miguel locks would be 3 feet higher than proposed by the commission, the ordinary summit level remaining at the same elevation of 85 feet above the sea. In other words, during dry seasons the depth of water in the summit level might be 3 feet less under the alternative plan, than provided by the commission.

Again, Mr. Morison believes that the commission made an unduly generous provision for the entrance of the canal in Panama Bay. The commission's proposition requires a depth of water in the entrance channel at the Panama end of 35 feet at low tide, whereas Mr. Morison would give the channel that depth at mean tide, or 25 feet at low tide. This saving of excavation, to a considerable extent in rock, at the Panama end, the saving of 3 feet of excavation in the Culebra section and the estimated saving by the shortened distance between Colon and Bohio enables the total cost to be figured down from about $144,000,000 to about $126,000,000 dollars. This is an attractive showing at first sight, but it is well to consider carefully just what it means. Mr. Morison states that the shallower channel in Panama Bay will have not less than 35 feet of water in it eighteen hours only, out of twenty-four. For one-quarter of the time, therefore, the capacity of the canal would be seriously crippled, the total depth at low tide being but 25 feet. During this six hour period or throughout a considerable portion of it the largest ships could neither get into the canal from one direction or get out of it in the other, at the Panama end. Throughout the Culebra section during dry seasons a serious diminution of capacity would also be found. Both these defects of capacity would create grave constrictions of accommodation, which would at all times be most inconvenient, and in case of military operations, those constrictions might be fatal.

If the United States is to undertake the construction of a great ship canal, it would be unwise to introduce into its plans constricting features at one or two points likely to impair the capacity and efficiency of the entire waterway.

The Society of Municipal Engineers of the city of New York held a meeting on February 25 at the house of the American Society of Mechanical Engineers, for organization, about 200 engineers being present. A previous notice of this new society appeared in The Engineering Record of November 8, 1902, but it is now being organized along broader lines than were then proposed. The membership will include practically all engineers in the city's employment—civil, mechanical, electrical, etc., there being in the neighborhood of 800 who are thus eligible. It is planned to have meetings much like those of other technical societies, and it is thought that in addition to being helpful to the members, the discussion of engineering problems at the meetings will make available in convenient form much valuable information now buried in the quarterly reports of the various departments. The chairman of the committee on organization is Mr. O. F. Nichols, engineer in charge of the Williamsburg bridge.

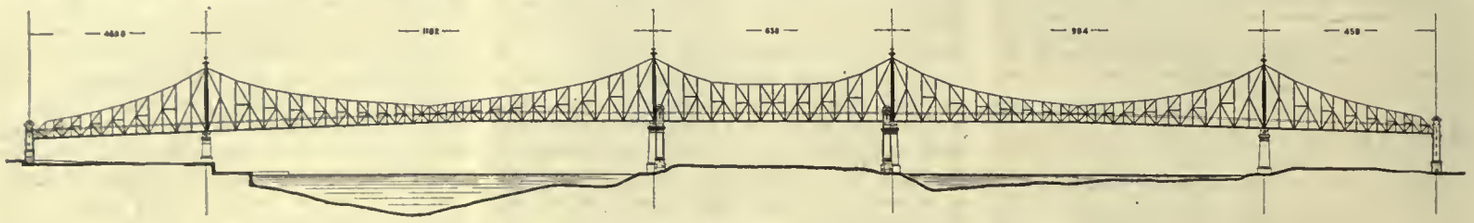
The Blackwell's Island Bridge.

The Blackwell's Island Bridge over the East River in Greater New York, and officially known as bridge No. 4, connects the Borough of Manhattan, between 59th and 60th streets, with the Borough of Queens, crossing the river nearly at right angles, farther north than any of the other bridges already commenced. It will be, when finished, much the heaviest and most capacious long span bridge ever constructed and, with one exception, the longest truss span ever built. The Forth Bridge has two double-track railroad spans of 1,710 feet between centers of towers, and the proposed double-track and highway Quebec Bridge will have one channel span of 1,800 feet. Both of these bridges are single deck structures, while the Blackwell's Island Bridge will have double decks designed for a heavy wagon traffic, six railroad tracks and two promenades, thus imposing a live load seldom encountered even in short span bridges, and necessitating trusses with corresponding dead weight. The total length of the main structure between centers of anchorages will be 3,714½ feet, which will include one span of 1,182 feet over the main channel, one of 984 feet over the east channel, a connecting span of 630 feet over the island and two shore spans of 459 and 469½ feet. As the United States Government requires a clearance of 135 feet for a length of 400 feet over each of the navigable channels under the two longest spans, it has been necessary to design long shore approaches which will both be plate girder and masonry viaducts with a total length of 3,634½ feet, each of them having a grade of 3.4 per cent.

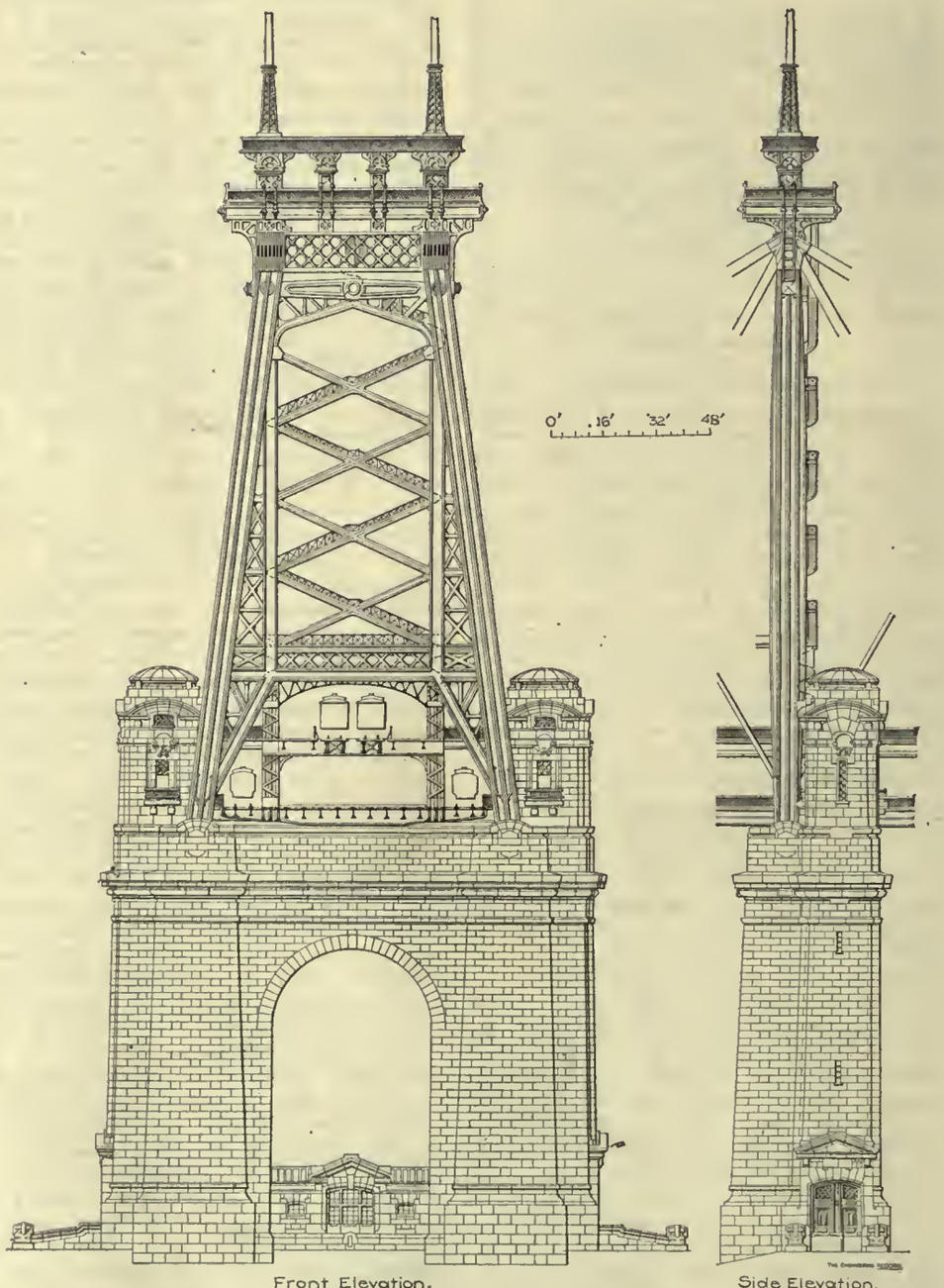
The main spans are carried on four intermediate piers and two anchorage piers, all founded on rock and built of ashlar, backed with concrete at anchorages. Both anchorage and intermediate piers are much longer than the transverse width of the superstructure, and at their ends have portal towers built up 50 feet or more above the bottom of the steel work to total heights of about 160 feet above the proposed surface of the ground. The masonry is built with very deep courses and has ornamental mouldings, cornices and arch work of a massive and imposing character. The foundations were constructed in open cofferdams of moderate depth, and an elaborate plant was installed for their erection as described in The Engineering Record of Dec. 13, 1902. The trusses are all cantilevers continuously connected from anchorage to anchorage and having main vertical posts or towers seated on the intermediate piers and common to both adjacent spans.

The steel towers will be about 300 feet high from their masonry seats to the beginning of the ornamental work on top. They will have center widths of 93 feet transverse to the bridge axis, and all of them will be substantially like that for the Blackwell's Island pier No. 2, shown in the accompanying elevation. Each tower will have two massive main posts battered about 1 to 10 and seated on unusually large riveted pedestals anchor-bolted to the masonry. These posts will have vertical members in the planes of the main trusses from the tops to just above the level of the upper deck clearance, which will be rigidly braced to them so as to be substantially integral with them. They will be braced together by heavy portal girders and struts above the lower deck, by horizontal transverse lattice-girders and deep portals at the top chord level and by several panels of intermediate X-bracing. Above connections of the top chord the tower will be finished with ornamental cornice and balconies at two levels, surmounted by finial towers carrying flagstaffs, this upper portion affording an extended view of the river and cities and being accessible by spiral stairways.

The trusses will be in vertical planes 80 feet apart on centers, 170 feet in maximum depth and 105 and 45 feet in minimum depth for the island span, the west channel and the east channel span respectively. The bottom chord will be horizontal, except for the grade and for the camber. The top chords will be in curved inclined sections. The trusses will be divided into main panels varying in length from 45 to 80 feet and each subdivided. They will be braced by the floor beams and transverse struts over the upper deck at the top chord panel points, and at intermediate points of the vertical posts, and will have rigid sway-bracing in the panels above the upper deck. There will be two main systems of lateral bracing, one in the plane of the upper chords and one in that of the lower chords, the latter being composed of buckle plates with concrete filling and designed to receive most of the wind stress. The trusses will be pin-connected, and maximum sections of the chords will approximate 1,000 square inches



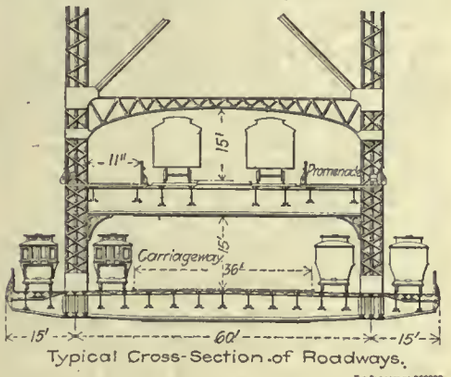
Main Spans of Blackwell's Island Bridge.



Front Elevation. Side Elevation.

Tower and Pier on Blackwell's Island.

each, the total estimated weight of the steel superstructure in the five main spans being about 80,000,000 pounds of which the 1,182-foot span is computed at 28,000,000 pounds. The cantilever trusses are designed with only one hinge in each main span and there will be no reverse stresses in the chords



Typical Cross-Section of Roadways.

under ordinary conditions of traffic, although slight ones may occur in the center panels under extreme loads. The bottom chords will be triple-web riveted members and the top chords will be composed of eye-bars throughout.

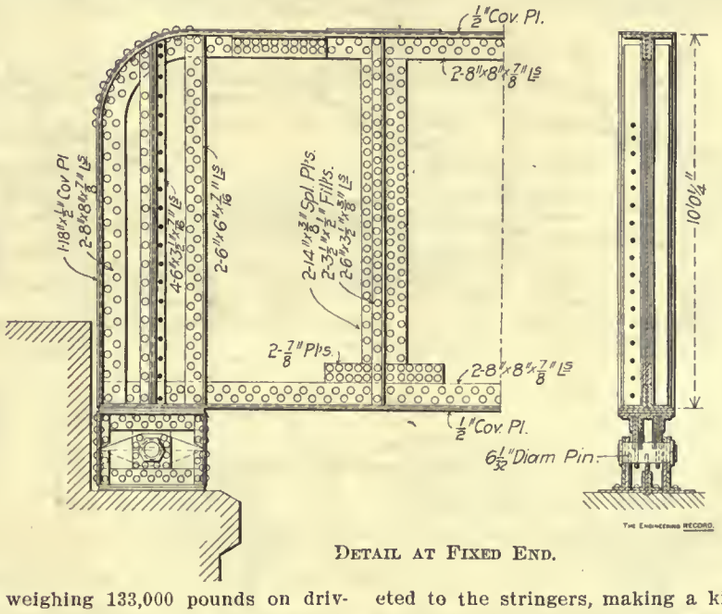
The channel spans are peculiar in that the top chord is inclined from the towers to the center points without any intermediate horizontal portion and that there is no suspended center span, the cantilever arms being united directly to each other. The lengths of the arms are proportioned so that the small amount of up-lift at the anchorage piers under dead and live load is positive. The 11-foot promenades are arranged so as to afford, in the main, unobstructed views from each side of the bridge. The electric car tracks on the lower deck are provided with overhead trolley wires between the trusses and with conduit wires outside the trusses. It is estimated that the trolley and elevated railroad tracks together have a capacity of 150,000,000 passengers a year. The carriageway will be carried on a solid buckle-plate floor and the construction throughout will be fireproof, including the track foundations for the railroads and the promenade floors.

The bridge will be accessible from Blackwell's Island by separate elevators in each of the four towers, for teams and passengers, besides which there will be public comfort stations at these points and stairways here and at the anchorage piers. Space will also be left in the piers for the future installation of passenger elevators. The total cost of the bridge is estimated at $12,500,000, of which $3,000,000 is for the right of way and $745,547 for the six main piers and $6,000,000.00 for the corresponding five main spans. The total amount of masonry in the six main piers is about 50,000 cubic yards. The contract for the substructure was awarded to Ryan & Parker, June 27, 1901. It is expected that invitations will be issued for bids on the superstructure of the main spans during the coming summer and that the bridge will be completed and ready for traffic in 1905. The main channels are each about 1,000 feet wide with water from 40 to 60 feet deep, and a swift tidal current. It is proposed, therefore, to erect the Blackwell's Island span and the shore spans of the anchor arms of the superstructure on trestle falsework and then to erect both channel spans by the cantilever method without falsework, thus avoiding all obstruction to the river or to navigation.

Plans for the bridge were commenced in 1898 under Mr. Samuel R. Probasco, who was then chief engineer, and Mr. John L. Shea, who was then commissioner of bridges. Progress has been made with the general design in charge of Mr. R. S. Buck, engineer. The designs have since been revised by Mr. Gustav Lindenthal, commissioner of bridges, Mr. H. A. La Chicotte being engineer in charge of this bridge and of No. 3. The architectural features were designed by Mr. H. H. Hornbostel, consulting architect, and the arrangement and capacity of floor space and other details conform essentially to the recommendations of Prof. W. H. Burr, of Columbia University, Prof. P. C. Ricketts, of the Rensselaer Polytechnic Institute, and Mr. H. W. Hodge, consulting engineer; members of the commission appointed by the Honorable Seth Low, Mayor of the city of New York.

The Yellow Creek Bridge.

The Lake Erie, Alliance & Wheeling Railroad is a single track line now being built to connect the coal fields of northern Ohio with Lake Erie. It crosses Yellow Creek on bridge No. 1, which is a single track, through plate girder of 108 feet clear span. The girders are 17 feet 9 inches apart, on centers, 114 feet 4¾ inches long and 10 feet 4¼ inches deep, over all. They are proportioned for the heaviest locomotives, and carry at present a traffic of gondolas with a capacity of 80,000 pounds and



DETAIL AT FIXED END.

locomotives weighing 133,000 pounds on drivers. The webs are 7/16-inch thick throughout, and are made of plates 74¼ inches wide and 10 feet long, except the end sections, which are 91¼ inches wide. Each chord is made with four pieces of 8x8x⅞-inch angles and 18x½-inch cover plates, four thick at the center. The top-chord angles are cut off 4 feet 10 inches from the ends of the girders and are spliced there to the end vertical angles of the same size which are curved to fit the rounded upper corners of the girders with a radius of 2 feet 5 11/16 inches. All web splices are shop-riveted and are made throughout, as shown in the elevation of the end of the girder. All vertical web stiffener angles have bearings on the flange angles, and all rivet holes in bottom flange angles are punched ¾-inch diameter and reamed to 15/16 inch for ⅞-inch rivets. Holes for field driven rivets in the floorbeam connections are reamed to iron templates.

Shoe plates ¾-inch thick are shop-riveted to the ends of the lower flanges and field-riveted to shoes having double webs and jaw plates which engage 6-inch pins through corresponding pedestals. At the fixed ends the shoes are bolted to the masonry with split and wedged stone bolts, and at the expansion ends they are seated on nests of eight 3-inch rollers. The floorbeams, 12 feet 3 inches apart, are 34-inch plate girders with ½-inch webs and 6x6x⅝-inch flange angles, without reinforcement plates. The end sections, about 3 feet long, are 7¼ feet high and are field-riveted to the vertical web stiffener angles of the girders, to which they act as knee braces, with inclined flange angles from the top flange of the floorbeam to that of the girder. There are two lines of 24-inch, 85-pound I-beam stringers 7 feet apart, web-connected to the floorbeams with 22 rivets at each end. The stringers are braced together, just below the top flanges, by a transverse angle in the center and an inclined angle from one end of it to each adjacent floorbeam. These angles are all in a horizontal plane, and are all 3x3x⅜-inch; riveted to horizontal connection plates which are shop-riveted to one flange of an angle which is field-riveted to the stringer web. Each panel between floorbeams and main girders is X-braced by single 3½x3½, 3½x4 and 3½x5-inch angles. These are riveted to the upper and under sides alternately, of connection plates which are notched to clear the vertical web stiffeners and are field-riveted to the lower flanges of the girders and of the floorbeams. The diagonal angles are connected to the lower flanges of the stringers by bent plates which are shop-riveted to them and field-riveted to the stringers, making a kind of offset connection instead of a thick solid packing between the intersecting members. The center line of the track is on a 5-degree curve which symmetrically intersects the axis of the bridge near each end, so that the ends of the curve are about 8 inches on one side of the axis and the center about 8 inches on the opposite side.

The girders were riveted up complete in the shop and shipped separately, loaded on three flat cars each. Each girder weighed 85,000 pounds, and was seated on two transverse timber sills about 23 feet from the ends, and close to the trucks nearest the spacer car. Inclined braces were bolted to the ends of the sills with vertical side fish plates and were fitted at the upper ends to the under sides of the top flanges and web of the girder. The upper ends of each pair of braces were connected by a long, wide U-plate with divergent wings, which crossed over the top of the girder and was bolted strongly to each brace. To the foot of each brace was bolted a pair of diagonal bars with bent connection plates riveted to the opposite ends and bolted to the girder webs. The girders were designed, built and erected by the King Bridge Company, and the drawings were signed and approved by Mr. O. E. Pfonts, consulting engineer.

Rapid Transit Extension in New York City.

A plan for the extension and unification of the entire rapid transit system of Manhattan and the Bronx has just been presented by Mr. William Barclay Parsons, chief engineer of the Board of Rapid Transit Commissioners of New York city, for the consideration of the board and of the general public. The immensity of the task which Mr. Parsons has performed in preparing this report need scarcely be referred to, the difficulties of the rapid transit problem in New York being so well known. The plan proposed in this report not only extends the subway, but makes it an evenly balanced system, with separate east and west side lines, and with intercommunication between them. If the board should carry out these suggestions the city would own a railway system complete in itself covering 37½ miles in Manhattan and the Bronx, with 100 miles of main track. In reading the report it should be remembered that the transit facilities of Brooklyn will be made the subject of a separate later report, and therefore no mention is made of the connections with the Williamsburg and Manhattan bridges. The following extracts from the report are given without comment:

The tremendous increase in passenger travel on all lines during the past year clearly indicates that when the subway system now under construction from Brooklyn to the Bronx is completed it will be almost immediately congested. To meet the growing and imperative demands, it is evident that new lines should be put under construction as soon as possible, and steps taken to improve the existing facilities so as to permit them to carry the increased burden during the time the new lines are being constructed. The scope and extent of the present subway system were unfortunately limited by a decision of the courts and the financial position of the city, so that the board was compelled to lay out one line to serve both the east and west sides. This attempt necessarily involved a sacrifice in directness, which is essential for quick time. This defect should now be removed by extending the subway south from Forty-second Street along Broadway, and north from Forty-second Street at Park Avenue.

When the bids for the Brooklyn extension were opened, Mr. August Belmont, as president of the Rapid Transit Subway Construction Company, offered to build a line from Forty-second to Fourteenth Streets at considerably below the estimated cost. Such a line would, however, but transfer the point of congestion from Forty-second Street to Fourteenth Street, and I therefore propose that this line be extended to the lower end of Manhattan Island at South Ferry, and thus furnish two additional tracks south of the Post Office. From this line at Broadway a subway under Thirty-second Street to Seventh Avenue should be built so as to bring the new Pennsylvania terminus to a connection with the subway and elevated railway for local distribution of passengers. In like manner, I propose to make a junction at about Fortieth Street and Park Avenue, and carry the new line, with three tracks, beneath the Grand Central Station to Lexington Avenue, and then along and under that thoroughfare to the Bronx, making a connection with the New York Central and New Haven railroads at Mott Haven. A branch from this line can be carried westward under 110th Street to Lenox Avenue, thus providing a connection between the east and west lines north of Central Park, as the Forty-second Street subway line provides one south of the Park. On the extreme easterly end, the line in the Bronx should be extended from West Farms along the east side of Bronx Park, unless the Park authorities prefer a direct route through the Park, in order to reach Wakefield and Mount Vernon, two rapidly growing sections of the city, now without rapid transit facilities. A branch should also be laid out continuing along the Southern Boulevard, and then westerly on 180th Street, thus reaching a section of the Bronx not served by any line. A connection between the Bronx Park line and the Manhattan elevated should also be made from Brook Avenue along Westchester Avenue to Third Avenue.

The additional lines, and especially those in the subway, will require years to complete, and during this time it is essential that relief measures be provided. The Manhattan Elevated Railway Company has never accepted former suggestions of the board to provide such additional facilities as the board deemed advisable. Recently, however, the management of this property has passed under the control of the Interborough Rapid Transit Company, and I am informed by Mr. Belmont that he will gladly and liberally meet the views of the board and extend the Manhattan lines, and so connect them with the subway system, that both systems may be operated as a unit with through trains at a single fare. Such an arrangement would at once confer a great benefit upon the local traveling public, as presenting the quickest means of securing immediate relief.

To this end I suggest the following alterations: Second Avenue Division—Add two tracks from the Harlem River to Chatham Square, carrying the two new tracks over the Chatham Square junction and over the Park Row line to City Hall. Third Avenue Division—Extend the third track from Fifty-ninth Street to Ninth Street, so as to make it continuous from the Harlem River to the latter point. Suburban Division—Add a third track from south of the Harlem River to Westchester Avenue.

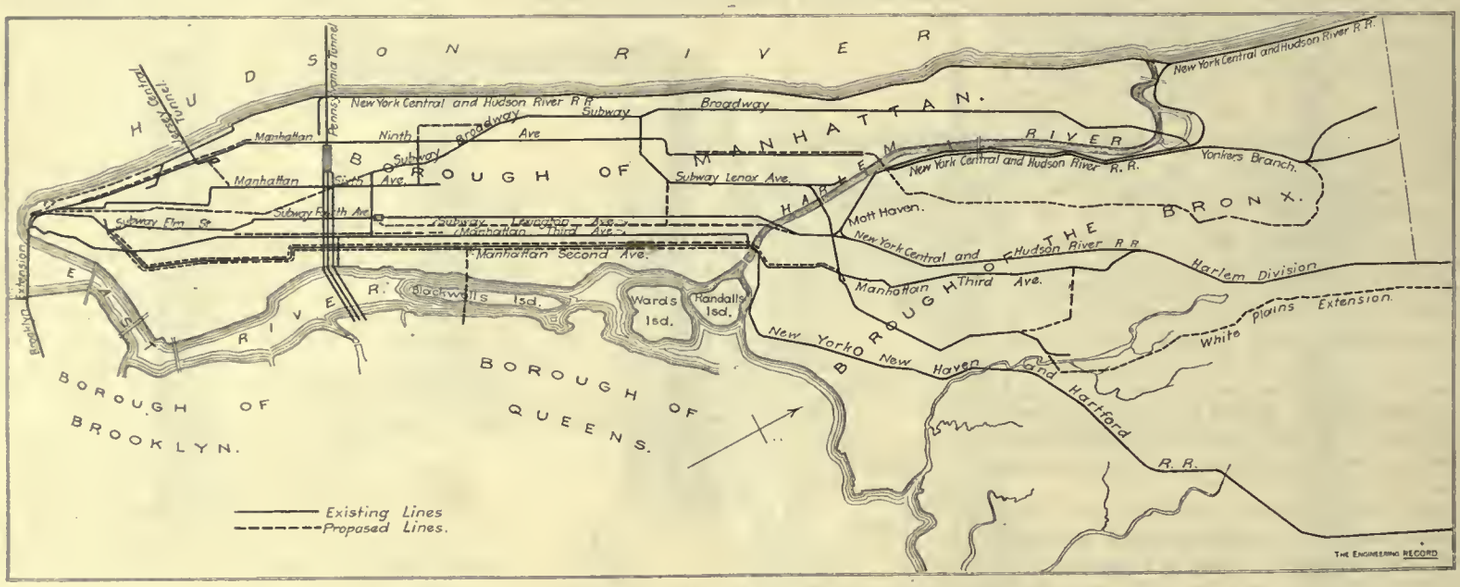
The Third Avenue division is the main system for local business on the East Side. To-day this local business is greatly interfered with by running the Bronx trains over the same structure, and in like manner the Bronx facilities are much restricted by the impossibility of running more trains over the Third Avenue structure. By converting the Second Avenue division into a four-track structure, and by extending it to the City Hall, an immeasurably better service will at once be provided for the east side of the city. Bronx passengers will then be carried direct on a continuously running express structure, while local passengers from points south of the Harlem will be carried by trains stopping at or starting from the river, and thus not come in contact with the through passengers. In like manner, by connecting the Rapid Transit Westchester Avenue line with the suburban line at 149th Street, through trains can be run from points south of Bronx Park, or Wakefield, or Mt. Vernon by a direct line to all points south of the Harlem River, including South Ferry and City Hall, in through trains and for a single fare. This would save passengers from the northeastern portion of the Bronx 1¾ miles. The saving in time would be even greater than the mileage would indicate, as the express service would begin at 149th Street and Third Avenue, instead of 110th Street and Lenox Avenue. The subway proper would then begin at 149th Street and Third Avenue, and furnish the people living in the center of the Bronx with fresh trains, transfers to which could be given at 149th Street for the small proportion of travel that might desire to go from Bronx Park to the west side of Central Park. This would also permit the present Lenox Avenue line to become a line for purely local Harlem travel.

Sixth Avenue Division—In order to furnish special trains for the retail shopping district north of Fourteenth Street, and a connection to the New York and Jersey tunnel at Greenwich and Christopher Streets, I would propose an extension of the Sixth Avenue division along Christopher Street to Greenwich Street, connecting with the Sixth Avenue division at the north end of the Eighth Street station, and thence lay a third track on the Sixth Avenue structure northward. By this means many north-bound trains could run "local" through the wholesale dry goods district as a gathering ground, and having become filled by the time they reach Eighth Street, could then pass on to the third track and run "express" to Harlem. The relief thus provided to the local track north of Eighth Street would permit trains to start from Christopher Street and run "local" through the retail district.

Ninth Avenue Division—I recommend: (1) The extension of the third track from Fourteenth Street south to Cortlandt Street, so that the express service may begin from the latter point. (2) A branch from the main structure at Fifty-third Street, running westerly along Fifty-third Street to Tenth Avenue, northerly along Tenth Avenue to Fifty-fifth Street, where, owing to the topography, the elevated structure can be depressed into the subway and so carried under Amsterdam Avenue to a connection with the subway at Seventy-second Street. This connection can be built rapidly, and would serve in connection with the third track extension to Cortlandt Street, as an immediate means of carrying the traffic assembling in the upper limits of the subway direct to South Ferry. (3) The extension of the third track from 116th Street north to 155th Street, making a continuous third track from Cortlandt Street to the Harlem River. (4) Make an arrangement with the Putnam Division of the New York Central Railroad by which the present bridge across the Harlem River can be reconstructed into a three-track structure, and then extend the Eighth Avenue line across the Harlem river, with three tracks, and by a short tunnel through the high ground on the east bank of the Harlem River to Jerome Avenue, thence through Woodlawn to a connection with the Putnam Division in Van Cortlandt Park.

The railroads now terminating at the Grand Central Station supply transportation facilities to various parts of the northerly district, and also to the suburban districts lying immediately north of the city. At present these passengers are discharged at Forty-second Street, and have to find their way to the lower part of the city or Brooklyn by other lines, the transfer involving serious delay. It is obvious that the proper method of handling such traffic is by direct means in through trains. If the consent of the above-mentioned railroads can be had, connections should be made at as many points as possible with the subway and elevated lines. In addition to this, the New York Central Railroad Company now owns the railway along its own right of way, from Spuyten Duyvil to Fifty-ninth Street, and thence on the surface of Eleventh, Tenth and other avenues and streets south to Houston and Beach Streets. This line might easily be converted into a passenger line and furnish a great measure of rapid transit relief. The existence of the tracks on the street surface south of Fifty-ninth Street is a great public burden, and should be removed if possible. I would suggest that negotiations be taken up with this company looking to the removal of these surface tracks, and substituting in place thereof an elevated structure along the same route or possibly along West Street, and which might be continued south to Battery Place, and so provide not only a freight, but also a passenger line along the water front. If this were done, the line should be constructed with four tracks south of Fifty-ninth Street, with the passenger tracks elevated above that point.

In regard to the Borough of Queens, the city is now constructing a bridge from the foot of Sixty-fourth Street across Blackwell's Island. When this is done I suggest that a branch of the Second Avenue Elevated be constructed along Sixty-fourth Street and over the bridge to Long Island, and that a plaza be then arranged, permitting the present surface lines now plying throughout that district to approach and deliver their passengers to the elevated, by which they can be carried by an express and local service to any point north or south in Manhattan, Brooklyn, or the Bronx. At present the development of Long Island City and Queens is not sufficiently concentrated to warrant the expensive construction of special rapid transit lines.



Present and Proposed Plans for New York Rapid Transit System.

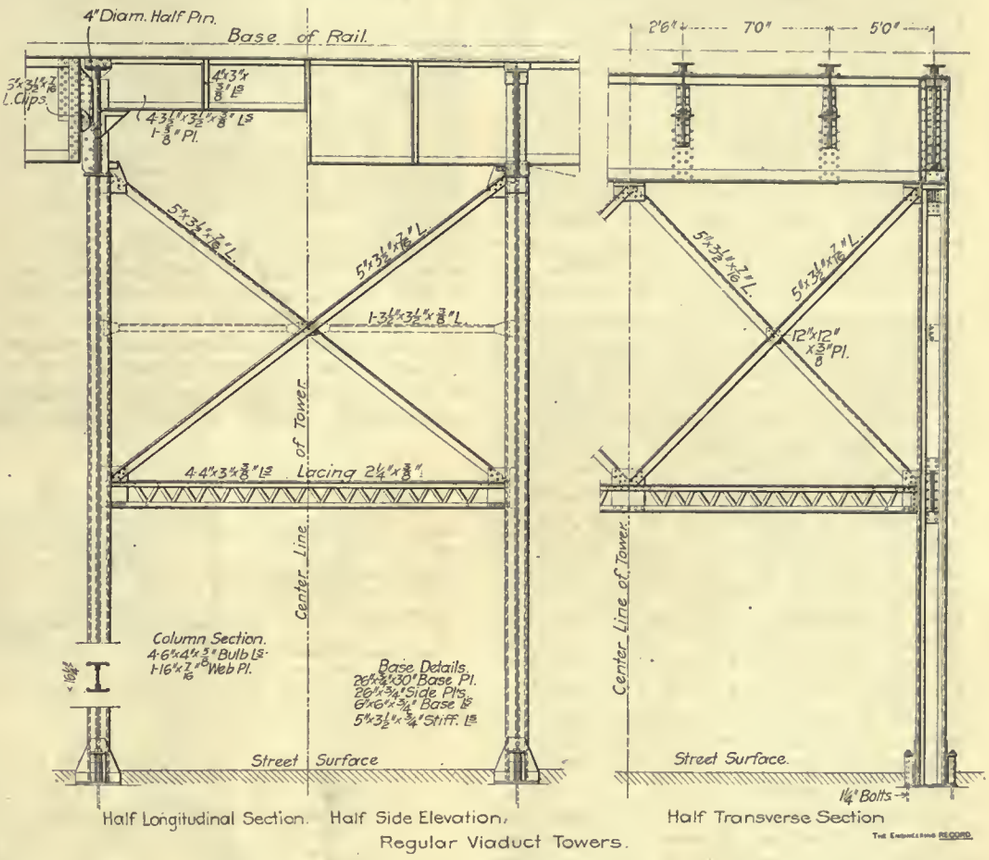
Standard Specifications for Cast-Iron Pipe and Special Castings, prepared by the New England Water Works Association, have just been issued in pamphlet form and can be obtained of the secretary, Mr. Willard Kent, 715 Tremont Temple, Boston, at ten cents per copy. Complete tables of dimensions and weights of all standard pipes and special castings, with diagrams indicating the shapes of the various patterns of castings, are appended to the specifications.

Elevated Structure of the New York Rapid Transit Railroad.

In parts of the New York rapid transit railroad as in section 10, where the tracks are above the surface, the standard structure is a three-track steel viaduct for the regular construction, weighing about 1,400 pounds per linear foot. Most of the viaduct is on tangents or on a curve of large radius; but at the intersection of East 174th Street and Southern Boulevard there is a special curved section which has the girders and columns arranged as shown in the diagram. Near the north end of the elevated structure there is also a special arrangement of columns and extended cross girders for bents 322 to 330, where the columns are about 50 feet apart transversely. In other places the construction is generally regular with the columns 29 feet apart on centers transversely. On the curves most of the bents are set radial. Where the height of rail does not exceed 29 feet above the grade, the columns are arranged in single bents, usually 50 feet apart, but varying from about 40 feet to 65 feet. Where the height of rail is more than 29 feet, the columns are arranged in double bents braced together to form towers 20 or 25 feet wide and 70 to 90 feet apart on centers. This gives alternate lengths of 25 and 50 to 65 feet for the longitudinal girders which at the Intervale Ave. crossing are increased to a span of 87 feet.

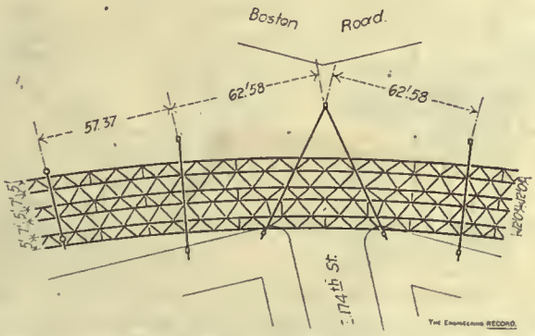
The tops of the towers have stiff X-bracing and the connecting spans have two panels of intermediate vertical sway bracing between the lines of longitudinal girders. Throughout the structure the longitudinal girders in each pair are connected by zigzag lateral angles. Where there are no towers every fourth panel has zigzag lateral bracing in the two panels between the pairs of longitudinal girders, thus making a solid bracing to stiffen the structure at the expansion joints which are 200 feet apart. The towers have columns made with a 16x7/16-inch web plate and four 6x4x⅝-inch bulb angles. Their lower horizontal struts are made with four straight angles riveted together in pairs and latticed to form an I-shaped cross section; and the diagonal bracing consists of single 5x3½-inch angles with their flanges turned in opposite directions and their webs riveted together at intersections.

The columns are planed at the tops and have horizontal cap angles on which are seated the lower flanges of the transverse girders. The girders are riveted to the cap angles and to the connections for the transverse diagonal bracing, which serve as gusset plates. Short vertical splice plates are also riveted to the end vertical angles and to the tops of the columns. Longitudinal girders are web-riveted to transverse girders and have no direct connections with the columns.

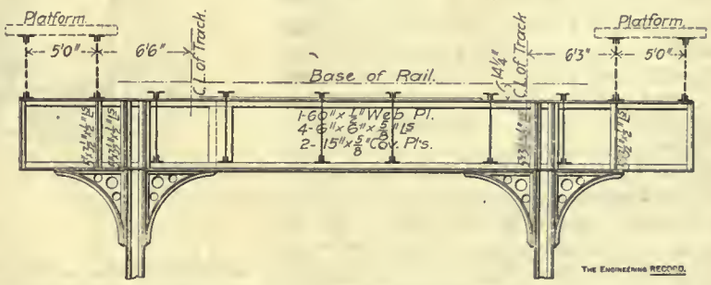


Half Longitudinal Section. Half Side Elevation. Half Transverse Section

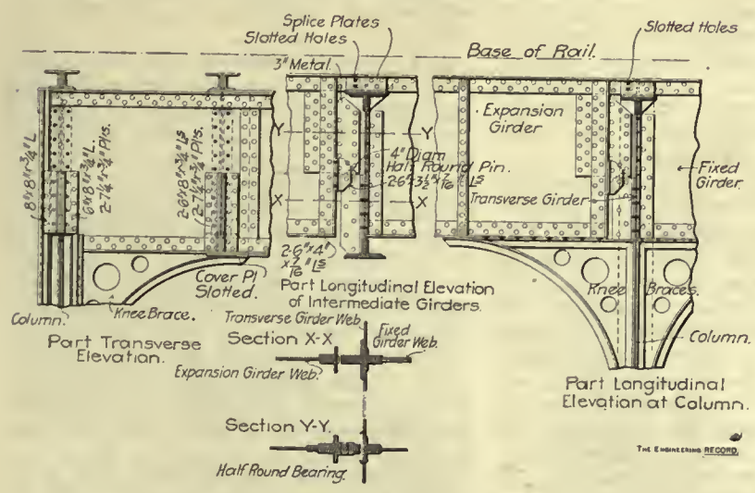
Regular Viaduct Towers.



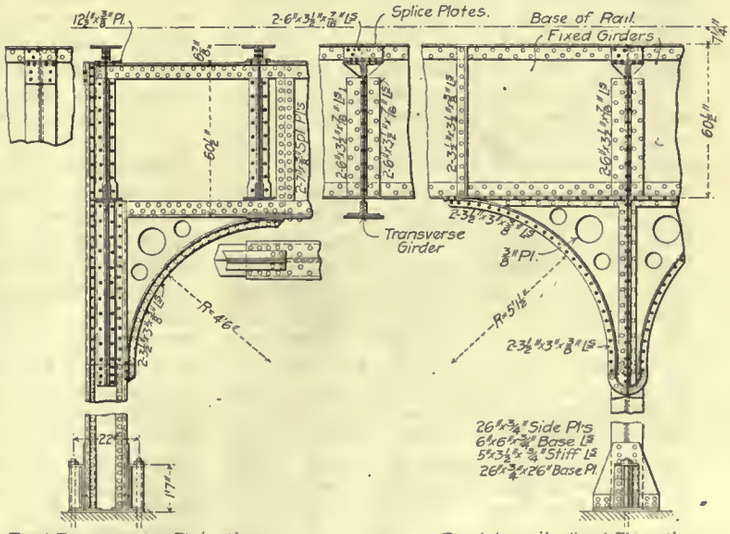
PLAN OF CURVED STRUCTURE AT 174TH STREET AND BOULEVARD.



Platforms carried on Cantilever Girders at Bent No. 311.



Connections of Main Longitudinal and Transverse Girder.



Typical Detail of Trestle Bent.

DETAILS OF ELEVATED STRUCTURE OF THE NEW YORK RAPID TRANSIT RAILROAD.

At the expansion joint there is one fixed and one sliding girder, the latter having a drop end which is supported on a pair of reinforced vertical angles riveted to the web of the transverse girder in the plane of the longitudinal girder web. These angles reach to about the middle of the transverse girder and engage the projecting part of the longitudinal girder web which forms the drop end and is reinforced for bearing on the lower bracket. This projection from the longitudinal girder has a clearance of 2 inches from the web of the transverse girder, and takes bearing on the bracket with a half-round piece of steel 4 inches in diameter and 3⅛ inches long to correspond with the thickness of the reinforced bracket. This piece fits, accurately, a half-round hole in the lower edge of the end of the girder and its horizontal face slides freely back and forth on the milled upper ends of the angles forming the supporting bracket. It is set loosely in position, but is confined by a pair of wide short vertical lug-angles riveted to the end of the longitudinal girder and forming jaws which engage its web and that of the supporting bracket, and have a working clearance on the latter. This prevents any transverse motion of the longitudinal girder, retains its bearing in place and allows for the expansion and contraction of the girder due to temperature changes. The convex surface receives the full weight of the girder and always affords a sufficient bearing area, and distributes the pressure over the supporting bracket regardless of the varying inclinations of the girder which may be due to its deflections or inaccuracies of construction. This arrangement was especially designed for the elevated structures of the Rapid Transit Railroad and is believed to afford a very satisfactory detail and to avoid the eccentric concentrations of bearing stresses due to other forms of expansion joints. It is also very simple and economical in construction.

Across the tops of the towers the outer longitudinal girders have the same depth as those in the connecting spans; but the four intermediate lines are made much shallower and are seated on solid web knee brace brackets.

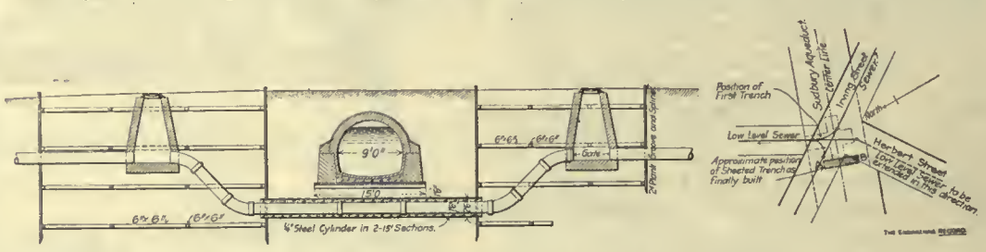
The columns in the single trestle bents and the girders which they support, correspond generally with the construction described above except that the diagonal bracing of the towers is replaced by solid, plate knee braces with curved stiffening angles on the lower edges, and having their webs perforated with large circular holes. In panels where there are variations in the lengths of the girders and the arrangement of the columns, a special construction is provided. The changes at these places are mostly due to the requirements of the station platforms and to the location of the columns on curves. In some places, as at bent 311, the transverse girders cantilever at both ends to support the platforms beyond the column line on pairs of lattice-girders. Here the outside longitudinal girders do not coincide, as on a tangent, with the center line of the column rows; but are a few inches eccentric from them, so as to bring one girder inside the column and the other outside of it. In other cases, as at bents 307 and 309, the columns are separated still farther and the platforms are located almost exactly above their centers. At bent 308 the tracks are very eccentric from the centers of the transverse girders, and one platform is carried inside and the other outside the columns. The columns have the same general dimensions and materials; but a variation in their cross-section to correspond with their loads is effected by changing the thicknesses of the plates and angles and by adding pairs of 12-inch cover plates in some cases.

Crossing under the Sudbury Aqueduct with a Sewer Pipe.

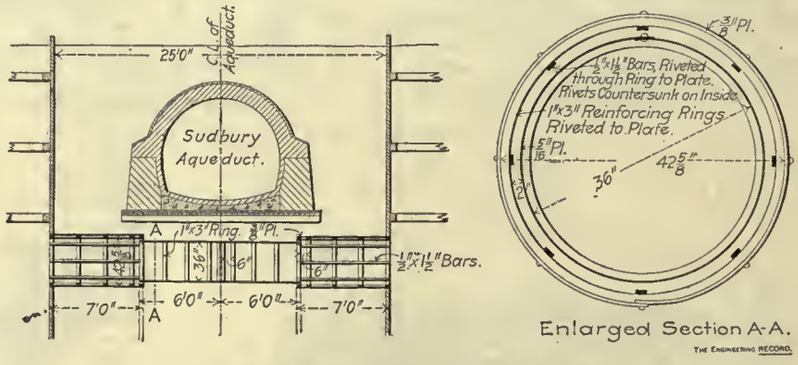
By Charles W. Sherman, M. Am. Soc. C. E., Division Engineer, Metropolitan Water Works, Boston, Mass.

In 1901 the town of Framingham, Mass., began the construction of a low-level sewer in the valley of Beaver Dam Brook, one of the feeders of Lake Cochituate. This lake was the original source of Boston's water supply, in 1847, and it is now one of the sources from which the water for the Metropolitan Water District is taken. The district to be served by this sewer contains a considerable population, and was therefore a menace to the purity of this part of the Metropolitan supply until the sewer should be built and used: consequently the Metropolitan Water and Sewerage Board had an interest in hastening the completion of this sewer.

Knowing that sewers had already been built under the Sudbury and Cochituate aqueducts by first forcing steel pipes through the earth, in which the sewers were subsequently built, the town engineer of Framingham prepared the plan for passing under the aqueduct shown in the accompanying illustration. This plan contemplated forcing a steel cylinder 30 inches in diameter through the earth from a pit at one side of the aqueduct. The cylinder was to be in two sections, each 15 feet long; after the first section had been driven to nearly its full length, the second section would be bolted on, and the whole forced on until the forward end emerged into the pit at the other side of the aqueduct. The 18-inch cast iron pipe would then be jointed and laid within the cylinder, and the space about the pipe would afterwards be filled with cement grout.



First Method Proposed for Putting Sewer under Aqueduct.



Second Method for Crossing under Aqueduct.

This plan was referred to Mr. Desmond FitzGerald, Past-President Am. Soc. C. E., then engineer of the Sudbury Department of the Metropolitan Water Works, who had charge of the aqueduct. His experience with the previous sewer crossings under the aqueduct at once made it plain that the scheme as it stood was impracticable. In the first place, it would not be possible to drive so long a pipe in one piece, as it could not be maintained even approximately true to line and grade, and the changes in direction caused by differences of resistance of the surrounding material, by stones, etc., would immensely increase the resistance to be overcome in driving the pipe. Moreover, the earth must be excavated from the heading as the pipe is forced ahead by the screws, and it is therefore necessary that the pipe be sufficiently large for a man to work in to good advantage: that is, he must be free to move from his hips up, which requires a clear diameter of about 34 inches.

Mr. FitzGerald then prepared the plan for a telescopic pipe shown by the second cut, which may be taken as showing the most advanced design for a tunnel of this sort. It will be observed that the sections are short, so that the resistance to their progress shall not be too great, and also so that the total departure from line due to unavoidable divergences of the cylinders shall not be large. The space between the outer and inner cylinders is sufficient to allow of rectifying the alignment when starting the second cylinder. The cylinders are heavily re-enforced, and the larger has longitudinal bars inside the re-enforcing rings to act as guides for the inner cylinder. The clear diameter of the smaller cylinder is nowhere less than 34 inches; the cylinders are driven at a sufficient distance below the aqueduct structure to avoid loosening all the earth between the aqueduct and the pipe. This plan also contemplates driving the cylinders from both sides, to meet under the center of the aqueduct. It was not expected that the cylinders would meet exactly, but that would not be necessary when laying an 18-inch pipe in cylinders of this size. This plan was adopted and work on it was begun in the summer of 1902.

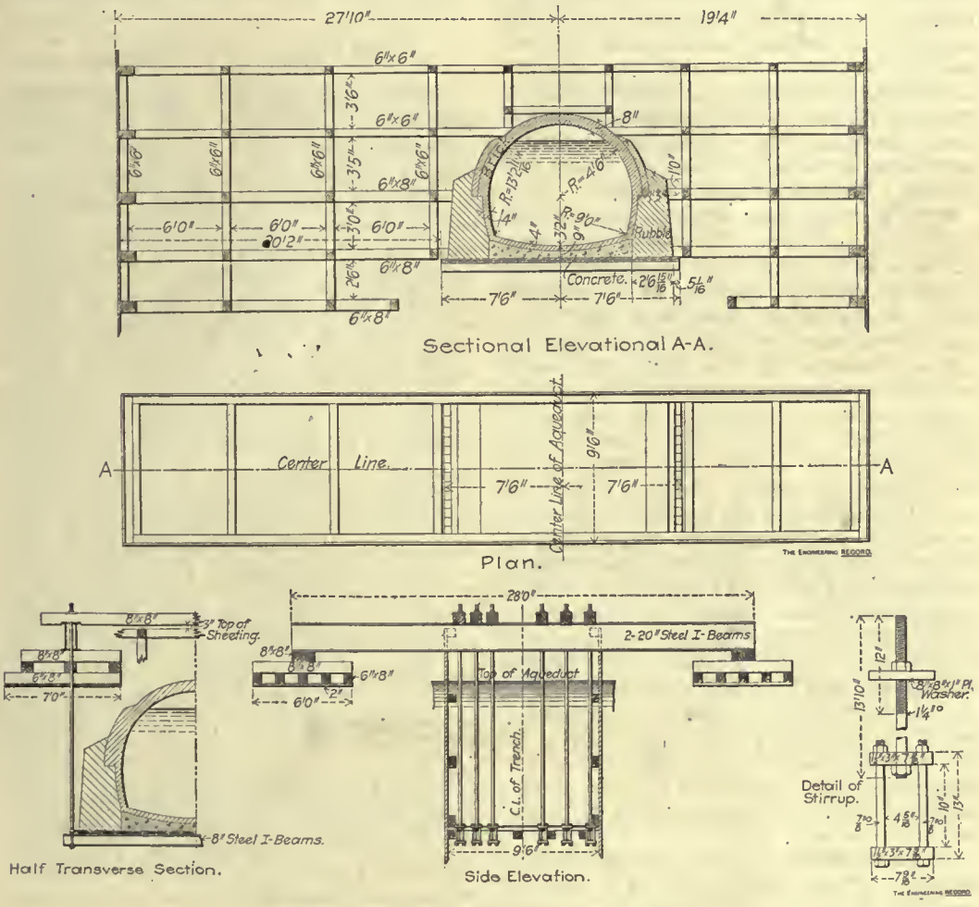
The cylinders were made, and the excavations carried down on both sides of the aqueduct, substantially as shown in the first illustration, through hard blue clay and gravel. The excavation was wet, but the amount of water did not increase appreciably with the depth of the excavation. When down to grade, the excavation was in a mixture of clay and sand, containing much water, but the water would not drain from the material, and there seemed to be no way to remove the water without taking the earth with it. A hole was cut through the sheeting and one of the cylinders placed in line, and an attempt made to force it into the earth, but it soon became evident that this could not be done, and work was stopped.

It was by this time evident that it would not be possible to drive a tunnel under the aqueduct without disturbing the earth above and around it, and a plan was therefore pre-

pared for removing the earth from the aqueduct, which would then be suspended from heavy girders while the earth was excavated from beneath and the pipe put through. This plan is shown in detail by the third and fourth illustrations.

By this time the town of Framingham, having but a small appropriation available for this sewer and finding it nearly exhausted, applied to the Metropolitan Water and Sewerage Board, which agreed to take over the work and at its own expense complete the excavation under the aqueduct and the refilling about the pipe, beginning on September 15, 1902.

Although the masonry aqueduct undoubtedly had a considerable strength and possibly would stand unsupported while the excavation was carried on beneath it, and although an accident to the aqueduct, which was in cut at this point, would not in any way affect the supply of water to the district, since the water would then flow through the ex-



METHOD USED FOR CROSSING UNDER AQUEDUCT.

cavation between the broken ends, nevertheless it would be very difficult to make the repairs in case of a break, since water could be shut off for but a few hours at a time, and it was therefore decided to take no chances but to assume that the whole weight of the aqueduct and its contained water would be carried by the girders. This weight, with the aqueduct full of water, amounted to 10,500 pounds per foot in length of the aqueduct.

On account of the larger excavations required and the difficulty of bracing the new openings to the trenches already excavated, it was decided to open new pits somewhat to one side of the old, and the location of the crossing was therefore changed to the position indicated by A-B in the first illustration. The details of the plan are shown so clearly on the drawing that no further description is necessary. It may be noted, however, that the bottom set of ranges and braces shown on the plan was omitted, as they were found not to be needed, and would have been greatly in the way. The earth was removed from over and around the aqueduct and the 8-inch I-beams forced through under the foundation platform; the suspension rods were then put on and the nuts tightened until the aqueduct was supported from the 20-inch beams. Levels were taken on the crown and both haunches of the aqueduct every day, and the nuts kept tightened so that there should be no cracking from deflection of the structure.

The sheeting of the trenches was driven to the full depth of the excavation. The bottom was then planked for a width of 4 feet 6 inches in the center, and side planks about one foot high completed a trough lengthwise of the trenches. The spaces between the side planks and the sheeting were filled with the material excavated from beneath the aqueduct, which acted as a support to the bottom ends of the sheeting. When the excavation beneath the aqueduct had been completed, it was planked for a width of 2 feet on the bottom, thus completing a continuous floor from end to end of the trenches. Two 12-foot lengths of 18-inch cast iron pipe were placed on this floor in one of the trenches, with two 4-inch wooden rollers under each length, and the lead joint was made; the pipe was then rolled into position beneath the aqueduct. Standpipes were then erected on either side of the aqueduct, and the entire space around the pipe and under the foundation platform was filled with Portland cement grout. Thirty barrels of cement, mixed one cement to one sand, were used in this grouting. As the pipes were left on the rollers, there was a space of 4 inches beneath the pipe, and much more above and around it, that was thus grouted. The pumps were still at work, and the pressure obtained by the standpipes was sufficient to fill all the cavities around the 8-inch beams and elsewhere under the platform.

The earth was backfilled nearly to the haunches of the aqueduct before the nuts of the suspension rods were slacked off: half a turn was sufficient to free the nuts. The rods were unscrewed from the nuts at the bottom by a pipe wrench, and the stirrups were left in the ground. It seems to be the universal opinion of the men engaged on this work that, as far as can be judged from appearances, the masonry aqueduct would have stood safely without support, and would even have supported a considerable external load. The total cost of this work to the Metropolitan Water Works, including the excavation, sheeting the trenches, the I-beams and suspenders (less allowance for the 20-inch beams, which were uninjured), placing but not furnishing the pipe, and grouting around the pipes and the beams left in place, but not refilling the trenches, was a little over $3,000.

Shone Ejector Plant at Worcester, Mass.

By Harrison P. Eddy.

The city of Worcester, Mass., is fortunate in that its water system and sewerage could be provided, until recently, without the necessity of pumping. The low and high service water systems have in the center of the city a pressure of 70 and 150 pounds per square inch respectively, and the mouth of the outfall sewer is 60 feet lower than Main Street at City Hall. Within a few years, however, the population has spread onto the watershed of Lake Quinsigamond, a beautiful sheet of water enjoyed by thousands of people as a pleasure resort in summer and from which large quantities of ice are cut in winter. It is obvious that the purity of this water must be preserved at any cost and a suggestion of discharge of sewage or even effluent from a purification plant into it would not be tolerated for a minute. So strong is this feeling that even the proposal to discharge surface water from slightly traveled gravel roads in the vicinity is looked upon with suspicion.

The possible methods of disposing of the sewage of this district have been made the subject of thorough investigation by the city engineering department. Two schemes for disposal naturally presented themselves, one requiring local treatment, the other resorting to some means of pumping the sewage over the divide into the old system of sewers with its discharge at the purification works now in use for the disposal of the sewage of the entire city. The former proposition required the construction of long trunk sewers, a disposal plant upon soil not very well suited to intermittent filtration and a long drain for the discharge of the filtrate below the ice houses. These items would require so large an expenditure that it was decided that the present population upon the watershed was not sufficiently large to warrant the undertaking. Accordingly a system of pumping was devised for immediate use, although it was pointed out that with a large increase in population local treatment might eventually replace the system of lifts.

For economy in construction and operation the district was subdivided and several pumping stations planned. These, it is intended to build as fast as the increase in population will warrant and each station will receive all the sewage of the portion of the district lying at the elevation which it is designed to accommodate. This avoids taking all the sewage to the lowest station and pumping it all back again. On account of the great variation in elevation of the different parts of the district, a material reduction in the mean lift is thus secured.

A small portion of the whole watershed in-

cluded in these studies is known as the Worcester Highlands. A number of houses, the majority being of the three-flat type, have been built here and several years ago a temporary disposal plant was constructed upon land leased for the purpose for a term of five years. This plant consisted of a septic tank and continuous filters and has just been replaced by a pumping station. The area which it is proposed to accommodate by this station is twenty-four acres in extent. The portion of it now populated is small, a special census showing 92 persons per acre and a water consumption of 12.9 gallons per capita.

In designing the plant the population was estimated at one hundred per acre, exclusive of street areas, and a water consumption of 15 gallons per capita per day, 80 per cent. of which to be returned in sixteen hours. In addition, the amount of ground water which might be expected to find its way into the sewers was estimated at 8 gallons per minute per mile of sewers. About 1.5 miles of sewers will be required to accommodate the entire area. The total population now connected with the sewers is 75 persons. The length of sewers now built is 0.66 mile. From the figures given it will be seen that the ultimate maximum flow of sewage to be provided for will be 42 gallons per minute, and that the maximum quantity under present conditions will be 6.2 gallons per minute.

The difference in elevation between the water line of the sewer just back of the ejector station and the water line of the sewer into which the sewage is to be pumped is 40.5 feet and allowing 1.2 feet for the fall from the sewer to the center of the ejectors the total average lift is 41.7 feet. The ejector well is built beneath the roadway and is of concrete, 8 feet in internal diameter. It is covered with a concrete roof and is reached from the street above by means of an ordinary manhole. The ejectors are in duplicate, each of 50 gallons capacity and were furnished by the Shone Co., of Chicago, through whom the entire mechanical outfit was purchased. They may be operated singly or in duplicate as conditions may require, although the plant is designed of such proportions that one ejector with its attending machinery will do all the work and in case of any break or repairs, the other outfit may be put into commission. With the present maximum flow of sewage and ground water, one ejector would be discharged every ten minutes.

The power house for furnishing compressed air is located on a lot of land owned by the city. It is a frame building 17x27 feet, one story high, the outside finished in Portland cement plaster, with battens. Two Clayton single air compressors, each of a capacity of 30 cubic feet free air per minute furnish the motive power for the ejectors. A pressure tank 3 feet in diameter and 10 feet long is provided to ensure an ample supply of air for immediate use upon the filling of the ejectors. The air compressors are driven by two independent 5-horse-power electric motors of the Crocker-Wheeler make and are operated by a 500-volt continuous current supplied by the Worcester Electric Light Co. The building and ejector chamber are lighted by incandescent electric lamps, the current being taken from the same wires.

A slate switchboard has mounted upon it the necessary switches and fuses, pressure gauge, two automatic pressure controlling gauges, adjustable between ten and forty pounds air pressure, and two automatic starters. The controlling gauges are constructed much like the ordinary pressure gauge with two adjustable contact points. Attached to the coil is a hammer which makes and breaks the circuit as it touches one or the other of these terminals when the pressure falls below the low point or rises to the high point. The making of the circuit causes a cutting in of the automatic starting apparatus and this in turn cuts in the motor. When the air pressure reaches the upper limit the controlling gauge breaks the circuit cutting out the starting rheostat when the motor stops. A three-pole switch permits the use of both motors and compressors, operated from one gauge controller if desired. The power plant is so designed that other ejector stations can be operated from it when desired.

Failure of a Reservoir Dam at Shelton, Conn.

At about 2 o'clock in the morning of February 22, the largest dam of the Shelton Water Company, about two miles from Shelton, Conn., gave way without warning. The water rushing down the steep and narrow valley caused the failure of a masonry dam lower down, and completely gullied out several streets at the north end of the town and badly frightened the inhabitants of several houses along its course. That the damage done was not greater is somewhat remarkable. The company considers that the cost of all repairs to reservoir, roads and buildings will hardly exceed $5,000.

There are three dams in connection with the water works of Shelton. The upper one forms the main collecting and storage reservoir, and is 500 or 600 feet long and of a maximum height of 18 or 20 feet. It was built many years ago, so that exact data as to its construction are not available. It is a combination earth and masonry dam, the masonry consisting of a rubble wall, about 6 feet thick at the base, probably laid with natural cement mortar. This wall forms the downstream face of the dam and has a batter of roughly 1 in 10. It rests on the natural surface of the ground or a few feet below. The main body of the dam consists of the earth embankment, for which the masonry apparently acts simply as a retaining wall. This embankment, which is about 10 feet wide on top, is largely composed of clay becoming very slippery when wet. The water face of the dam is protected with very heavy riprap, having a slope of perhaps 1 to 1 near the top and becoming flatter toward the bottom. About 15 feet from the masonry wall there is a single thickness of 2-inch horizontal sheeting, which, judging from the portion showing in the break, was badly decayed.

At about the center of the dam there is a masonry spillway some 20 feet wide, and at one side of this is a blow-off pipe, through which the water was discharged when necessary to fill up the smaller pond below. It was at the further side of the spillway from this blow-off that the break occurred, and there seems to be little doubt but that the trouble was caused by muskrats burrowing in the embankment. Evidently the water found its way through the embankment and under the masonry wall. A passage once having been formed at that time of night, the result was inevitable. A peculiar thing about the break is that the masonry wall remained intact, not even showing a crack, and the whole reservoir emptied itself through a hole perhaps 25 feet long and 10 or 12 feet deep under the wall. As the reservoir covers several acres and as it was full at the time of the accident, there was a large quantity of water discharged through the break.

About a mile below this main reservoir is a small one built about two years ago, from which a 12-inch pipe line carries the water supply to Shelton. This reservoir is formed by a masonry dam 25 or 30 feet long. As there is a broad level stretch of meadow just above this dam the force of the flood was expended at this point without doing serious damage, the dam being practically uninjured. Just below this dam the valley becomes narrow and steep again and the course of the water was barred by an old masonry dam about 60 feet long and 30 feet high, which had not been used for several years. The flood carried away about 10 feet of the top of this dam for nearly its whole length, and passing down through the town reached a culvert under Howe Avenue, the main street of the town. This culvert was 6 feet wide and 7 feet high and the fill above it was about 30 feet high. The water overflowed the avenue and cleaned out the whole gully to rock bottom. Several streets in the town were washed out and the foundations of two or three houses partly undermined, and when the flood finally reached the power canal, which runs parallel with the Housatonic River, it completely choked up the canal with a mass of gravel and debris.

New Laboratories at Rensselaer.

The chemical laboratory and the Proudfit Memorial building, which were recently partially destroyed by fire, are being rebuilt. The chemical laboratories will be contained in two adjacent and connected buildings. These buildings contain ten rooms including a large lecture room for general chemistry, two large main laboratories for quantitative and qualitative analysis, small laboratories for special work, assaying, and water analysis, a chemical library and a recitation room. Besides these there will be weighing rooms and closets and rooms for apparatus. The Proudfit Memorial Laboratory will have three stories and a basement. Thirteen of its rooms will be used for the laboratories and lecture rooms of the Department of Physics and Electricity. Unusually complete sets of generators and motors with the necessary meters, indicators and brakes, as well as a large storage battery, will be installed in the electrical laboratory. One room will be a construction and repair shop for apparatus. Three rooms will be used as laboratories for the Department of Mechanics. One will contain the 100,000-pound and 300,000-pound testing machines driven by an electric motor, a wire testing machine, and one of 50,000 pounds' capacity for testing long columns. Another will be completely equipped as a modern cement testing laboratory. The third will contain a rattler for testing paving bricks. Adjacent to this building will be the boiler house, containing two 75-horse-power Babcock & Wilcox boilers, one with a superheater for experimental tests, and a steam turbine.

The Block Pavement laid in Fitchburg, Mass., during 1902 has been with pebble and pitch joints and on a sand foundation, according to the annual report of City Engineer David A. Hartwell, with the exception of the paving between car tracks, which was with pebble and sand joints on a cement concrete foundation.

The Des Moines Water Supply, according to a small pamphlet issued by the Water Works Company, is drawn from galleries in the gravel beds along the bank of the Raccoon River, 25 or 30 feet below the surface. The pumping plant consists of an 8,000,000-gallon Holly pump, a 5,000,000-gallon Gaskell pump, and a 6,000,000-gallon Worthington pump. The present daily consumption of water is about 5,000,000 gallons per day. There has been some trouble with the supply due to the growth of crenothrix in the water, and it is very hard, but otherwise is of good quality.

Data on Illumination.

At a recent meeting of the Northwestern Electrical Association, at Milwaukee, Wis., some valuable data were given by Mr. W. D. Ryan, of the Lynn, Mass., works of the General Electric Company on the subject of illumination, particularly with respect to arc lighting. While he recognized the difficulty of offering definite data on the amount of light required to illuminate a given area, on account of the wide difference of opinion as to the volume of light which should be called satisfactory for a given set of conditions, and the fact that the conditions are so variable, he has succeeded, after a careful study of general lighting, in compiling the figures printed in the accompanying table. Besides these figures, which will answer for average conditions, he has added a maximum and a minimum to cover extremely good or very bad conditions of lighting.

His explanation regarding the figures were substantially as follows: It will not be necessary to differentiate between alternating or direct current as one set of figures will in general answer for either, nor will it be necessary to consider the size of the unit. If the area illuminated has a high-studded ceiling of say 14 or 15 feet, it is better practice to use say 6-ampere lamps and take advantage of the higher efficiency of the larger units. If, on the contrary, the ceiling is low, say 8 or 10 feet, and there are a number of obstructions which would intercept the light from the various lamps, to get the best effect it will be necessary to use small units of say 4 amperes. The better distribution of the small units in this particular case would offset the higher efficiency of the larger units. The amount of power consumed per square foot should figure up about the same in either case.

When laying out a lighting plan, if the question arises of a few watts more or less one way or the other, he believed it might be well to bear in mind that as an advertising feature, a strong illumination inside associates itself better with the building making the display, than a moderate light inside and an incandescent display on the front of the building. In many cases it would be better policy to add the power expended on the front of the building to the lighting of the interior. This he believes is a point of considerable importance, and well worthy of consideration, as it would not only act in many cases as a better advertising feature, but would undoubtedly result in increased sales due to the superior light.

Watts* Per Square Foot for High Class Arc Lighting.

Building.	Average conditions.	Range of variation.
Machine shops, high roofs, electrically driven machinery, no belts	.75	.5 to 1
Machine shops, low roofs, belts and other obstructions	1	.75 " 1.25
Hardware and shoe stores	.75	.5 " 1
Department stores, light material, bric-a-brac, etc	1	.75 " 1.25
Department stores, colored material	1.25	1 " 1.5
Mill lighting, plain white goods	1.1	.9 " 1.5
Mill lighting colored goods, high looma	1.3	1.1 " 1.5
General office, no incandescents	1.5	1.25 " 1.75
Drafting rooms	1.75	1.5 " 2

*Energy based on watts at lamp terminals.

He also referred in his lecture to his concentric light diffuser, which the General Electric Company has introduced, to reduce what remains in the enclosed-arc lamp of the objectionable wandering arc. With the diffuser he said that one could get along with 25 per cent. less lights, but he did not advocate that reduction, urging rather that customers get better light with the same amount of power. He mentioned an instance where 105 incandescent lamps, used with five arcs, were replaced by five other arcs with diffusers; no more power was used and the light was much better and better diffused. He stated that the diffuser makes the illuminating power of the lamp practically independent of the nature or color of the ceiling; that is, it is immaterial whether the ceiling is light or dark.

Weakening of Cylindrical Vessels by Manholes.

In the course of an investigation made by Prof. C. Bach on some boiler explosions two cylindrical vessels provided with proper manholes were tested by him. As reported by Prof. Bach in a recent number of the "Zeitschrift des Vereines dentscher Ingenieure," the two cylindrical vessels were made of tough cast iron, cast from the same material and ladle. Their inside diameter was 23.6 inches and the thickness of the shell was 0.79 inch. The length over all each vessel was 62 inches, and it was made up of 31.5 inches of cylindrical shell and two domed heads. One of these spherical ends extended into a cylindrical portion 7.5 inches inside diameter, closed by a cover securely bolted to it. One vessel was subjected to a hydrostatic test and the pressure required to break it was thus determined. In the other vessel a manhole was cut by boring and reaming and then closed by a suitable manhole cover. The manhole was elliptical 15 by 11.8 inches and the edges did not show any cracks or defects. This vessel was also tested to failure by hydrostatic pressure. The vessel without the manhole broke at a pressure of 990 pounds per square inch and the one with the manhole at 330 pounds per square inch. The former practically failed by cracking longitudinally for the whole length on one side, while the latter cracked longitudinally from the apex of the manhole ellipse to one of the heads. The fractured surface of the first vessel showed at three points less thickness of shell by 0.138 inch due to the provision for the core made in casting.

In discussing the results, two cases were considered: First, averaging the shell thickness for the whole length of the straight portion giving 0.725 inch; and, second, considering the reduced thickness in mid-length of the cylindrical portion giving a shell thickness of 0.738—0.138=0.6 inch. Applying the well known formula for the strength of cylindrical vessels, $2ts=pd$, the stress in the shell may be computed. Here t is the thickness of the vessel in inches; d, the inner diameter of the shell in inches; p, the hydrostatic pressure at failure in pounds per square inch; s, the breaking stress in pounds per square inch. For a diameter $d=23.7$ inches, the first case gives $s=1,620$; the second case gives $s=1,955$. On the fractured surface of the vessel with the manhole no weakened spots were found. The diameter was $d=23.6$ inches, thickness of shell at manhole, 0.807 inch. The above determined values of the breaking stress of the first shell should give when applied to this shell the following values for the hydrostatic pressure it could sustain. For $s=1,620$: $p=1,110$; for $s=1,955$: $p=1,340$. But the shell with the manhole failed under a pressure of 330 pounds. The relative strengths of the vessel without manhole and the vessel with manhole will then be: For first case, $1,110 : 330 = 3.37 : 1$, and for the second case, $1,340 \cdot 330 = 4.07 : 1$, or an average of 3.73 to one.

Owing probably to the difference of the temperature of the iron when cast from the same ladle, the tensile stress of test pieces of the two shells showed considerable differences, which reduces the above ratio of strength of vessels to 3.27 to 1. It thus follows that the ratio of the strength of a cylindrical vessel without manhole to the strength of an identical cylindrical vessel with manhole is 3.27 to 1. A similar test made some years ago on a cylindrical vessel with a side branch connecting to it gave the ratio of 2.73 to 1.

The reason for this very great weakening can be found in the first place in the unequal distribution of the tensile stresses due to the portion cut out. In addition there are the bending stresses caused at the edges of the hole by the pressure of the manhole cover against the shell, due to the pressure of the fluid inside of the vessel. In the case of one of the exploded boilers, this pressure at the edges amounted, for 60 pounds per square inch above atmospheric pressure, to about 67,000 pounds. Considering the stresses caused by this load, which is resisted by the bending strength of a plate ¼ to 5/16 inch thick it will be recognized at once that stresses will be induced here which will pass far outside of the allowable limits. The stresses caused by the tightening of the manhole cover should also be added, especially in view of their repeated occurrence. If the material of the shell is tough it will yield and undergo permanent deformation, throwing thereby some of its load to the surrounding material. If the material is brittle it will break under a sufficiently high pressure, and this result will be hastened by fine cracks at the edges of the hole.

From the above, it can be seen that, while tests on cast-iron cannot be directly applied to tough wrought iron or steel, the manhole forms a very weak portion of a boiler unless the edges have been sufficiently strengthened by reinforcing or by making the plate containing the manhole of greater thickness.

Stevens Institute of Technology, Hoboken, N. J., has recently received from Mr. Andrew Carnegie, vice-president of the board of trustees, an additional endowment of $125,000 for the Carnegie Laboratory of Engineering.

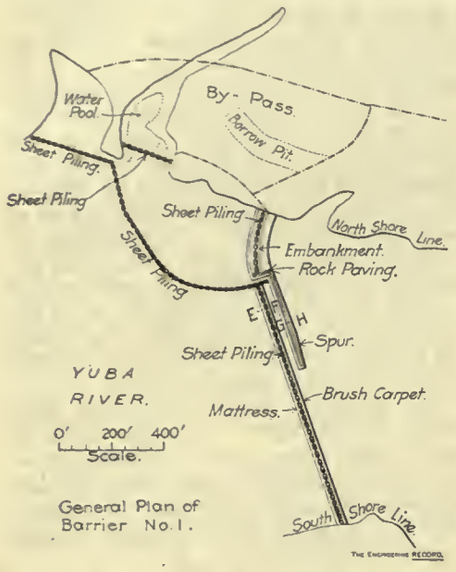
The Extension of the Sewer System of Brooklyn, N. Y., to provide for the rapidly increasing population in the outlying districts is being carried on as fast as the appropriations for such work will allow. Superintendent of Sewers John Thatcher states that proposals for three contracts in the Paerdegat and Parkville sections at a total estimated cost of $920,200 will be asked for about March 4. The work, which will all be in open cut, will include brick sewers ranging in size from 12 feet to 30 inches and a small amount of pipe sewers.

Mr. N. P. Simin, Chief Engineer of the Moscow, Russia, water works, who is pleasantly remembered by many American engineers who met him during his visit to this country a few years ago, has just sent The Engineering Record eight technical pamphlets, the titles of which, given below, indicate that Russian engineers are giving earnest attention to up-to-date water-works problems. Mr. Simin is the author of all the papers but the last. The titles are: "The Corrosion of Water Pipes by Return Currents of Electric Street Cars;" "The Domestic Fire Protection Water Works at Tobolsk, Siberia, of the System of N. P. Simin, C. E.;" "The Desirability, the Possibility and the Usefulness of Building City Water Works Adapted to a Direct Fighting of Fires;" "New Directions in the Art of Purification of Public Water Supplies;" "Ozonization of Water as a Method to Overcome the Defects of its Filtration for Public Water Supplies;" "Scientific Investigation of the American Method of Water Purification and Cases of Its Practical Application;" "About Fire Protection Water Works;" "Results of the Use of the Samara Domestic Fire Protection Water Works During 15 Years of Their Existence, (from 1887 to 1902)."

Impounding Mining Debris in Yuba River, California.

By Franklin Riffle, M. Am. Soc. C. E.

During the early eighties the watershed of the Yuba River, California, was the scene of the most extensive hydraulic mining operations in the world. The mines were bountifully supplied with water by elaborate systems of storage reservoirs, ditches, flumes and pipe lines. The reservoirs of three of the largest mines covered a combined area of 11,600 acres,

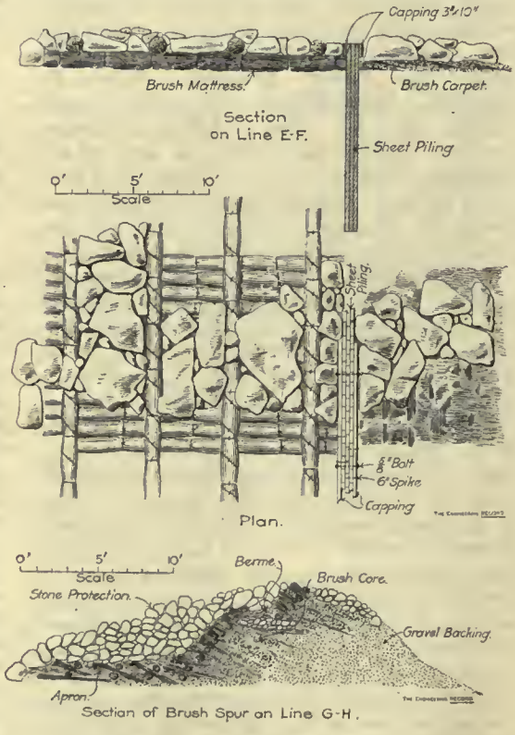


or about 18 square miles. Their combined capacity was 2,200,000,000 cubic feet. Five of the largest mining and ditch companies had in operation 650 miles of ditches and flumes with a total carrying capacity of 24,000 miner's inches, or nearly 500 cubic feet per second. The plants of these five companies represented an aggregate cost of $4,000,000.

The North Bloomfield mine was the largest hydraulic mine in this section. Its operations were confined to the ancient river channel on San Juan Ridge, which lies between the Middle and South Forks of the Yuba. This channel is about 25 miles long, from 3,000 to 8,000 feet wide, and from 300 to 600 feet deep. Its gravel contents were estimated to be about 800,000,000 cubic yards, 100,000,000 of which had been removed when mining was discontinued by decree of the United States Circuit Court. The discharge of the vast quantities of debris from the North Bloomfield and other mines into the Yuba and its tributaries resulted in the destruction of valuable farming lands in the valleys below and the shoaling of the channels of the Feather and Sacramento Rivers, both navigable streams. Levees were constructed along the lower Yuba to protect the town of Marysville and the surrounding country from further injury, but not until the channel had been completely filled by the debris, and 15,000 acres of rich farming and horticultural lands had been ruined. In 1884, after a long period of litigation, the farmers were successful in obtaining from the United States Circuit Court a decision which had the effect of closing all the hydraulic mines operating on the watershed of the Yuba River. The decree of the Court "perpetually enjoined and restrained the defendants from discharging or dumping into the Yuba or any tributaries to said river, or any of its forks or branches . . . any of the tailings, boulders, cobblestones, gravel, sand, clay, debris or refuse matter from any of the tracts of mineral lands or mines described in the complaint."

The ultimate effect of this decision was to close every hydraulic mine situated on the watersheds of the Sacramento and San Joaquin rivers. Nine years later Congress passed an act permitting hydraulic mining in the enjoined districts, under certain restrictions. The act provided for the appointment by the President of a commission composed of three officers of the Corps of Engineers U. S. A. This commission, styled the California Debris Commission, is empowered to issue permits for hydraulic mining when satisfied that the applicants have made adequate provisions for impounding tailings. Permits are subject to cancellation whenever it is apparent to the commission that the debris is not being properly impounded. Although several hundred mines in the State have resumed operations since 1893, the large mines of the Yuba have remained practically inactive; and while little if any debris has been added to the Yuba and its tributaries for a period of 18 years, the annual floods have continued to carry down detritus from the old deposits. As a result, the bed of the lower Yuba is rising higher above the surrounding country each year, while the Feather and Sacramento Rivers are gradually becoming more shoal.

After an exhaustive study of the conditions prevailing in the Yuba, the Debris Commission have formulated a comprehensive plan for storing the detritus now in the river above the levees. This is to be accomplished by constructing barriers across the channel about 14

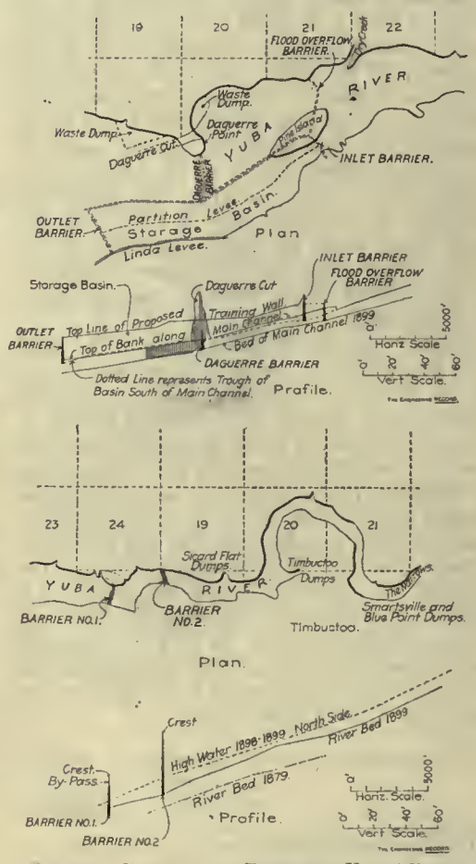


DETAILS OF BARRIER NO. 1.

miles above Marysville to restrain the coarse material, and a settling basin a few miles below the barriers to store the sediment carried there in suspension. The plan also provides for the control of the channel below the storage basin and the reclamation of the extensive deposits lying on either side.

The site selected for barrier No. 1 (see Map A) is about 14 miles above Marysville. The contract for this portion of the impounding works has been awarded to the Atlantic, Gulf & Pacific Co., of San Francisco, and construction is now in progress. Barrier No. 1 will be a rock and brush dam with a masonry crest and a double row of piles driven in the toe. Its height will be about 20 feet, and its crest length about 1,100 feet. Except in flood stages the water of the river will flow around the dam, through a by-pass at its northerly end. No water can pass over the dam until the flood-flow reaches 19,000 second-feet. It is estimated that with a maximum flood-flow of 125,000 second-feet the by-pass will carry 70,000 second-feet with a weir depth of 7 feet, and that 55,000 second-feet will pass over the dam with a crest depth of 3½ feet. Barrier No. 2 will be built about ½ mile above barrier No. 1, and will be of similar construction. Its height will be approximately 40 feet above the present river bed, and its crest length will be about 1,000 feet. It will be built up gradually. Although submerged at all stages of the river, the dam will be amply protected from undermining by the water cushion formed by barrier No. 1. The two barriers combined will raise the plane of the river bed about 40 feet, reducing its gradient to about 15 feet per mile. It is estimated that 36,000,000 yards of coarse material will be impounded behind these structures at a cost of 7/10 cent per cubic yard.

The flood overflow barrier (see Map B) will be a rock-filled crib dam extending from the inlet wall of the settling basin to the north bank of the river. Its length will be 4,000 feet.



GENERAL PLANS AND PROFILES, YUBA RIVER IMPROVEMENTS.

The flood overflow barrier is designed to regulate the discharge when flood water passes over it; to maintain the necessary level of the water to insure the maximum flow into the settling basin; and to act as a grade consumer.

The Daguerre Point barrier will be a brush and gravel structure 3,000 feet long and 14 feet high, extending across the channel from Daguerre Point southerly to the northerly wall of the settling basin. The chief object of this barrier is to divert a portion of the flood water through Daguerre Cut, which will have a bottom width of 430 feet through the body of the cut and a width of 600 feet at the entrance. In entering the cut the water will flow over a

its crest will be 4 feet higher than the inlets to the settling basin and 4 feet lower than the top of the basin wall at the junction. The

wall and apron of concrete. The settling basin will be about three miles below barrier No. 1. It will have a length of three miles and an average width of half a mile. It will be divided longitudinally into two sections by a partition wall. The southerly wall will consist partly of the Linda Levee and partly of the natural bank. The inlet and northerly walls will consist of rock-faced embankments. The outlet wall will be built of brush and gravel to the height necessary for beginning operations, after which it will be built up gradually as the silt is deposited behind it, the object being to keep the crest 2 or 3 feet above the plane of the deposit. The inlet and outlet walls will be provided with four gates each, by means of which the inflow and outflow can be regulated as the conditions may warrant. The water will leave the basin through concrete culverts in the lower story, and by a weir device above. The four openings in the entrance wall will be sufficiently large to accommodate the average winter flow of the river. The settling basin will cover an area of about 1,000 acres, and will have a capacity of about 14,000,000 cubic yards of sediment, the cost of impounding which will be about 1¾ cents per cubic yard. By extending the basin westwardly the storage capacity can be increased to 60,000,000 cubic yards.

In reporting on this project to the Chief of Engineers, the Debris Commission emphasize the fact that provision has been made only for the storage of the detritus now in the Yuba, and that not until this shall have been successfully accomplished will it be possible to determine whether or not, by enlarging the works, the tailings from future hydraulic mining operations can be taken care of without requiring each mine to impound, either wholly or partially, its own debris. A joint appropriation of $800,000 by the Federal and State governments is now available for constructing restraining barriers in the tributaries of the Sacramento. It has been decided to confine this appropriation to the Yuba River since this stream contains more debris than all the other streams of the watershed of the Sacramento combined.

The reclamation of the vast deposits of debris between the settling basin and Marysville will follow the construction of the works described. Although no well-defined plans have been adopted for this work, the report of the commission mentions in a general way that measures will be taken to confine the flow of the river to a single channel, and that the operations will consist of clearing brush to facilitate flow, closing side channels, building brushwork spurs to direct the current, dredging, snagging, etc.

The whole project, as outlined by the Debris Commission and Assistant Engineer Vischer, is distinctively unique, since there is no record of anything of the kind ever having been undertaken. The problems involved have been so thoroughly investigated, however, that there would seem to be little doubt concerning the ultimate success of the experiment. The writer is largely indebted to the comprehensive report of Mr. Hubert Vischer, assistant engineer, for much of the information contained in this article.

Through the courtesy of R. P. Johnston, first lieutenant, Corps of Engineers, there are added some detail drawings and extracts from the specifications for barrier No. 1 of the above work. Half the expense is to be borne by the federal government and half by the State of California. At the location for this barrier the Yuba River has a total width at high water of 1,500 feet, but at low water there is usually only a channel about 100 feet wide with 2½ feet of water. The work involves the furnishing and placing of the following materials: 50,000 linear feet of Wakefield sheet piles, 13,000 feet B. M. of capping, 2,333 square yards brush mattress, 1,500 square yards brush carpet, 3,400 tons random stone, 6,000 cubic yards earth fill, 1,000 cubic yards giant backing and 1,200 cubic yards loose brush. The piles are cut off about 1 foot above the bed of the stream, and capped with two pieces of 3x10-inch lumber bolted every 6 feet with ⅝-inch bolts and each spiked to alternate piles with 6-inch wire spikes.

Brush may be of any live, straight brush, willow preferred, as long as practicable, but no piece to be less than 4½ feet long. The brush for fascines will consist mostly of straight single pieces, no piece to be greater than 1½ inches in diameter at the butt. The brush for other purposes must be of such character and so placed that it will lie compactly; no piece to be more than 2 inches in diameter at the butt. Stiff, bushy brush like manzanita, oak, etc., will not be accepted.

Poles where used are to be from 2 to 4 inches in diameter at the tips and as long as practicable. All bougha are to be trimmed off and the poles are to be sufficiently straight and flexible to lie compactly in the work.

The brush (for the mattress) is to be bundled and made into fascines of selected straight brush, each fascine to be not less than 20 feet in length, unless otherwise ordered, and 12 inches in diameter, and to be tightly compressed at intervals of 3 feet with a chain or heavy rope and lever compressor, and while so compressed to be tightly bound at the ends and at each 3 feet of length with two turns of No. 16 black annealed wire, the ends of the wire to be securely twisted to each other and then bent into the brush. These fascines are then to be laid side by side, in place, approximately parallel to the current, the upper end of each fascine in contact with the row of sheet piling. On these fascines, and at right angles to same, four rows of binder fascines are to be securely fastened; the binder fascines are to be built exactly like the others except that they must be made as much longer as may be required, each binder fascine to be securely fastened to each alternate fascine beneath by two turns of No. 16 black annealed wire.

The brush for protection or carpet above sheet piling is to be laid in a reasonably compact layer about 1 foot in thickness, part of the brush parallel to the current and part at right angles to it. This layer of brush is to be 10 feet wide and is to follow the sheet piling.

The brush mattress and carpet are to weighted, as fast as laid, with a layer about 1 foot thick of stone placed by hand in the form of a rough pavement, 50 per cent. of the stone by weight to be in pieces each weighing 500 pounds or more, 30 per cent. in pieces from 300 to 500 pounds each, and 20 per cent. in smaller pieces to be chinked in by hand between and around the larger pieces.

Portland Cement in Construction.

The Association of Portland Cement Manufacturers has just issued, from the president's office, Philadelphia, a report of the committee on new uses of cement, presented by its chairman, Mr. T. H. Dumary. The report enumerates about twenty-five different uses for cement, some of which are novel and others of which are extensions or adaptations of well known constructions. Taken in conjunction with the standard use of Portland cement for all kinds of masonry and concrete work, and the growing substitution of concrete for ashlar masonry, it indicates the extent of its practical application and explains why the production of so many large mills has of late years often failed to keep pace with the demand. A partial list of the new uses of cement mentioned in this report includes protection of structural steel by a Portland cement wash, or by dense stone or cinder concrete mixed wet and applied after the steel is thoroughly cleaned by scraping, pickling, sand blast or equivalent process; concrete piles to replace timber in mining shafts and tunnels; hollow concrete blocks to replace brick work; injected grout to construct foundations and other masonry below the surface in inaccessible quicksand; concrete piles cast in steel shells, driven into the ground, as described in The Engineering Record of Dec. 27, 1902; waterproofing for the riveted cases of drilled petroleum wells in Russia; butts for wooden telegraph poles; burial vaults; veneering for dwelling houses; railroad cross ties, which are stated to cost three times as much as oak, and to last twenty-five times as long; reinforced reservoirs for oil, water, etc.; storage tanks with skeleton steel construction to contain dry material; slow setting concrete to exclude water from mines; ballast tanks on board ship; fuel bricks made with coal dust; wheel tracks on concrete beams proposed for an automobile track between New York and Chicago.

Letter to the Editor.

Computations for Two-Hinged Arch.

Sir:—In your issue of February 14 there appears a short communication signed by "C. S.," which would seem to make the proportioning of a two-hinged arch a matter of recreation. C. S. states that, after reactions are assumed and members proportioned on the stresses found, from the change in length in every member, the deflection, horizontal and vertical, in every triangle, is laid off to increased scale and the total deformation of the frame easily summed up with due regard to the leverage. He does not say to what scale a triangle whose sides change about one-three-thousandth in length should be drawn to make this change measurable. He does not state what deflects or what remains stationary to gauge the deflection by. There are a few other practical points that are not quite clear. The last paragraph states that the application of the elastic theory is rare, and intimates that assumptions based upon it are subject to risk. His own method is the elastic theory pure and simple; how else could he find the change in length of the members? If the elastic theory is so uncertain, are we to quit designing girders and beams of any sort by it? Are columns, and almost everything else that we are called upon to proportion in steel work, resting upon a theory that is of rare application? If so, it is time for C. S. to come out from under the bushel and light our way to something more sure.

Very respectfully,
Edward Godfrey.

Pittsburg, Pa., February 17, 1903.

The Pennsylvania Railroad Company, according to a statement issued from the office of the chief engineer, Mr. William H. Brown, laid on its various lines during the year 1902, a little over 156 miles of track, of which 12.4 miles were on sidings.

A Search for the Magnetic North Pole is to be made during the coming spring by Capt. Roald Amundsen, of Norway, according to "The Western Electrician." He will make a magnetic survey of the vicinity of the pole and attempt to determine whether it is a point or a restricted area.

The Philadelphia Engineers' Club had an unusually large and interesting meeting on the evening of February 21. Mr. John W. Hill, chief engineer of the Bureau of Filtration, gave an informal description of the large filtration works being constructed for the city, illustrated by stereopticon.

The Metric System Bill is not to be pressed further at the present session of Congress. The House Committee on Coinage, Weights and Measures is favorably disposed toward it, but believes that the consideration of the measure should be carried on a little longer throughout the country. It is said that it will be brought up early in the next session of Congress.

Ventilation and Heating in the East High School, Rochester, N. Y.—I.

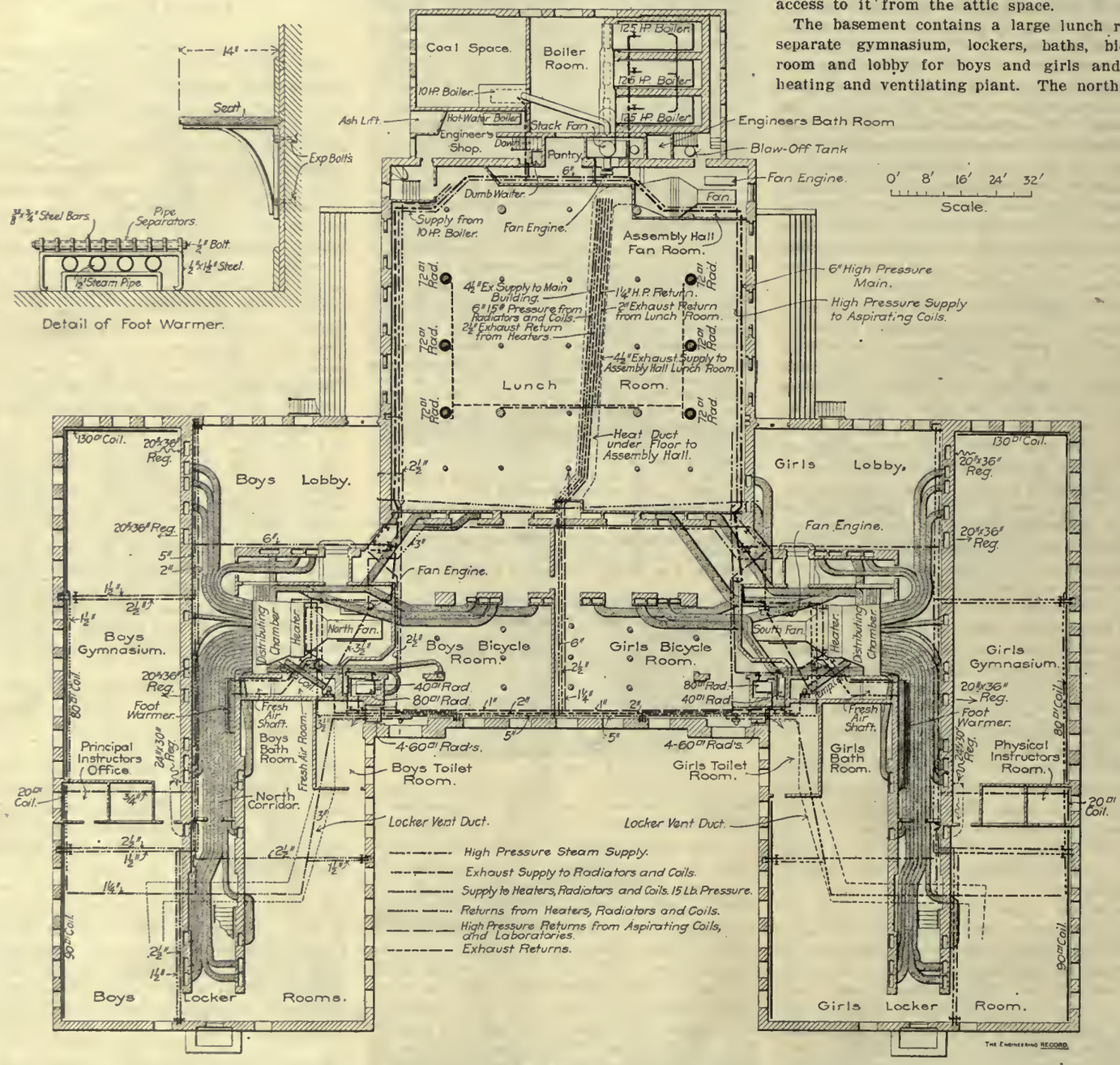
The East High School, in Rochester, N. Y., now nearly completed, is on the east side of Alexander Street between Main Street East and University Avenue. The building is of buff pressed brick with red Albion and buff Indiana stone trimmings, and contains three stories, an attic and a basement. The building, with the exception of the toilets and lockers, is heated and ventilated by a plenum system established by three sets of fans, engines, heaters and tempering coils located in the basement. All outside rooms also have a certain amount of direct radiation for use when no sessions are being held nights and when the outside temperature drops below 32 degrees. For the toilet and locker rooms in the basement, the heating and ventilating are accomplished by natural draft through indirect systems. Most of the heating apparatus throughout is automatically regulated, but in certain instances where it was deemed desirable, hand control has been maintained. The design of the building, in all of its details, mechanical as well as architectural, was the work of Mr. J. Foster Warner, of Rochester, N. Y.

Two unusual features are found in the mechanical equipment. The first is an air economizer used in connection with the induced draft apparatus for heating the air before it goes to the furnaces; and the second, the arrangement for feeding the boilers either by pumps or by gravity with the returns of the heating system.

As may be seen on the basement plan, the building is rectangular having a court cut in front and an extension of nearly equivalent area at the rear, the whole covering a ground space of about 31,500 square feet. The first and second floors of the rear extension are taken up by the assembly hall. The remainder of the first floor contains ten class rooms, four recitation rooms, the executive offices and a library. The second floor is similar to the first, having the same number of class and recitation rooms, the upper part of the assembly hall and its gallery, and replacing the library and offices of the floor below by a conversation room and teachers' locker rooms. The third floor is quite different; it consists mostly of laboratories and lecture rooms for physics, chemistry, physiology, botany and zoology, and besides these has a museum, drawing room, four class rooms and two recitation rooms. It will be noticed that the work requiring the most light has been accommodated on the third floor where the rooms have the additional light furnished by eleven skylights. The space between the skylight in the ceiling of the room and roof skylight above the attic is bounded by plastered walls so as to reflect as much light as possible. To allow some light to the attic space small windows are placed in the four sides of the box and a door at the bottom of one side gives access to it from the attic space.

The basement contains a large lunch room, separate gymnasium, lockers, baths, bicycle room and lobby for boys and girls and the heating and ventilating plant. The north and south fan rooms and the assembly hall fan are under the building proper, but the boilers are in an addition to the basement beyond the rear extension and extending about half a story above ground.

The heating and ventilating system was designed to fulfil the following requirements. With a steam pressure of 10 pounds on the heaters and radiation, and with exhaust steam only on the tempering coils, all rooms must be heated at the same time to 70 degrees when the outside temperature is zero; the corridors and



BASEMENT PLAN.

VENTILATION AND HEATING IN THE EAST HIGH SCHOOL, ROCHESTER, N. Y.

J. FOSTER WARNER, ARCHITECT; R. T. FORD, CONTRACTOR.

halls, including the lobbies and lunch room, must be heated to 60 degrees. The minimum quantities of air that must be delivered to the various rooms at the same time are given in the accompanying table:

Quantities of Air to be Supplied; Cubic Feet per Minute.	
All regular class rooms	1,300
All regular recitation rooms	900
General lecture room, third story	2,200
Five lecture rooms, third story, each	1,300
Chemical laboratory and physics laboratory, each	1,800
Museum and geology laboratory, third story	1,300
Conversation room, second story	1,000
Teachers' rooms, second story	900
Library, first story	1,000
Office, first story	500
Gymnasiums in basement, each	2,600
Assembly hall or lunch room, alternately	24,000

The separate system of indirect radiation as used in the toilets is required to heat them to 60 degrees in zero weather.

The north and south halves of the building are furnished with hot air for their combined heating and ventilating by two independent equipments; and the assembly hall and lunch room have one which they use interchangeably, as the two rooms are never occupied by many people at one time. The locations of the fans and distributing ducts are shown on the plan of the basement. The fresh air for the north and south wings is taken in at the roof through dormers on the north and south sides, thence down through brick shafts to the respective fresh air rooms in the basement. The fresh air for the assembly hall or lunch room is taken through a screened inlet in one of the basement windows in the south wall of the rear extension.

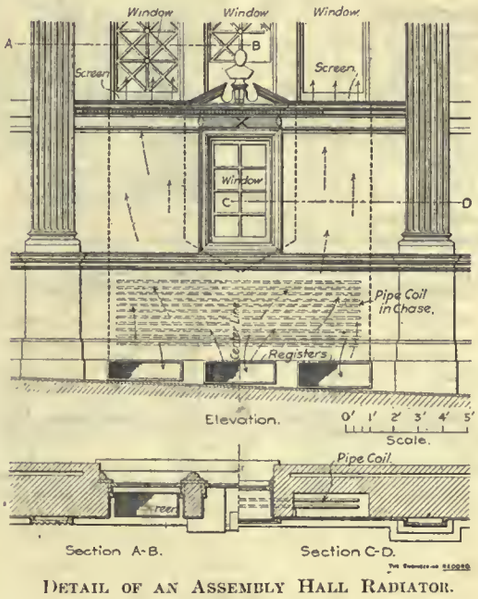
As the north and south fan systems are practically identical in the sizes of parts and symmetrical in the placing of them, a description will be given of the north system only. The tempering coil is placed at the entrance of the fan chamber and contains 2,600 linear feet of 1-inch pipe giving a total heating surface of 896 square feet. It is constructed upon two 4-row and two 2-row sections, the sections being 4 feet long and the pipes 7 feet high. The 4-row sections are placed on the outside where they take the fresh air first, such sections being subject to the greatest amount of condensation.

The fan is a 160-inch Sturtevant blower direct-driven by a 10x10 inch center-crank engine. The wheel is 9 feet in diameter and 48 inches wide, and when running at a speed of 160 revolutions gives the fan a capacity of 35,000 cubic feet of air per minute. The heater is located in the discharge of the fan and consists of 8,600 linear feet of 1-inch pipe giving 2,960 square feet of heating surface. It is constructed upon eight sections 6 feet long with four rows of pipe 7 feet high in each. The heater is set in a double group and has two large manifold headers. A portion of the merely tempered air is by-passed under the heater and kept separate from the heated air in the distributing chamber.

The hot air supply to the two gymnasium registers and each of two of the recitation room registers is carried to their risers through 16-inch tile pipe conduits under the basement floor. All other distributing ducts are of galvanized iron, rectangular in cross section, having a uniform depth of 24 inches and widths varying according to the volume of the room supplied. They are located on the ceiling of the basement, one duct being run for each riser and one riser for each fresh air register. As a rule, each room supplied by the north and south systems receives air from but one register; the larger lecture rooms on the third floor being the only exceptions. The air is received into the ducts from the two parts of the distributing chamber through pipes having Y branches and provided with Johnson butterfly mixing dampers operated from each room by pneumatic regulators and thermostats, of which there about 60 in all. The average velocity of the air in the ducts is 830 feet per minute, in the risers 460 feet, and upon entering the rooms about 270. The air inlets into the rooms are placed 7 or 8 feet above the floor, the usual size being 22x32 inches, with two about 30x48 inches in the chemical and physical laboratories. They are arranged with curved vanes in the elbows following the contour of the bend and deflectors at the point of discharge. The vanes are for the purpose of equalizing the discharge through the orifice and the deflectors for spreading the air to all parts of the room. A detail of a fresh air outlet is shown with the combined plan of the first and third floors.

It was not advisable to run the heat risers necessary for the supply of the laboratories in the third floor of the rear extension directly through the assembly hall. To get around this the bases of those risers are connected by horizontal ducts in a furred down space over the assembly hall ceiling with the tops of heat risers at the rear of the hall.

The foul air from the rooms is removed through registers near the floor. In general the rooms have three 12x20-inch vent registers;



DETAIL OF AN ASSEMBLY HALL RADIATOR.

a few of the smaller rooms have but one or two, usually of a larger size. In the lecture rooms on the third floor where the seats are ranged on a stepped-up platform, the vent registers are placed in the face of the rises and are of sufficient number and area to give a total air outlet 50 per cent. greater than the air inlet. A special exhausting system is provided for the chemical laboratory with down draft hoods over the benches to remove fumes. The system delivers into a riser in the vent shaft at the back of the rear extension. In all other rooms the velocity of the air leaving is about the same as that entering, and is thus kept low so that it will not create disagreeable drafts.

The vent flues convey the air to the attic space delivering it thereto through an outlet of special form, which is also shown with the plan of the first and third floors. The vent flues are separate for each room and are usually in groups of two or three in a single shaft, the divisions being made by galvanized iron partitions. The tops of the shafts, some 60 in number, are capped with hoods faced so as to direct the air toward the point of final egress through openings in the two towers. To prevent back draft the mouths of the hoods are covered with screens and horizontal flaps of oiled silk.

In each of the towers there is a set of double counter-balanced doors closing the entire foul air outlet of 9 square feet. The doors are made of heavy galvanized steel riveted on a light angle-iron frame. The fresh-air inlets in the attic are similarly equipped with double doors of ⅞-inch matched pine boards. For the operation of each of the above doors Johnson pneumatic damper regulating devices are used and are so arranged that the engineer in the boiler room may open or close the valves in the towers and fresh air ducts simultaneously. An indicator in the boiler room shows the exact position of the doors.

The assembly hall and lunch room are supplied alternately by a fan located near the boiler room and shown on the plan of the latter. It is a 140-inch Sturtevant blower having a wheel 7 feet in diameter and 4 feet wide. It is driven by a 7x12-inch side-crank engine at a speed of about 185 revolutions per minute, at which its capacity is 32,000 cubic feet per minute. The tempering coil consists of two sections 7 feet long with pipes 8 feet high, and contains 1,215 linear feet of 1¼-inch pipe giving a total of 528 square feet of heating surface. The heater consists of three similar sections with 1,845 feet of 1¼-inch pipe or 802 square feet of surface. Under the heater a damper is placed which, by means of a Johnson pneumatic device, automatically regulates the admixture of tempered and heated air so as to maintain a temperature of 70 degrees in the assembly hall.

In the distributing chamber of both the north and south fans and in the assembly hall heat duct, the air is moistened by steam jets controlled by three humidostats, located, one in the assembly hall, one in the north wing and one in the south wing. The moistening apparatus is guaranteed to provide not less than 50 per cent. moisture when the fans are running. A Draper recording hygrometer is placed in each of the locations affected to furnish a check on the apparatus. From the mixing chamber the air is conveyed through a brick tunnel, 4 feet 6 inches wide by 4 feet deep, under the lunch room floor to the base of a 48x72-inch riser shaft. In this riser at a point near the ceiling of the lunch room a 32x72-inch opening with flaring deflectors is provided. A counterweighted damper hangs behind the opening. When the lunch room is occupied the damper is swung to a nearly horizontal position deflecting the air into that room, and when the assembly hall is occupied the damper is pulled down against the opening stopping the exit of air at that place and allowing it to pass to the hall.

The plan for securing a uniform distribution of air in the assembly room is quite elaborate. The space between the inclined floor of the hall and the ceiling of the lunch room below is utilized as a large air chamber and is fed by an enclosed tree-form system of ducts with gradually decreasing trunk and branches. At the branches there are deflectors by which the supply may be adjusted for uniformity. These are operated by keys, the sockets being flush with the floor. One half of the system is shown on the right side of the combined first and third floor plan. There are 72 outlets from the ducts, each 6x8 inches, all discharging the air horizontally toward the front of the hall.

The air inlets to the hall from this plenum chamber beneath the floor are distributed about the room beneath the seats, about 1,200 in all, each being a piece of 3-inch pipe screwed into the floor and projecting 3 inches above it. The gallery is furnished with fresh air in a like manner from

two tapering ducts beneath the floor, one for either side, each starting at the top of a 24x24-inch riser from the larger shaft below and having 28 outlets in both sides, and discharging horizontally into the air chamber. The velocity of the air in the ducts is about 1,200 feet per minute, but leaves the plenum chamber at about 500 feet per minute.

The vitiated air is removed through two 24x24-inch registers in each of the side walls and the rear wall of the main floor and four more on the gallery floor, eight perforated ceiling ornaments and through registers in the face of the stage platform, whence they pass to a large shaft behind the stage. These vent flues discharge into the attic space, as do those of the north and south wings. Mechanical means are not resorted to in removing foul air, but as will be shown later, some assistance is afforded by the stack fan, which takes the air for the furnace draft from the attic space, and by the aspirated vent shaft from locker rooms in basement.

All air ducts are of No. 24 galvanized steel and are generally suspended from the ceilings with copper wire, for which small holes are drilled through the concrete floors, the wires being fastened on top of the concrete. The clusters of ducts over the north and south corridors in the basement are supported on steel angles, 10 feet on centers extending from wall to wall, and the angles at their centers are suspended by rods secured through the concrete construction above. The many steam pipes and air ducts in the basement, which is occupied throughout, are concealed above suspended ceilings.

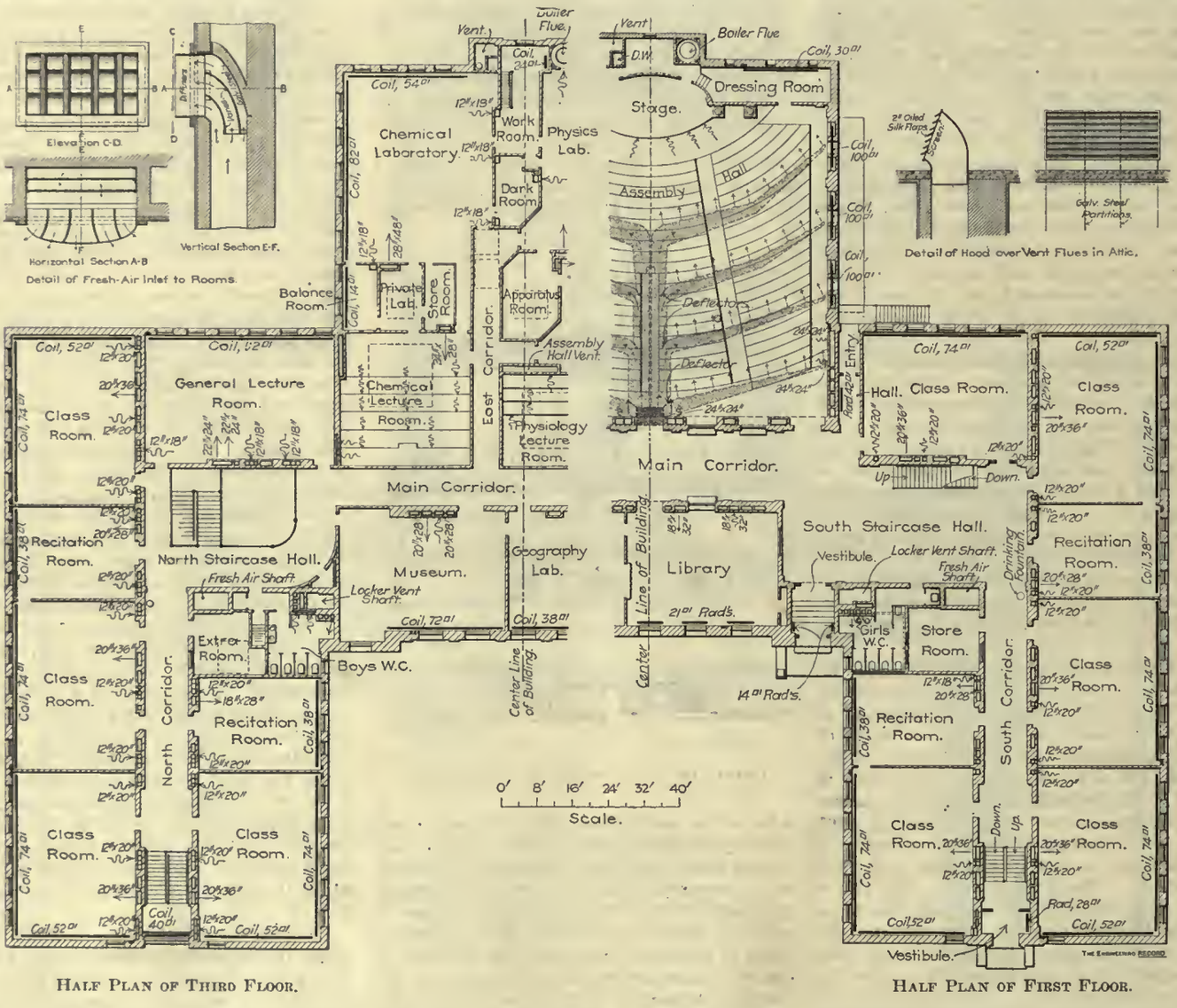
Additional heating to serve when fan is not running and for extreme weather is afforded to the assembly hall by means of radiators concealed in the lower part of the side walls, consisting of three pipe coils on each side of the hall, each containing 100 square feet of surface. The action is that of an indirect radiator taking its air supply from within the room instead of from out-of-doors. The air for each coil is received through three registers near the floor and, passing over the coils, is divided under the lower window and discharged, through two 12x32-inch registers in the sills of the large windows to counteract the cold radiation from the glass. A detail of one of these coil equipments is given showing the construction of the coil boxing and the short heat flues to the upper registers. The coils and the fan hot-air supply are controlled by a thermostat on each side of the room. The coils also have hand valves.

The direct radiation distributed in other parts of the building is exposed and almost invariably the radiators or coils are suspended on the wall below the line of the window sills. They are connected up on a two-pipe system to run at any pressure up to 15 pounds. The radiators are placed only along the outside walls and with but three or four exceptions have diaphragm valve control regulated by thermostats. The proportion of radiating surface in these coils to the length of exposed wall surface in class and recitation rooms has been found to follow very closely the ratio of 2 to 1. For example, where the length of the outside wall is 42 feet the surface contained in the coils is 82 square feet.

The typical class room radiator is a horizontal coil of four 1¼-inch pipes. The three upper pipes are connected with the horizontal supply header by right-angled connections to allow for expansion and terminate at the opposite ends in a vertical header from the bottom of which the fourth pipe starts. Through the latter the returns of the whole coil are passed. An automatic air valve is placed in the outer end of this pipe just before it connects with the return system and all air valves are piped into a system of their own. The total radiating surface in pipe coils and cast iron radiators on all floors above the basement is 6,418 square feet. The lunch room has six circular cast iron radiators set around columns and having a combined surface of 432 square feet.

In the north corridor of the basement a 12-foot horizontal set of coils is used for foot-warmers by the boys. The girls have a 24-foot set in the south corridor. Both are supplied from 15-pound pressure heating mains, and are covered with steel gratings. Seats are secured to the wall just above them. The construction of a foot warmer is shown in a detail at one corner of the basement plan. The remainder of the basement heating includes 640 square feet of radiation in the gymnasium and locker rooms.

As the direct radiation is only used out of sessions and when the outside temperature falls below 32 degrees, it follows that for temperatures above that value the hot blast must be admitted at above 70 degrees to compensate for the heat lost through the walls. The following calculation for this excess temperature is based on severe conditions, an outside tem-



Half Plan of Third Floor. Half Plan of First Floor.

perature of 32 degrees and a corner room where there are two exposed sides. The exposed wall surface is 857 square feet and the glass surface 100 square feet. Allowing 46 British thermal units as the probable amount of heat transmitted per hour through 1 square foot of glass surface and 11 units for the wall surface (the temperature range being 38 degrees) the total loss in one hour will be 13,920 units. Increasing this quantity by 25 per cent. to allow for winds and air leakage, 17,400 heat units will be the amount of heat that must be furnished by the air blast before its temperature drops to 70 degrees. For a fall of one degree 55 cubic feet of air will emit one heat unit, therefore the 78,000 cubic feet delivered per hour to the room will drop 15 degrees in temperature in order to supply the loss through the walls. Hence, it must be received initially at about 85 degrees.

It may be interesting to investigate the performance of the combined apparatus when the outside temperature is zero and that within, 70 degrees. The heat now lost through the walls of the same corner room will be about 32,000 British thermal units per hour. Assume that horizontal wrought iron pipe coils should send out 300 heat units per square foot per hour, or for the total of 126 square feet 37,800 units. This is more than enough to counteract the heat lost through the walls, there being a surplus of 5,800 units available for heating the 78,000 cubic feet of air forced in by the hot blast in an hour, and capable of raising its temperature about 4.1 degrees, so that it might now be admitted as low as 66 degrees, which is practically the temperature of the tempered air. This indicates that in the most severe weather ample provisions have been made to ensure the maintenance of the required 70 degrees, without the necessity of reducing the amount of ventilation. In the event of a disabling of the fan system the direct radiation is capable of warming the rooms satisfactorily when the air is changed but two or three times per hour instead of five times as it is by the fan system.

The building contains two tiers of four toilets each, located at the two inner corners of the court. Each toilet receives heated air through an individual flue from the basement, at the bottom of which is placed an indirect stack with 60 square feet of surface. The fresh air for the stacks of the two tiers is taken through two 1½x2½-foot screened inlets, set in nearby windows of the basement. Back draft in the two fresh air ducts is prevented by oiled silk flaps supported against screens covering the full cross-section and serving as check valves. The temperature of 60 degrees specified for the toilets is obtained by an automatic mixing of the cold and heated air governed by a thermostat in each toilet. The mixture is admitted through a wall register near the ceiling and the wall vent register is near the floor. Flues from each toilet carry the foul air down to the basement where it enters a 12x48-inch shaft with an aspirating coil of 40 square feet at its base, whence it is discharged through flues by one of the towers so that none escapes into the attic to mingle with the air from other parts of the building.

The foul air from the lockers is disposed of in a similar manner, being kept separate from all other exhausts. The lockers are ventilated by passing air through them into underground ducts conveying the air to the base of a vent shaft containing an aspirating coil of 80 square feet. The vent tunnels are spread out under the floor so as to ensure a thorough removal of the vitiated air. At the largest part the tunnels are 4 feet 6 inches wide and 5 feet deep. The large amount of air required for this purpose is supplied by waste air from the attic, which is arranged to pass down through the staircase at front end of corridors in north and south wings and to enter locker rooms through perforated risers in basement stairs.

(To be continued.)

New Books Received.

Under this heading books received from publishers will be punctually announced. Reviews may be published in subsequent issues. Publishers are requested to send retail price with each book.

Lime and Cement Industries of New York. By Heinrich Reis, Ph. D. Chapters on the Cement Industries in New York. By Edwin C. Eckel, C. E. Bulletin of the New York State Museum, No. 44, Vol. 8. Albany: University of the State of New York. 968 pages, illustrated.

Statics by Algebraic and Graphic Methods. By Lewis J. Johnson, C. E., Assoc. M. Am. Soc. C. E., Assistant Professor of Civil Engineering in Harvard University. New York: John Wiley & Sons. 141 pages, illustrated. Price $2.

Book Notes.

An Elementary Treatise on the Mechanics of Machinery, with Special Reference to the Mechanics of the Steam-Engine, by Joseph N. LeConte, Instructor in Mechanical Engineering at the University of California. New York: The Macmillan Co. 303 pages, 212 diagrams and 15 plates.

A scholarly work. It comprises an introduction to the general principles of kinematics, six chapters upon the transmission of motion and two upon the mechanics of the steam-engine. The treatment of the questions of transmission-gearing, which includes couplings, friction-gearing, belts, toothed wheels, straight-line motions and cams, is aimed much more at problems of a kinematic than at those of a dynamic character. Of the chapters devoted to the steam engine the first is allotted to the kinematics of the crank and connecting-rod and to valve-gearing; the second covers the dynamics of fluid-forces from within the cylinder, the dynamics of the reciprocating parts and of governors. The methods of analysis are apparently accurate, there is a generous number of diagrams and the entire presentation gives one the impression of having been thoroughly carried out, with no sparing of pains. This is offset by two general characteristics which seem to be great drawbacks. The first of these is that the treatment is almost entirely analytical. The great progress made in graphical methods in recent years and their wide adoption by the engineering profession seems to have been entirely ignored. Analytical methods are cumbrous at best. Here they are carried to the extreme. Even this, however, would be excusable if the graphical methods were also given, or if the short approximations of the analytical methods which are regularly relied upon in engineering work were appended; but they are not. In some problems of pure kinematics, or in the dynamics of governors, perhaps there is no better method than the analytical; but to attempt to cover the question of toothed gearing or that of steam-engine valve-gearing by analytical methods alone, with no word as to the shop-production of "developed" teeth with a single cutter or of the design of valve-gearing by cut-and-try diagrams or by template methods, certainly seems incomplete. Even in the discussion of the dynamics of reciprocating parts, which must be handled almost wholly by analytical methods, to close the subject with formulae so complicated, albeit exact, that no drafting-room would think of taking time to employ them, is hardly a modern way to teach engineering. The second characteristic is the monopoly of the book's space by mathematical analyses as if they were the chief end in view, instead of their relegation to their proper place as mere means to an end, the understanding of the subject. In other words, there is an almost complete absence of statement of problems, of general discussion of methods of solution and of conclusions to be drawn from the mathematical results of the calculations. As a reference-book for the experienced engineer who knows what he is about but who has forgotten the details of his mathematics, this plan makes the book an excellent one; but for the teaching of the inexperienced mind how to think through a strange problem it is not well suited. The execution of the press-work is excellent. The diagrams and plates are clear, the paper heavy, the binding attractive.

Steam Power Plants. Their Design and Construction. By Henry C. Meyer, Jr., M. E. New York: McGraw Publishing Co. 150 pages, illustrated. Price, $2.

This is a highly valuable treatise. It is not only a good example of what a book with the title "Steam Power Plants" and the date "1903" ought to be, but it is, curiously enough, in view of the vast general importance of the subject, almost the only book of its kind to be obtained. The only other book of like character is one by Birkmire, which deals with the power plant and machinery of high office buildings. Into that field this book does not enter. It is primarily intended to afford as much definite knowledge as a book alone can convey to those mill superintendents who, without previous experience in such matters, are confronted with the problem of buying and erecting a new steam power plant; but it is safe to say that as a compendium of the art it has at least an equal value to the expert consulting engineer.

The defect of many books on engineering affairs, in consequence of which they generally give disappointment to those who are seeking information of immediate practical use, is that, though overlaid with a display of much scientific and mathematical learning, they nevertheless are not written by men who have qualified themselves for the task by a right experience in addition to their scientific training. For example, a man who would neither know nor care whether the single or the double wrist-plate Corliss engine is to be preferred, or whether a coal conveyor will or will not save its cost within a reasonable time, can yet write glibly enough about adiabatic expansion and theta-phi diagrams. Information of a practical nature seldom gets into his books until it is of such long standing that everybody already knows all about it, and, very likely, the most advanced engineers have discarded it in favor of something better. The instruction given in the book is not only sound, practical and concisely stated, but fully abreast of the present state of the art. It covers the selection of the building site, the types and general details of such buildings and their foundations; the chimney, the piping, and the selection, purchasing and general arrangement of the boilers, engines and auxiliary machinery.

The illustrations are numerous and unusually satisfactory. Special attention may be called to the admirable plates of existing electric power stations, finely executed on bond paper. The text is without "padding;" debatable questions are presented with fairness to both sides.

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers.. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Personal Notes.

Mr. William Gavin Taylor has been reappointed city engineer of Medford, Mass.

Mr. E. T. E. Lansing has been reappointed city engineer of Little Falls, N. Y., for two years.

Mr. John H. McConnell has been re-elected superintendent of the water-works of Minneapolis.

Mr. J. H. Martin has been elected superintendent of the East Riverside Water Co., of Riverside, Cal.

Mr. John W. Maxcy, of Houston, Tex., has been appointed superintendent of roads for Harris county, Tex.

Mr. G. Everett Hill delivered a lecture February 18 before the Franklin Institute on the bacterial disposal of sewage.

Mr. C. A. Gavin, chief engineer of the St. Louis, Memphis & Southeastern Railroad, has moved his office to Cape Girardeau, Mo.

Mr. D. C. Washburn, of Minneapolis, has been appointed city engineer of Aberdeen, S. D., succeeding Mr. E. W. Van Meter, who has resigned.

Messrs. F. C. Tucker, E. L. Woolley, E. J. Robinson and George S. Hopkins have formed the Black Hills Engineering Co. at Deadwood, S. D.

Messrs. Alexander C. Bruce, Thomas H. Morgan and John Robert Dillon have petitioned for incorporation as Bruce, Morgan & Dillon, Inc., Atlanta, Ga., to practice architecture.

Mr. J. D. Hurley and Mr. A. B. Holmes, formerly connected with the Standard Pneumatic Tool Co., are now associated with the Rand Drill Co., in the Imperial Pneumatic Tool Department.

Messrs. D. H. Burnham, John M. Carrere and Arnold W. Brunner met last week in Cleveland, O., as a board of supervising architects in connection with the public buildings grouping project in that city.

Prof. John H. Barr has resigned as professor of machine design in Sibley College, Cornell University, to become general manager of the Smith Premier Typewriter Company, of Syracuse.

Mr. W. D. Barkhuff has been elected city engineer of Everett, Wash. It was incorrectly stated in this column a few weeks ago that a Mr. Ezra Barkhuff had succeeded Mr. Norton L. Taylor, the present city engineer of Tacoma.

Mr. Henry Hartwell, Assoc. M. Am. Soc. C. E., formerly chief engineer of construction of the Sao Paulo Tramway, Light & Power Co., Sao Paulo, Brazil, has joined the London office of J. G. White & Co., Ltd., as assistant superintendent of construction.

Mr. Merrill Van G. Smith has been appointed associate professor of mechanical engineering in the Clarkson School of Technology at Potsdam, N. Y. He was graduated from Stevens Institute of Technology in 1896 and recently was acting professor of mechanical and electrical engineering at the Delaware College, Newark, Del.

The Massachusetts Highway Association at a recent meeting in Boston, elected the following officers: President, George W. Stiles, of Malden; vice-president, Charles F. Knowlton, of Quincy; secretary, Austin B. Fletcher, of West Medford; treasurer, William L. Dickinson, of Springfield; directors, Richard A. Jones, of Waltham, and George F. Stuart, of Newton.

The American Institute of Mining Engineers elected the following officers at its meeting in Albany last week: President, A. R. Ledoux, of New York; vice-presidents, John Markle, of Jeddo, Pa.; Philip W. Moen, of Worcester, Mass., and James F. Kemp, of New York; treasurer, Theo. D. Rand; secretary, Rossiter W. Raymond, of New York.

Mr. Beverly R. Value, M. Am. Soc. C. E., has resigned as engineer of the third division of the Rapid Transit Railroad Commission, of New York, to become resident engineer for the Toronto and Niagara Power Company, which is to develop a 125,000 horse-power plant on the Canadian side of the Niagara River. Mr. Julian Thornley, Assoc. M. Am. Soc. C. E., assistant engineer of the commission, has accepted the position of assistant engineer with Mr. Value, and Mr. C. V. V. Powers has been appointed to succeed him as division engineer.

Obituary Notes.

E. T. Ivins, who has been in the employ of the Thomson Meter Company, Brooklyn, N. Y., for over ten years, died suddenly at Trenton, N. J., on February 17.

Piles and Foundations.

Papers and Discussions at the Meeting of the Boston Society of Civil Engineers, February 18.

Mr. Robert B. Davis described a 5,000-ton 44x300-foot coal pocket at the Lincoln Wharf of the Boston Elevated Railway Company, equipped with two moving towers and machinery, handling coal at a cost of 3 to 5 cents per ton. The wharf is 66 feet wide and extends 300 feet from the shore line. The dock was dredged to a depth of 22 feet and borings showed good clay to 40 feet. The outer piles were driven on a slope of 1 in 20 and cut off 1 foot below the tops of the plumb piles. The flooring is 3-inch plank and the load on the floor under the pocket averages 200 pounds per square foot. Mr. C. T. Fernald described a sea-wall built in Cambridge about 1866 which failed in 1901 under a load of 12,000 tons of coal, pushing into the river 12 feet and downward 6 feet. The wall was 8 feet wide at base, 2 feet at top and 13 feet high and built on piles. The excessive loading on the wharf immediately back of the wall compressed the mud towards the river, the wharf piles not having been driven into the clay to a sufficient depth. Mr. E. W. Howe mentioned a novel method of driving inclined piles in foundations for the Atlantic Avenue bridge by the aid of a steel case 13 inches square and 39 feet long placed at the desired inclination. With this apparatus 95 piles were driven in 10 hours. Mr. R. A. Hale mentioned a chimney 225 feet in height imposing a load of 2,250 tons on an area of 1,225 square feet, the foundation being sharp river sand 19 feet below the surface of the ground, into which piles had been driven to a depth of 5 feet; allowing for wind the extreme pressure is 2.4 tons per square foot and no settlement has occurred. Mr. George B. Francis said that he believed that too much information could not be obtained about important foundations and recommended thorough examination by borings and testing pits. In harder material he believed that concrete should be used around the tops of piles, but that in soft earth timber grillages were better.

A Great Blast was recently set off at the entrance to the Cache la Poudre Canyon, near Greeley, Col. According to the local reports three carloads or 640 kegs of black powder were fired at once, throwing down a large mass of rock to make way for an irrigation ditch to have a capacity of about 800 cubic feet per second.

A Yard Hydrant especially designed to meet the requirements of service in railroad yards, for stables, stock yards, street washing, etc., is now being made by the Chapman Valve Manufacturing Company. It is made of extra strong design in all working parts, and with an antomatic drip valve at the bottom of the post. This drip valve is operated by means of a bronze rod extending to the top of the hydrant where the operating screw and hand wheel is located. The valves are also made to open by a lever and be self-closing.

The Osaka Military Arsenal, Japan, has been provided with an electric power plant for operating the electric cranes and cupola blowers in a new foundry. The foundry is built of red brick, with a corrugated iron roof, and is 283x 109.5 feet in size. It is equipped with four 10-ton, one 25-ton and one 20-ton Morgan cranes, also four 4-ton and six 7-ton cupolas, two being made by the Whiting Foundry Equipment Company and the others in the Arsenal itself. Four Root blowers, each driven by a Westinghouse 40-horse-power induction motor, supply the cupola blast. In the boiler room are two Sulzer Freres Cornish shell boilers, center fired, each having heating surface of 667 square feet and a grate surface of 19.4 square feet. Each boiler is complete with its own heater, consisting of two plain cylinders each of 23.6 inches diameter and of the same length as the boilers. These heaters are mounted over the boiler shells and suspended from the angle irons supporting the brick work. One Worthington duplex pump and one restarting injector are provided for supplying feed water to the boilers. There are two Sulzer-Freres vertical, tandem-compound, single, balanced-crank engines with high-pressure cylinders, 12.8 inches in diameter, low-pressure cylinders 18.7 inches in diameter and stroke 11.8 inches, operating under a steam pressure of 8 atmospheres at 257 revolutions per minute. The low-pressure cylinders have a fixed cut-off and the high-pressure cylinders a variable cut-off. Direct-coupled to each engine is a Westinghouse, 100-kilowatt, 220-volt, 3-phase, 30-cycle, composite-wound generator of the revolving armature type. There are two 11¼-kilowatt, 125-volt, multipolar exciters, driven by belt from the main engines, each exciter having sufficient capacity for two generators. The power house and foundry were designed under the supervision of Mr. Gompei Kuwada, the mechanical engineer of the Arsenal. The apparatus was supplied by Messrs. Takata & Co., of Japan.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 21, 22, 24 and 26.

WATER.

Rosedale, Cal.—The Rosedale Water Co. has been incorporated, with a capital of $5,000, to furnish water to the Rosedale Terrace. Directors: Fred H. Hyer, of Highgrove; J. F. Schofield and T. E. Moon, of Colton.

San Pedro, Cal.—A press report states that the Seaside Water Co. has under consideration the enlargement of its distributing system. J. B. Lippincott, Ch. Engr.

Colorado Springs, Colo.—Local press reports state that the Council on Feb. 13 passed an ordinance providing for an issue of water bonds to be used as follows: $15,000 for construction and extension in the city proper, $116,200 for the construction of reservoir No. 4 B and $25,000 for the construction of reservoir No. 5, both in the Seven Lakes Dist.; $62,000 for the construction of the St. John tunnel, in the same district, and $205,000 for the new 24-16 inch pipe line which will connect the Seven Lakes system with the new High Line reservoir.

La Veta, Colo.—The question of constructing water works is reported under consideration by the Town Bd.

Shelton, Conn.—A press report states that 3 reservoirs at Shelton burst on Feb. 22. They will have to be rebuilt.

Washington, D. C.—Bids for filter materials and work for Aqueduct filtration plant were opened Feb. 20 by Lt. Col. A. M. Miller, Corps Engrs., as follows: A, excavation; B, embankment under filters; C, other embankment; D, filling over filters; E, puddle; F, seeding; G, sodding; H, concrete in floors; I, concrete in walls; K, concrete in piers; L, concrete in vaulting; M, granolithic pavt.; N, placing materials in 29 filters; O, drainage of roofs for 29 filters. In addition to bids tabulated, Harmer & Quinn bid also for the steel cast-iron and wrought-iron pipe, exterior drainage system, vitrified pipe, filter gravel and filter sand, making a total for all the work, $1,987,183; D. J. McNichol similarly bid for all the work, total, $2,130,710. For cast-iron pipe, the Camden, N. J., Iron Wks. bid $43,400, and the U. S. Cast Iron Pipe & Fdy. Co., Phila., $49,781, including haul; for vitrified pipe, B. Wallis & Co., Balto., bid $32,000; Thos. J. Somerville & Sons, Washington, $23,266; Potomac Terra Cotta Co., Washington, $24,747; for 42,300 cu. yds. filter gravel, R. M. Evans, Phila., $3.37 per cu. yd.; Edward G. Gummel, Washington, $2.98; Chas. G. Smith & Sons, Washington, $3.47; L. E. Smoot, Washington, $2.75; for 140,200 cu. yds. filter sand, R. M. Evans, $3.87; L. E. Smoot, $2.25.

	Talty & Allen, Washington.	Harmer & Quinn, Philadelphia.	Brennan Constr. Co., Washington.	D. J. McNichol, Philadelphia.
A, 880,000 cu. yds.	$0.35	$0.47	...	$0.38
B, 65,400 cu. yds.	.40	.37	...	.48
C, 46,700 cu. yds.	.35	.37	...	.43
D, 123,400 cu. yds.	.40	.37	...	.48
E, 2,000 cu. yds.	4.50	2.37	...	6.20
F, 31 acres	100.00	73.00	...	110.00
G, 9,700 sq. yds.	.40	.37	...	.39
H, 39,300 cu. yds.	...	4.37	5.24	6.96
I, 26,300 cu. yds.	...	6.37	5.60	7.56
K, 8,200 cu. yds.	...	8.37	6.60	9.26
L, 37,400 cu. yds.	...	6.87	7.97	8.16
M, 35,000 sq. yds.	...	1.37	.89	.90
N, per filter	...	57.00	250.00	60.00
O, per filter	...	573.00	450.00	597.00
Totals	$415,845	...	$756,860	...

Joliet, Ill.—Contracts are about to be let for a water main on Jasper St., at a cost of about $6,600.

Abingdon, Ill.—The Secy. Bd. Local Improv. writes that it is proposed to lay about 5 miles of water mains. Bids for the pipe, hydrants and specials will be received Mar. 3.

Shawneetown, Ill.—The citizens are reported to have voted on Feb. 10 to construct water works.

Sterling, Ill.—J. Decker, Secy. Sterling Water Co., writes that about $4,000 will be expended for extensions. The company will buy the pipe direct.

Alton, Ill.—The New England Water Co. will extend its water mains about 4,000 ft. and set 15 fire hydrants.

Dedham, Ia.—Banker Caton is stated to have secured a franchise for water works.

Boone, Ia.—Bids will be received Mar. 13 by Jesse L. Hull, City Clk., for furnishing material for constructing extensions to water mains on portions of 3 streets. Approximate quantities: 2,550 ft. of 6-in. cast iron water pipe, 33 lbs. per lin. ft., 7 double nozzle Eddy or Ludlow hydrants, etc.

St. Francisville, La.—The following bids for a system of water works were received by Bd. of Mayor and Aldermen Feb. 18: P. H. Porter, Clinton, Ky., $18,013 (awarded contract); M. T. Lewman, Louisville, Ky., $23,300; Thos. Wagner, Mobile, Ala., $24,600. C. H. Jenks, Engr., Fayette, Miss.

Donaldsville, La.—J. F. Fernandez, City Secy., writes that it is proposed to extend and enlarge the water works.

Salem, Mass.—An appropriation of $20,000 has been made for cast iron pipe to replace cement pipe. Frank F. Newell, Chmn. Com. on Water Wks

Brockton, Mass.—Chas. R. Felton, City Engr., writes that the following bids have been received for cast iron pipe and specials: *a*, 3,000 tons 24-in.; *b*, 200 tons 6 and 8-in.; *c*, 10 tons specials, price given per net ton: M. J. Drummond, *a*, $31; *b*, $32; *c*, $57.50. U. S. Cast Iron Pipe & Fdy. Co., *a*, $30.70; *b*, $32.30; *c*, $57.50. R. D. Wood & Co., *a*, $30.30; *b*, $31.96; *c*, $55. Warren C. I. Pipe & Fdy. Co. (awarded contract), *a*, $28.90; *b*, $28.90; *c*, $55.

Rockport, Mass.—Water bonds amounting to $15,000 are reported sold.

Brownfield, Me.—A public hearing will be held at State House, Augusta, Me., Feb. 25, on an act to incorporate the Brownfield & Williamsburg Water Co.

Worcester, Mass.—John G. Brady, Water Comr., writes that it is proposed to rebuild the Mamville dam on Kettle Brook, at an estimated cost of $120,000. City Engineer F. A. McClure is in charge. No bids for the work will be asked, as it will be done by the city by the day.

Boston, Mass.—Bids will be received Mar. 7 by the Water Comr. for furnishing 2,900 tons cast iron water pipes.

Standish, Mich.—See "Power Plants, Gas and Electricity."

Currie, Minn.—Bids will be received Mar. 7 by the Village Council for $5,000 water works bonds. C. H. Cooper, Village Recorder.

Callaway, Neb.—The Business Men are stated to have appointed Geo. O. Benger and R. E. Brega as a committee to figure on the probable cost of putting in water works.

Mt. Airy, N. C.—Bids are wanted Mar. 3 for $50,000 water and light bonds. Jas. C. Hollingsworth, Secy.

Oxford, N. C.—See "Power Plants, Gas and Electricity."

Fargo, N. D.—It is reported that the City Auditor is taking bids for a 5,000,000-gal. pumping engine.

Williston, N. D.—See "Power Plants, Gas and Electricity."

Walpole, N. H.—The N. H. Legislature has passed a bill to incorporate the Walpole Water & Sewer Co. for the purpose of furnishing Walpole with a water supply and a sewage system. Capital, $50,000. Copley Amory, Walpole, N. H., is reported interested.

Hudson, N. H.—See "Power Plants, Gas and Electricity."

Jersey City, N. J.—Water Purveyor Chas. Kavanagh recommended to Common Council that a water main be laid in Meadow St., and City Surv. Emmet Smith was directed to prepare the necessary plans and specifications.

New York, N. Y.—Among the appropriations authorized by the Bd. of Estimate and Apportionment are: $1,270,000 for water supply, $50,000 for pumping water, Westchester Water Supply Co.; $250,000 for improvement of parks, $1,000,000 for Dept. of Docks & Ferries and $90,000 for stock and plant St. Cleaning Dept., Boro. of Richmond.

Bids will be received Mar. 5 by Edw. M. Grout, City Compt., for $2,500,000 bonds to be used as follows: New aqueduct, $1,000,000; new East River bridge, $500,000; for an additional water supply, $250,000; for interior public baths, $250,000; Department of Correction, $150,000; improvement of parks, etc., $150,000; Zoological Society improvements in Bronx Park, $50,000; Botanical Museum and Herbarium, $50,000.

Niagara Falls, N. Y.—The Western New York Water Co. is reported to have absorbed the Niagara Falls Water Works Co., and will probably supply all Niagara Falls with water in the future.

Jersey City, N. J.—The following bids were received Feb. 16 by E. W. Harrison, Chief Engineer of the Jersey City Water Supply Co., for constructing a masonry conduit—prices for lining and masonry not including Portland cement, which is to be furnished contractor. Four totals are given in each case, alternate bids being allowed; the first covers all items, but the reinforced lining of the conduit and the remaining three covers all items including lining reinforcement, being, respectively, a bid for expanded metal conduit lining, for the Ransome system of conduit lining and for electrically welded fabric reinforcement, the unit prices for these alternate bids also being given in the tables in this order:

Section 1.	Joseph S. Qualey Co., New York.	Eastern Constn. Co., New York.	N. Y. Cont. Jewell Filtr. Co., New York.
Trenches, 2,980 lin. ft.	$3.50	$3.20	$1.00
Drifts, 1,670 lin. ft.	5.50	3.50	5.00
Earth excavation, 1,400 cu. yds.	0.60	0.75	0.75
Rock excavation, 200 cu. yds.	2.00	3.00	2.50
Embankment, 3,440 lin. ft.	0.85	3.00	2.00
Conduit lining, 2,200 lin. ft.	8.50	7.50	9.50
Conduit lining, 700 lin. ft.	10.00	9.00	10.00
Conduit lining, 1,400 lin. ft.	9.50	9.25	12.00
Conduit lining, 120 lin. ft.	9.00	10.00	18.00
Conduit lining, 150 lin. ft.	9.00	11.00	19.00
Reinforced lining, 80,000 sq. ft.	0.10	0.06	0.07
Reinforced lining, 80,000 sq. ft.	0.10	0.05	0.06
Reinforced lining, 80,000 sq. ft.	0.10	0.05¼	0.06½
Overflow pipe, 720 lin. ft.	5.00	2.75	2.50
Concrete, 50 cu. yds.	3.50	7.50	8.00
Gate chamber	2,600.00	2,200.00	2,000.00
Dry rubble paving, 50 cu. yds.	1.50	2.50	2.00
Totals	$71,695.00	$70,631.00	$73,770.00
"	79,659.00	75,431.00	79,370.00
"	79,659.00	74,631.00	78,570.00
"	79,659.00	74,831.00	78,970.00

Section 2.	Harold Bouton, Boonton, N. J.	Eastern Constn. Co., New York.	N. Y. Cont. Jewell Filtr. Co., New York.
Excavation, 2,760 lin. ft.	$4 00	$2.00	$1.50
Earth excavation, 50 cu. yds.	1.00	0.75	0.75
Rock excavation, 5 cu. yds.	5.00	3.00	3.00
Embankment, 2,760 lin. ft.	0.97	3.00	2.00
Conduit lining, 2,500 lin. ft.	8.23	7.50	10.00
Conduit lining, 90 lin. ft.	9.87	8.50	14.00
Reinforced lining, 50,000 sq. ft.	0.08	0.06	0.07½
Reinforced lining, 50,000 sq. ft.	0.08	0.05	0.06½
Reinforced lining, 50,000 sq. ft.	0.08	0.05¼	0.07
Concrete, 50 cu. yds.	4.00	7.00	9.00
Gate chamber	2,250.00	2,600.00	2,250.00
Gate chamber	2,250.00	2,600.00	2,500.00
Dry rubble paving, 50 cu. yds.	4.00	1.80	2.00
Totals	$40,155.00	$39,007.00	$41,272.00
"	44,155.00	42,007.00	45,022.00
"	44,155.00	41,507.00	44,522.00
"	44,155.00	41,632.00	44,772.00

Section 3.	The Metropolitan Constn. Co., Jersey City.	Eastern Constn. Co., New York.	N. Y. Cont. Jewell Filtr. Co., New York.
Earth excavation, 40,000 cu. yds.	$0.75	$0.75	$0.75
Rock excavation, 7,000 cu. yds.	2.50	3.00	3.00
Conduit lining, 9,600 lin. ft.	9.26	6.50	9.50
Conduit lining, 100 lin. ft.	10.30	7.50	12.00
Conduit lining, 50 lin. ft.	9.71	9.50	15.00
Reinforced lining, 270,000 sq. ft.	0.06	0.05½	0.07
Reinforced lining, 270,000 sq. ft.	0.06	0.04½	0.06
Fabric reinforced lining, 270,000 sq. ft.	0.06	0.04¾	0.06½
Concrete, 350 cu. yds.	9.00	6.75	8.00
Gate chamber	2,200.00	3,400.00	2,750.00
Gate chamber	2,800.00	2,200.00	2,000.00
Dry rubble paving, 250 cu. yds.	3.00	1.80	2.00
Totals	$146,811.00	$123,037.00	$152,200.00
"	163,011.00	137,887.00	171,100.00
"	163,011.00	135,187.00	168,400.00
"	163,011.00	135,862.00	169,750.00

Section. 4.	Hudson Co. Tunneling Co., Jersey City.	Eastern Constn. Co., New York.	N. Y. Cont. Jewell Filtr. Co., New York.	United Eng. & Contg. Co., New York.
Earth excavation, 14,000 cu. yds.	$0.65	$0.75	$0.75	$2.15
Rock excavation, 1,000 cu. yds.	1.75	3.00	3.00	3.50
Conduit lining, 3,250 lin. ft.	8.26	7.00	9.50	7.60
Conduit lining, 150 lin. ft.	9.30	8.00	12.00	9.00
Conduit lining, 200 lin. ft.	8.71	10.00	14.00	8.40
Reinforced lining, 100,000 sq. ft.	0.06	0.05½	0.07	0.04
Reinforced lining, 100,000 sq. ft.	0.06	0.04½	0.06	0.036
Reinforced lining, 100,000 sq. ft.	0.06	0.04¾	0.06½	0.05
Concrete, 100 cu. yds.	9.00	7.25	8.00	5.20
Gate Chamber	2,000.00	2,200.00	2,250.00	1,500.00
Gate Chamber	2,000.00	2,200.00	2,000.00	1,500.00
Crossing at Third River	3,500.00	3,000.00	3,000.00	2,150.00
Dry rubble paving, 100 cu. yds.	3.00	2.65	2.00	3.50
Totals	$49,532.00	$47,840.00	$57,225.00	$67,350.00
"	55,532.00	53,340.00	64,225.00	71,350.00
"	55,532.00	52,340.00	63,225.00	70,950.00
"	55,532.00	52,590.00	63,725.00	72,350.00

Ithaca, N. Y.—The City Council is stated to have accepted the offer of Cornell Univ. to build a filtering plant to filter the water supplied the city and university. The proposition involves the expending of $150,000, which the university will furnish.

Buffalo, N. Y.—Bids will be received Mar. 7 by F. W. M. Heerwagen, City Compt., for $75,000 water and $150,000 school bonds.

Akron, O.—The stock of the old Howard Street Water Co. is stated to have been purchased by a company headed by W. F. Laubach. The new company has secured permission to lay pipes in the city and will furnish Akron with spring water.

Findlay, O.—John W. Riegle, City Engr., writes that all bids received Feb. 12 have been rejected by the Bd. of Water Works Trus. Bids are now asked until Mar. 10 for furnishing 52,300 ft. 24-in. vitrified pipe and 500 ft. 24-in. iron pipe; also 9,000 ft. 8-in. iron pipe.

Youngstown, O.—Bids will be received Mar. 2 by the Water Wks. Bd. for furnishing approximately 600 tons 4 to 12 in. cast iron water pipe and 15 tons special castings. D. N. Simpkins, Secy.

Cleveland, O.—Bids are wanted Mar. 12 for furnishing and delivering f. o. b. cars approximately 75 4-in. and 150 6-in. fire hydrants required during the year 1903 by the Water Wks. Division of the Dept. of Pub. Wks. Chas. P. Salen, Dir. Pub. Wks.

Bids are wanted Mar. 13 for furnishing and delivering at the water works office, all multiple connections, stop cocks, corporation cocks, air cocks, valves; also for furnishing and delivering at the office of the water works division, 354 Superior St., cast iron stop cock boxes required during the year 1903 by the Water Wks. Division, Dept. Pub. Wks. Chas. P. Salen, Dir. Pub. Wks.

Lima, O.—A press report states that this city will expend the coming summer $150,000 to improve its water works system.

Cincinnati, O.—The following bids were opened Feb. 17 for buildings for the Western Pumping Station: *a*, with engine house of limestone; *b*, of sandstone; *c*, Ransome concrete system; *d*, Hennibique system: W. H. Ellis & Co., Cincinnati, *a*, $435,033; *b*, $451,733; *c*, $418,033. F. H. Kirchner & Co., Cincinnati, *a*, $458,656; *d*, $413,656; alternate, Hennibique system, $350,000. U. S. Constn. Co., Milwaukee, *a*, $379,635. Western Constn. Co., Lafayette, Ind., *a* or *b*, $440,857.

South Bethlehem, Pa.—The stockholders of the Consolidated Water Co. are stated to have decided to complete the new filter in the Lehigh River; they are also reported to be considering the question of increasing the pumping capacity.

Coatesville, Pa.—The citizens are stated to have voted Feb. 18 to issue $40,000 bonds for improvements to the water works and sewerage systems.

Indiana, Pa.—The Yellow Creek Water Co. has been incorporated, with a capital of $5,000, by E. E. Davidson and H. M. Bell, of Indiana.

Stroudsburg, Pa.—See "Power Plants, Gas and Electricity."

Dubois, Pa.—The citizens are reported to have voted to increase the borough debt for the purpose of completing the new water system to Anderson Creek.

Meadville, Pa.—It was voted Feb. 17 to issue $35,000 bonds for a new water supply, pumps, boilers, etc. A. C. Purdee, City Clk.

Tipton, Pa.—The Tipton Water Co. has been incorporated, with a capital of $5,000, to be directed by Edw. Hutchinson, B. Maurice Gaskill and Bertram L. Townsend, of Philadelphia, Pa., to supply water in Antis Township, Blair County.

Pittsburg, Pa.—The Council is reported to have passed an ordinance providing for an appropriation of $315,000 for an extension of the water system in the downtown district.

Philadelphia, Pa.—D. J. McNichol has been awarded the recent filtration plant contract, which according to reports amounted to $350,000 for sand for the Belmont filter, $1,040,000 for sand for Torresdale filters, $50,000 for work on Roxborough filters, and $1,000,000 for water mains; total, $2,440,000.

Eagan, S. D.—Press reports state that bids are wanted Mar. 18 for $5,000 water works bonds.

Sioux Falls, S. D.—It is stated that the South Dakota Water Co. will construct a standpipe 20 ft. in diameter and 115 ft. high.

Marshall, Tex.—A press report states that at a meeting of the Council Feb. 11 Water Works Engr. Myers reported to the Council that repairs on the pumping station would cost the city about $12,500. The Mayor was authorized to purchase 25 meters for the water works.

El Paso, Tex.—A charter has been granted to the International Water Co., of El Paso, to establish water works in the United States and Mexico; capital, $1,000,000. Incorporators: W. J. Davis and Gordon McLean, of Los Angeles, Cal.; Walter Douglas, of Bisbee, Ariz., and Felix Martinez, of El Paso.

Houston, Tex.—The Dayton Canal & Irrigation Co., of Houston, has been incorporated, with a capital of $500,000, to build canals for irrigation and milling and stock raising. Incorporators: Geo. L. Glass and Frank A. Reichardt, of Houston; C. H. T. Shaw, Dixon, Ill., and others.

Mt. Pleasant, Tex.—The Bd. of Aldermen is stated to have adopted plans for water works.

Spanish Fork, Utah.—The question of constructing water works is reported under consideration.

Fair Haven, Vt.—Local press reports state that bids will be received Mar. 10 by the Village Trus. for $50,000 water and sewer bonds.

Pomeroy, Wash.—The citizens are stated to have voted on Feb. 11 to issue $19,000 bonds for the construction of water works.

Tacoma, Wash.—City Engr. Taylor is reported to have completed plans for an all gravity system for supplying the flats beyond the city waterway with water; it will cost about $8,000.

Elma, Wash.—The question of constructing water works is reported under consideration.

No. Milwaukee, Wis.—The following awards have been made: The U. S. Cast Iron Pipe & Fdy. Co., Chicago, $31.40 per ton for 494.5 tons of cast iron pipe, 4, 6 and 8-in. in dia., according to bids opened Feb. 6; R. D. Wood & Co., $31.50 and $28.70 per hydrant for 5 4-in. and 21 5-in. hydrants, respectively; National Meter Co., $1,267 for two 6-in. meters.

Centennial, Wyo.—The Centennial Water Works Co. has been incorporated, with a capital of $250,000, to construct water works at Centennial. Incorporators: Fred A. Miller, J. B. McKee, and others.

Toronto, Ont.—Bids will be received by Willis Chapman, C. E., 103 Bay St., Toronto, on Apr. 1, for constructing 3 steel water tanks for municipal water works purposes—one at Bridgewater, Ont.; another at Edmonton, Alberta, N. W. T., and the third at Strathroy, as advertised in The Engineering Record.

SEWERAGE AND SEWAGE DISPOSAL.

Demopolis, Ala.—L. Kaufman, City Clk., writes that it is proposed to construct a sewerage system, at a cost of about $25,000. Work will probably not begin before August.

San Francisco, Cal.—It is proposed to reconstruct the Baker St. sewer between Union and Lewis Sts.: length of sewer is about 4,100 ft., and the cost will be about $50,000.

San Francisco, Cal.—See "Paving and Roadmaking."

Colorado Springs, Colo.—A proposition for the disposal of the city's sewage has been presented to City Council by J. W. Coffey, who proposes building vats and reservoirs for the sewage in return for the use of the water for irrigation purposes.

Augusta, Ga.—L. H. Hankinson & Son, of Augusta, has secured the contract for constructing 2,500 lin. ft. of brick sewer, single ring, egg shape, 36x54-in., average cut 6 ft., at $1.78 per lin. ft. complete.

Belleville, Ill.—It is reported that the City Engineer estimates the cost of sewers on W. Main St. at $18,480.

Kokomo, Ind.—W. F. Mann, City Engr., writes that bids will be received on Mar. 9 for the construction of 2,500 ft. of 12-in. vitrified sewer and 2,400 ft. of 24-in. double strength tile sewer.

Terre Haute, Ind.—The City Engineer has been instructed to prepare plans and specifications for a pipe sewer in 19th and Elm Sts.

Burlington, Ia.—Cameron, McManus & Joyce, Keokuk, Ia., were lowest bidders for North Oak St. sewer, to be constructed under direction of Emmet Steece, City Engr. The bid, received Feb. 16, offers to do the 6,800 ft. of sewer for $1.93 per ft., ¾-in. water pipe connections for 28 cts. per ft., and extra catch-basins, manholes, lamp holes and flush tanks for $60, $49, $2.15 and $49, respectively; total, $13,124.

Independence, Ia.—Bids will be received Mar. 9 by the Com. on Sewers of the City Council for furnishing material and constructing sanitary sewers in portions of 3 avenues. P. McCorstin, Chmn.

Des Moines, Ia.—It is stated that bids are wanted by the Bd. of Pub. Wks. until Mar. 10 for 3,428 lin. ft. of Portland cement curb, 4,712 lin. ft. of 12-in. pipe sewer, 290 lin. ft. of 48-in. and 370 lin. ft. of 60-in. brick sewer. J. W. Budd, City Engr.

Houghton, Mich.—The Governor has signed the bill authorizing the village to borrow $25,000 to construct sewers.

Standish, Mich.—See "Power Plants, Gas and Electricity."

St. Paul, Minn.—Bids will be received Mar. 2 by the Bd. of Pub. Wks. for constructing a sewer in several streets. R. L. Gorman, Clk.

Crookston, Minn.—Bids will be received Mar. 10 by W. A. Lanctot, City Clk., for constructing 6,300 ft. 9, 12 and 15-in. clay pipe sewers in portions of several streets and 1 alley. Geo. A. Ralph, City Engr.

St. Paul, Minn.—Plans for the sewer which will be laid this spring in St. Anthony Park are about completed. They were prepared by City Engr. Rundlett and will cost about $100,000.

Rochester, Minn.—Asst. City Engr. Fraser estimates the cost of the east side sewer, 6,600 ft. vitrified pipe and necessary appurtenances, at about $13,698.

Lewiston, Mont.—This city contemplates putting in a sewerage system this coming summer. Geo. M. Stafford is City Engr.

Walpole, N. H.—See "Water."

Camden, N. J.—The Street Com. is stated to have decided to construct sewers on Spruce St. and Mt. Ephraim and Marlton Aves.

Plattsburg Barracks, N. Y.—See "Government Work."

Brooklyn, N. Y.—Contracts will soon be let by J. E. Swanstrom, Pres. Boro. of Brooklyn, for the construction of sewers in 3 divisions: The 1st division for brick sewers 120 to 60 inches in diameter, pipe sewers 18 and 15 in., 50 manholes and 63 receiving basins; estimated cost, $338,500. The 2d division for brick sewers 144 to 132 in., 16 manholes and 19 receiving basins; estimated cost, $296,500, and the 3d division brick sewers 132 to 30 in. and vitrified stoneware pipe sewers 18 and 15 in., 70 manholes and 45 receiving basins; cost, $285,200. John Thatcher, Supt. of Sewers.

Bids will be received Mar. 11 by J. Edw. Swanstrom, Boro. Pres., for furnishing material for constructing sewers in portions of E. 12th St. and Windsor Place. Engineer's estimate, 2,773 lin. ft. 12 to 30-in. vitrified stoneware pipe sewer laid in concrete, 26 manholes, 1 receiving basin, etc.

Buffalo, N. Y.—John Mumm, 176 Best St., has secured the contract for constructing a. 48, 45, 42, 39, 36, 33 and 27-in. brick sewer in Mumford Ave., for $14,900. The Common Council intends ordering the construction of a 24 and 20-in. tile sewer in Dewey Ave., from Fillmore Ave. to about 1,080 ft. east.

Toledo, O.—The lowest bid received for extending the Jefferson St. sewer was that of M. Rabbit & Sons, at $7,905.

Canton, O.—Philip H. Weber, City Engr., writes that bids will be received Apr. 6 for 11½ miles of sanitary pipe sewers; probable cost, $70,000.

Cincinnati, O.—The B. of L. is stated to have adopted ordinances providing for the construction of sewers and drains in Morris Pl. and Eastern and Murdock Aves.

Youngstown, O.—Bids will be received Mar. 7 by the Bd. of City Comrs. for constructing sewers in portions of Forest Ave., Pearl St. and Charlotte Ave. C. E. Cross, Clk.

Cleveland, O.—Bids are wanted Mar. 10 for constructing sewers in portions of 4 streets. Chas. P. Salen, Dir. of Pub. Wks.

Bids are wanted Mar. 19 for constructing sewers in portions of Gordon Ave., Louis, Sheridan, and Upton Sts. Chas. P. Salen, Dir. of Pub. Wks.

Continental, O.—It is stated that bids are wanted Mar. 9 for constructing 380 lin. ft. of 8-in. sewer, 2,728 fl. of 4-in. tile and furnishing 14 catch basins. R. W. Kissell, Village Clk.

Philadelphia, Pa.—The Council Com. on Survey has recommended the construction of main sewers, as follows: Pratt St. sewer, cost $30,000; Orthodox St. sewer, cost $15,000; 5th and York Sts. sewer, $20,000, and for a sewer to drain new municipal hospital grounds in 33d Ward, $35,000.

Easton, Pa.—Bids will be received Mar. 12 by L. A. Francisco, City Engr., for grading and sewering portions of Berwick St.

Hazleton, Pa.—A. B. Cellax, City Engr., estimates the cost of a 15-in. terra cotta pipe sewer for the Diamond sewerage system, at $4,715.

Pittsburg, Pa.—Local press reports state that contracts to the amount of about $300,000 for street and sewer work were awarded on Feb. 16 by Recorder J. O. Brown and Dir. J. Guy McCandless, of the Dept. of Pub. Wks. The successful bidders were: J. B. Sheets, J. N. McQuaide, Pennsylvania Asphalt Paving Co., Thos. Sweeney & Co., the Pittsburg Asphalt Paving Co., the Empire Asphalt Paving Co., Booth & Flinn, Ltd., J. C. McSpadden, Cronin & O'Herron, Garey & Kissane, Chas. C. Kohne, W. C. Fishburn and Jacob Mensinger. The bids for the asphalt work ranged from $1.77 to $1.90 a sq. yd.

Coatesville, Pa.—See "Water."

Scranton, Pa.—J. P. Phillips, Ch. Engr., Dept. Pub. Wks., writes that Donohue & O'Boyle, contractors for the sewer in Wyoming Ave., Ash St., etc., have assigned this work to Ruch & Miller, of Philadelphia.

Westerly, R. I.—Wm. Hoxsey, Town Clk., writes that the matter of constructing a sewerage system is being agitated, but no definite action has as yet been taken.

Fair Haven, Vt.—See "Water."

Janesville, Wis.—A. E. Badger, City Clk., writes that C. V. Kerch is preparing plans for a sewerage district; cost of construction not yet estimated.

Hallville, Ont.—Bids will be received Mar. 6 by Hugh Martin, Township Clk., for $12,463 drainage bonds.

BRIDGES.

New Haven, Conn.—Maj. Chas. F. Powell, Corps Engrs., New London, has submitted to the War Dept. a report recommending that the Kimberly Ave. bridge in this city be 23 ft. high at high water mark.

Hartford, Conn.—President Roosevelt has signed the bill authorizing the construction of a bridge across Connecticut River, in this city.

Peoria, Ill.—Bids are wanted Mar. 3 (readvertisement) for constructing a 65-ft. span bridge, 20-ft. roadway over Farm Creek, East Peoria Road. Address R. M. Orr, City Clk.

Washington, Ind.—Bids will be received Mar. 3 by the Co. Comrs. for constructing stone abutments for a bridge across Aikman Creek, in Harrison Township. Robt. Russell, Co. Aud.

Decatur, Ind.—Bids will be received Mar. 9 by the Bd. of Co. Comrs. for constructing a steel bridge. Samuel Doak, Chmn.

Columbia City, Ind.—Bids will be received Mar. 11 by the Co. Comrs. for constructing 2 steel bridges and several culverts.

Lake Charles, La.—It is stated that bids are wanted by Leon Charvarens, Police Juror, until Mar. 3 for erecting a steel and wooden bridge about 1,000 ft. long, across English Bayou. John W. Ithorer, Parish Surveyor.

Hanover, Mass.—The Town Clk. writes that it is proposed to construct a bridge here to cost about $12,000. Plymouth County is also reported interested (Plymouth, Mass., C. H.).

Fall River, Mass.—Press reports state that the N. Y., N. H. & Hartford R. R. Co. has awarded to the Boston Bridge Wks., of Boston, and the McClintic-Marshall Construction Co., of New York City, contracts for constructing 12 steel bridges in Fall River.

Three Rivers, Mich.—Bids are wanted Apr. 1 for $30,000 bridge and paving bonds. Jas. R. Bunn, City Clk.

Plainwell, Mich.—The Township Clerk writes that it was voted Feb. 20 to issue $18,000 bonds for the erection of a bridge.

It is stated that bids are wanted Mar. 10 for constructing an 8-span concrete or steel bridge at Main St. A. L. Nichols, Superv.

Detroit, Mich.—Local press reports state that the officials of the Michigan Central and the Grand Trunk R. R. Companies have appointed Engr. Geo. S. Morrison to select the site for the proposed international bridge across Detroit River.

Crystal Falls, Mich.—Press reports state that the officials of the Chicago & Northwestern Ry. intend building a steel bridge in this city, at a probable cost of $30,000. E. C. Carter, Ch. Engr., Chicago, Ill.

Berrien Springs, Mich.—It is stated that a $20,000 bridge may be built by Orinoko and Berrien Townships, across St. Joseph River, to replace present structure at Berrien Springs.

St. Paul, Minn.—The following bids for the superstructure of Arende St. bridge were opened by the Comrs. of Pub. Wks. Feb. 18: American Bridge Co., N. Y. City, $27,540 (awarded contract); Mt. Vernon Bridge Co., $28,378; St. Paul Foundry Co., $28,048; Minneapolis Steel & Machinery Co., $28,849; Horace E. Horton, $30,565.

Bids are wanted Mar. 3 for furnishing material and constructing the superstructure of the Grand Ave. bridge. Matt Jensen, City Clk.

Missoula, Mont.—Surveyor Hughes has, according to reports, completed a survey for a bridge to be built across Missoula River, from Van Buren Ave. to John St. The proposed structure will consist of two 100-ft. spans, with approaches of 100 ft. on each side.

PAVING AND ROADMAKING.

San Francisco, Cal.—The Bd. of Wks. has been directed to proceed with the repaving of 3d St., a distance of 4,500 ft. It will be paved with basalt blocks on a concrete foundation, and cost about $80,000.

Denver, Colo.—The Bd. of Superv. has passed a bill creating sidewalk district No. 12, on the South Side, and carrying with it an appropriation of $54,600. The bill provides for the construction of new 5-ft. stone sidewalks and the widening of existing walks where necessary.

Cheshire, Conn.—Bids will be received Mar. 10 by the Bd. of Selectmen for turnpiking 110 miles of road. Jacob D. Walter, 1st Selectman.

New York, N. Y.—Bids will be received Mar. 7 by Louis F. Haffen, Pres. Boro. Bronx, for regulating and regrading, resetting curbstones, flagging and reflagging the sidewalks, paving with granite blocks on a sand foundation, etc., portions of Tremont Ave. Engineer's estimate, 23,800 sq. yds. granite block pavement on a sand foundation laid with sand joints, 5,000 lin. ft. curbstone furnished and set, 4,600 lin. ft. old curbstone rejointed and reset, etc.

New York, N. Y.—The Bd. of Estimate and Apportionment Feb. 20 authorized the issue of revenue bonds aggregating $5,615,000 for street paving.

Little Falls, N. Y.—A contract is about to be let for 1,260 ft. of brick pavement. E. T. E. Lansing, City Engr.

New York, N. Y.—The following bids were opened Feb. 18 by the Aqueduct Comrs., 280 Bway., for building 14 highway bridge steel superstructures across Croton Lake—*a*, Berlin Constr. Co., Berlin, Conn.; *b*, Penn Bridge Co., Beaver Falls, Pa.; *c*, Augustus Smith, 39 Cortlandt St., N. Y.; *d*, King Bridge Co., 120 Cortlandt St., N. Y.; *e*, F. R. Long Co., Hackensack, N. J.; *f*, New Jersey Bridge Co., 7 W. 22d St., N. Y.; *g*, H. C. Webster, Cleveland, O.; *h*, American Bridge Co., 100 Bway., N. Y. (awarded contract):

Bridge.	A	B	C	D	E	F	G	H	J	L	M	N	O	P	Total.
a	$78,100	$67,200	$75,050	$5,476	$7,151	$35,300	$6,406	$7,151	$2,028	$7,151	$6,406	$21,805	$17,395	$7,753	$344,372
b	71,700	68,300	80,405	5,900	7,200	7,200	7,200	31,900	2,000	21,000	6,200	6,200	16,800	7,300	339,300
c	85,652	64,261	74,534	5,900	7,940	29,100	5,120	7,940	2,389	7,940	5,120	18,160	15,609	6,500	336,165
d	76,000	64,200	74,500	6,300	8,300	30,900	5,850	8,300	2,200	8,300	5,850	19,800	16,000	7,800	334,300
e	70,000	62,000	72,000	7,350	9,400	32,700	6,900	9,450	2,000	9,200	6,800	20,000	16,000	7,600	331,400
f	72,000	63,000	82,000	6,000	7,000	29,000	4,000	7,000	2,000	7,000	4,000	20,000	12,000	5,000	320,000
g	73,200	62,440	66,567	5,717	7,020	28,865	3,927	7,020	4,082	7,020	3,927	18,852	15,760	6,853	311,250
h	66,600	59,000	67,500	7,100	8,200	28,300	6,100	8,200	2,300	8,200	6,100	19,600	16,000	7,500	310,700

Buffalo, N. Y.—Local press reports state that the officials of the Lake Shore and Erie Railroads have agreed with the Grade Crossings Comn. in regard to the plans for abolishing the grade crossings in Perry St., and the viaducts will be built during the coming season. According to Edw. B. Guthrie, Ch. Engr. of the Comn., the approaches will be of stone masonry and steel structure work will be used over the tracks. The Lake Shore viaduct will be 1,500 ft. in length and the Erie viaduct about 1,000 ft., and the cost is roughly estimated at $150,000 and $120,000 respectively.

Syracuse, N. Y.—The building of a hoist bridge, or a viaduct across the Erie Canal at Crouse Ave. is reported to be under consideration.

New York, N. Y.—See "Water."

Flushing, L. I., N. Y.—Press reports state that the old Flushing Bridge that connects Bridge St. and Jackson Ave. will be rebuilt in the near future. The plans for the change have been completed and are now on file at the office of Edward M. Byrnes, Asst. Engr. of Queens. Comr. Lindenthal has asked the Bd. of Estimate for $270,000 for the bridge and approaches, and when this money becomes available in July, contracts for the work will be let.

Phillipsburg, N. J.—Reports state that the Northampton Bridge Co., of Phillipsburg, has been incorporated, with a capital of $125,000, to erect and maintain toll bridges over the Delaware River. Incorporators: John H. Hagerty, Harry H. Haines, W. H. Sawin, and others.

Canton, O.—Local press reports state that the building of 2 bridges across the East Creek, one at North St. and the other at 8th St., is being considered. Probable cost, $10,000 each.

Cincinnati, O.—Local press reports state that in the matter of improvements contemplated by the officials of the Cincinnati, New Orleans & Texas Pacific Ry., lessees of the Cincinnati Southern Ry., is the building of a new bridge across the Ohio River at this point. G. B. Nicholson, Ch. Engr., Cincinnati.

Lebanon, Pa.—The city is about to raise the grade along Cumberland, Chestnut and 12th Sts., which will necessitate the building of a bridge over Quittapahilla Creek, which will be built by the Cornwall & Lebanon R. R. Co. and the city jointly. T. R. Crowell is City Engr., and Gen. W. Hayes is Acting Ch. Engr. of the Cornwall & Lebanon R. R. Co., both of Lebanon, Pa.

Wilkesbarre, Pa.—The Bridge Com. of the City Councils has decided to ask the Delaware & Hudson, Jersey Central and Lehigh Valley R. R. Companies to assist in the building of a viaduct across the tracks near Butler St.

Sharon, Pa.—The officials of the Erie R. R. are reported to be interested in the building of a $30,000 viaduct in this city. C. W. Buchholz, Ch. Engr., New York City.

Washington, Pa.—A bill has passed the Senate authorizing Washington and Westmoreland Counties to construct a bridge across Monongahela River.

Aspinwall, Pa.—The Senate has passed a bill authorizing the Pennsylvania R. R. Co. to construct a bridge across the Allegheny River near Aspinwall.

Philadelphia, Pa.—Councils' Survey Com. has favorably reported ordinances for 2 bridges at railroad crossings. One provides for a bridge over the Germantown & Norristown branch of the Reading Ry., at 17th St., for which $70,000 is available. The other is to carry Allegheny Ave. under the connecting railroad, near 9th St., at a cost of $80,000.

Montgomery, Pa.—Press reports state that the officials of the Pennsylvania R. R. are about to construct a double track stone arch bridge across the tracks of the Philadelphia & Reading R. R. tracks, in this city. H. R. Leonard, Engr. of Bridges, Philadelphia, Pa.

Colorado, Tex.—Wm. Filan, of Weatherford, is reported to have secured the contract to construct a steel suspension bridge across Colorado River in the western part of the city, at $5,750.

Ruby, Tex.—Bids are wanted Mar. 9 for furnishing material and constructing 2 iron bridges. Jesse Wright, Co. Judge.

Bridgeport, W. Va.—The Riverside Bridge Co., Martins Ferry, is reported to have secured the contract to construct a steel bridge across Wheeling Creek for $20,999.

Appleton, Wis.—C. H. Vinal, City Engr., is to submit plans to Council on Mar. 4 for an arch bridge of either stone or concrete over Bellaire Park; estimated cost, $60,000.

Fredonia, Wis.—Bids are wanted Mar. 3 for constructing new abutments and pier; also for repairing the bridge across Milwaukee River at Waubeka. Bernhard Franzen, Town Clk.

Shelbyville, Ill.—C. E. Chester writes that two bids were received Feb. 20 for 9,077 sq. yds. of brick paving on Main St. J. W. Stipes, Champaign, $14,844, and Thompson & Case, of Peoria, $14,759. The detail bid of the latter is as follows: 3,400 cu. yds. excav., 28 cts.; 2,050 lin. ft. resetting curb, 12 cts.; 1,600 lin. ft. combined curb and gutter, 50 cts.; 9,077 sq. yds. brick pavement on concrete, $1.34; 35 lin. ft. 15-in. vitrified pipe, 4 ft. deep, 57 cts.; 60 lin. ft. 12-in. vitrified pipe, 4 ft. deep, 47 cts.; 185 lin. ft. 8-in. vitrified pipe, 4 ft. deep, 32 cts.; 8 catch-basins without covers, 3.5 ft. dia., per ft. in depth, $3.50; 4 catch-basin covers, $7 ea.; 56 crossing plates, $4 ea.; 196 lin. ft. stone curbing, 50 cts.

Elgin, Ill.—Press reports state that the Local Bd. of Improv. has under consideration the improvement of Grove St. According to preliminary plans made by Engineer Gifford, 12,192 square yards are to be paved on this street. It is estimated to cost about $29,991.

Burlington, Ia.—Resolutions have been adopted by the City Council to grade, curb and pave with asphalt on a portion of Arch St. and with brick on a portion of Franklin St.; also a resolution authorizing the City Engr. to receive bids for paving a portion of So. Main St.

Boone, Ia.—Bids will be received Mar. 13 by Jesse L. Hull, City Clk., for furnishing material for grading, paving and curbing portions of several streets and alleys; approximate quantities, 19,295 sq. yds. 2 course brick paving, 6,195 lin. ft. cement curbing, etc.

Atchison, Kan.—The Council has adopted a resolution providing for the grading, curbing and paving on 6th St. in So. Atchison. It will require 15,760 sq. yds. vitrified brick and 10,740 lin. ft. cement curb.

Baltimore, Md.—Bids are wanted Mar. 4 (readvertisement) for grading, paving, curbing or recurbing a portion of East Fayette St. Thos. G. Hayes, Pres. Bd. of Awards.

Houghton, Mich.—The Common Council is considering the grading, curbing and paving with asphalt, brick, creosoted wood block or tar macadam, portions of Shelden and Franklin Sts.

Saginaw, Mich.—The City Council has adopted resolutions to pave with brick on portions of Michigan Ave. and 10th St.

Three Rivers, Mich.—See "Bridges."

Detroit, Mich.—The Dept. of Pub. Wks. have estimates for repaving for the coming year as follows: Brick, $167,865; cedar, $181,468; block asphalt, $161,666; sheet asphalt, $55,767.

St. Paul, Minn.—Bids will be received Mar. 2 by the Bd. of Pub. Wks. for curbing, filling, leveling portions of Dale St. L. I. Gorman, Clk. Bd. Pub. Wks.

W. Duluth, Minn.—The paving of a portion of Central Ave. early in the spring is under consideration.

St. Paul, Minn.—The St. Paul St. Ry. Co. is stated to be contemplating the expenditure of about $250,000 in improving its property this year in St. Paul, the greater part to be paving and track improvements.

Sedalia, Mo.—Press reports state that steps are being taken to pave Main St. C. H. Zoll, City Engr.

St. Louis, Mo.—Bids are wanted Mar. 10 for constructing and reconstructing by grading, curbing with granite, and paving with asphalt, vitrified paving brick and granite blocks portions of numerous streets. Waller Edwards, Secy. Bd. Pub. Improv.

Camden, N. J.—The Street Committee has under consideration the repaving of a portion of 14 streets, mostly with asphalt. It will cost about $100,000, of which the Camden & Suburban Railway Co. will pay about $75,000.

Trenton, N. J.—A bill has passed the Senate authorizing the appropriation of $350,000 annually for the betterment of roads.

Newark, N. J.—The Bd. of Freeholders has adopted a resolution declaring intention to pave and grade the Plank Road from Blanchard St., this city, to a point in Jersey City 21,000 ft. east from the Hackensack River bridge, under the State road act, and instructing Co. Engr. Owen to prepare maps and profiles for the improvement. It has not been decided whether granite blocks upon a concrete foundation or a telford pavement will be used.

Binghamton, N. Y.—State Engr. Bond has sent to Clk. A. W. T. Back plans and specifications for the improvement of the Gulf Bridge Road, in the town of Chenango, a distance of about 1¾ miles, at a cost of about $15,250; also plans and specifications for improving Union-Main road, in the town of Union, a distance of about 3 miles, at a cost of about $23,100.

Brooklyn, N. Y.—The following bids for grading, curbing and laying sidewalks were opened Feb. 18 by Wm. C. Redfield, Comr. Pub. Wks.—*a*, Dennis Norton; *b*, James H. Holmes & Co.; *c*, Murphy Bros.; *d*, Daniel Douglass; *e*, Walter L. Castle; *f*, M. F. Hickey:

Flatbush Ave.—Ave. E to Ave. N.

Bidders.	Earth excav., 6,350 cu. yds.	Filling, 1,850 cu. yds.	Concr. curb, 15,660 ft.	Cement walks, 54,840 sq. ft.
a	$0.48	$0.73	$0.64	$0.20
b	.49	.75	.63	.23
c	1.00	1.00	.65	.25
d	.45	.65	.65	.23
e	.60	1.50	.55	.24

Pitkin Ave.—Linwood St. to Queens Co. Line.

Bidders.	New curb, 10,534 ft.	Earth excav., 5,430 cu. yds.	Filling, 9,772 cu. yds.	Cement walks, 28,923 sq. ft.
a	$0.93	$0.48	$0.73	$0.25
b	1.00	.45	.75	.27
c	1.00	.60	1.50	.20
d	.85	.30	.60	.21

Grading on Prospect Ave., near Ft. Hamilton Ave., and paving with granite on sand foundation near Vanderbilt St.

Bidders.	Granite, 4,800 sq. yds.	New curb, 4,330 ft.	Earth excav., 15,560 cu. yds.	Filling, 720 cu. yds.	Cement walks, 18,000 sq. ft.
a	$2.44	$0.93	$0.48	$0.20	$0.23
b	2.59	1.00	.39	1.00	.25
c	2.50	1.00	.70	.70	.25
*f**	2.05	.85	.27	.10	.17

*M. F. Hickey asked to have bid withdrawn on account of error.

Brooklyn, N. Y.—The following bids were opened Feb. 18 by Wm. C. Redfield, Comr. Pub. Wks., for grading and paving with asphalt on concrete foundation—*a*, Eastern Bermudez Asph. Pavg. Co.; *b*, Cranford Co.; *c*, Interstate Pavg. Co.; *d*, Uvalde Asph. Pavg. Co.; *e*, Brooklyn Alcatraz Asph. Co.:

Barbey St., from Jamaica to Belmont Aves.

Bidders.	Asph., 9,790 sq. yds.	Concrete, 1,370 cu. yds.	Old curb, 50 ft.	Manhole covers, 31.	Earth excav., 5,120 cu. yds.	Conc. curb, 6,560 ft.	Cement walks, 20,840 sq. ft.
a	$1.48	$5.60	$0.30	$6.00	$0.40	$0.65	$0.25
b	1.43	5.30	.30	5.00	.30	.55	.18
c	1.42	5.50	.45	5.50	.35	.55	.22
d	1.48	5.50	.25	5.00	.35	.50	.18

Cleveland St.—Atlantic to Pitkin Aves. (main items).

Bidders.	Asph., 3,650 sq. yds.	Concrete, 660 cu. yds.	New curb, 2,690 ft.	Earth excav., 880 cu. yds.	Filling, 140 cu. yds.	Manhole covers, 16.	New flags, 13,070 sq. ft.
a	$1.48	$5.60	$0.90	$0.40	$0.40	$6.00	$0.30
b	1.43	5.40	.80	.30	.20	5.00	.30
c	1.42	5.50	.90	.35	.35	5.50	.28
d	1.48	5.75	.90	.35	.01	5.00	.33

Christopher St.—East New York to Livonia Aves.

Bidders.	Asph., 13,198 sq. yds.	Concrete, 2,239 cu. yds.	New curb, 7,299 ft.	Earth excav., 13,760 cu. yds.	Cement walks, 34,175 sq. ft.
a	$1.48	$5.60	$0.90	$0.40	$0.25
b	1.42	5.30	.80	.30	.18
c	1.42	5.50	.90	.35	.22
d	1.40	5.50	.90	.40	.18

Park Pl.—Classon to Franklin Aves. (main items).

Bidders.	Asph., 3,270 sq. yds.	Concrete, 550 cu. yds.	New curb, 1,330 ft.	Old curb, 400 ft.	Earth excav. 290 cu. yds.	Cement walks, 950 sq. ft.
a.....	$1.48	$5.60	$0.90	$0.30	$0.40	$0.25
b.....	1.43	5.00	.80	.30	.40	.18
c.....	1.42	5.50	.90	.45	.35	.22
d.....	1.30	5.00	.80	.25	.25	.18
e.....	1.45	5.50	.85	.35	.50	.18

Bids were also opened same time and place for repairing and maintaining asphalt pavts. on various streets where original guarantees have expired, as follows—*a*, 50,000 cu. ft. asphalt wearing surface, laid; *b*, 10,000 cu. ft. binder, laid: Uvalde Asph. Pavg. Co., *a*, $.95; *b*, $.40. Cranford Co., *a*, $.97; *b*, $.35. Brooklyn Alcatraz Asph. Pavg. Co., *a*, $1.00; *b*, $.50.

Albany, N. Y.—Bids will be received Mar. 2 by the Bd. of Contract and Supply for furnishing material, grading, curbing and paving the carriageway with vitrified paving blocks, repairing and laying sidewalks with flags and vitrified bricks and building receiving basins on portions of 4 streets. Isidore Wachsman, Clk.

Watertown, N. Y.—The Bd. of Pub. Wks. has requested the City Engr. to submit an estimate for a bituminous macadam pavement on State St.

Sandusky, O.—Local press reports state that the following bids were received for paving Hayes Ave.: Geo. B. Herring & Son, Collinwood block, sandstone curb, tar filling, $32,712; Portland filling, $31,823; concrete curb, tar filling, $31,847; Portland filling, $31,021; asphalt block, 4-inch, $46,198; 3-inch, $44,346. Barber Asphalt Paving Co., Logan or Metropolitan block, Trinidad asphalt, sandstone curb, $34,910; concrete curb, $34,099. A. G. O'Donnell, Trimble block, sandstone curb, $26,961; Collinwood, $28,591; Malvern, $27,553; Bolen block, brown granite, $28,295; there is a slight decrease for concrete curbing; asphalt block, 4-inch, $41,188; 3-inch, $38,817. Ayers Asphalt Co., Athens, Nelsonville, Harris, Malvern block, Trinidad asphalt, sandstone curb, $33,832. Cleveland Trinidad Paving Co., Malvern, Hocking Valley, Trinidad asphalt, sandstone curb, $45,551. M. McKean, Trimble block, sandstone curb, tar filling, $28,758; cement filling, $27,869; other blocks are higher; asphalt block, 4-inch, $41,059; 3-inch, $39,281. C. F. Hartman, Bolen block, sandstone curb, tar filling, $28,739; cement filling, $27,998; Hocking or Malvern, $27,998 and $27,257; there are slight reductions for cement curb; asphalt block, 4-inch, $39,632; 3-inch, $37,779.

Cincinnati, O.—City Engineer Stanley has been directed by the Bd. of Pub. Service to prepare plans and specifications for the improvement of Ludlow Ave. from Brookline to Whitfield Aves. with asphalt.

The Bd. of Pub. Service has approved an ordinance to improve Calhoun St. from Jefferson St. to Vine with granite and from Jefferson to Clifton Aves. with asphalt.

Bids are wanted Mar. 19 for furnishing material and paving with boulders, redressing and resetting old curb, furnishing and setting new granite curbs, etc., on St. Gregory St. from Pavillion to Hill St. and a portion of Hill St. Robt. Allison, Pres. Bd. Pub. Service.

Bids are wanted Mar. 5 for furnishing material and improving by curbing and paving with asphalt a portion of Pavilion St. and on St. Gregory St. from Hatch to Pavilion Sts.; also for grading, curbing and paving with granite a portion of Hamer St. Robt. Allison, Pres. Bd. of Pub. Service.

Canton, O.—The following bids for paving portions of, *a*, So. Cherry; *b*, South, and, *c*, 9th Sts. with repressed block and Cleveland split curb and repressed block and sandstone curb respectively, were received by City Clerk and City Engr. P. H. Weber, Feb. 23—bidders all of Canton: A. C. Shekels, *a*, $1,686 and $1,524. T. K. Turnbull & Son, *b*, $5,143 and $5,122; *c*, $6,198 and $6,191. F. A. Piero, *b*, $5,213 and $5,200; *c*, $6,285 and $6,249. Harry Carl, *b*, $4,988 and $4,988; *c*, $5,968 and $5,968.

Columbus, O.—Bids will be received Mar. 9 by John A. Connor, Clk. Bd. of Pub. Wks., for improving by grading and paving with asphalt, hard burned bricks or blocks, granite, macadam or other substantial material portions of Garfield and Sullivant Aves.; also for constructing artificial stone walks in city park.

Cleveland, O.—The following bids for paving portions of lower Boule. in Rockefeller and Gordon Parks with telford macadam were received by Chas. P. Salen, Dir. Pub. Wks., Feb. 18: Spence Bros., 2923 Euclid Ave., $35,015; Northern Ohio Paving & Construction Co., $43,615; W. H. Ford & Co., $50,834. Robt. Fisher, Contract Clerk.

Wapakoneta, O.—Bids will be received Mar. 19 by the Co. Comrs. for grading, culverts and stoning portions of Wubker and Werner Pikes. Samuel Craig, Engr.

Continental, O.—It is stated that bids are wanted Mar. 9 for paving 8,495 sq. yds. on Main St. with block. R. W. Kissell, Village Clk.

Cleveland, O.—Bids are wanted Mar. 17 for improving by grading, draining, curbing and paving with Medina dressed block stone on a concrete foundation portions of Petrie St. Chas. P. Salen, Dir. Pub. Wks.

Toledo, O.—Bids are wanted Mar. 9 for furnishing material and improving with vitrified paving blocks or asphalt blocks on a sand foundation a portion of Utah St. Chas. H. Nauts, City Clk.

Toledo, O.—Street improvement bonds, amounting to $59,965, have been sold.

Kent, O.—It is stated that $15,000 paving bonds have been sold.

Lima, O.—Bids will be received Mar. 13 by Fred C. Beam, City Clk., for improving a portion of Jameson Ave., by grading, draining, curbing and paving with vitrified brick on a concrete foundation; also portions of Cole St. and Lakewood Ave. by grading, draining, curbing and paving with sheet asphalt on a concrete foundation.

Oklahoma City, Okla. Ter.—Chas. S. Wadsworth, City Engr., writes that bids will be opened Mar. 2 for about 150,000 sq. yds. of paving, of which about 50,000 sq. yds. is for sheet and rock asphalt. The specifications include also vitrified brick.

Pittsburg, Pa.—See "Sewerage and Sewage Disposal."

Williamsport, Pa.—The paving of 3 squares of Hepburn St. is contemplated. Jas. F. Fisher, City Engr.

Harrisburg, Pa.—M. B. Cowden, City Engr., writes that it is proposed to pave 5th and 2d Sts. with asphalt, brick, and Warren's bituminous macadam, at a cost of about $150,000.

Stevens Point, Wis.—It is stated that the Council has decided to lay 1 mile of brick pavements. W. J. Dumbleton, City Clerk.

Cheyenne, Wyo.—Byron Sessions, according to reports, has been granted a contract for the construction of a Government road from the eastern boundary of the Yellowstone forest reserve to Sylvan Pass. The road will be 30 miles in length, will connect at each end with Government highways, and will cost about $40,000.

Montreal, Que.—Bids are wanted Mar. 5 for furnishing and delivering supplies required by the Road Com. during the year 1903, consisting of brick, vitrified clay pipes, iron castings, cement, blocks, paving blocks, etc. L. O. David, City Clk.

POWER PLANTS, GAS AND ELECTRICITY.

Birmingham, Ala.—The Birmingham District Coal Light & Power Co. is reported incorporated, with a capital of $100,000, by T. H. Aldrich, Jr., and Y. Spear. The company proposes opening the mines and building an electric plant at the mines for supplying electric power and lighting in Birmingham and vicinity.

Los Angeles, Cal.—R. M. Adams, Secy. Los Angeles Lighting Co., writes that it is proposed to extend the gas mains to Pasadena.

Denver, Colo.—A press report states that the New Century Light & Power Co. has been formed to supply power to manufacturing plants in Denver and also towns and cities of this State. The site of the reservoir and power plant is near Kremmling, and it is reported that the capacity of the reservoir is to be about 600 billion gals., and that the probable cost of the work is $6,000,000. R. G. Munn, Pres.; Fred W. Hart, Ch. Engr.

Calhoun, Ga.—A press report states that a company is being formed here, to put in an electric light and power plant, to cost about $11,500. J. T. Black is reported interested.

Marion, Ind.—The Citizens' Electric Light Co. is reported to have been organized here Feb. 17, with a capital of $50,000.

Alexandria, Ind.—Alonzo Maggart, of Gas City, is stated to have presented a lighting proposition to Council. It provides for a 10-year contract, and he offers to furnish 65 street lights at $75 a year. A franchise for commercial lighting and for a steam heating plant is also asked for.

Terre Haute, Ind.—M. O. Payne and J. Horning, in the employ of Wm. Schott, a Chicago, Ill., contractor and engineer, are reported to be here making a survey for a hot water heating plant. Capt. A. C. Ford is reported interested.

Syracuse, Ind.—The Syracuse Power, Light & Mfg. Co. has been incorporated, with a capital of $60,000, and has taken options on the mill race in Elkhart River, and proposes to develop electric power for Syracuse.

Sac City, Ia.—J. B. Paxton and F. V. Healy are reported to have petitioned for a franchise for a gas and heating plant.

Ft. Riley, Kan.—J. A. Fisher, an electrician of the Q. M. Dept., of Washington, D. C., is reported to be here to make an estimate for an electric light plant at this post.

St. Francisville, La.—The following bids for an electric light plant were received by Bd. of Mayor and Aldermen, Feb. 18: P. H. Porter, Clinton, Ky., $6,300 (awarded contract); M. T. Lewman & Co., Louisville, Ky., $8,000; Standard Electric Co., Atlanta, Ga., $6,656. Bid of Standard Electric Co. being informal was not considered. C. H. Jenks, Engr., Fayette, Miss.

New Orleans, La.—See "Electric Railways."

Salem, Mass.—The Salem Gas Light Co. is stated to have petitioned the State Gas Comrs. for permission to issue $50,000 additional stock. Extensive improvements are to be made to the plant including the building of a new gasometer.

Standish, Mich.—The House has passed the bill to authorize this village to issue bonds for the purchase or construction of an electric light plant and water works and the construction of a sewereage system.

Argyle, Minn.—It is stated that bids are wanted Mar. 9 for $5,600 electric light bonds.

Chinook, Mont.—Attorney J. N. Booth, of Great Falls, is stated to have petitioned the City Council of Chinook, for a franchise for an electric light and power plant.

Fremont, Neb.—L. D. Richards and Fred W. Vaughan are stated to have petitioned the City Council for a franchise to install a subway and conduit system in Fremont.

Hudson, N. H.—A bill has passed second reading in the House, to authorize the town to establish an electric light plant, and construct water works.

Hempstead, L. I., N. Y.—The Nassau Gas Co. is reported to have obtained control of the Hempstead Gas Co., and about $150,000 will be expended on the plant at once, and the company intend to add about $200,000 additional within the next few months. Pipes will at once be laid to villages within 5 miles of Hempstead. These are Freeport, Baldwins, Rockville Centre and Lynbrook. It is also reported that a conduit will be laid beside the gas mains and electricity furnished as well as gas. Martin V. Wood and Chas. F. Gittens, of Hempstead, are among the directors.

Binghamton, N. Y.—Local press reports state that bids are wanted Mar. 31 for furnishing about 318 Incandescent gas or naphtha lamps of 60 candle power. Address I. C. Hull, City Clk.

Cohoes, N. Y.—The Hudson River Electric Light Co. has petitioned the Council for a franchise to furnish heat, light and power in Cohoes.

Oxford, N. C.—A bill has been reported favorably in Legislature to allow Oxford to issue $25,000 bonds for an electric light plant and water works.

High Point, N. C.—The Senate has passed on second reading the bill to allow this city to issue $90,000 for electric lights, etc.

Mt. Airy, N. C.—See "Water."

Williston, N. D.—Ex-Mayor Johnson, of Fargo, is stated to have secured a franchise for water works and an electric light plant.

Columbus, O.—The Bd. of Pub. Wks. is stated to have awarded to the Western Electric Co. the contract for 1,500 lamps and equipment, for $33,200.

Medina, O.—The Medina Electric & Illuminating Co., of Medina, has been incorporated, with a capital of $25,000 by G. C. Stephens, C. E. Gleeson, and others.

Stroudsburg, Pa.—A charter has been granted to the Monroe County Water Power & Supply Co., of Stroudsburg, with a capital of $10,000. It proposes to supply water and water power for commercial and manufacturing purposes in the township of Stroud and the boroughs of Stroudsburg and East Stroudsburg. Incorporators: W. S. Shafer, Saml. E. Shull, and others, all of Stroudsburg.

Perkasie, Pa.—The citizens are stated to have voted to expend $8,000 for a duplicate electric light plant.

Shenandoah, Pa.—The Town Council has granted M. J. O'Hara, and others, representing the People's Artificial Light Co., of Shenandoah, a right of way through the streets. The company proposes constructing an electric light plant.

Corry, Pa.—Bids are wanted Mar. 16 for lighting the streets of the city with 65 1,200 nominal c. p. electric arc lights, and the furnishing of 50 16 c. p. incandescent lights in the City Bldg. Nevein R. Dickson, City Engr.

Doland, S. D.—Wm. Wells writes that he will receive bids about June 1 for the construction of an electric light plant.

Chattanooga, Tenn.—The General Electric Co., of Schenectady, N. Y., is reported to have secured a $250,000 contract from the Chattanooga Light & Power Co.

Temple, Tex.—The City Council is stated to have granted Smither & Merrill a steam heating franchise.

Readsboro, Vt.—W. D. Howe, of Readsboro, and E. W. Kelly, of Providence, R. I., are reported to be planning to build a dam at the foot of Howe Pond in Readsboro to generate power to be transmitted throughout upper Deerfield Valley and to North Adams, Mass.

West Allis, Wis.—The Village Trus. are stated to have granted the Northwestern Heat, Light & Power Co. a franchise to light the village with 25 1,600 c. p. electric lights for a period of 30 years.

Bruce, Wis.—It is reported that the Bruce Electric Light Co. will construct a plant.

Copenhagen, Denmark.—Bids will be received by the Lighting Dept. of the corporation of Copenhagen until Apr. 7 for the supply and erection of a 3 lift gas holder of 3,000,000 cu. ft. capacity. Full particulars and drawings may be obtained on application to the Royal Danish Consulate, New York.

ELECTRIC RAILWAYS.

Huntsville, Ala.—It is said that the Huntsville Ry., Light & Power Co. has decided to extend its lines to McCalley Grove, 2 miles west of Huntsville, and that a summer pavilion will be built there. A. B. Coryell, Gen. Mgr., Huntsville.

Walnut Ridge, Ark.—Engineers are said to be estimating the cost of building an electric railway between Hoxie and Walnut Ridge.

Little Rock, Ark.—A site has been selected for the power house of the Little Rock Traction & Electric Co. and the work of building the plant is to be begun soon. R. F. Boise, Ch. Engr., Little Rock.

Harrison, Ark.—The Arkansas Traction Co. has been incorporated, with a capital stock of $500,000, to build an electric railway from Harrison to Keener, Lead Hill and other cities, including Dodd City. About 30 miles of line will be built. The charter of the company permits the company to generate electricity for commercial purposes. Directors: Thos. Helm, of Harrison, and C. Irving Page, of Rochester, N. Y.

Santa Ana, Cal.—Application has been made to the City Council by Collins & Scott for a franchise to build an electric railway from this city to Newport Beach, a distance of about 10 miles.

San Bernardino, Cal.—The San Bernardino Highlands Electric Ry. Co. has been incorporated, with a capital of $150,000, to build an electric railway from San Bernardino to Highland and Redlands, a distance of 15 miles. Directors: Henry Fisher and A. C. Denman, Jr., of Redlands, and E. D. Roberts, of San Bernardino.

Bakersfield, Cal.—Articles of incorporation have been filed by the Bakersfield & Ventura Ry. Co.; capital, $1,000,000. The plan is to build an electric railway over the route for which J. W. Burson was recently granted a franchise. Surveys are now in progress. Directors: Eben Smith and Gervaise Purcell, of Los Angeles. Headquarters of company to be at Los Angeles.

Modesto, Cal.—Denschel F. La Motte has petitioned the Co. Comrs. for a franchise to construct an electric railway from Chinese Station along the county road to the western boundary of Yosemite Natl. Park, via Chinese Camp, Jacksonville, Hughes Station, Priests, Groveland and Colfax Springs. Franchise is to be offered for sale March 16.

Oakland, Cal.—The City Council has granted a franchise to the Oakland Transit Co. for the construction of an electric railway on numerous streets.

Pueblo, Colo.—The Pueblo & Interurban Ry. & Power Co. has secured franchises from the Co. Comrs. to operate electric railways over certain highways in the county for a period of 25 years. It proposes constructing lines in Florence, La Junta, Rocky Ford and Canon City.

Groton, Conn.—It is understood that the two local petitioners for an electric railway franchise between Groton and Westerly have decided to combine their interests. The petitions in question are those headed by B. A. Armstrong and others, represented by H. A. Hull, and by A. H. Chappell and others, represented by C. B. Whittlesey.

Atlanta, Ga.—The Chattahoochee Terminal Co. has been incorporated, with a capital of $250,000, to build an electric railway from Atlanta to Marietta. The road will extend from Atlanta through Fulton and Cobb Counties to Marietta, and will be 20 miles long. Incorporators: Newton A. Morris and T. W. Glover, of Cobb County.

Rock Island, Ill.—The stockholders of the Kewanee, Cambridge & Geneseo Ry. Co. are stated to have decided to increase its capital from $100,000 to $850,000. Plans are reported under consideration for building the road, and the erection of the main power house at Cambridge.

Rockford, Ill.—The Rockford & Interurban Ry. Co. is to apply to the Council for franchises for two extensions, one in the Southeast End, the other from Rockton Ave. to Independence Ave., in W. State St.

Peoria, Ill.—The Central Ry. Co. is to apply to the Council for the right to extend its lines. A. L. Kellogg, Ch. Engr., Peoria.

Dixon, Ill.—The City Council has passed an ordinance granting a franchise to the Sterling, Dixon & Eastern Electric Ry. Co.

Danville, Ill.—The interests that already have the necessary franchises and right of way for an electric railway between Danville and Lafayette, Ill., have organized a company to build the road. Directors: C. M. McCabe, Covington, Ind.; H. C. Martin, of Attica, Ind., and G. T. Buckingham, of Danville.

Dixon, Ill.—The City Council has granted a franchise to the Sterling, Dixon & Eastern Electric Ry. Co.

New Castle, Ind.—Harrison Township is stated to have granted a subsidy of $10,000 to the New Castle & Pendleton Interurban Ry. Co.

Dublin, Ind.—The Council has granted franchises to the Richmond St. & Interurban Ry. Co. (E. B. Gunn, Gen. Mgr., Richmond) and the Dayton & Western Traction Co. (V. Winters, Mgr., Dayton, O.).

Huntington, Ind.—Articles of incorporation are soon to be filed by the Huntington City, Columbia & Northern Traction Co., with a capital of $50,000, to build from Huntington to Columbia City. J. A. W. Kintz, Pres., Huntington; W. A. Jones, Secy., Huntington.

McPherson, Kan.—It is said that a private right of way has been secured through Summer and Cowley Counties for the proposed electric railway between McPherson and Geuda Springs. W. W. Spencer, of Geuda Springs, Kan., is interested.

Columbia, Ky.—The promoters of the proposed electric railway between Columbia and Campbellsville are rapidly perfecting the preliminary plans for building the road. Water power rights have been obtained, as have also grants of land for the right of way. The road will be about 19 miles long, and the cost of construction and equipment will be about $300,000. W. K. Azbill is interested.

Somerset, Ky.—Bids will be received until Mar. 23 for the purchase of a street railway (electric) franchise over the streets of the city. E. H. Hansford, City Clk.

Newport, Ky.—The Ohio Valley Traction Co. has applied for a franchise in Newport.

Louisville, Ky.—Application is to be made by the Louisville Road Co. for a franchise to operate between Louisville and Prospect. This company plans to equip the Louisville, Harrod's Creek & Westport R. R. with electricity. Lafon Allen, Pres.

The Louisville Ry. Co. has purchased a site adjoining its power house at Logan and Jacobs Sts. It is said that an extension is to be built to the power house. F. H. Miller, Ch. Engr., Louisville.

New Orleans, La.—The Southern Light & Traction Co., of New Orleans, has been incorporated, with a capital of $500,000, to build electric railways and power plants in the interior towns of La. and Mississippi. Sol. Weiler, Pres.; G. H. Hovey, Secy.

Winterport, Me.—The Winterport, Frankfort & Prospect Electric Ry. is seeking incorporation. The company plans to build an electric railway from Hampden through the towns of Hampden, Winterport, Frankfort and Prospect, to Stockton Springs. Chas. A. McKenney and Frank C. Young, of Winterport, and Albert Pierce, of Frankfort, are among the incorporators.

Biddeford, Me.—The R. R. Comrs. have granted the Biddeford Pool Electric Ry. Co. a location from the Pool to Biddeford and over certain streets in Biddeford.

Frederick, Md.—Preliminary surveys are being made by the Baltimore & Frederick Electric Ry. Co. for its proposed line from Baltimore to Frederick, a distance of 45 miles. John E. Ingram, Jr., Pres.

Hagerstown, Md.—The Hagerstown Co. contemplates extending its lines into Berkeley County and possibly as far as Martinsburg, W. Va. J. Lesher, Ch. Engr., Harrisburg, Pa.

Billerica, Mass.—The Selectmen have granted the Lexington & Boston Ry. Co. permission to lay double tracks from the Bedford line to the junction at the center of the village. R. A. Sears, Secy., Newtonville.

Lowell, Mass.—The route is announced of the Lowell & Fitchburg St. Ry., now seeking incorporation. From Lowell the road will extend to West Chelmsford, Westford, Groton, Groton Center, West Groton, Lulenburg and Fitchburg, a distance of 34 miles.

West Roxbury, Mass.—The Aldermen have granted the Old Colony St. Ry. Co. permission to build new lines on Washington, South and Brandon, Beech, Center, Grove and Spring Sts. and Hyde Park and Belgrade Aves. E. C. Foster, Gen. Mgr., Boston.

Jackson, Mich.—The Jackson Belt Line Ry. Co., recently incorporated, is about to apply to Council for a franchise to build several miles of electric railway here.

Duluth, Minn.—It is said that the Duluth-Superior Traction Co. is planning to spend $200,000 in improvements. J. Carson, Ch. Engr., Duluth.

Bozeman, Mont.—J. W. Yates has petitioned for a 10-year franchise for a street railway.

Moberly, Mo.—J. D. Houseman, of St. Charles, has secured right of way for an electric railway from Moberly to Huntsville, a distance of 7 miles.

Littleton, N. H.—The Littleton, Franconia & Bethlehem Electric Ry. Co., with a capital of $100,000, is seeking incorporation. The company proposes to build from Littleton through Bethlehem, with a branch to Franconia. The plan is to develop Fifteen Mile Falls in the Connecticut River for power. A. S. Batchellor, of Littleton, is interested.

Perth Amboy, N. J.—Surveyors are at work at Bonhamtown preparing for an extension of the line of the Middlesex & Somerset Traction Co. to Perth Amboy. F. E. Woodward, Ch. Engr., New Brunswick.

Cape May, N. J.—The Ocean St. Passenger Ry. Co., controlled by the Philadelphia & Reading R. R. (Wm. Hunter, Ch. Engr., Philadelphia, Pa.) has been granted a franchise to build about 2 miles of line here.

Westfield, N. Y.—The State R. R. Comrs. have approved the application of the Lake Shore Traction Co. for permission to build an electric railway from Westfield to Silver Creek, a distance of 14 miles. The plan of the company is to build through to Buffalo. J. E. Latimer, Gen. Mgr., Fredonia, N. Y.

Amityville, L. I., N. Y.—The New York & Long Island Traction Co. has applied to the Village Trus. of Amityville for a franchise to build a line to the easterly village limits.

Troy, N. Y.—An ordinance has been passed granting the Springfield, Troy & Piqua Traction Co. a franchise over North Market St.

Lowville, N. Y.—It is said that the construction of the proposed electric railway from Lowville to Croghan will be begun soon. It will be 12 miles long, and will extend through New Bremen and Beaver Falls. Lafayette Wetmore, Pres. of the Wetmore Electric Co. of Lowville, is reported interested.

Olean, N. Y.—Interests identified with the Olean St. Ry. Co. are said to have in contemplation the construction of an electric railway from Bolivar to Little Valley, running through Olean, Allegany, Vandalia, Olean and Bradford, Pa.

Hornellsville, N. Y.—Frank J. Kilpatrick, of New York, and J. F. Turk are reported interested in the construction of an electric railway from Hornellsville to Branchport through Bath and Hammondsport.

New York, N. Y.—Corporation Counsel Rives, Park Comr. Wilcox, and representatives of the Manhattan Elevated Ry. Co. have reached what will probably turn out to be a work plan for the removal of the old elevated tracks in Battery Park and the substitution of a new artistic structure that will occupy less room. It is planned to legalize the occupation of the park by the company.

Salem, O.—The Youngstown & Ohio River Ry. & Light Co. has secured a franchise for an electric railway in Salem. The company plans to build to connect Youngstown, Salem, Lisbon and East Liverpool.

Zanesville, O.—The Muskingum Valley Traction Co. is to be incorporated, with a capital stock of $100,000, to build an electric railway from Zanesville to Muskingum. Among those interested in the company are: W. B. Cosgrove, Pres. of the Union Natl. Bank of Zanesville, and Newton P. Shurtz, Pres. of the Coml. Natl. Bank.

Ironton, O.—H. C. Hart is securing right of way for the construction of an electric railway from Ironton to Proctorville and Gallipolis.

Cleveland, O.—C. H. Hubbell and A. E. Williams have petitioned the Co. Comrs. for an electric railway franchise from South Brooklyn, following the Wooster pike and Badgley road to Berea.

Fostoria, O.—The Toledo, Fostoria & Findlay Ry. Co. has placed $1,000,000 in bonds with Toler & Higgins, of New York, N. Y., and a contract has been closed with J. G. White & Co., of New York, N. Y., for the immediate construction of the extension from Fostoria to Toledo. The line will be about 22 miles in length.

Kenton, O.—The Council has granted a franchise to the Appleyard syndicate for a line from Kenton to Bellefontaine. The road will be known as the Kenton & Southern Ry.

Akron, O.—The Northern Ohio Traction & Light Co. has secured a franchise for a line on Rose Ave., enabling it to make a belt line of the present W. Market and W. Exchange St. lines. T. W. Shelton, Ch. Engr., Akron.

Canton, O.—It is reported that the Canton-Akron Co. has secured the right to double track its entire system in Canton. A new line is also to be built on South St. J. B. Anderson, Ch. Engr., Canton.

Hamilton, O.—Judge John A. Caldwell, Cincinnati, and Jas. A. Magaw, of Rising Sun, Ind., have in contemplation the construction of an electric railway from Hamilton to Richmond, Ind., where connections are to be made with a line operating to Indianapolis. The road will pass through Boston, Fairhaven, Darrtown, and Morning Sun.

Martinsburg, O.—Dr. J. F. Shroutz, one of the promoters of the Newark, Mt. Vernon & Martinsburg Electric Ry. is reported to have secured 18 miles of right of way for the proposed road.

Mansfield, O.—It is stated that the capital stock of the Citizens' Electric St. Ry. Co. is to be increased to $1,000,000, to take up present bonded indebtedness and for the extension of the interurban lines from Shelby to Shiloh and Plymouth on the north and to Mt. Vernon on the south. M. B. Sloan, Ch. Engr., Mansfield.

Hummelstown, Pa.—Application has been made for a charter for the Hummelstown & Campbellstown St. Ry. Co. The company plans to build a road to connect with the Lebanon Valley St. Ry. lines at Palmyra.

Masontown, Pa.—The Monongahela Valley Electric Ry. Co. has secured a franchise in Masontown. F. Uhlenhaut, Ch. Engr., Pittsburg.

Bellevernon, Pa.—The Borough Council has granted a franchise to the Monongahela Valley Electric Ry. Co.

Philadelphia, Pa.—Local press reports state that W. S. Twining, Ch. Engr. of the Philadelphia Rapid Transit Co., has sent to certain contractors blue print plans and specifications, inviting bids for the building of that section of the proposed subway in Market St., between Broad St. and Schuylkill River. This section will carry four tracks. Bids to be in on or before Mar. 16th.

Watertown, S. D.—The City Council has passed an ordinance granting a franchise to the Watertown & Lake Kampeska Ry. & Transportation Co., to build a street railway in Watertown and to Lake Kampeska, 3½ miles distant.

Chattanooga, Tenn.—A survey has been completed for the new line of the Chattanooga Electric Ry. Co. to Chickamauga Park over Missionary Ridge. An unofficial estimate places the cost of building the line at $100,000.

Nashville, Tenn.—The Co. Comrs. have granted a franchise to the McMinnville, Woodbury & Nashville Electric Ry. Co.

Dallas, Tex.—Surveys are being made in the interest of Stone & Webster, of Boston, Mass., who control the Dallas Consolidated Electric St. Ry., for the construction of 2 suburban electric railways, one from Dallas to McKinney, the other from Dallas to Corsicana.

Waco, Tex.—Plans are being discussed for the building of an electric railway to traverse Hamilton, Comanche, Bosque, Hood, Somerwell, Johnson, Hill, Tarrant and Dallas Counties. J. W. Riggins, of Waco, is interested.

Phoebus, Va.—The Hampton Roads Ry. & Electric Co. has secured a franchise through the lands of the Hampton Normal and Agricultural Institute, and will build an extension to Phoebus. J. W. Smith, Supt., Hampton, Va.

Tacoma, Wash.—The Tacoma Ry. & Power Co.'s extension franchise ordinance has been passed by City Council. The ordinance grants the company franchise to build and operate new lines as extensions of present system. S. G. Ames, Ch. Engr., Tacoma.

Vancouver, Wash.—W. E. Stowe, Pres. of the Columbia River Lumber Co., has asked the City Council for a franchise to operate an electric railway. The plan is to build a line through Fruit Valley.

La Crosse, Wis.—Interests identified with the La Crosse St. Ry. Co. have just incorporated the La Crosse & Northern Ry. Co., which will build an electric railway from La Crosse to Winona by way of Galesville, with a branch from Galesville to Whitehall and Ettrick. Incorporators: B. E. Edwards, W. W. Cargill, and others.

Fond du Lac, Wis.—Plans are being prepared for an electric railway to be constructed from Fond du Lac to Peebles, Calumet, Stockbridge and Chilton. F. H. Sweet and Dr. W. H. Willson, of Fond du Lac, are reported interested.

Wausau, Wis.—The Wisconsin River Valley Ry. & Power Co., recently incorporated to build an electric railway from Amherst to Merrill, has organized with Neal Brown as Pres., and G. D. Jones as Secy. The company has applied for a franchise at Stevens Point.

Sheboygan, Wis.—It is stated that a private right of of way has been secured for the extension of the lines of the Sheboygan Light, Power & Ry. Co. from Sheboygan to Plymouth. J. C. Liggett, Gen. Mgr., Sheboygan.

Berlin, Ont.—The Berlin & Bridgeport Electric Ry. Co. has in contemplation the extension of its lines through Bloomingdale, Conestoga, West Montrose and Fergus. Alex. Miller, Secy., Berlin.

RAILROADS.

San Bernardino, Cal.—It is stated that the Southern Pacific R. R. Co. will expend about $150,000 in improving the terminal facilities here, including the erection of a passenger station, freight depot and new trackage. Wm. Hood, Ch. Engr., San Francisco.

Bakersfield, Cal.—The Bakersfield & Ventura R. R. Co. has been incorporated to build a railroad from Sunset to Hueneme, a distance of 125 miles; capital, $5,000,000. Directors: Eben Smith, J. W. Burson, and others.

San Francisco, Cal.—The North Shore R. R. Co. is stated to have awarded the contract for a tunnel through Whites Hill to Martin & Hinkle, of San Francisco. While the tunnel will be 3,120 ft. in length, the work will cover a distance of 3.14 miles. It will cost about $250,000.

Lake Charles, La.—A charter has been granted to the Gulf, Calcasieu & Northern R. R. Co., with a capital of $2,000,000. The road will start from a point near the Gulf south of Lake Charles, and extend to Natchitoches, to connect with a northern road. The promoters are all business men of St. Charles.

McComb, Miss.—Bids are wanted by the Liberty-White R. R. until Mar. 10 for grading its roadbed. J. J. White, Pres.

Beatrice, Neb.—Engr. J. E. House, with the local officers of the Kansas City, Beatrice & Western R. R. Co., is stated to have started across the country for Va. to begin the preliminary examination and survey for the permanent location of a line between Virginia and Beatrice.

Stillwater, Okla. Ter.—An amended charter has been filed by the Kansas, Oklahoma & Southwestern R. R. Co., with the principal place of business at Stillwater, and with $11,000,000 capital stock. The proposed lines are 640 miles in length. The main line runs from Peru Junction, Kan., to Kirkland, Tex., striking Stillwater, Guthrie and El Reno, in Okla.; branch lines are provided for running southeast from Stillwater, through Indian Ter. to Ft. Smith, Ark., and from Stillwater through Okla. Ter. to Woodward, Okla. S. F. Swinford, President; J. E. Sater, Secy. The Missouri Pacific is financing this line, which is now surveyed permanently from Peru to Guthrie.

The Dalles, Ore.—The Oregon House of Representatives is stated to have passed the bill appropriating $165,000 for the construction of the Portage Ry. from The Dalles to Celilio, on the Columbia River.

Brownstone, Pa.—Geo. W. Hayes is engaged on surveys for the doing away of a very difficult reversed curve at the point where the Brownstone & Middletown R. R. pierces the South Mountain. The improvement will probably be made this spring. Allen K. Walton is Pres. of the road, Waltonville, Pa., and Geo. W. Hayes, Lebanon, Pa., is Ch. Engr.

Philadelphia, Pa.—W. H. Brown, Ch. Engr., Pennsylvania R. R. Co., writes that contract for grading and masonry for a double track road from Parkesburg to Columbia (bids opened Feb. 16) has been awarded as follows: Sec. A. Wm. G. Stall's Sons, Altoona; Sec. 1, Chas. A. Sims & Co., Philadelphia; Sec. 2, John Shields, 2900 Bway., New York, N. Y.; Sec. 3, P. McManus, 224 N. 32d St., Philadelphia; Sec. 4, Ryan & Kelley, 8 S. Broad St., Philadelphia; Sec. 5, Wm. H. Carl & Co., 925 Chestnut St., Philadelphia; Sec. 6, C. A. Sims & Co., Philadelphia, Pa.

Crossville, Tenn.—The charter of the Cumberland Coal, Iron & R. R. Co. is reported to have been filed here. The company proposes to construct a railroad from South Pittsburg or Jasper to Kismet to connect with the Southern. J. H. McCord, Pres., and P. W. Keith, Secy.

Palestine, Tex.—A bill has been passed in Legislature authorizing the International & Gt. Northern R. R. Co. to acquire the franchises of the Houston, Beaumont & New Orleans Ry. and the Houston, Oaklawn & Magnolia Park Ry. The H., B. & N. O. Ry. has been finally located from Houston to Beaumont, 82 miles, and is projected in Texas as far as the Sabine River at Orange. It is stated that as soon as the Consolidation bill is approved construction will begin at once between Houston and Beaumont. L. Trice, Gen. Mgr.; J. D. Tramwell, Ch. Engr., Palestine, Tex.

Hillsboro, Tex.—The Trinity & Brazos Valley R. R. Co. is stated to have received a franchise from the City Council to construct its road through the city and traverse a portion of Bois d'Arc St. The road enters the town through Freetown, on the southeast.

Madison, Wis.—The Chicago & Northwestern Co. is stated to have filed in the office of Secretary of State notices that the system of the company in Wisconsin would be extended. One extension to be 20 miles in length, in Shawano, Marathon and Portage Counties, and the other extension to be 25 miles in length, in Langlade, Oconto and Marathon Counties. E. C. Carter, Ch. Engr., Chicago, Ill.

PUBLIC BUILDINGS.

Elba, Ala.—Bids are wanted Mar. 16 for erecting a $20,000 courthouse. F. M. Cushing, Judge of Probate.

Montgomery, Ala.—The Senate is stated to have reported favorably on the proposed appropriation of $150,000 for extending and improving the Capitol grounds and buildings.

Pasadena, Cal.—It is stated that a new building committee has been selected by members of First Baptist Church, with power to select an architect and supervise drawings for a new edifice.

Hartford, Conn.—The plans of Davis & Brooks of New Britain are stated to have been approved for the State Arsenal to be erected at Church and High Sts. The structure will be a 308x264-ft. brick building.

Waynesboro, Ga.—Andrew Carnegie is stated to have offered Waynesboro $75,000 for a library.

Carthage, Ill.—Robt. Hotchkiss, of Peoria, is reported to have prepared plans for the Hancock Co. Court House; estimated cost, $100,000.

Indianapolis, Ind.—Arthur Bohn, of Vonnegut & Bohn, Indiana Trust Bldg., is in Germany preparing plans for the Art Institute to be located at 16th and Pennsylvania Sts., Indianapolis.

Shelbyville, Ind.—The contract for erecting a city hall (bids opened Feb. 17) has been awarded to Frasier & Davis, of Shelbyville, for $35,211.

Worcester, Mass.—Fuller & Delano, 425 Main St., are the architects for the proposed additions to the City Hospital, which will cost about $200,000.

Boston, Mass.—Bids will be received Mar. 9 by Jas. Donovan, Supt. of Streets, for erecting a brick engine house at the pumping station; estimated cost, $50,000.

Hyde Park, Mass.—Warren Hilton has secured the contract for erecting the new building for the New England Peabody Home for Crippled Children, at $17,500.

Boston, Mass.—Plans have been filed with the Building Com. for buildings as follows: At 150 Tremont St., store and warehouse, 8 stories; cost, $175,000; owners, William Lawrence estate, 83 Devonshire St.; builders, Geo. A. Fuller Co., Board of Trade Bldg.; Architects, Winslow & Bigelow, 3 Hamilton Pl., and for a steel frame, fireproof, 11-story business and office building, to be erected at 33-35 Congress St.; cost, $225,000; owner, Richard J. Monks; builders, Geo. A. Fuller Co.; architects, Peabody & Stearns, 53 State St.

Muskegon, Mich.—Bids are wanted Apr. 1 for furnishing material and erecting the Hackley Hospital buildings; separate bids will be received for electrical plumbing and heating work. A. W. Fuller and W. B. Pitcher, Archts., Albany, N. Y. Address Harry Sawyer, Secy.

Albert Lea, Minn.—Bids are wanted Mar. 16 for erecting a City Hall fire station and jail. C. E. Brainard, City Clk.

Concord, N. H.—The State Com. on Appropriations has recommended $30,000 appropriation a year for 2 years for new buildings for State Asylum for Insane.

Sonyea, N. Y.—The following contracts have been awarded for erecting, heating, plumbing, electric wiring and fixtures of Men's and Women's Bldg. at the Craig Colony for Epileptics, bids for which were received by the Bd. Mgrs. of Craig Colony Jan. 13: Construction, Thomas Whalen, Ogdensburg, N. Y., $62,784; plumbing, Richard T. Ford, Rochester, N. Y., $4,645; heating, Russell, Culley & Miller, Sonyea, N. Y., $6,018; electric wiring and fixtures, Jesse F. Miller, Sonyea, N. Y., $1,713. G. L. Heins, State Archt.

New York, N. Y.—See "Water."

Brooklyn, N. Y.—The Bd. of Estimate has appropriated $1,000,000 for the court house to be erected on Joralemon St.; $50,000 for the Gates Ave. Court House; $90,000 for the public bath in the Eastern District, and $50,000 for improvements to the Borough Hall.

Buffalo, N. Y.—Plans are stated to have been filed for the edifice to be erected at Sycamore St. and Sweet Ave., for the Congregation of the Church of the Holy Mother of the Rosary; probable cost, $73,000.

New York, N. Y.—Bids will be received Mar. 5 by the Park Bd. for general work, repairs, etc., in the Metropolitan Museum of Art; also for erecting a comfort station near the Arsenal, Central Park. Wm. R. Willcox, Chmn. Park Comrs.

Plans have been filed for a 5-story brick hospital to be erected at Lenox Ave. and 136th St., at a cost of $300,000. Architects, Horgan & Slattery.

The following appropriations are stated to have been made by the Bd. of Estimates, for completion of the Harlem Hospital, $125,000; Carnegie Library sites, $250,000; sites and buildings for the Department of Health, $250,000; schools and school sites, $3,000,000, and for new buildings for the Dept. of Public Charities, $250,000.

Massena, N. Y.—The citizens are stated to have voted to issue $20,000 bonds for the erection of a town hall.

Long Island City, L. I., N. Y.—The two lowest bids received Feb. 20 by Thos. Sturgis, Fire Comr., N. Y. City, for erecting a building for Hook & Ladder Co. No. 66, on Jackson Ave., Long Island City, were those of Geo. L. Walker, 156 5th Ave., N. Y. City, $21,745, and Alfred Nugent & Son, 508 E. 117th St., N. Y. City, $26,890.

Newark, O.—Bids are wanted Mar. 6 for furnishing material and erecting a building for Fire Dept. F. T. Manrath, City Clk.

Columbus, O.—It is stated that bids are wanted by the Com. on Plans & Specifications until Mar. 19 for erecting St. Peter's German Evangelical Lutheran Church. Christian Gotsch, Secy.

Athens, O.—Bids will be received Mar. 19 by the Bd. of Trus. of the Athens State Hospital for furnishing material and erecting additions to the dining rooms at Athens State Hospital. Frank L. Packard, Archt., New Hayden Bldg., Columbus, O. Address E. H. Rorick, M. D., Secy.

Allegheny, Pa.—It is stated that the Central Presbyterian Congregation has decided to erect a church, to cost $26,000. Rev. J. A. Platts, Pastor.

Latrobe, Pa.—H. M. Fink, Boro. Secy., writes that it was voted Feb. 17 to issue $17,500 bonds for the erection of a city hall.

Philadelphia, Pa.—Henderson Bros., of Philadelphia, are stated to have secured the contract for erecting the smallpox pavilion of the new Municipal Hospital for Contagious Diseases, to be erected on the Macalester Farm, for about $140,000.

Mitchell, S. D.—Plans are stated to have been accepted for the City Hall to be erected here; probable cost, $30,000.

Morristown, Tenn.—According to reports bids are wanted Apr. 7 for remodeling the county jail. J. J. Long, Chmn. of Com.

Corsicana, Tex.—The plans of J. E. Flanders, of Dallas, are stated to have been accepted for the 3-story court house, to be erected here, to cost about $125,000.

Comanche, Tex.—The County Clk. writes that the plans and bids of Martin & Moodie, of Comanche, have been accepted for a $27,000 jail for Comanche County.

Philippi, W. Va.—The contract for the erection of the courthouse here is stated to have been awarded to John P. Conn, of Uniontown, Pa., for $125,000.

Morgantown, W. Va.—Stuart Wertenhaver, of Martinsburg, is stated to have received the contract for the erection of the edifice for the Methodist Episcopal Church, at a cost of $70,000.

Madison, Wis.—The Sayles Bldg. and Mfg. Co. is stated to have received the contract for the erection of the city hospital, at a cost of $23,244.

Ottawa, Ont.—The contract for the erection of the hospital of the Sisters of Mercy on Cambridge St. is stated to have been awarded to Jos. Bourque, of Hull; probable cost, $70,000.

BUSINESS BUILDINGS AND DWELLINGS.

San Jose, Cal.—The Masons of this city are reported to be having plans prepared for a temple to be erected on N. 2d St., at a cost of $60,000.

Washington, D. C.—The plans of Wood & Donn, of this city, are stated to have been selected for the Masonic Temple to be erected here.

Jacksonville, Fla.—The Bd. of Trade is reported to have decided to erect a building on Main and Adams Sts., to cost $35,000.

Summerville, Ga.—It is stated that Saml. J. Sexton will erect a residence here, to cost $100,000.

Macon, Ga.—Henry Horne is reported interested in the erection of a 10-story office building here, to cost $125,000.

Atlanta, Ga.—G. W. Foote, Inman Bldg., has prepared plans for a 15-story steel fireproof building for a Stock Co. to be erected on Broad and Alabama Sts., to cost $300,000.

The Atlanta Journal will soon let a contract for the erection of a steel, marble and pressed brick office building.

Chicago, Ill.—It is stated that C. C. Heisen will erect a warehouse at Kinzie and Armour Sts., to cost $100,000

Louis Sievers Sons Co. is reported to have had plans prepared for a 2-story, 40x100-ft. warehouse, to be erected at 139 Grand Ave., at a cost of $20,000.

Terre Haute, Ind.—The plans of S. S. Beaman, 1019 Adams St., are stated to have been accepted for the 5-story building to be erected by the United States Trust Co.

Topeka, Kan.—The Commercial Club is reported to be considering the erection of a building at 7th and Jackson Sts., to cost $65,000.

New Orleans, La.—Bids are wanted Mar. 9 for erecting the superstructure of the 2-story brick cold storage warehouse for the N. O. Cold Storage & Warehouse Co. Favrot & Livandais, Archts., Abraham Bldg. Address H. Thom Cottam, Chmn. Bldg. Com.

Fall River, Mass.—The Fall River Daily Globe Publishing Co. has invited architects to compete for an office building. Probable cost, $75,000. It will be 5 stories above ground and 2 underground.

Northampton, Mass.—The Norwood Engineering Co., of Northampton, is to erect a steel building, 53x100 ft., 2 stories high, to be used for setting up machines.

Grand Rapids, Mich.—Arthur Fabish and Felix Dumas, of Chicago, Ill., and Col. Wood are reported interested in the erection of a theater here, to cost $100,000.

Detroit, Mich.—Albert Kahn, Union Trust Bldg., is reported to have prepared plans for the 5-story addition to the 65x100-ft. building, at Jefferson Ave. and Brush St., for H. B. Joy.

Glendive, Mont.—It is reported that the building of Thos. F. Hagan was destroyed by fire.

Kansas City, Mo.—Orthwein & Thompson will erect amusement buildings at Hardesty and Independence Aves., to cost $74,000.

Jersey City, N. J.—The W. B. Watson Amusement Co. is reported to have decided to erect a theater here, to cost about $100,000.

Buffalo, N. Y.—The Keystone Warehouse Co. is reported incorporated, with a capital of $600,000, to erect a 4-story, 400x100-ft. warehouse at Fillmore Ave. and S. Clinton St.

Coshocton, O.—Hart & Co., of Columbus, are stated to be preparing plans for a theater to be erected here by the Coshocton Opera House Co., recently incorporated, with a capital of $40,000. J. H. Hanley is reported interested.

Toledo, O.—Bids will be received Mar. 12 at The Dollar Savings Bank for erecting a Masonic Temple at Adams and Michigan Sts.; probable cost, $100,000. Harry W. Wachter, Archt., No. 701 The Nasby. Barton Smith, Pres. Toledo Masonic Building Co.

Lawrenceville, Pa.—W. A. Thomas, Carnegie Bldg., Pittsburg, is reported to be preparing plans for a 4-story commission house, to be erected at Penn Ave. and 18th St., at a cost of $60,000.

Pittsburg, Pa.—Plans are stated to have been prepared by W. A. Thomas, Carnegie Bldg., for a 4-story apartment house to be erected at Negley Ave. and Mignonette St., at a cost of $28,000.

Homestead, Pa.—It is stated that the Homestead Trust Co. will erect a bank building here, to cost $100,000.

New Castle, Pa.—It is stated that the New Castle Trades and Labor Assembly will erect a 3-story brick temple here, at a cost of $40,000.

Seattle, Wash.—Cyrus Walker and the Puget Mill Co. are reported to be considering the erection of a 6-story office building, at 1st Ave. and Spring St., to cost about $110,000.

SCHOOLS.

East Lake, Ala.—The House is stated to have passed a bill providing for an appropriation of $20,000 for the Boys' Reformatory School.

Washington, D. C.—Ruttan & Russell, of Pittsburg, Pa., are reported to be preparing revised plans for the 2-story brick Washington-Jefferson College Library to be erected here, at a cost of $50,000.

Pullman, Ill.—The Bd. of Educ. is reported to have decided to erect a 12-room brick school at 106th and Fulton Sts., to cost $80,000.

East St. Louis, Ill.—The contract for erecting a school (bids opened Feb. 12) has been awarded to B. Koesters, 1010 Allen Ave., St. Louis, Mo., for $23,489.

Canton, Ill.—Bids are wanted Mar. 6 for erecting a school in Union Dist. Wm. Wolf, Archt.; James F. Whiting, Secy. Bd. Educ.

Sac City, Ia.—Bids are wanted Mar. 13 for furnishing material and erecting a school. W. H. Hart, Secy. School Bd.; Murphy & Ralston, Archts., Waterloo.

Ames, Ia.—Proudfoot & Bird, of Crocker Bldg., are stated to have prepared plans for the 4-story main building of the Iowa State College; estimated cost, $250,000.

Baltimore, Md.—Bids will be received Mar. 4 by the Bd. of Awards for erecting a school at Mount and Saratoga Sts.; also steam heating plant for same. Thos. G. Hayes, Pres.

Greenfield, Mass.—It is stated that $35,000 has been appropriated for the rebuilding of the high school recently destroyed by fire.

Ionia, Mich.—H. J. Rill, of Detroit, is stated to have prepared plans for a school, for the Congregation of the Catholic Church, to cost $20,000. Rev. Fr. Wm. J. Flerte is Rector.

St. Paul, Minn.—The plans of A. F. Gauger, Bank of Minn. Bldg., are stated to have been approved for the Cushman K. Davis School in the 5th Ward; estimated cost, $30,500.

Somerville, N. J.—The citizens are reported to have voted to erect a school here, to cost $24,000.

Brooklyn, N. Y.—The following bids were opened Feb. 24 by C. B. J. Snyder, Supt. School Bldgs., New York, for general construction of addition to and alteration in School 84, Boro. of Brooklyn: Thos. Cockerill & Son, $144,900; Myron C. Rush, $163,688; Geo. Hildebrand, $133,671; Tolmie & Kerr, $133,670; Edwin H. Thatcher, $144,295; Richard E. Henningham, $131,485; Peter Cleary, $150,000; Wm. & Thos. Lamb, 99 Nassau St., N. Y. City, $130,634 (awarded contract).

Buffalo, N. Y.—The lowest bids received Feb. 5 for the erection of a 6-room brick extension to the Lobriski St. school are as follows: Masonry, Geo. Kempf & Sons, Virginia and Locust Sts., $12,152; carpenter work, Mosier & Summers, 1266 Seneca St., $5,492; roofing, Rupert, Gruber & Co., 541 Sherman St., and plumbing and gas fitting, N. L. & H. V. Barr, 13 W. Huron St., $1,547.

Bids are wanted Mar. 4 for erecting an 8-room brick school at Leroy Ave. and Girder St., including ventilating, heating, gas fitting, plumbing, electrical work, iron work, fireproofing, steel ceilings, etc. Francis G. Ward, Comr. Pub. Wks.

Long Island City, N. Y.—Bids will be received Mar. 9 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures and electric bell system in high school.

New York, N. Y.—Bids will be received Mar. 9 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary work at School No. 188.

New York, N. Y.—The following bids were opened Feb. 24 by C. B. J. Snyder, Supt. School Bldgs., for installing ventilating and heating apparatus in School 145, Boro. of Bronx: Williams & Gerstle, $31,000; Jas. Curran Mfg. Co., $33,950; Blake & Williams, $32,568; United Htg. Co., 366 W. Bway, $29,732 (awarded contract); E. Rutzler, $31,200; Wm. N. Tobin, $30,253.

Buffalo, N. Y.—See "Water."

New York, N. Y.—See "Public Bldgs."

Mayville, N. D.—The Legislature is reported to have passed the bill authorizing the issue of $60,000 bonds for the completion of the Normal School.

Springfield, O.—Bids will be received Mar. 2 by the Bd. of Educ. for $36,000 bonds. Oliver H. Miller, Clk.

Bellaire, O.—The Bd. of Educ. is stated to have decided to erect a high school here, to cost $20,000.

Cleveland, O.—Bids are wanted Mar. 16 for furnishing material and erecting a school on Mound St., including ventilating, heating, plumbing, gas fitting, iron and steel work, electric wiring, fireproofing, etc. Starr Cadwallader, School Dir., Bd. of Educ.

Bids are wanted Mar. 9 for furnishing material and erecting a school on Locust St., including ventilating, heating, plumbing, gas fitting, sewers, electric wiring, fireproofing, iron and steel work, etc. Starr Cadwallader, School Dir., Bd. of Educ.

Philadelphia, Pa.—The Wells Bros. Co. is stated to have received the contract for the erection of the gymnasium and grand stand at Franklin Field, for the Univ. of Pennsylvania, at a cost of $400,000.

Hazleton, Pa.—The citizens are stated to have voted to issue $60,000 bonds for the erection of schools.

Harrisburg, Pa.—Bids will be received Mar. 4 by the Com. on Finance of the Bd. of School Dir. for $103,000 school bonds. D. D. Hammelbaugh, Secy.

McKinney, Tex.—Dr. W. H. Claggett, Pres., Texas Presbyterian Univ., is reported to be having plans prepared for the university building to be erected here; probable cost, $75,000. Architects, Theo. C. Link, of St. Louis, Mo.

Elkins, W. Va.—The Bd. of Trus. of the Davis and Elkins College is reported to be having plans prepared for a college building, to cost $40,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Cohoes, N. Y.—Local press reports state that the City Clk. will receive bids Mar. 3 for street cleaning and the collection of garbage.

New York, N. Y.—See "Water."

Spokane, Wash.—Local press reports state that the following bids were opened by the Bd. of Pub. Wks. Feb. 12 for constructing a garbage crematory: The Dixon Garbage Crematory Co., of Toledo, offered to put up the furnace and inclose it in a brick fireproof building with steel roof trusses, the city to do the excavation work, for $21,480. The Decarie Patent Garbage Incinerator Co., of Minneapolis, Minn., sent in two bids. The 1st is for a steel water jacket furnace complete for $22,500; the 2d is for a steel and brick furnace for $18,500. Neither bid includes the erection of a building. Comr. Weymouth estimates that the building would cost approximately $3,000.

GOVERNMENT WORK.

Alaska.—The House Com. on Interstate & Foreign Commerce has favorably reported a bill appropriating $350,000 for the establishment of lighthouse and fog signal stations in Alaskan waters.

Chicago, Ill.—The following bids were opened at the Treas. Dept., Washington, D. C., on Feb. 24 for electric generators for the Post Office Building at Chicago: Westinghouse Electric & Mfg. Co., New York, N. Y., $52,875; Crocker, Wheeler & Co., New York, N. Y., $38,750; Chicago Edison Co., Chicago, $53,881; Sprague Electric Co., Chicago, $47,700; Christensen Engineering Co., Milwaukee, Wis., $41,100.

Bids were to have been opened at the same time and place for an engine plant for the Post Office Building, but no bids were received.

Burlington, Ia.—The following bids were opened Feb. 19 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction of an extension to the U. S. Post Office at Burlington: A. L. Shaw, Burlington, $38,590; Congress Const. Co., Chicago, Ill., $60,699; M. Yeager & Son, Danville, Ill., $43,882.

New Orleans, La.—The following bids for 455,000 cu. yds. earthwork in Pontchartrain Levee Dist. were opened Feb. 12 by Capt. Chas. S. Bromwell, Corps Engrs., U. S. A. The quantities involved are, in the order that sections are placed in table, 62,500, 63,000, 34,500, 54,000, 55,000, 45,600, 45,400, 34,000 and 60,000 cu. yds., respectively, and prices given in cents. In addition to the bidders given in table, Helgason Bros., Vicksburg, Miss., bid 19½ and 20½ cts. for the Belmont and Hester work, respectively, and Jas. R. Marlow, Mabel, La., 13.39 cts. for the La Place work:

	M. L. Linnan, St. Jos., La.	R. T. Clark, Natchez.	C. D. Lepper, Darrow, La.*	B. O'Brien, Smithland, La.	W. T. Barbour & Son, Magna Vista, Miss.	Dameron & White, New Orleans.	Ogden Bros., Baton Rouge.	Menzies & Co., New Orleans.
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
Uncle Sam..	14.74	12.72	14	14.90	14.7	18	18	13.75
Convent	17.44	13.95	14	....	15.75	18	18	13.75
College Pt..	18	13.95	14	....	14.9	18	17	13.75
Belmont ...	24.97	18.45	19	19.9	....	38	20	....
Hester	24.97	18.45	19	19.9	....	36	21	....
Poche	15.45	12.72	..	14.73	14.4	..	16	13.75
St. Jos.....	17.45	12.72	..	....	14.4	..	..	13.75
Angelina ...	29	24.87	..	....	....	..	..	....
La Place....	....	12.72	..	14.73	15.2	..	17	....

*Awarded contract.

Ft. McKinley, Me.—Bids are wanted Mar. 2 for installing the necessary plumbing in 11 public buildings at this post. Address Capt. A. W. Yates, Q. M., U. S. A., Portland.

Gloucester, Mass.—The contract for the completion of Dog Bar Breakwater, at the entrance of Gloucester Harbor, was on Feb. 19 awarded by Capt. Harry Taylor, Corps Engrs., U. S. A., of Boston, to the Rockport Granite Co. and the Pigeon Hill Granite Co., both of Rockport, Mass., who will finish the work as one firm for the sum of $275,000. The contract is in the form of a continuous contract, and when completed the structure will extend 2,500 ft. out from Eastern Point. Winslow L. Webber, City Engr.

Boston, Mass.—The following bids for delivering 25,000 tons of rubble stone in breakwater at Isles of Shoals, Me., were received by Capt. Harry Taylor, Corps Engrs., U. S. A., Feb. 20, price given per net ton: The Massachusetts Contracting Co., Worcester, Mass., $1.07, and Rockport Granite Co., Rockport, Mass., $2.97.

Bids are wanted Mar. 28 for constructing a 30-ton crane scow for the Navy Yard, Boston; appropriation, $19,800. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Capt. Harry Taylor, Corps Engrs., U. S. A., received on Feb. 16 bids for breakwater at Rockport Harbor, Mass., from Rockport Granite Co. and Pigeon Hill Granite Co., both of Rockport, Mass., at $1.53 per net ton for rubble stone and 50 cts. per net ton for shifting rubble stone now in main breakwater.

Grand Rapids, Mich.—The following bids for repairs of piers at (*a*) St. Joseph and (*b*) Black Lake, Mich., were received by Capt. Chas. Keller, Corps Engrs., U. S. A., Feb. 19: Burk, Smith & Nelson, Muskegon, *a*, $12,144; *b*, $24,553. J. Beauvais, Muskegon, *a*, $12,576. J. Gaylord, Ludington, *a*, $12,661; *b*, $25,120. The Lydon & Drews Co., Chicago, *a*, $14,390.

Ft. Lincoln, N. D.—Bids are wanted Mar. 23 for constructing a hospital at this post. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Plattsburg Barracks, N. Y.—Bids are wanted Mar. 4 for constructing drains at this post. Capt. T. B. Lamoreaux, Q. M., Burlington, Vt.

New York, N. Y.—Col. S. M. Mansfield, Corps Engrs., U. S. A., writes that no bids were received on Feb. 20 for dredging in Canarsie Bay, N. Y.

Chilocco, Okla. Ter.—The following bids were opened by W. A. Jones, Comr. of Indian Affairs, Washington, D. C., Feb. 19 for a stone dormitory and an addition at the Chilocco School: G. L. Harper, Arkansas City, $29,800; M. McElroy, Arkansas City, $30,400.

Philadelphia, Pa.—The following bids were opened by Mordecai T. Endicott, Ch. Bur. of Yards & Docks, for constructing a brick and steel building for machine, boiler and blacksmith shops, Navy Yard, League Island, Pa.: Henderson & Co., Philadelphia, $344,197; Snare & Triest, New York, N. Y., $335,700; Doyle & Doak, Philadelphia, $339,820; Penn Bridge Co., Beaver Falls, $349,737; American Paving & Const. Co., Philadelphia, $346,900.

The following bids were opened Feb. 14 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the completion of the concrete and stone dry dock at the League Island Navy Yard: *a*, price for completion of work if allowed use of appliances and plant now on site; *b*, price for completion of work without use of the plant and appliances; *c*, price for electrical apparatus and work if allowed use of machinery, etc.; *d*, price for all work other than that set forth in item *c* if allowed use of machinery, etc.; *e*, price for all electrical apparatus and work called for, under item *c* without being allowed use of machinery, etc.; *f*, price for all work other than that set forth in item *c* without being allowed use of machinery, etc.: General Electric Co., Schenectady, N. Y., *c*, $87,650; *e*, $87,650. John C. Rogers & Co., 31 W. 125th, New York, N. Y.; *c*, $113,600; *e*, $112,000; *d*, $1,243,000; *f*, $1,230,000. Westinghouse Electric Mfg. Co., Land Title building, Philadelphia, Pa., *c*, $95,000. The G. M. Schofield Co., Arrot building, Pittsburg, Pa., *a*, $1,148,500; *c*, $89,000; *d*, $1,063,500.

Newport, R. I.—Bids are wanted Mar. 21 for constructing 5 mooring piers, 5 dolphins, a wharf and 4 bulkheads at the torpedo station, Newport. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Charleston, S. C.—Bids are wanted Apr. 4 for constructing at Navy Yard a brick and steel building for machine, boiler and blacksmith shops; appropriation, $342,000. Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Memphis, Tenn.—The following contracts have been awarded for levee work in accordance with bids opened Feb. 10 by Capt. E. W. Van C. Lucas, Corps Engrs.: Stout & Schmidt, Caruthersville, Mo., 12.89 cts. per cu. yd. for a portion of the Lower St. Francis district; Walker Stansell, Greenville, Miss., 16.94 cts. for a portion of the Lower St. Francis district; Shutt Improvement Co., St. Louis, Mo., 19.5 cts. for Upper St. Francis and 17 cts. for a portion of Lower St. Francis; M. J. Roach, Memphis, 17.7 cts. for White River district, and 14.45 for Redfort work; Arnold & Co., Memphis, 16.48 and 13.98 cts. for St. Francis work; Lowrance Bros., Friars Pt., Miss., 14.94 cts. for White River work; Geo. H. Lowrance, Friars Pt., 18.87 cts. for Upper Yazoo work.

Texas.—The House is reported to have passed the bill to amend the river and harbor act so as to authorize the expenditure of $125,000 for the construction of a channel through Sabine Lake, to connect with Taylors Bayou or Port Arthur Canal, Texas.

Dallas, Tex.—The following bids were opened by the Superv. Archt., Treas. Dept., Feb. 18 for the construction, including heating apparatus, electric wiring and conduits of the U. S. Post Office at Dallas: Congress Const. Co., Chicago, Ill., $129,987; Knight & Kenyon, Dallas, $119,900; Theo. Bailhaus, Dallas, $120,690; L. R. Wright, Dallas, $123,000; Jno. Bardon, Ft. Worth, $107,232.

Galveston, Tex.—Bids are wanted Mar. 25 for improving Aransas Pass, Tex., by removing part of old jetty. Capt. C. S. Riche, Corps Engrs., U. S. A.

Norfolk, Va.—The only bid received for dredging harbor at Cape Charles City, Va., by Major Jas. B. Quinn, Corps of Engrs., U. S. A., on Feb. 13 was that of the Coastwise Dredging Co., Baltimore, Md., at 47c. per cu. yd.

Burlington, Vt.—The following are lowest bidders for constructing buildings at Ft Ethan Allen, Vt., according to bids received Feb. 20 by Capt. T. B. Lamoreux, Q. M.: Two barracks, Fitzpatrick & Pennington, Plattsburgh, N. Y., $32,971 each; bachelor officers' quarters, Chas. King & Co., Boston, $26,000; two stables, E. H. Denniston Co., Syracuse, $15,600 each; two gunsheds, Fitzpatrick & Pennington, $10,456 each.

Wheeling, W. Va.—Bids will be received at U. S. Engr. Office, Wheeling, on Mar. 27 for building a power house near Merrill, Pa., as advertised in The Engineering Record.

NEW INDUSTRIAL PLANTS.

W. S. Mize, Harmony Grove, Ga., is interested in the erection of a 40-ton 2-press oil mill and gin.

The Bozeman, Mont., Milling Co. will erect a 300-bbl. mill and a 100,000-bu. elevator.

The Fort Collins-Colorado Sugar Co., Fort Collins, Colo., has let a contract to the Kilby Mfg. Co., Cleveland, O., for a plant to have a daily capacity of 1,200 tons.

Dr. Hess & Clark, Ashland, O., makers of stock food, etc., will erect a 3-story and basement, 220x40-ft. addition to their plant and install a 200-H.-P. engine.

The plant of the Detroit, Mich., Sulphite Fibre Co., with the exception of the steam plant, has been almost completely destroyed by fire.

The Davis Sewing Machine Co., Dayton, O., will probably install additional power plant of at least 300-H.-P. capacity required for its addition of 97,412 sq. ft. floor space.

The General Pneumatic Tool Co., Montour Falls, N. Y., will erect an additional building in the early spring to be used as a store and engine house. The company is in the market for screw machines, turret lathes, shaper, universal grinder, gear cutter, milling machines and engine lathes.

Lyman C. Smith, Syracuse, N. Y., is interested in the establishment of a large Portland cement plant at Hudson, N. Y.

MISCELLANEOUS.

Los Angeles, Cal.—The Bd. of Pub. Wks. is stated to have decided to recommend to Council that the request of the San Pedro, Los Angeles & Salt Lake R. R. Co. (H. Hawgood, Ch. Engr., Los Angeles) for certain changes in the plans for riprapping the levee on the east side of Los Angeles River, from Buena Vista St. to below 9th St. be granted. This work involves the expenditure of $250,000 by the R. R. Co.

Terre Haute, Ind.—It is stated that bids are wanted Mar. 12 for $25,000 bonds, the money to be used for the purchase of a park. H. C. Steeg, Mayor.

Muncie, Ind.—The Muncie & Hartford City Traction Co. will expend $50,000 in improving Eaton Park. The contract will be let to an experienced landscape gardener. The park has a frontage of a mile on the river. Address S. M. Hexler, Pres., Muncie, Ind.

Boston, Mass.—Bids will be received Mar. 4 by Jas. Donovan, Supt. of Streets, for reconstructing piers at the North Ferry.

Silver City, N. M.—Howard H. Betts, City Clk., writes that it was voted Feb. 11 to issue $15,000 bonds for the construction of a dam across the lower end of Main St.

New York, N. Y.—The lowest bid received Feb. 20 for constructing steel fireboat was that of John W. Sullivan, 365 Front St., for $78,000.

Buffalo, N. Y.—The following bids were opened Feb. 6 by F. G. Ward, Comr. Pub. Wks., for dredging Buffalo River—A, section 1, 60,000 cu. yds. scow meas.; B, sec. 2, 85,000 cu. yds. scow meas.; C, sec. 3, 60,000 cu. yds. scow meas.; D, sec. 4, 12,450 cu. yds. earth excav. and 18,600 cu. yds. rock; E, sec. 5, 54,370 cu. yds. earth excav. and 74,620 rock; F, sec. 6, 53,200 cu. yds. earth and 39,100 rock:

	A	B	C	D	E	F
Buffalo Dredging Co., Morgan Bldg.	$0.29½	$0.29½	$0.29½	$63,300	$212,100	$129,500
A. F. Chapman, White Bldg.	.31½	.31½	.31½	67,150	221,400	134,000
Lake Erie Dredging Co., Morgan Bldg.	.32	.32	.32	66,040	219,730	137,160
James B. Donnelly, Ellicott Sq.	.32	.33	.32	72,200	233,600	141,500
L. P. & J. A. Smith, Cleveland, O.	.34½	.33½	.34½	73,200	234,700	146,150

Brooklyn, N. Y.—The New York Dock Co. is reported to have about decided to dig a tunnel under East River from Manhattan to Brooklyn; the plans also contemplate the building of an elevated railroad along the Brooklyn water front from Catherine Ferry to Red Hook.

New York, N. Y.—See "Water."

Georgetown, S. C.—The House has passed the bill authorizing S. M. Ward & Co. to construct and maintain a dam across Kinloch Creek.

BUSINESS NOTES.

The American Locomotive Co. has sent the Burt Mfg. Co., Akron, O., the fifth order for oil filters to be used at their works at Schenectady, N. Y.

Frank B. Rae, consulting electrical engineer, New York City, has arrived at Parral, Mex., and is looking over the ground at the mines of the Terrenates Consolidated Mining Co., preparatory to the installation of a complete electrical equipment, which will consist of two 300-H.-P. De Laval turbine dynamos of 200-Kw. each, two 50-H.-P. electrical hoists and two 350-gal. pumps. Power will be transmitted on aluminum conductors 1¼ miles to distributing center. These are the first De Laval turbines to be installed in a Mexican mine, and it is believed that the plant will be one of the most economical in the district.

Northern Engineering Works, Detroit, Mich., report business equal to the corresponding period of last year, and an increasing demand for electric traveling cranes. Among cranes recently installed by the company, ranging in capacity from 3 tons to 40 tons, are the following: C. D. Jackson & Co., 25-ton; Detroit Ship Building Co., five of 5 to 40 tons; Allis-Chalmers Co., Milwaukee, 12; American Ship Building Co., 3; P. A. Clum & Co., C. & G. Cooper Co., Macbeth Iron Co. The company has also installed hand power cranes of the traveling or jib type in the works of the Carpenter Steel Co., Insurance Stove & Range Co., Western Gas Construction Co., Mathewson Alkali Works, Colburn Machine Tool Co., 5 cranes; American Car & Foundry Co., Berwick, Pa., 24 cranes. An increased demand for cranes and foundry machinery for export, as compared with the corresponding period of last year, is also reported.

The Diebolt Brewing Co., Cleveland, O., has recently purchased a direct-connected unit, the Ball Engine Co., Erie, Pa., furnishing the engine, the Triumph Electric Co., Cincinnati, the generator; the Electric Light Company at Carrington, N. D., has recently placed in operation a direct-connected unit, consisting of a Ball engine and a Northern Electric generator.

The Llewellyn Iron Works, Los Angeles, Cal., are to be equipped throughout for driving by electric motors. Induction motors will be direct-coupled or belted to lathes, planers, and other machinery, and line shafting will be entirely done away with. The Pacific Light & Power Co. has recently purchased from the Westinghouse Electric & Mfg. Co. for this plant 20 induction motors, ranging in size from 2 to 75-H.-P., which are now being installed. The Kern River Power Co., Los Angeles, Cal., has recently purchased from the Westinghouse Electric & Mfg. Co. two Type C, compound-wound, 150-Kw. generators to be installed in its power house.

The General Pneumatic Tool Co., recently incorporated, is a reorganization of the business of the machinery department of the Havana Bridge Works, Montour Falls, N. Y., which has been engaged for some years in the production and sale of pneumatic tools. The new corporation will manufacture pneumatic tools, compression riveting machines, pneumatic motor hoists, air compressors, cranes, etc. Extensive improvements in the manufacturing plant have already been made. Orders for compression riveting machines, pneumatic hammers, and pneumatic motor hoists, covering the capacity for several months, are already booked. Several new types of compression riveting machines have recently been brought out, in addition to those which have been on sale for several years.

The York Mfg. Co., York, Pa., reports the following among recent contracts for ice-making plants: 15-ton plants to Purcell, I. T., Water Co.; Milton P. Skinner, Summerville, S. C.; Grace Bros. Brewing Co., Santa Rosa, Cal. (also 40-ton refrigerating machine); W. Y. Jernigan, Brewton, Ala.; Parka & Luckie, Helena, Ga.; Jesup, Ga., Mfg. Co.; San Marcos, Tex., Ice Mfg. Co.; Varn & Beckett, Warsaw, Ga. (also 10-ton plant); 20-ton plant to Charleston, Ill., Gas & Electric Co.; 25-ton plants to C. E. Wright Ice Co., Greenwood, Miss.; Hamlet, N. C., Ice Co.; Consumers' Ice Co., Jackson, Tenn. (also a 35-ton refrigerating machine); Independent Ice & Fuel Co., Hull, Mass.; 30-ton ice plant to Seventh District Ice Mfg. Co., New Orleans; 35-ton ice making and two 65-ton refrigerating plants to Huntington, W. Va., Cold Storage & Commission Co.; 50-ton ice-making plants to Broadway Ice & Coal Co., Memphis, Tenn.; John R. Murray, Arverne, N. Y.; Independent Ice Co., Baltimore; two to Utah Ice & Cold Storage Co., Salt Lake City; 100-ton ice-making plant to Polar Wave Ice & Fuel Co., St. Louis; 40-ton compression sides to Fayetteville, Ark., Ice & Cold Storage Co. and Cerveceria del Pacifico, Mazatlan, Mex.; 30-ton refrigerating machines to Eagle Brewery, Waterbury, Conn.; John Ebner Ice Co., Vincennes, Ind.; 40-ton refrigerating plant and piping for Union Brewing & Malting Co., San Francisco; 65-ton refrigerating machines, two to Scranton, Pa., Cold-Storage & Commission Co.; Frank Stell Brewing Co., Baltimore; a 225 and 125-ton refrigerating machine and 85-ton ice-making plant to Conron Bros., New York; 100-ton refrigerating plant and direct-expansion piping to Jas. L. Humphrey, Jr., New Bedford, Mass.; 175-ton refrigerating machine to Duquesne Brewing Co., Pittsburg; 12,000 ft. direct-expansion piping to Western Packing Co., Denver; 125-ton compression side to Mervin Provision Co., New Haven.

Richardson & Co., Pittsburg, Pa., have put in a new yard at Shady Side station and trackage to handle twelve cars and are erecting skids to accommodate 2,000 tons of assorted rails. When these improvements are finished, which will be in about 30 days, the company will carry an assortment of weights from 8 to 100 lbs. for immediate delivery.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Mar. 2.	Youngstown, O.	Feb. 28
Mar. 3.	Abington, Ill.	Feb. 28
Mar. 3.	St. Martinsville, La., Adv. Feb. 21.	Feb. 21
Mar. 3.	Water Wks. Extension, Allentown, Pa. Adv. Feb. 21.	Feb. 21
Mar. 3.	Concord, N. C., Adv. Feb. 14, 21.	Feb. 14
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 4.	Bottineau, N. D.	Feb. 21
Mar. 4.	Lewiston, Idaho	Feb. 21
Mar. 5.	Kansas City, Mo.	Feb. 21
Mar. 5.	Pipe, Yonkers, N. Y., Adv. Feb. 14.	Feb. 14
Mar. 6.	Engine, Allentown, Pa., Adv. Feb. 21.	Feb. 21
Mar. 7.	Pipe, Boston, Mass.	Feb. 28
Mar. 7.	Cleveland, O.	Feb. 21
Mar. 10.	Findlay, O.	Feb. 28
Mar. 12.	Hydrants, Cleveland, O.	Feb. 28
Mar. 12.	Pipe, etc., Cleveland, O. Adv. Feb. 21, 28.	Feb. 21
Mar. 13.	Boone, Ia.	Feb. 28
Mar. 13.	Cleveland, O.	Feb. 28
Mar. 14.	Washington, D. C., Adv. Feb. 28.	Feb. 28
Mar. 14.	Dillon, Mont.	Jan. 10
Mar. 16.	Lake Park, Minn., Adv. Feb. 28.	Feb. 28
Mar. 16.	Pumping Engine, Winnipeg, Man. Adv. Jan. 17 to Feb. 14.	Jan. 17
Mar. 17.	Cincinnati, O., Adv. Feb. 21.	Feb. 21
Mar. 18.	Tower, Marshall, Tex., Adv. Feb. 28.	Feb. 28
Mar. 18.	Georgetown, S. C., Adv. Feb. 21.	Feb. 21
Mar. —	Alcester, S. D.	Feb. 21
Apr. 1.	Toronto, Ont. Adv. Feb. 28.	Feb. 28
May 1.	Chinook, Mont.	Feb. 7
———	**Meters, Schenectady, N. Y.**	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Mar. 2.	St. Paul, Minn.	Feb. 28
Mar. 3.	New York, N. Y.	Feb. 21
Mar. 3.	Rock Island, Ill.	Feb. 14
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 4.	Brooklyn, N. Y.	Feb. 21
Mar. 5.	Pipe, etc., Meriden, Conn Adv. Feb. 14, 21.	Feb. 14
Mar. 7.	Youngstown, O.	Feb. 28
Mar. 9.	Kokomo, Ind.	Feb. 28
Mar. 9.	Independence, Ia.	Feb. 28
Mar. 9.	Continental, O.	Feb. 28
Mar. 9.	Toledo, O	Feb. 14
Mar. 10.	Cleveland, O.	Feb. 28
Mar. 10.	Crookston, Minn.	Feb. 28
Mar. 11.	Brooklyn, N. Y.	Feb. 28
Mar. 12.	Easton, Pa.	Feb. 28
Mar. 14.	Bowling Green, O.	Feb. 21
Mar. 17.	Dayton, O.	Feb. 21
Mar. 18.	Georgetown, S. C., Adv. Feb. 21.	Feb. 21
Mar. 19.	Cleveland, O.	Feb. 28
Mar. 30.	South Bethlehem, Pa., Adv. Feb. 28).	Feb. 28
Mar. 30.	Marshfield, Wis.	Feb. 21
Apr. 6.	Canton, O.	Feb. 28
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. —	Crookston, Minn.	Feb. 21
	BRIDGES.	
Mar. 3.	Washington, Ind.	Feb. 28
Mar. 3.	Peoria, Ill.	Feb. 28
Mar. 3.	Fredonia, Wis.	Feb. 28
Mar. 3.	St. Paul, Minn.	Feb. 28
Mar. 3.	Lake Charles, La.	Feb. 28
Mar. 4.	Frankfort, Ind.	Feb. 21
Mar. 4.	Atlantic City, N. J.	Feb. 21
Mar. 6.	Milwaukee, Wis.	Feb. 14
Mar. 9.	Ruby, Tex.	Feb. 28
Mar. 9.	Delaware, O.	Feb. 21
Mar. 9.	Colville, Wash.	Feb. 21
Mar. 10.	Plainwell, Mich.	Feb. 28
Mar. 11.	Columbia City, Ind.	Feb. 28
Mar. 17.	Kearney, Neb.	Feb. 14
Mar. 25.	Plymouth, Wis.	Feb. 14
Mar. 26.	Chatham, Ont.	Feb. 21
Mar. 27.	Washington, D. C., Adv. Feb. 7 to 28.	Feb. 7
	PAVING AND ROADMAKING.	
Mar. 2.	Oklahoma City, Okla. Ter.	Feb. 28
Mar. 2.	St. Paul, Minn.	Feb. 28
Mar. 2.	Albany, N. Y.	Feb. 28
Mar. 3.	Trenton, N. J.	Feb. 21
Mar. 3.	New York, N. Y.	Feb. 21
Mar. 3.	Cincinnati, O.	Feb. 21
Mar. 3.	Winnipeg, Man., Adv. Feb. 7, 14.	Feb. 7
Mar. 4.	Baltimore, Md.	Feb. 28
Mar. 4.	Brooklyn, N. Y.	Feb. 21
Mar. 4.	Itensselaer, Ind.	Feb. 14
Mar. 4.	Somerville, N. J.	Feb. 14
Mar. 5.	Cincinnati, O.	Feb. 28
Mar. 5.	Ironton, O.	Feb. 21
Mar. 5.	Cleveland, O.	Feb. 21
Mar. 5.	Roanoke, Va.	Feb. 14
Mar. 6.	Ft. De Soto, Fla., Adv. 7 to 28.	Feb. 7
Mar. 7.	New York, N. Y.	Feb. 28
Mar. 9.	Toledo, O.	Feb. 28
Mar. 9.	Columbus, O.	Feb. 28
Mar. 9.	Continental, O.	Feb. 28
Mar. 10.	Cheshire, Conn.	Feb. 28
Mar. 10.	Des Moines, Ia.	Feb. 28
Mar. 10.	St. Louis, Mo.	Feb. 28
Mar. 11.	Tiffin, O.	Feb. 21
Mar. 13.	South Bend, Ind., Adv. Feb. 28.	Feb. 28
Mar. 13.	Lima, O.	Feb. 28
Mar. 13.	Boone, Ia.	Feb. 28
Mar. 16.	Menominee, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 17.	Cleveland, O.	Feb. 28
Mar. 19.	Cincinnati, O.	Feb. 28
Mar. 19.	Wapakoneta, O.	Feb. 28
Mar. 23.	Newburgh, N. Y., Adv. Feb. 7 to 28.	Jan. 31
Mar. —	San Diego, Cal.	Jan. 31
Apr. 6.	Vallejo, Cal.	Feb. 21
———	**Ogden, Utah**	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Mar. 3.	St. Martinsville, La., Adv. Feb. 21.	Feb. 21
Mar. 4	Franchise, Manila, P. I.	Nov. 19
Mar. 6.	Ft. Stevens, Ore.	Feb. 21
Mar. 10.	Muscatine, Ia.	Feb. 21
Mar. 16.	Corry, Pa.	Feb. 28
Mar. 16.	St. Paul, Minn.	Feb. 21
Mar. 16.	Prince Albert, N. W. Ter.	Feb. 21
Mar. 31.	Binghamton, N. Y.	Feb. 28
Apr. 7.	Copenhagen, Denmark	Feb. 28
Apr. 7.	Oneida, N. Y.	Feb. 7
———	Hyattsville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Mar. 2.	Ft. McKinley, Me.	Feb. 28
Mar. 2.	Milwaukee, Wis. (5 advs.) Adv. Feb. 7 to 28.	Feb. 7
Mar. 2.	Detroit, Mich., Adv. Feb. 7 to 21.	Feb. 7
Mar. 2.	Ft. McKinley, Me., Adv. Feb. 7 to 28.	Feb. 7
Mar. 2.	Jamestown, N. Y., Adv. Jan. 31, Feb. 7.	Jan. 31
Mar. 3.	Ft. Riley, Kan., Adv. Feb. 7 to 28.	Feb. 7
Mar. 3.	Ft. Totten, Willets Point, N. Y.	Feb. 7
Mar. 3.	Helena, Mont., Adv. Jan. 24, 31.	Jan. 24
Mar. 4.	New York, N. Y., Adv. Feb. 7 to 28.	Feb. 7
Mar. 4.	Alexandria, Va., Adv. Feb. 7, 14.	Feb. 7
Mar. 4.	Plattsburg Barracks	Feb. 28
Mar. 4.	Grand Rapids, Mich., Adv. Feb. 7 to 28.	Feb. 7
Mar. 5.	San Francisco, Cal.	Feb. 21
Mar. 5.	Ft. Myer, Va., Adv. Feb. 14 to 28.	Feb. 14
Mar. 5.	Buffalo, N. Y.	Feb. 14
Mar. 5.	Cincinnati, O., Adv. Feb. 7 to 28.	Feb. 7
Mar. 5.	Haines, Alaska	Jan. 24
Mar. 5.	Janesville, Wis.	Jan. 24
Mar. 7.	Bldg., St. Paul, Minn.	Feb. 21
Mar. 7.	St. Paul, Minn., Adv. Feb. 14 to 28.	Feb. 14
Mar. 9.	Dredging, Duluth, Minn.	Feb. 21
Mar. 9.	Duluth, Minn., Adv. Feb. 14 to 28.	Feb. 14
Mar. 9.	Wilmington, Del., Adv. Feb. 14 to 28.	Feb. 14
Mar. 9.	Jamestown, N. Y.	Feb. 7
Mar. 10.	Washington, D. C.	Feb. 21
Mar. 10.	Ft. Mott, N. J.	Feb. 21
Mar. 10.	St. Augustine, Fla., Adv. Feb. 14 to 28.	Feb. 14
Mar. 10.	Well, Ft. Morgan, Ala., Adv. Feb. 14.	Feb. 14
Mar. 10.	Ft. Smith, Ark., Adv. Feb. 7, 14.	Feb. 7
Mar. 11.	Ft. Wright, Wash.	Feb. 21
Mar. 11.	Grand Rapids, Mich.	Feb. 21
Mar. 11.	Chattanooga, Tenn., Adv. Feb. 28.	Feb. 14
Mar. 11.	Wilkesbarre, Pa., Adv. Jan. 31, Feb. 7.	Jan. 31
Mar. 12.	Jefferson Barracks, Mo.	Feb. 21
Mar. 12.	Portland, Me., Adv. Feb. 14 to 28.	Feb. 14
Mar. 12.	Janesville, Wis.	Feb. 7
Mar. 14.	Bldg., Ft. Morgan, Ala., Adv. Feb. 14.	Feb. 14
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
Mar. 16.	Portland, Ore.	Feb. 21
Mar. 16.	Burlington, Vt.	Feb. 21
Mar. 16.	Harbor Work, Boston, Mass.	Feb. 21
Mar. 16.	Wilmington, Del.	Feb. 21
Mar. 16.	Granite, Boston, Mass.	Feb. 21
Mar. 16.	Wiring, P. O., Wilkesbarre, Pa. Adv. Feb. 14, 21.	Feb. 14
Mar. 17.	Cincinnati, O., Adv. Feb. 14 to 28.	Feb. 14
Mar. 18.	Buffalo, N. Y., Adv. Feb. 21, 28.	Feb. 21
Mar. 19.	Wilmington, Del., Adv. Feb. 21, 28.	Feb. 21
Mar. 19.	Minneapolis, Minn.	Feb. 21
Mar. 20.	Richmond, Ky.	Feb. 21
Mar. 20.	Ft. Howard, Md.	Feb. 21
Mar. 21.	Newport, R. I.	Feb. 28
Mar. 23.	Wheeling, W. Va., Adv. Feb. 21, 28.	Feb. 21
Mar. 23.	Ft. Lincoln, N. D.	Feb. 28
Mar. 24.	Kalamazoo, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 25.	New York, N. Y., Adv. Feb. 28.	Feb. 28
Mar. 25.	Galveston, Tex.	Feb. 28
Mar. 27.	Wheeling, W. Va., Adv. Feb. 28.	Feb. 28
Mar. 27.	Sioux City, Ia., Adv. Feb. 28.	Feb. 28
Mar. 28.	Boston, Mass.	Feb. 28
Apr. 4.	Charleston, S. C.	Feb. 28
Apr. 17.	St. Augustine, Fla., Adv. Feb. 21.	Feb. 21
	BUILDINGS.	
Mar. 2.	Hospital, New York, N. Y.	Feb. 21
Mar. 2.	Jail, New York, N. Y.	Feb. 21
Mar. 3.	Pub. Bldgs., Orange City, Ia.	Feb. 21
Mar. 3.	Courthouse, Decorah, Ia.	Feb. 14
Mar. 4.	Hospital, Buffalo, N. Y., Adv. Feb. 28.	Feb. 28
Mar. 4.	School, Buffalo, N. Y.	Feb. 28
Mar. 4.	School, Baltimore, Md.	Feb. 28
Mar. 4.	Pub. Bldg., Long Island City, N. Y.	Feb. 21
Mar. 4.	Armory, Providence, R. I.	Feb. 14
Mar. 5.	Pub. Bldg., New York, N. Y.	Feb. 28
Mar. 5.	Hospital, Springfield, O.	Jan. 31
Mar. 6.	Pub. Bldg., Newark, O.	Feb. 28
Mar. 6.	School, Canton, Ill.	Feb. 28
Mar. 9.	Warehouse, New Orleans, La.	Feb. 28
Mar. 9.	School, Long Island City, N. Y.	Feb. 28
Mar. 9.	School, New York, N. Y.	Feb. 28
Mar. 9.	School, Cleveland, O.	Feb. 28
Mar. 9.	Engine house, Boston, Mass.	Feb. 28
Mar. 9.	Library Plans, Dover, N. H.	Feb. 21
Mar. 10.	School, Des Moines, Ia.	Feb. 21
Mar. 11.	School, Columbus, O.	Feb. 14
Mar. 12.	Masonic Temple, Toledo, O.	Feb. 28
Mar. 12.	School, Valley City, N. D.	Feb. 28
Mar. 12.	Gateway & Lodge, Dayton, O.	Feb. 21
Mar. 12.	Pub. Bldg., Johnson City, Tenn. Adv. Feb. 14, 28.	Feb. 14
Mar. 13.	School, Sac City, Ia.	Feb. 28
Mar. 16.	School, Cleveland, O.	Feb. 28
Mar. 16.	Pub. Bldg., Albert Lea, Minn.	Feb. 28
Mar. 16.	Library, Portsmouth, O.	Feb. 14
Mar. 18.	Pub. Bldg., Mansfield, O.	Feb. 21
Mar. 19.	Hospital, Athens, O.	Feb. 28
Mar. 19.	Church, Columbus, O.	Feb. 28
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
Apr. 1.	Hospital, Muskegon, Mich.	Feb. 28
Apr. 1.	Elevators in bus. bldgs., Tacoma, Wash.	Feb. 21
Apr. 2.	Hotel, Bemidji, Minn.	Feb. 21
Apr. 7.	Jail, Morristown, Tenn.	Feb. 28
	MISCELLANEOUS.	
Mar. 3.	St. Cleaning, etc., Cohoes, N. Y.	Feb. 28
Mar. 3.	Cement, Winnipeg, Man. Adv. Jan. 17 to 31.	Jan. 17
Mar. 4.	Piers, Boston, Mass.	Feb. 28
Mar. 4.	St. Ry. franchise, Manila, P. I.	Nov. 19
Mar. 5.	Montreal, Que.	Feb. 28
Mar. 5.	Levee Work, Bossier City, La.	Feb. 21
Mar. 7.	Cement, Marietta, O., Adv. Feb. 7 to 28.	Feb. 7
Mar. 9.	St. Ry. franchise, Port Clinton, O.	Feb. 21
Mar. 10.	R. R. Work, McComb, Miss.	Feb. 28
Mar. 16.	El. Ry. Work, Philadelphia, Pa.	Feb. 28
Mar. 16.	El. Ry. franchise, Modesto, Cal.	Feb. 28
Mar. 23.	St. Ry. franchise, Somerset, Ky.	Feb. 28
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	Cement, Ill.	Feb. 21
———	R. R. work, Cincinnati, O.	Dec. 20
May 2, '04	R. R., Oodnadatta, So. Australia.	Feb. 21

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The Economy of Small Contracts.

The tenders for sewer work in New Orleans, reported this week in the contracting news columns, prove the wisdom of the decision made last fall by the Sewerage and Water Board of that city to subdivide the work into a number of comparatively small contracts. Last August bids were asked on the basis of three contracts, each involving work amounting to $500,000 to $600,000, and although the proposed construction was extensively advertised, but three offers were made to do the work, and the aggregate amount of the lowest bids was over $2,187,000, against $1,641,369, the estimated cost. These tenders were rejected, and on February 2, bids were received for the same work divided into eight contracts. The result was that 26 proposals were made by 11 contractors; and the aggregate of the lowest bids on the eight sections amounted to $1,897,136.75, or 9.5 per cent. above the estimated fair value, and about $500,000 less than the total amount for which the work would have been let if it had been awarded last August to the lowest formal bidder for all three contracts. In two of the eight bids, however, Mr. George G. Earl, the general superintendent of the board, finds prices that he considers too high, and he has recommended that only six of the contracts be awarded, at a total of $1,415,412.75, which is 4.2 per cent. in excess of his estimate of the cost of that work. His stand in the matter has a very important bearing on the large amount of construction yet to be undertaken. It seems that about 87 per cent. of the total mileage of sewers will be of 8-inch pipe, laid mostly 6 to 8 feet deep. He holds that the price bid on this one item is really an index to the general character of each bid. Two of the approved proposals cover pipe sewer work only, and he points out that the lowest bids are 70 and 80 cents per linear foot for the 8-inch pipe sewer, while in the case of the disapproved bids the lowest bids are $1 and $1.15. He feels that the lower prices quoted bear a fair margin of profit, and in view of the fact that the two approved contracts will involve the laying of 28 miles of pipe sewer, he not only advises against the letting of the 45 or 46 miles of pipe sewer involved in the disapproved bids but expects that by so doing that there will be little trouble in getting even lower prices for the 312 miles of pipe-sewer work yet remaining to be considered. As he himself has urged, however, it is essential that prompt, decisive action be taken in respect to the proposals, as it is not at all assured that if the bids are rejected the board can again inspire the confidence of contractors, or that better, if as good, prices will prevail, particularly when it is remembered that the city has for some time borne a reputation for difficulty of underground construction.

Ventilation of Subways and Tunnels.

Hundreds of miles of subways and tunnels for transportation of passengers are under construction and proposed in the leading cities of this country, and the problems of supplying a sufficient quantity of reasonably pure air and maintaining proper temperatures within these underground ways after they shall have been completed and put into service come up for solution. Of course the use of motors which do not require combustion within the underground passages is postulated as a prime requisite, and this is now so generally conceded that it needs no more than bare mention. Professor S. Homer Woodbridge, in a report to the Boston Transit Commission in 1895, stated that if steam locomotives were used thirty times as much fresh air would be required for ventilation as with electric propulsion. On some of the proposed tunnels there will also arise during construction the questions of maintaining proper atmospheric conditions for the workmen and of detecting properly and promptly indications of the presence of dangerous gases encountered in the headings. On these latter questions an article printed elsewhere in this issue gives some valuable information deduced from experiences in some recent tunneling beneath Lake Erie.

The publication in London, not long ago, of some tests made to determine the quality of air in the "tubes" in that city, indicate, as many experts in ventilation are already aware, that the movement of trains through tunnels cannot be relied upon to change the air sufficiently to produce even moderate ventilation. Seven different determinations made upon a station platform during rush hours showed over 11 parts carbonic acid for 10,000 volumes of air. A number of tests made from air in the cars showed from 13.7 to 20.4 parts carbonic acid per 10,000 volumes of air. When it is considered that a room is pretty badly ventilated when it contains 8 parts carbonic acid, it can be imagined that a ride in a London "tube" may not be over exhilarating, to say the least.

The interesting part of this matter lies in the fact that some persons, at least, suppose that it is possible to change the air of such a tunnel satisfactorily by the movements of the trains. If the tests reported be correct, this idea is shown to be an erroneous one, and all the more so when it is considered that the tunnel in which the tests were made is most favorably constructed for securing piston-like action by means of train movements, because the sides and roof of the tunnel conform quite closely to the sides and roofs of the cars, the clearance between them being unusually small. The effect of a train passing through a tunnel of comparatively small cross-section is to cause the air ahead of it to move in the direction of the train to the nearest outlet, perhaps at a station where communication with the outer air may occur. As soon as the train passes such a relief point for air, the partial vacuum in the rear of the train causes an in-rush to occur, the air previously discharged, or a large part of it, being again drawn into the tunnel, mixed perhaps with more or less fresh air. As the ratio of the cross-section of the tunnel to that of the cars becomes greater the plunger-like effect of the trains in moving air along the tunnel becomes less until the conditions accompanying the use of two or three or more tracks is reached, when the air is simply churned up by a passing train, although a train movement even under these conditions causes a noticeable air movement in its own direction.

The problem of ventilation is not the same for any two subways or tunnels, and the varying atmospheric conditions for any one will put materially different aspects upon its difficulties from time to time.

Air movements are exceedingly difficult to control, and the only manner in which one can be reasonably sure of them is to create a sufficient difference of pressure between two points and then maintain that difference. The latter, the occasional or even frequent movements of trains will not do. On the basis of present knowledge, some engineers believe that the most practicable way to satisfactorily ventilate tunnels is by means of fans. A long tunnel can be divided into sections with air outlets and inlets at intervals. Midway between adjacent inlets an air outlet may be provided, equipped with an exhaust fan; or, a pressure fan could be located between adjacent outlets. For example, if A, B, C, D and E represent equidistant points in a tunnel, with A and E at the portals, a shaft at B and one at D could each be equipped with a fan of either the suction or pressure type; if of the former type, to draw in air at the portals and down the shaft at C, in the middle of the tunnel; or, if the fan be of the pressure type, to force air into the tunnel to escape by the remaining openings.

Other engineers, however, believe that the proper first step in subway ventilation is to exclude moisture as completely as possible, and especially to shut out the foul water and gases with which the soil beneath the streets of a large city is impregnated; and consider it important to provide ample air storage space by giving the subway a liberal cross-section. Few openings, only those provided unavoidably by station entrances, are then preferred, rather than numerous additional apertures solely for ventilation.

Up to the present time comparatively little has been said in the reports of commissions having such work in charge concerning the ventilation of subways. In one of the most extensive systems of underground railways, very great care has been taken, by means of an elaborate method of waterproofing, to prevent water or moisture from finding its way into the subways from the surrounding earth. This waterproofing will also prevent the inleakage of gases from the same source, and thus one of the most frequent causes of impure air will have been eliminated. But granting that all chances of air pollution from outside sources are removed, there remains still the possibility of the air being vitiated by the people using the trains, and this may occur to an objectionable degree in rush hours, particularly in a small tunnel. Of course, persons can endure for the twenty minutes or half hour of their ride the breathing of very bad air, but they should not be obliged to do so in order

to avail themselves of the most convenient lines of travel, if good ventilation is attainable.

It is interesting, just for the sake of considering a concrete case, to compute the amount of air that would be needed in a part of the New York subways, basing the estimate upon an assumed number of passengers. Suppose the cars so ventilated that air may enter them freely and the tunnel for one mile above City Hall to contain four tracks and have a cross-section of 650 square feet, and a volume of about 3,500,000 cubic feet. Suppose, further, that there were 4,000 people in different trains and upon station platforms in the mile section, at one time. Allowing 1,800 cubic feet per capita per hour, as the Massachusetts law requires for public schools, then air would have to enter the one mile section of tunnel at the rate of about 7,000,000 cubic feet per hour, which is approximately equivalent to two changes of air per hour.

There is one serious difficulty that may be expected in some climates, which would occur in any tunnel ventilated during the summer season—namely, the precipitation of moisture that is bound to occur when fresh air at high temperature and heavily laden with moisture is forced into the cooler tunnel. Doubtless many who entered the Boston subway, when it was first opened to travel, on a day when the outer air was hot and moist, remember how the moisture condensed upon the walls and roof. This difficulty has been pretty successfully overcome by the application of non-conducting coverings to the exposed metal surfaces in Boston, and has been anticipated by special construction in the stations of the New York subways. The tunnel walls in summer will have a temperature that will not vary greatly from the average air temperature, consequently when a high atmospheric temperature occurs outside moisture will tend to condense from the air drawn in, if the hygrometric conditions are favorable.

At first natural air currents and the movements of the cars were relied upon to ventilate the Boston subways, but these means were soon supplemented by a small temporary fan. Later several large fans were installed, and in the fall of 1901, when all but one of these fans were stopped because the motors were out of commission, complaints were soon made by the public of the impurity of the air. The two-track tunnel beneath Boston Harbor, to East Boston, will be ventilated by means of a passage of 45 square feet cross-sectional area which is being constructed on the roof. This passage will be connected with the interior of the tunnel and with a ventilating shaft on each side of the harbor.

Still another important advantage claimed for using fans lies in the fact that with them it is possible to maintain a temperature in a tunnel or subway that does not vary greatly from that of the outer air. Although refreshing, it is a dangerous practice for a person to pass from the outer air, when it is of a high temperature, to the much cooler air of a tunnel, particularly when one is exposed to drafts brought about by train movements or other causes. The problem of ventilation is being studied by engineers connected with some of the largest subways; the results of their experiments and experiences when made available from time to time will add greatly to the information in the possession of the profession.

Fuel Bricks have been made with a mixture of twelve parts coal yard siftings and one part Portland cement compacted in large blocks under heavy pressure. It is said that the cement in the bricks does not detract from the usefulness of the fuel.

Foundations and Steel Work in the Government Printing Office, Washington, D. C.

The 175x408-foot seven-story U-shaped building for the government printing office, in Washington, is built of steel, brick and concrete with floor arches, fireproofing and roof details, as illustrated in The Engineering Record of December 6, 1902. The roof and floors are supported by 178 main riveted steel columns with rectangular cross sections which are nearly all arranged about 12 feet apart in six longitudinal rows from 31½ to 35 feet apart. These are all seated on battered solid concrete piers carried down to a depth of 6 feet or more below the basement floor, according to the conditions encountered.

The soil is mainly sand with some gravel and occasional pockets of clay, and is saturated with water which rises nearly to the basement floor at one corner of the building, and is about 3 feet lower at the diagonally opposite corner. The foundation pits were sheeted, and whenever clay was encountered they were carried through it to clean sand, regardless of the depth. The columns have separate foundations which, for the interior rows, are truncated pyramids 7 feet square on top, nearly 7 feet deep and 15 feet square at the bottom. Under the wall columns they are 6 feet square on top, have battered longitudinal faces and vertical transverse faces, are 13 feet wide at the base, and are usually 6 feet deep. They are all proportioned for maximum loads of 20 tons per square foot on the top surface, and the sides are sloped to give a bottom area corresponding to the bearing value of the soil as determined by special preliminary tests.

The depth of the foundations was such that the line of pressure making a 60-degree angle with the horizontal should always be 7 inches inside the pier. At least 12 inches of the lower part of the pier was made with vertical sides all around so as to avoid a thin weak toe. The concrete was hand mixed with Portland cement in proportions varying from 1:3:6 to 1:3:7. The total quantity of concrete in the piers is about 6,960 yards, and cost $5.98½ per yard. The piers were built in forms, the use of which resulted in an economy of about 2,000 cubic yards of concrete with a net saving of $8,800.00. The total cost of the forms was about $3,100.00. Labor cost $1.18 per yard for the concrete, and the total cost of concrete, including forms, was $6.50 per yard as compared with $7.50 for concrete built by private parties on similar work. The spaces in the pits around the piers were filled up to subgrade with 1:4:12 concrete. The crushed stone was screened, and the concrete was mixed rather dry and rammed with 6x6-inch white ash rammers.

The preliminary bearing tests of the soil were made by excavating pits inside of drums 6 feet in diameter and setting up in them 12x12-inch vertical timbers which were found to sustain, without settlement, loads of from 8 to 12 tons. It was assumed that the soil had a safe bearing power of 4 tons per square foot; but the foundations were designed with a bearing surface of 1 square foot for each 4 tons of live load and 1 square foot for each 3 tons of dead load, the building being assumed to be fully loaded.

Under the basement floor there is a sub-soil drain of 12-inch terra-cotta pipe with 8-inch flanges all laid with open joints covered with burlap and surrounded by broken stone. This has proved effective in keeping the floor dry; but as an additional safeguard the basement has been water-proofed by putting a damp-proof course on all foundations, on the backs of retaining walls and in the basement on horizontal surfaces. This consists of Neuchatel asphalt and fine gravel with a very small addition of bitumen and Trinidad asphalt spread hot to a thickness of about ¼ inch. For vertical surfaces it was moulded in plates on a burlap backing and covered with crushed slag which was bedded one-half its depth in the hot asphalt. The wall surface was faced with Portland cement mortar in which the slag surface or the asphalt was bedded and the blocks braced in position until thoroughly set. Afterwards the burlap was stripped off and the joints between the plates welded with a painter's hand furnace and hot asphalt, making a continuous surface.

The tops of all the main piers are flush with the basement floor and are capped with grillages made of crossed layers of steel I-beams very solidly riveted together with pairs of vertical web-connection angles at all intersections, as shown in the plan and elevation of a typical grillage 6 feet square. The lower tier of beams covers the entire surface of the pier top and is, in most cases, 15 inches deep. Short cross beams are coped to fit between the flanges of the long beams and two or more 1-inch rods are screwed up inside 1¼-inch gas pipe separators to tie the webs of the long beams together. The upper tiers of beams are 15 or 18 inches deep with coped I-beam separators and no tie-rods. This design gives an unusually rigid and massive grillage, which is substantially equivalent to a very wide riveted pedestal. It receives a cast iron column base. In one case the lower tier was 15¼ feet long x 5 feet wide and supported two sets of three cross beams each, all beams being 18 inches deep. Two grillages consisted simply of five 24-inch 80-pound I-beams 12 feet long fastened together with tie-bolts and gas pipe separators.

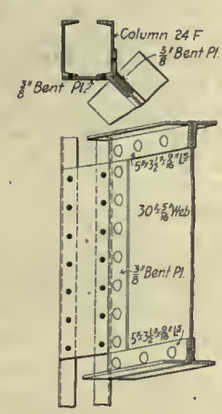
The intermediate single-story basement columns have their cast-iron pedestals seated directly on rectangular concrete foundation piers 5 feet square and 3 feet deep, with their upper surfaces below the basement floor. One hundred and eight of the pedestals, which have 15-inch channel columns, are 3 feet square at the bottom and 18 inches high with two longitudinal and three transverse vertical webs which enclose two open wells between their intersections over the center of the base plate. The upper edges of the webs are covered by a 19x24-inch horizontal flange supported at the four corners by diagonal vertical webs running to the angles of the base plate. The metal is 1 inch thick in some parts of the pedestals and 1½ inches thick in others. There are numerous holes in the top and bottom plates for the connection bolts for the columns and grillages. The other pedestals are similar to these; but vary in dimensions and in the number of vertical webs, except those which are made, as shown in one of the details, to fit the bases of cylindrical columns.

All main columns are made with two channels back to back, connected by lattice bars or cover-plates, according to the required sections. This type allows the wall columns to be made, in most instances, with 15-inch channels without cover-plates. When designing the columns, great pains were taken to insure symmetrical loading and when the loading was eccentric, allowance was made for the bending strains which resulted from the eccentricity. All floors were assumed to be fully loaded and the column sections determined from the formula $p = \frac{17{,}000}{1 + \frac{l^2}{11{,}000\, r^2}}$. For the second and third stories, the numerators of the second term were increased to 18,000, and for the first story and basement to 20,000, these being the only places in which the design of the building

recognized the assumption that a full load might not exist.

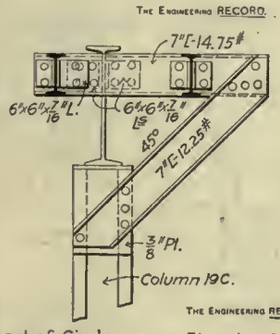
The column channel webs are parallel to the transverse girders and in the wall columns their sizes decrease in the 5th and 7th stories, where the splices are made with bent flange cover-plates offset to engage the columns of diminished width. The interior column channels receive equal floor girder loads through ordinary web and reinforced bracket shelf connections on opposite sides, so that there is no difficulty in loading them symmetrically. The wall columns are so arranged that the single loads from the transverse girders are also applied symmetrically. This is effected by inserting the end of the transverse girder between the channels on the center line of the column, and supporting it there by a solid plate and angle bracket shelf with its vertical longitudinal web forming a diaphragm riveted to the webs of both column channels, as shown in the detail drawings.

All girders are riveted to their shelf supports and to transverse angles across their top flanges and the flanges of the column channels. The girder connections to the stairway wall columns, with closed rectangular sections, were made as shown in the detail A with bolts through their vertical end web stiffeners and through the cover plates which engage short



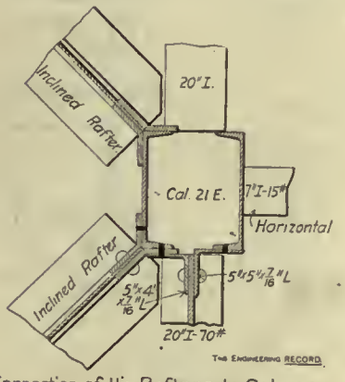
Connection of Hip Rafter to Corner Column.

THE ENGINEERING RECORD.



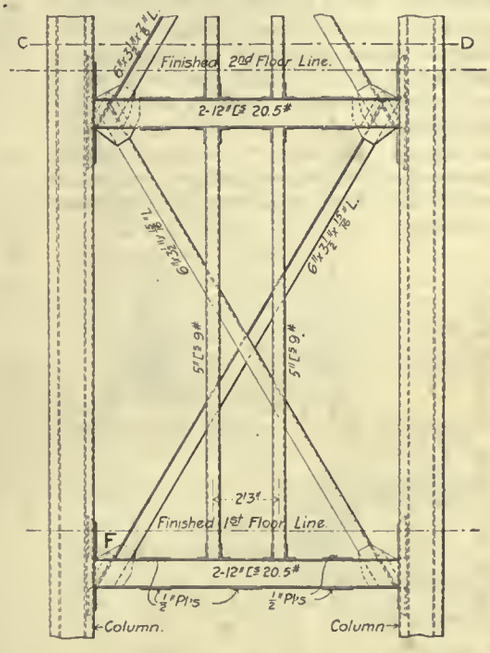
THE ENGINEERING RECORD.

Support of Girders over Elevator Shaft.



THE ENGINEERING RECORD.

Connection of Hip Rafters to Column.

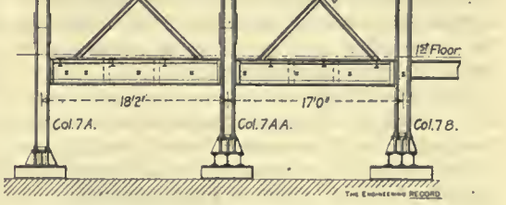




Sectional Plan C-D.

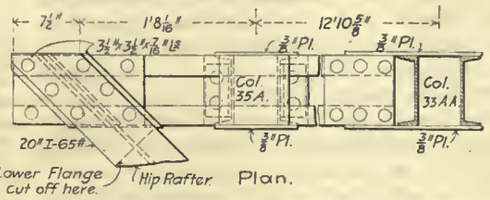
Lower Panel of Bracing in Vent Shaft.

THE ENGINEERING RECORD.

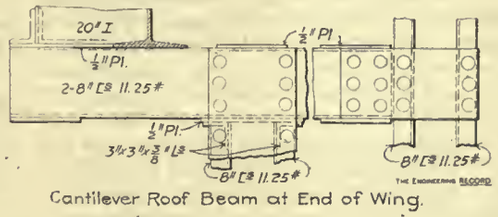


THE ENGINEERING RECORD.

Wind Bracing in Side Stair Wells.

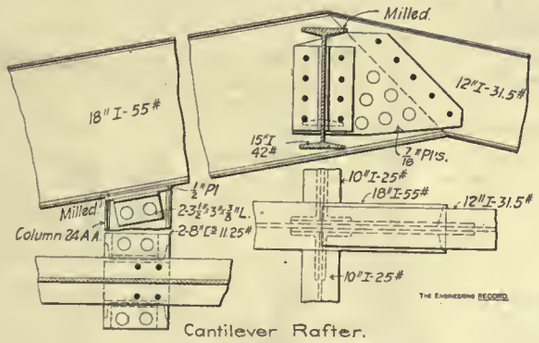


Plan.



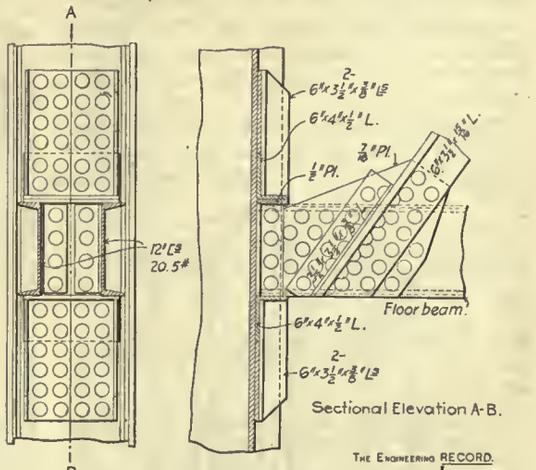
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Cantilever Roof Beam at End of Wing.



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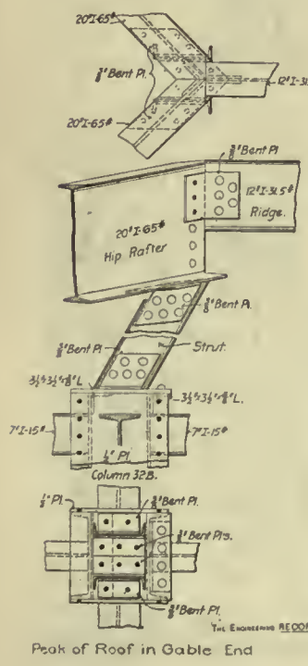
Cantilever Rafter.



Sectional Elevation A-B.

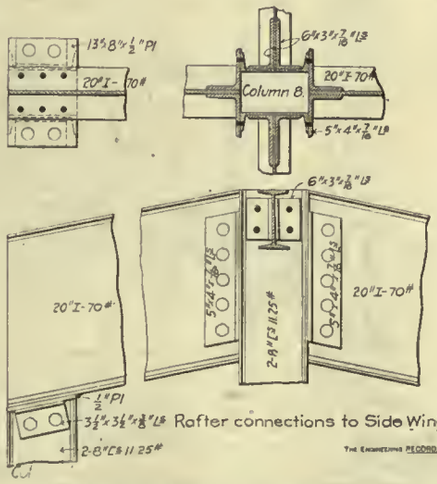
THE ENGINEERING RECORD.

Detail of Wind Bracing in Vent Shaft at F.



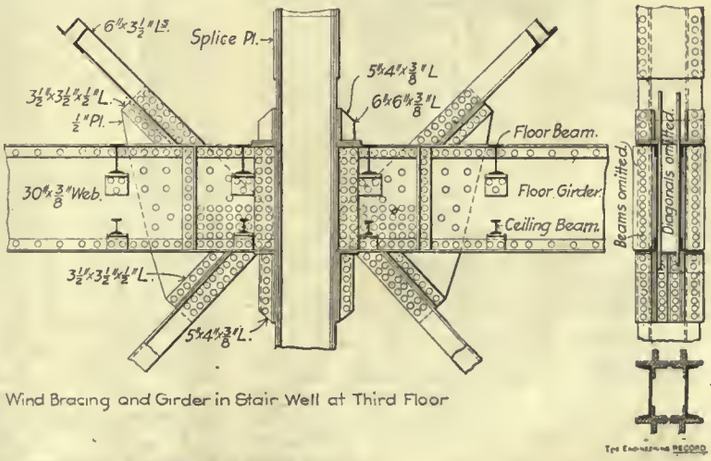
THE ENGINEERING RECORD.

Peak of Roof in Gable End



Rafter connections to Side Wing.

THE ENGINEERING RECORD.



Wind Bracing and Girder in Stair Well at Third Floor

THE ENGINEERING RECORD.

FRAMING DETAILS, GOVERNMENT PRINTING OFFICE, WASHINGTON.

vertical reinforcement angles shop-riveted to the webs of the channels in the inaccessible interior of the column. All column splices are made with milled butt joints and coverplates on the column flanges only. At splices where the sizes of the column channels change the lighter upper sections are supported by ¾-inch horizontal diaphragm plates and the spacing of the channels, back to back, remains constant. In the wall columns splice cover-plates could be put only on the outside flanges because it was necessary to leave clearance between the inside flanges for the insertion of the transverse girders. Inner flanges were therefore spliced with vertical angles having their flanges turned inwards and covered below the transverse girder with tie-plates which stiffen the column section, but do not serve as splices because they were riveted wholly to the lower sections of the columns.

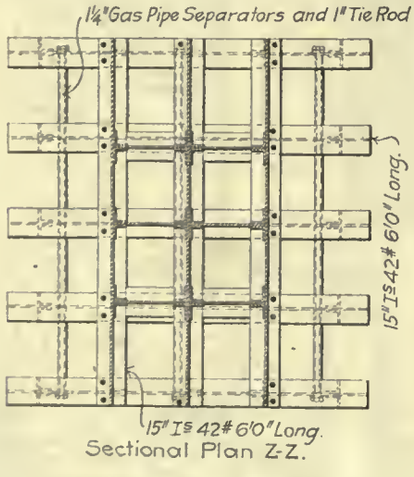
The 15-inch girders for the sidewalk vaults are supported on special columns made of single lengths of 5-inch extra heavy wrought iron pipe which, at the bottom, is seated on the turned shoulder of the cast-iron pedestal. At the top the pipe is screwed into a cast-iron flange cap that is beveled to suit the grade of the girders. These columns are enclosed by sections of 8-inch wrought-iron pipe centered by collars on the pedestals and caps. Where these columns support a stair frame, their caps receive, on the center point, the mitered corner of the I-beams which are enclosed in a riveted steel casing, as shown in the detail.

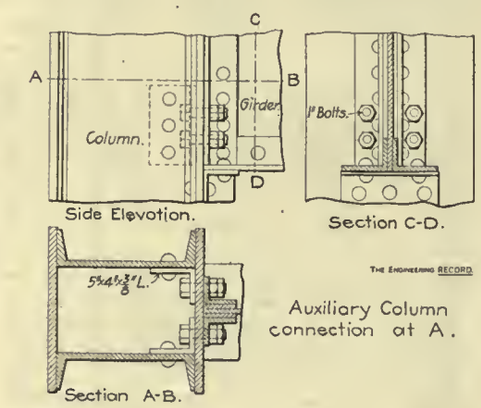
As described in the previous article, the columns carry nine tiers of long-span transverse girders which, in each of the upper stories, support double sets of longitudinal I-beams usually about 3 feet apart horizontally and about 1 foot apart in the clear vertically. These upper beams carry the floors, and the lower ones support the independent ceilings and leave an accessible chamber between, which is chiefly intended for the convenience of installation and connections with electric and other conduits. This space is omitted in the attic and in the 7th story where there are no separate ceiling beams.

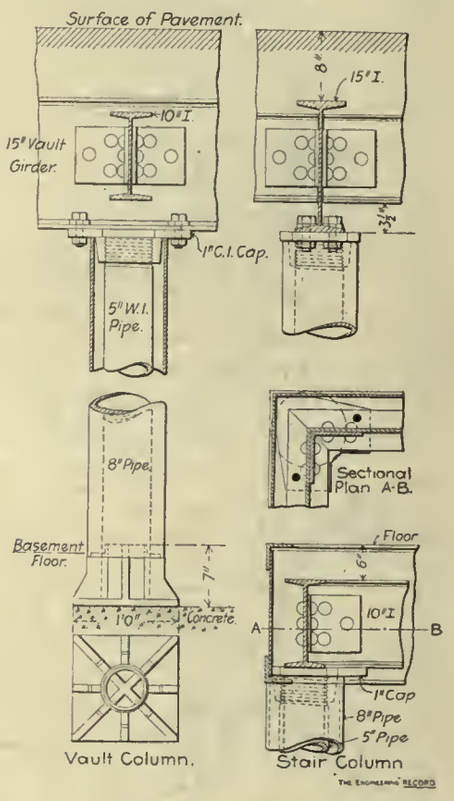
The double pitched roof is hipped at the ends of the building, and is carried by 20-inch 70-pound long span I-beam rafters corresponding to the transverse floor girders; but connected to the columns in a different manner. Each rafter is, in general, continuous from the wall column to the interior column in the center of the wing and rests across the cap of the former, while it is web-connected to the face of the letter in the ridge line, as shown in the detail of column B in the side wing. The rafters support 7-inch 15-pound I-beam purlins generally 12 feet long and 6 to 7 feet apart, which are web and shelf-connected to them and carry the pitched roof of flat concrete slabs.

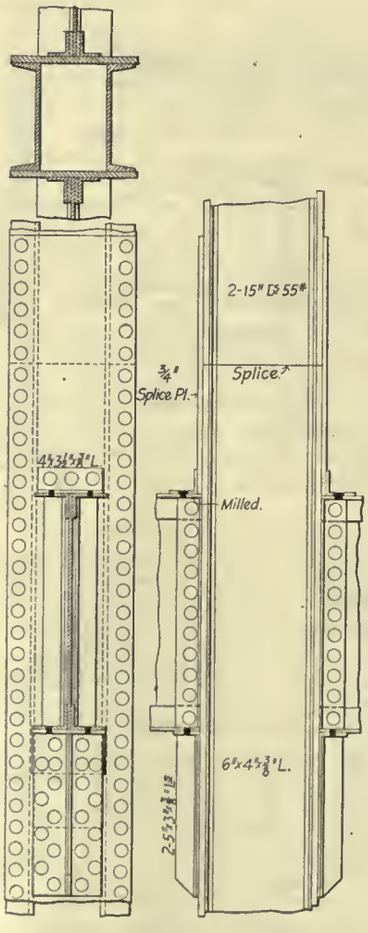
Special construction is required for the long span hip-rafters at the rear ends of the side wings. These are deep plate girders and are connected to the wall columns with pairs of vertical bent plates shop-riveted to their webs and field-riveted to the webs and flanges of the column channels, as shown in the details of columns 21 E and 24 F, the former being at the apex of the hip, and the latter at the corner of the building.

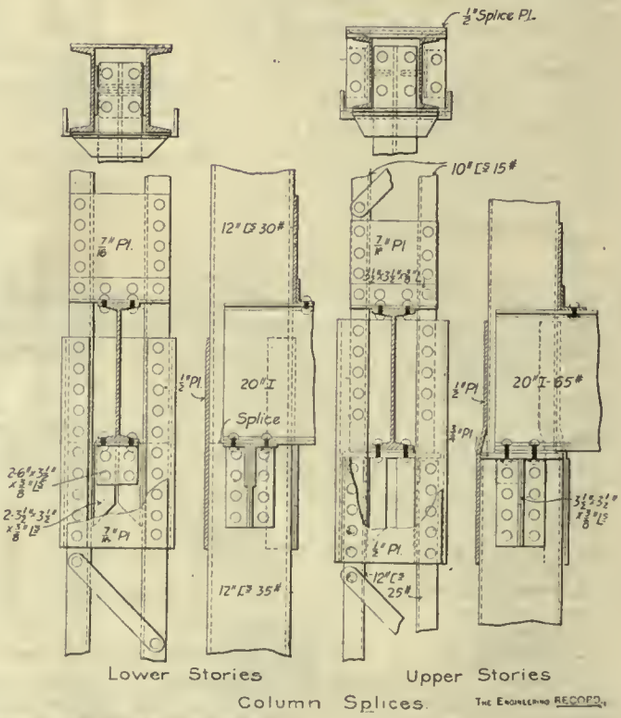
In the rear extension of one wing, the arrangement of columns is changed in a single bent, so as to have two intermediate columns and no center columns to support the ridge. At this point an 18-inch I-beam rafter is supported on the wall column and on an intermediate column 24 AA, which it overhangs, and receives at the end a mitered connection to a 12-inch rafter, as shown in the detail of a cantilever rafter. At the end of the wing extension, the pitch of the roof brings the apex of the hip between the transverse planes of adjacent column bents, and the ends of the 20-inch I-beams forming the hip rafters are here supported partly by their balanced reactions against each other and the 12-inch I-beam ridge strut, and partly by an inclined I-beam strut in the vertical plane through the ridge, which is riveted at the top to the bottom flange of the hip rafters, through bent plate connections, and at the bottom to the cap plate of column 32 B, which terminates at the attic floor level. The lower ends of these hip rafters are supported outside the











DETAILS OF COLUMNS, GOVERNMENT PRINTING OFFICE, WASHINGTON.

corner columns on the overhanging ends of cantilever girders which are formed by pairs of 8-inch channels seated on the caps of the corner columns and extend beyond them to the interior columns of the same bent, to which they have an anchorage connection with pairs of jaw plates riveted to the backs of the channel webs and the flanges of the column. The lower flange of the rafter is cut off at the intersection of the cantilever beam, and its web is field-riveted between pairs of connection angles on top of the beam, as shown in the detail marked "cantilever roof beam at end of wing."

Elevator No. 5 is located in the light court between the wings, and its framework is supported by two wall columns and two additional columns carried up to the roof level. These columns support, at their upper ends, a system of longitudinal and transverse beams and girders, which are carried from and braced to the wall columns as shown in the detail at top of column 19 C.

A wind pressure of 30 pounds per square foot was assumed for all the exposed faces of the building, and provision was made to resist it by the stiffness of the floors, which were designed to avoid transmitting it to the columns, because the great depth of the former would produce a considerable inclination of the mean fibre curve at points of support and cause objectionable bending stresses if the girder connections were rigid. Systems of diagonal bracing in vertical transverse planes extending from basement to roof were provided in some of the elevator, stairway and ventilation wells and were assumed to afford rigid reaction points for taking up any shear transmitted by the floor system, a large portion of which is, of course, absorbed by the parallel walls of the completed building. All diagonals of this bracing were made of stiff members, those in opposite directions being assumed to work together and transmit compression in one simultaneously with tension in the other, so that each was proportioned to carry one-half the maximum total stress. In the stairway walls, the horizontal girders required to carry floor beams and enclosing walls were utilized for wind struts; considerable depth was required for their vertical loads and they were proportioned for them only and made with double built channels. Symmetrical diagonal connections were made considerably below the neutral axes of these channel girders, so that the compression in the latter, due to stress in the diagonals, merely covered part of the tension in the lower chords of the girders without dangerously increasing the compression in their upper chords.

In the wings there are three elevator and stairway walls about 39 feet long transversely and two bents, or 34 feet, long longitudinally. They are enclosed by three wall and three center columns and two additional columns in the middle of the transverse sides. The bracing in each transverse plane is therefore divided into two horizontal panels in each of the seven stories, and is arranged throughout to correspond with the lower story, which is shown in the diagram marked "wing bracing in side stair wells" where column 7 A is a wall column and column 7 B is an interior column in the center of the wing. There is no bracing in the attic and the diagonals in the upper panels do not differ essentially from those in the first story, except in the sizes of the angles which diminish from 6x3½x7/16-inches in the third story to 3½x3½x⅜-inches in the seventh story. The channels of the deep horizontal girders or struts are connected to the columns by ¾-inch turned bolts through their end web stiffener-angles. The webs of the channels are connected by 6-inch Z bar separators, and all the diagonal angles are connected by single gusset plates riveted to the channel webs. Where the diagonals intersect one of the interfering flanges is notched to clear the other angle, and the parallel flanges of the two angles are field-riveted together, the flange of the notched angle being reinforced by a cover-plate across this joint. In the 6th and 7th stories this connection is strengthened by a short transverse angle riveted to both the diagonals at one side of their right angle intersection. In the lower stories the 6-inch flanges of the diagonals afford spaces for double rows of splice rivets, and the transverse angle is omitted.

The bracing in the upper panels of the vent shafts corresponds with that shown for the first story, except that the sizes of the diagonal angles diminish to 3½x3½x½ inches in the 7th story, and the number of rivets in the column connections are correspondingly reduced to eight at the 7th floor where the gusset plates are omitted and the ends of the diagonals and their angle clips are riveted directly to the channel webs. A longitudinal vertical plane through two of the interior columns bisects the vent shaft and contains all of the wind bracing, the sides of the shaft not being constructed with heavy members.

All of the steel work in the building is thoroughly fire-proofed with concrete or brick covering. Window and door frames throughout are made of cast-iron, and cast-iron is also used for the base-board and for corner guards on salient angles of brick work.

Capt. John Stephen Sewell, Engineer Corps, U. S. A., is in charge of construction of this building, and to him acknowledgment is made for the blueprints and photographs from which illustrations have been prepared, and for data contained in his annual report to the chief of engineers, U. S. A. Mr. J. G. Hill, of Washington, was the architect in charge of the elevations of the building; and Mr. H. K. Collins chief engineer; and Mr. W. A. Tapley, chief electrician of the government printing office, assisted in the studies for the design and equipment of the building. Mr. Mark Willmarth, assistant engineer, was in charge of field work. S. Carmody & Sons were the contractors for the general foundations and excavations. The concrete work was done by day labor. The Cranford Paving Company was the contractor for the cellar water proofing, and the Phoenix Iron Company, Philadelphia, was the contractor for the structural steel work. The Brown-Ketcham Iron Works, Indianapolis, Ind., was the contractor for the cast-iron door and window frames.

The Opportunities for Capital in Honduras are good according to Consul William E. Alger in "Consular Reports" for February. The principal wealth of Honduras lies in its mineral deposits, although it contains large forests of mahogany and other cabinet woods as well as pine. The laws of the country are particularly favorable to the foreigner, all that is asked of him being that he respect the authorities and obey the laws.

The University of Michigan is erecting a new engineering building at a cost of $140,000. Among the more important features of the building and its equipment will be a naval testing tank, a compressed air room, a hydraulic laboratory, a cold-storage department and steam engine and electric rooms. The tank for testing ship models is 300 feet long, 22 feet wide and 10 feet deep. It has connected with it a dry dock large enough to hold a model 10 feet long. The air compressors in the compressed air laboratory will be capable of delivering air at pressures as high as 3,000 pounds per square inch.

Three-Cylinder Compound Gas Engine.

A three-cylinder compound gas engine has recently been constructed by Messrs. Clarke, Chapman & Company, of Gateshead, England. It is of 100 indicated horse-power and has two high-pressure cylinders, in which the explosions occur, and one low-pressure cylinder, in which the products from the exploding cylinders are expanded. The valve is of the rotary type, making one revolution to four of the cranks, and is balanced by a duplication of its admission ports. The charge, being mixed prior to its admission, is throttled by a fly-wheel governor and ignited by an electric spark. All of the cylinders are single-acting, the high-pressure cranks moving together and the low-pressure crank set at somewhat more than 180 degrees in advance of the others. The high-pressure cylinders act alternately in a four-stroke cycle. The low-pressure cylinder has the ordinary two-stroke cycle and serves first one exploding cylinder and then the other. By this arrangement there is an exploding impulse on every alternate stroke and an expanding impulse during the intermediate ones. While the expansion cylinder, according to indicator cards, does roughly but one-fifth of the work done by each exploding cylinder, it is of considerable value due to its balancing and scavenging effects. During its down stroke expansion extends usually below atmospheric pressure, thus producing a slight vacuum which rarefies the traces of the burnt gases remaining in the high-pressure cylinder then exhausting. The return stroke of the low-pressure piston finally expels the gases. The exploding cylinders are 13 inches in diameter; the expanding cylinder, 18.5 inches; the stroke, 20 inches. It runs at 120 to 200 revolutions per minute.

New York Canal Improvements.

In 1895 the citizens of New York State voted to expend $9,000,000 upon canal improvements, principally in connection with the Erie Canal, based on imperfect estimates which the state engineer, Mr. Campbell W. Adams, was obliged to make in an unreasonably short time and without having at hand the requisite data. The work then projected was never completed as the appropriation was found, when the real conditions were more fully known, to be entirely inadequate. The present state engineer and surveyor, Mr. Edward A. Bond, having obtained better data, estimated later that $19,000,000 would be required to finish the work. In 1900 a scheme for replacing the Erie Canal by a so-called "barge canal" was advocated and the state engineer estimated that at prices then current the work would cost $82,000,000. A bill is now before the State Assembly which, if passed by the Legislature and ratified by the voters in a general election, will provide for these improvements.

In answer to questions recently asked by the Assembly, the state engineer has stated in a report just presented that the work could not now be done for $82,000,000. The estimate for the work covered by the bill is increased to $91,674,553. The bill provides for a canal large enough for 1,000-ton barges from Troy to Buffalo and from Three River Point to Oswego, and for a 7-foot depth of water in the Champlain canal. The revised estimate includes $5,900,000 for increases in prices of labor and materials since 1900 and $4,365,000 "for unforeseen contingencies and for estimates that may prove erroneous by reason of defective foundations, etc., being 5 per cent. of the total." A few items outside of the provisions of the bill, the chief of which is a barge canal from Waterford to Whitehall, estimated to cost $7,500,000 swell the total to over $100,000,000.

Air Testing in Tunnel Construction.

A paper presented by Joseph W. Ellms to the Laboratory Section, American Public Health Association, at the New Orleans meeting, December, 1902.

The frequent resort to tunneling in modern engineering construction involves the necessity of furnishing by artificial means a pure, cool, and abundant supply of air for the men engaged in carrying on the work. The fumes arising from the use of explosives, the possible presence of inflammable gases, and the exhalations of the workmen, all tend to vitiate the atmosphere of the tunnel headings. These conditions require that effective methods of ventilation shall be employed to insure the safety and health of the workmen. In nearly all underground excavations carbon dioxide, marsh gas, and sometimes hydrogen may be present in greater or less amounts. Sulphuretted hydrogen occurs occasionally, and carbon monoxide may be present as the result of the combustion of inflammable gases and from the use of certain explosives. Some of these gases, such as marsh gas and hydrogen are dangerous because of their inflammable and explosive character when mixed with air; some are poisonous to inhale, such as carbon monoxide and suiphuretted hydrogen; and others like carbon dioxide and nitrogen cause asphyxiation. Excepting the combustion of inflammable gases, the exhalations of the workmen form the chief source of carbon dioxide, and ordinarily the ventilation of a tunnel has largely to do with the removal of the vitiated air thus produced. Ventilation is commonly effected by means of exhaust fans, blowers, and compressors; the latter also supplying air for operating drills at the face of the excavation and for other purposes.

A part of the new system of water works being built for Cincinnati, Ohio, is a tunnel 4 1/5 miles long, which is to convey the water from the reservoirs and filter plant to a distributing pumping station situated at the eastern end of the city. The tunnel lies about 120 feet below the surface of the ground, and has a diameter of 7 feet in the finished brickwork. The diameter of the excavation averages between 9½ and 10 feet. The portion of the tunnel thus far excavated passes through a limestone and shale formation. From the first more or less gas of an inflammable and explosive character was encountered and several explosions occurred. It was therefore decided by Mr. G. Bouscaren, the chief engineer of the Commissioners of Water Works, to test the air of the various headings daily in order to detect inflammable and explosive gases, and also to determine the efficiency of the ventilation of the headings. The writer has had charge of this testing.

It was apparent from the first that the ordinary methods of chemical gas analysis were not well suited to detect gases of an explosive character in the air of the tunnel with the rapidity that was necessary to make the tests of any immediate value. The use of miners' testing lamps of the Davy type by inspectors was considered unsafe and for certain reasons inadvisable. Our attention was called at this time to a mechanical device known as "Shaw's Gas Tester," which seemed to be able to give the necessary information, and which after some investigation was purchased. The machine is capable of detecting quite small quantities of gases of an inflammable character, although it is not able to differentiate between them as a chemical analysis would do. It determines quantitatively the amount of explosive gas present and is sensitive to differences as small as 0.1 to 0.2 per cent. With this device samples of air can be tested very rapidly and it has proven to be well adapted to the case in hand.

The machine consists of two cylinders fitted with airtight pistons attached by rods to one side of a beam which oscillates on a pivot. The larger of the two cylinders is situated at the extreme end of the beam; the other cylinder is movable and can be placed close to the larger cylinder or next to the pivot on which the beam turns. The beam is moved by means of a winch, which actuates gears connected by a rod to the end of the beam opposite from that to which the piston rod of the larger cylinder is attached. From the lower ends of the cylinders tubes lead to a two-way valve, which is turned automatically by the movement of the beam. From this valve tubes, so arranged as to mix the air and the inflammable gas pumped respectively through the large and small cylinders, lead to an explosion gun. This gun consists of a long narrow cylinder having at one end a movable head and at the other a cap provided with a small hole. A small tube projects from the side of this cylinder and connects with it through a small flap valve. The outer end of the projecting tube is immediately over the top of a Bunsen burner. Near the movable head of the gun is a gong, which is rung whenever an explosion in the gun is of sufficient force to drive out the movable head far enough to hit the gong.



The Shaw Gas Tester.

A scale on the side of the beam, to which the piston rods of the cylinders are attached, is so graduated that when the piston rod of the movable cylinder is set to coincide with any division of the scale, the number corresponding represents the percentage by volume which the displacement produced by the piston of the small cylinder is of that produced by the piston of the large cylinder. As the position of the large cylinder is fixed and the movement of the piston always the same, the air which it pumps is a constant quantity. The piston of the movable cylinder, however, moves a longer or shorter distance, depending on its nearness to the large cylinder or to the pivot on which the beam is oscillating. It is evident, therefore, that by changing the position of the small cylinder varying proportions of any inflammable gas may be mixed with a constant volume of air, and may then be forced into the gun to determine whether the mixture is explosive or not.

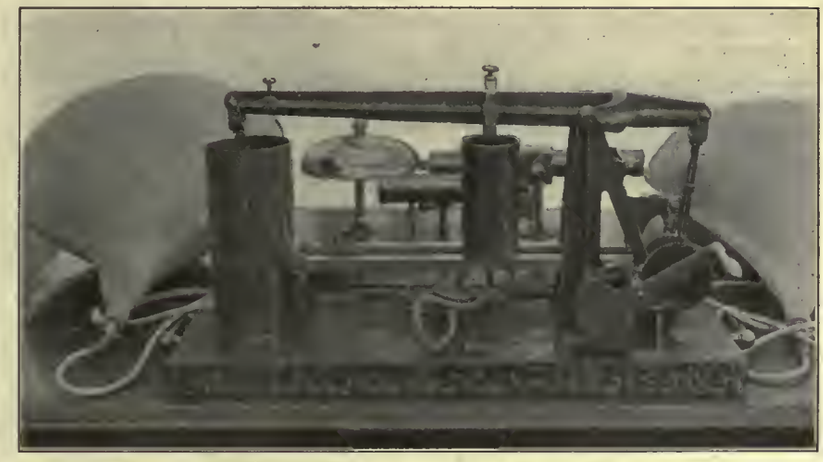
The method of operating the machine is as follows: A 5-gallon rubber bag is filled with illuminating gas and attached to the tube leading to the movable cylinder. The piston rod of the cylinder is set at about nine on the scale on the beam. The Bunsen burner is lighted in front of the ignition hole of the gun. By turning the winch the beam is made to oscillate. On the up stroke of the beam air from the room is drawn into the large cylinder, and illuminating gas into the small or movable cylinder. The two-way valve is automatically changed at the end of the up stroke so that the ports open to the tubes leading to the explosion gun. On the down stroke the air from the large cylinder and the illuminating gas from the small cylinder pass into the gun well mixed, and the mixture is gently forced through the gun. A portion of the mixture passes out the side tube of the gun over the top of the flame of the Bunsen burner and is ignited. At the end of the down stroke the ignited gas and the flame of the burner suck back into the main portion of the gun and ignite the mixture in the gun proper. If the mixture is of such proportions as to be explosive an explosion occurs, which drives out the movable head of the gun causing it to strike the gong.

By gradually decreasing the percentage of illuminating gas added to the air, a mixture can be obtained of such proportions that the force of the explosion is not quite sufficient to cause the bell to be rung. Such a mixture is termed a "standard ringing mixture," and is determined for each set of tests made. It is obvious that, if now in place of the pure air of the room a sample of air containing gas of an inflammable character be pumped through the large cylinder, the gas contained in this air added to the known quantity of illuminating gas being used to form the "standard mixture," will cause a sufficient strong explosion to ring the bell. By further decreasing the percentage of illuminating gas a point is again found where the force of the explosion is insufficient to cause the bell to be rung. If, for example, it was found that a standard mixture of air and illuminating gas, in which the latter formed 8 per cent. of the whole, was barely sufficient to cause the bell to ring, and that when air containing inflammable gas was substituted for the pure air used in the "standard mixture," the force of the explosion was hardly great enough to cause the bell to ring with the addition of only 6 per cent. of illuminating gas, then it would be assumed that the difference

between 8 and 6 or 2 was the percentage of inflammable gas present in the sample of air being tested.

The samples of air from the various headings are collected in four-gallon pear-shaped rubber bags, fitted with stopcocks. When empty their sides lie flat together. A small brass air-pump is used to inflate the bags when taking samples of air in the headings. The suction pipe of the pump can be placed at the roof, middle, or bottom of the excavation so as to obtain samples from these different positions. The sample is usually taken near the top of the excavation so as to obtain the inflammable gases, which because of their less specific gravity lie near the roof of the tunnel. These samples are brought to the laboratory daily to be tested for explosive gases and for carbon dioxide.

The testing for carbon dioxide is carried out by the usual method of absorption of the gas in a barium hydrate solution. The air from the sample bags is transferred to calibrated bottles of about one liter capacity. Ten cubic centimeters of a standard solution of barium hydrate are run into the bottle, which is then closed with a rubber stopper. The bottle is then shaken several times to permit the carbon dioxide in the air to be absorbed by the barium hydrate. After standing from five to ten minutes the excess of barium hydrate is titrated with a standard oxalic acid solution. Corrections are applied for temperature and barometric pressure, and the results are stated in parts per hundred for standard conditions of temperature and pressure.



Gas Tester, Showing Bag for Collecting Samples.

The present method of ventilating the various tunnel headings is by means of air compressors, which supply air for operating the drills and for other purposes. The air passes from the compressors to a receiver and thence is conveyed by a 4-inch pipe to the bottom of the working shafts, where the pipe is reduced to 3 inches. This 3-inch line is laid along the bottom of the tunnel to the face of the excavation. The exhaust from the drills forms the source of the fresh air supply when the latter are in operation. When the drills are not in use the air is permitted to escape at intervals along the line as well as from the end of the pipe.

The explosive gases thus far encountered have generally entered the excavation at points where water was leaking into the heading in considerable quantity. It may occur in pockets and be liberated in the course of blasting; or it may permeate the rock in places and leak into the excavation because it is under a slight pressure. An approximate analysis was made of the gas bubbling up through the water in one of the headings. It was found to contain 31.0 per cent. of hydrogen, 45.7 per cent. of marsh gas (methane), 2.2 per cent. of carbon dioxide, beside oxygen and nitrogen. The two latter gases were very likely of atmospheric origin, although the oxygen was in excess. There were also some indications of other hydrocarbons being present beside methane. In general the gas is similar in composition to the natural gas found in the Ohio and Indiana fields. It owes its explosive properties to the marsh gas and hydrogen which it contains. The so-called "explosive limits" for mixtures of methane and air and hydrogen and air, as recently determined by Bunte and Eitner, are as follows:

	Lower limit. Per cent.	Upper limit. Per cent.
Marsh gas (methane).....	6.1	12.8
Hydrogen	9.4	66.4

It will thus be seen that the mixtures containing between 6.1 per cent. and 12.8 per cent. of marsh gas, and 9.4 per cent. and 66.4 per cent. of hydrogen, will form explosive mixtures with air. Other investigators vary these limits somewhat, and all state that the manner of igniting the mixture affects the results obtained. Below the "lower limit" of explosion mixtures will not explode, and above the "upper limit" no explosions occur, but the mixture burns freely where it lies in immediate contact with a layer of air which will furnish the necessary oxygen to support combustion. The chief danger from the presence of these gases in any quantity, lies in their rapid diffusion through the air with the consequent formation of mixtures of such proportions as will explode if accidentally ignited.

It was found that the "lower limit" of explosion of as pure a sample of the gas as could be obtained from one of the tunnel headings, was about 7.0 per cent. The "upper limit" was not definitely ascertained, but it appeared to be less than 20.0 per cent. These figures refer to tests made with the Shaw gas tester and to conditions such as exist in using this machine. This should be borne in mind if comparisons are made with figures obtained in more exact experiments. Moreover it must be rememberd that the explosive gas occurring in the headings is a mixture of gases and that its composition is probably variable. In the course of the daily testing, samples of air containing as high as 67.0 per cent. of explosive gas have been found. Such samples could not be exploded directly, but burned freely when ignited. In order to obtain an explosive mixture in such cases dilution with air was necessary.

Traces of inflammable gas are not infrequently found. If present at all, however, it usually is in amounts of less than 1.0 per cent. The larger part of the time these gases are absent from the majority of the headings. But since it has been shown that inflammable gases are liable to be encountered at any time, the only safety lies in a continuous testing of the air in order to detect dangerous conditions immediately. About 1,800 tests for explosive gases and 1,700 tests for carbon dioxide have been made during the past year.

An Interesting Boiler House at Apponaug, R. I.

An interesting boiler plant has recently been completed at Apponaug, R. I., to serve a bleachery works at that place owned by Mr. William Wanton Dunnell. It is housed in a remarkably well appearing building architecturally and comprises vertical boilers, with mechanical stokers, economizers and induced draft. Space has been provided for ten boilers of an aggregate of 2,000 boiler horse power and each boiler is arranged to feed into a low or a high-pressure system of pipes, so that any number can be run at the one pressure and the remainder at the other pressure. An unusual feature in connection with the draft apparatus is the use of a short stack of brick, which, of course, goes toward improving the exterior aspect of the plant. Messrs. Lockwood, Greene & Company, of Boston, were the architects and engineers for the work, which in both design and equipment represents good up-to-date practice.

The bleachery comprises a number of detached buildings covering several acres of land and the boiler house is a 33x168-foot building in ground plan, containing the boiler room proper, an economizer and pump room and the fan room for the mechanical draft apparatus. The boiler room is constructed of 20 and 16-inch brick walls with lofty windows and it is 34 feet high in the clear, having a monitor which provides space for drawing boiler tubes and affords ventilation and additional light.

The rest of the building was not carried so high, sufficient headroom only being left, as in the case of the boiler room, for handling the apparatus. A view of the boiler house and a plan and longitudinal elevation are given in the accompanying illustrations. The boiler room, economizer and draft fans lie in a straight line, and the products of combustion thus travel the length of the house, which, as indicated, could thus be correspondingly narrow. The floors throughout are of brick paving, and the walls inside are painted white.

In the boiler room there are at present installed six Manning boilers, made by The Bigelow Company, of New Haven, with provision for a future installation of four more. They are rated at 200 horse power each and have 284 tubes 2½ inches in diameter, 2,768 square feet of heating surface, of which 738 is above the normal water lining and considered as superdrying surface. The usual furnace of this type of boiler has been replaced by one of lesser height, and the boiler is mounted on a brick furnace to which has been fitted a Roney mechanical stoker. Soft coal is ordinarily to be burned, and the two steam pressures to be carried are 60 and 120 pounds, respectively. Each boiler has a smoke connection to the breeching of 8 square feet area and the smoke breeching, which is supported behind the boilers and maintained at a constant width and a constantly increasing depth, has a maximum cross-section equivalent to sum of the smoke connections of six to seven of the boilers.

The economizer consists of two groups of 200 tubes each. It was built by the Green Fuel Economizer Company, and is provided with a steam driven engine for cleaning the tubes. There will be a duplicate installation of draft fans when the plant is completed, each fan driven by its own steam engine and capable of serving the entire boiler plant, so that one fan

will always be held in reserve. One unit has been installed and comprises a Sturtevant centrifugal exhauster, with a blast wheel 9 feet in diameter and 4 feet wide at the periphery, and an 8x12-inch horizontal Sturtevant steam engine directly connected to it. The mechanical draft unit was designed to run at 50 revolutions with eight boilers in operation, and to maintain under those conditions a normal draft of ¾ inch of water. The steam supply pipe to the fan engine is fitted with a valve controlled by a Locke damper regulator to maintain a constant steam pressure by varying the speed of the fan. The chimney into which the fans discharge is of brick, as stated, and its walls are formed with an enclosed air space to allow for differences in expansion between the inside and outside brickwork. It is square in cross-section, 36 square feet in area and 50 feet high above ground level.

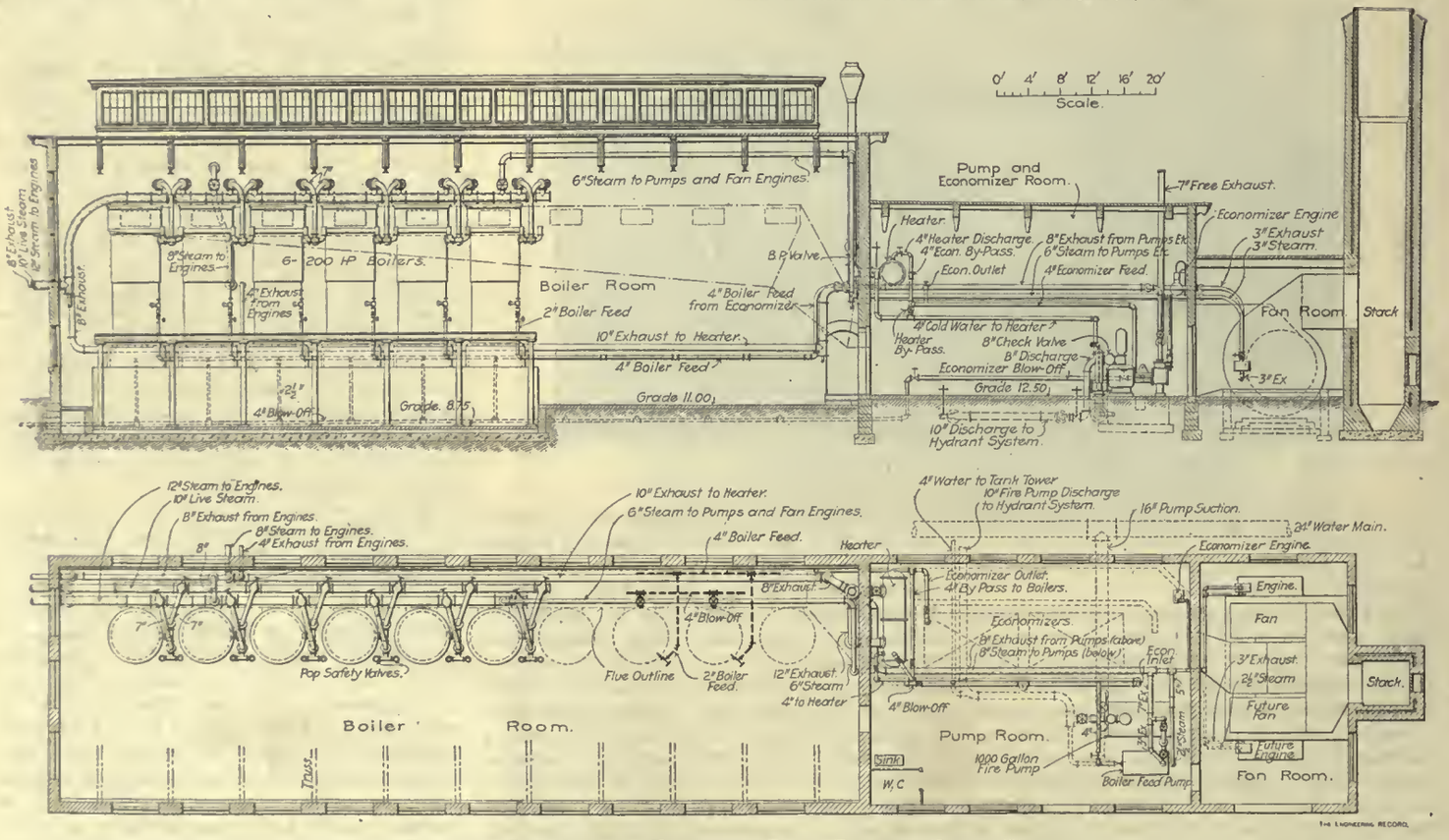
Steam is taken from each boiler through a 7-inch connection in the side of the bonnet. The connection joins a tee, from the opposite ends of which the two branch pipes are taken to the two steam mains corresponding to the two pressures that are carried. The front end of each tee besides feeding one of the branch pipes is connected to two pop safety valves which are set at 125 pounds, two being employed with each boiler as a double means of security against the sticking of the valve. The smaller valve "leads" the larger by about 1 pound. Each steam supply connection has one valve which is of the Jenkins angle type placed vertically above its corresponding steam main. The mains are hung from the roof trusses, and the valves are reached from a walk provided above the breeching. Steam for the pumps and fan engines is taken from the high-pressure main, and the pump main runs, as indicated, through the economizer room into the draft room.

The pump equipment will include two 1,000-gallon 18x10x12-inch fire pumps which will be used to feed the boilers as well as to deliver to the hydrant lines in case of fire. One of these pumps, of the Barr make, has been installed, and for the second fire pump there is at present in its place a duplex direct-acting steam pump which is ordinarily used for boiler feeding. The steam generated by the plant is largely used in dye processes, and the condensation cannot be returned to the boilers. Fresh water has therefore been drawn constantly from private supply, and it is delivered ordinarily to the feed-water heater and economizer in turn, as usual; but both the heater and the economizer can be bypassed. The run of the feed piping is indicated in the illustrations. The heater is a Wainwright horizontal heater supported above the economizer setting and has a heating surface of about 437 square feet. The exhaust steam which can thus be utilized by the feed heater is collected at the heater, where the free exhaust pipe is fixed, this fitted, in the usual way with a back-pressure valve which is placed immediately above the supply connection to the heater and capped with an exhaust head above the roof. The heater is of the two steam connection type, and the steam discharge pipe connects into the free exhaust above the back-pressure valve.

The steam piping throughout is full weight wrought iron with extra heavy fittings and the Van Stone joint, made by the Walworth Manufacturing Company, on piping 6 inches and larger in diameter. The feed piping is of brass, iron pipe size, and the blow-off pipe of cast-iron flanged pipe. Corrugated copper gaskets are used with all joints in the steam and blow-off piping.



The Dunnell Boiler House, Apponaug, R. I.



Plan and Longitudinal Elevation of the Dunnell Boiler House.

The Sale and Storage of Matches in New York City are hereafter to be regulated by the municipal authorities. Among the "suggestions for the proper use of matches in households" accompanying the general regulations is the following: "Children under ten years of age should not be permitted to play with or use matches of any kind."

American Capital invested in Mexico amounts in round numbers to $500,000,000 gold, according to "Consular Reports" for February. Of this, about 70 per cent. is invested in railroads, and the next important industry is mining, agriculture being third in the amount of American capital invested. There are 1,117 companies, firms, and individuals representing this capital.

A Water-Power Plant near Grenoble, France.

A water-power plant, chiefly interesting, perhaps, from the fact that it uses a hooped-steel concrete conduit for conducting the water, has been completed at Champ, in Isere, France, on the Drac River, about 9⅛ miles above its confluence with the Isere River, near Grenoble. A net head of 105 feet has been utilized and waterways have been provided for harnessing 600 cubic feet of water per second, or sufficient to develop 7,200 horse-power. The plant is of the class in which the water is conducted as far as practicable in open canal and then by a pipe line to the turbines. The pipe line is 10.82 feet in diameter, and the first portion of it, that is, until the head becomes 65.6 feet, is of the reinforced concrete. The plant was described recently in "Le Genie Civil."

The head works are located at a point where the river issues from a gorge and flows into a wide plane leveled by its deposits. During floods, when over 42,000 cubic feet of water are passed per second, the stream takes a width of more than 3,000 feet; while under ordinary conditions, the discharge amounts to 2,120 to 2,830 cubic feet, and the stream only occupies a channel which it cuts out in its deposits, frequently changing its course. The water for power purposes is diverted by means of a fixed submerged dam, which extends from the left bank of the stream toward the head-gates of the canal. The gate structure runs from the right bank in a direction parallel with the stream, and between its outer end and the river end of the dam there is located a movable dam, to set up a stronger current of the river, or a larger volume of flow across the front of the gates.

The fixed dam is a mass of concrete 426.5 feet long, 39.4 feet thick at the base and 6½ to 16½ feet high, according to the depth of the river bed. The concrete is covered by heavy riprap to protect it against disintegration from gravel carried by the torrent, which, it appears, is commonly heavily charged with sand and stones. The top of the dam is scarcely more than 5 feet above the stream bottom. The movable dam contains two gates 26.24 feet wide and 4.92 feet high, operated from a footbridge supported at one end by a pier between the movable and the submerged dams and at the other end by the head-gate structure. The pier and the bottom or apron of the movable dam rest on a metal caisson, 55.8x19.7 feet in size, lowered 32.8 feet below the bottom of the fixed dam by means of compressed air. Here again, to protect against erosion by the gravel, the top of the caisson is covered with a flooring of oak joists 5.5 inches thick, fixed under the corners of the caisson and by bands of iron, 3.28 feet apart on centers fastened by bolts imbedded in the concrete.

The head gate structure consists of a concrete wall, 262.5 feet long, pierced by 15 openings 6.56 feet wide and 4.92 feet high. The openings are protected by a rack of iron bars extending the length of the wall and of the usual construction, except that the flat iron bars are inclined slightly downstream, like the slats of window blinds, so that pebbles entrained by the current produced by the open movable dam cannot easily reach the intake canal. The wall of the gate structure is built on piles, around the heads of which was spread a mass of concrete 6.23 feet thick. The water entering the head-gates flows into a settling chamber and from this into the open canal. The settling chamber, which covers an area of 2,990 square yards, takes the form of a mouth to the canal, and the flow of water from it into the canal occurs over a stop wall, 1.96 feet high above the bottom of the chamber. This is apparently designed to catch sand, and the settling chamber has an overflow wall, running from this stop wall to the head-gate structure, 4.26 feet above the bottom of the chamber, to discharge excess water into the river. For flushing out the settling chamber, a number of waste gates are provided.

The canal is nearly 2,000 feet long, and varies in width from 196.8 to 72.18 feet with a depth of 4.9 to 13.1 feet. It is built partly in excavation and partly of embankment; its banks are protected with a lining of concrete, and it has a slope of 4 in 1,000. Under normal conditions, with the plant working at full load, the mean velocity of the water in the canal is about 1.14 feet per second, which allows sand in suspension to deposit. When it is desired to clean out the canal, the flow of the water is increased by opening six discharge gates and closing the head gates. The forebay, built of concrete walls, has an area of 1,075 square yards and a depth of 13.1 feet. It is divided into two compartments separated by a wall 3.9 feet high. The first compartment receives the water from the canal, and its purpose is to change the direction of the current and to catch sand. It is about 65x100 feet in size, and extending across it at right angles to the direction of the flow of the canal there are six gutters formed in its bottom, each leading to a discharge opening by which the water can be wasted into a canal leading to the river. These six wasteways have already been referred to. At the opposite end of the chamber from these discharge openings is the wall, 100 feet long, separating the two chambers. The water passes over the top of this wall, which is 3.28 feet above the bottom of the first chamber. The second compartment varies in depth from 13.1 to 23 feet and leads at its lowest end into the trumpet-shaped mouth of the pipe line.

The pipe line, as already stated, has a diameter of 10.82 feet. It has a slope of 7 in 1,000 and is 15,090 feet long, 6,890 feet of it being of reinforced concrete construction and the remaining 8,200 feet of soft steel plates. The reinforced concrete section is subjected to a maximum pressure of 65.6 feet of water and is of hooped steel concrete, with walls 7.87 to 9.84 inches thick. The hoops are of round iron, 0.433 to 0.880 inch in diameter, and they encircle round-iron bars 0,236 to 0.472 inch in diameter, which run longitudinally with the pipe. The hoops and the longitudinal bars are fastened together by wires and form meshes of 3.9x4.3 inches, on centers. The concrete was put in place between a center or mandril and two outside half-cylinder shells or molds. The pipe line is imbedded in a foundation of lime concrete filling the excavation made for it and is covered with a bed of earth and gravel about 15 inches thick on top and sloping 3 to 2 to ground level, this covering to protect it against outside temperature and resulting expansion changes. About 118 feet of conduit were built per day.

The steel conduit consists of riveted plates 0.27 to 0.59 inch thick, resting like the concrete-steel conduit on a bed of concrete in the excavation and protected by an earth and gravel covering. The velocity of flow through the pipe line is 6.5 feet per second, and to avoid water hammer, in case of a sudden stoppage at the power station, three towers have been installed on the pipe line, two on the concrete steel portion and one of the lower end. The first tower is 29.5 feet high and 1,300 feet below the forebay; and the second is 65.6 feet high, placed at the junction of the hooped concrete and the sheet steel pipes. This is 3.6 feet in inside diameter. The third tower is 114.8 feet high, 10.82 feet in diameter at the base and 4.59 feet at the top. It is located at the end of the steel pipe line, of which it is in reality the prolongation. Its top is about 2 feet above the normal level of the water in the forebay, and is surmounted with a sheet steel reservoir, 9.84 feet in diameter and 6.56 feet high, from which three pipes 23.6 inches in diameter discharge into the tail race.

The generating plant is in a 144x39-foot building founded on concrete. It contains five direct-connected electric turbine units, each of 1,350 horse-power capacity. The turbines are of the horizontal inward flow type with draft tubes of 16.4 feet effective length. They operate at 300 revolutions per minute and under full load pass 141 cubic feet of water per second. The alternators are three-phase 3,000-volt 50-cycle generators with revolving fields. Current is stepped up for transmission purposes to 15,000 and 26,000 volts, by means of oil-cooled transformers and stepped down in substations. The efficiencies of the different portions of the plant are as follows: Turbines, 76 per cent.; alternators, 94 per cent.; transformers, 97.5 per cent.; transmission line, 31 miles, 94 per cent.; substation transformer and secondary transmission lines, 90 per cent. This gives a combined efficiency for transmission over the 31 miles with double transformation, of 58 per cent. The net cost of the installation per horse-power delivered to the customer is about $230; the cost per horse-power on the turbine shaft is about $105.

The Eleventh International Railroad Conference of the Young Men's Christian Associations, Railroad Department, will be held in Topeka, Kan., April 30 to May 3. President Roosevelt has signified his purpose to attend.

Work on the Pennsylvania Railroad Tunnels beneath New York City and the North and East rivers were begun a few days ago by the demolition of buildings to clear the site for the shaft head and the construction plant on the New York shore of the North River.

The Association of Railway Superintendents of Bridges and Buildings has appointed a special committee of seven members to report at the next annual convention, to be held at Quebec in October, on the subject "Best Method of Making Annual Inspection of Bridges and Culverts, and the Form of Report to be Made." A circular containing eleven questions has been prepared. The committee desires information from all persons interested. Communications should be addressed to Mr. Walter G. Berg, chief engineer of the Lehigh Valley Railroad, 26 Cortlandt Street, New York.

An Explosion of Pulverized Coal occurred in the new Edison Portland Cement Works near Stewartsville, N. J., on March 2nd, resulting in the death of five or more persons and serious injury to as many more. It is stated that the explosion occurred in the coal grinding room; whether it was due to spontaneous combustion or to the presence of a naked light has not been learned. Reports state that property valued at $100,000 was destroyed. The explosion adds another to the list of accidents where pulverized fuel is used and emphasizes the fact that the greatest care is necessary to prevent such accidents. The fine particles of coal suspended in the air seem to act like gunpowder in the rapidity with which combustion occurs. The many friends of Mr. Edward A. Darling, the general superintendent of the plant, formerly superintendent of buildings at Columbia University in New York City, will regret to learn that he was very seriously injured.

The Furens Dam.

While studies were in progress for the Wachusett Dam of the (Massachusetts) Metropolitan Water Works, which is now being built at Clinton, Mass., attention was given to its architectural features and its setting in the landscape. As a guide in these studies information was sought along these lines regarding noted existing dams, and a number of photographs were collected. It was found, however, that as most dams are located in out-of-the-way places but little thought had, apparently, been given to their appearance; and, furthermore, that but few photographs of dams could be found for sale, although views of buildings and monuments could be gotten readily. Through the courtesy of Mr. Frederic P. Stearns, chief engineer of the Metropolitan Water and Sewerage Board, The Engineering Record is permitted to reproduce a few of the photographs which were collected by his assistants. The illustrations presented herewith show three views of the celebrated masonry dam built across the Furens River near the town of St. Etienne, in 1862-1866, by the French Government. The purpose of the works was the control of the floods of the river in order to prevent the inundations of the town, but the water is utilized by the town and factories.

The dam is located in a V-shaped gorge and has rock abutments on each side. It is curved, in plan, to a radius of 828 feet, and its maximum height is about 170 feet, with an extreme thickness at bottom of about 160 feet. It was the first dam to be constructed in accordance with the rational theory now followed in the design of great masonry dams. Indeed, it was largely in connection with the design of this dam that the modern theories were developed by MM. Sazilly and Delocre. The cross-section of the Furens dam is familiar to all who have made a study of large masonry dams; it closely approximates the so-called profile of equal resistance. The top of the dam is only 10 feet thick, but 16½ feet below the top there is an 8-foot berm which makes the thickness at that level about 21 feet. The thinner upper portion serves principally as a guard wall to prevent waves from being driven over by the wind in times of extreme high water and also provides a support for a passage across the valley. The reservoir is at an elevation of 2,600 feet above sea level, and in severe winters has ice 20 inches thick formed upon it.





FURENS DAM, ST. ETIENNE, FRANCE.

View across Down-Stream Face from Left Bank. View of Up-Stream Face from Left Bank

The Constituent Parts of Concrete.

The fact that different engineers attempt to produce the same result in concrete work by widely differing mixtures is often brought to the attention of those particularly interested in the subject. As there is still room for improvement in the matter of the preparation of the specifications for concrete work, the following abstract of a paper read February 10, by Mr. Charles M. Crawford, before the Connecticut Society of Civil Engineers, is presented.

In the specifications for a concrete dam recently built in Connecticut, the proportions were set forth as follows: For the body of dam and abutments,—1 part Portland cement, 3 parts sand and 3 parts of broken stone. For 12 inches on the outside face of the dam,—1 part Portland cement, 3 parts sand and 2 parts of broken stone. From Prof. Baker's results, stated in his "Treatise on Masonry Construction," the structural value and relative cost of these mixtures would be, according to Mr. Crawford, about as given in the accompanying table, both being compared with a 1:2:4 mixture:

Mixture.	Structural value.	Cost.
1:2:4	1.00	1.00
1:3:3	0.60	1.21
1:3:2	0.58	1.64

On the same basis even a 1: 3:6 mixture would show a relative structural value of .0.615, being stronger than either of the mixtures specified, while the cost would be only 87 per cent. of the 1: 2: 4 mixture.

Mr. Crawford's practice has followed the views set forth by Prof. Baker. He has used from 1: 1: 2 for the surface of artificial stone sidewalks, where density and resistance to wear is required, and 1: 2: 4 for the arches of concrete bridges, to a mixture of 1: 6: 12, to cover the bottom of a "shoot-the-chutes" pond in order to do away with trouble from the stirring up of the mud. An 8-inch cube of 1: 4: 8 concrete taken directly from the mixing board during the construction of an abutment at Middletown, Conn., tested by Messrs. Lathbury & Spackman, of Philadelphia, broke at 1,032 pounds per square inch one year after mixing. The individual pieces of trap rock broke prac-

tically in a plane without pulling out of the mortar. Attention is called, however, to the great difficulty of filling such a small cube with a concrete that is absolutely representative of the mass.

The important question as to the actual content of a barrel of Portland cement appears to be open to discussion. The Atlas Portland Cement Company state regarding this: "Figures are seldom quoted on account of the difficulty of obtaining them under equal conditions of packing." Mr. E. D. Graves, chief engineer of the Connecticut River Bridge and Highway District Commission, gives the following as the result of measurements made in 1898 of barrels in which Portland cement had been packed:

Alpha domestic cement	3.59 cubic feet
Champion domestic cement	3.40 "
Alsen imported cement	3.38 "
Alsen imported cement (cylinders)	3.24 "

In 1899 Mr. Henry Souther in making some tests for the Hartford Paving & Construction Company (of which Mr. Crawford is the secretary), established the weight of a cubic foot of Atlas Portland cement loose at 91.27 pounds, making a barrel (380.1 pounds) equal 4.16 cubic feet. Major Walter L. Fisk, Corps of Engineers, U. S. A., in his report (1899, page 1,001) to the Chief of Engineers on the defenses of the mouth of the Columbia River, gives figures demonstrating that he considered the content of a barrel of Portland cement for the purpose of concrete to be 4 cubic feet. The volume of a barrel of Portland cement is established by the Aurora, Elgin & Chicago Railway, which has used concrete construction extensively, by the following clause in its specifications: "The proportions above expressed are units of volume, a quarter-barrel sack of Portland cement as packed by the manufacturer being accepted as a cubic foot. The sand must be measured loosely."

Concerning the volumes of mortar to be used in a concrete, the report of Mr. Souther, already referred to, contains data of interest. These tests were made for the purpose of verifying the results of work on which the contractor's return was governed by the amount of stone a 1: 2 mortar would flush. Mr. Souther found that one barrel of cement (taken at 4 cubic feet) plus 8 cubic feet of sand, when mixed with 16 gallons of water made 8.35 cubic feet of mortar, and that the stone experimented with contained 45.05 per cent. of voids; so that 8.35 cubic feet of mortar should flush theoretically 18.53 cubic feet of stone. A practical determination was made as follows: Six boxes, each 6x6 feet were filled with three different mixtures of concrete, made in duplicate. These were rammed in the boxes as nearly level as possible, and the volume of concrete measured by taking twelve points along the edge and four through the center, to obtain the average depth. The proportions of the concrete and the resulting volumes are given in the accompanying table, the mortar in every case being composed of 1 barrel of Atlas cement and 8 cubic feet of sand, mixed with 16 gallons of water:

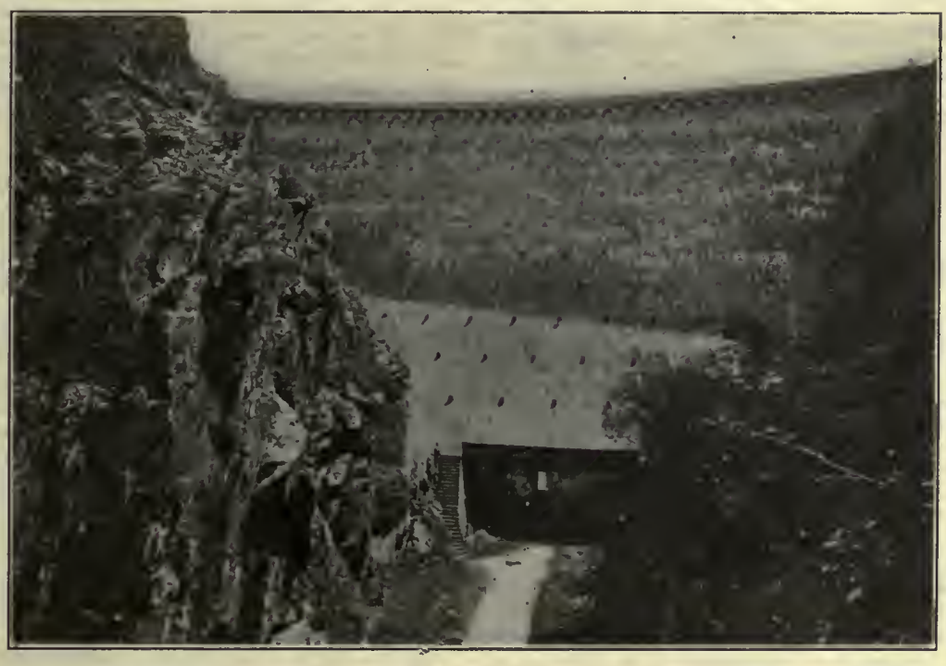
Sample.	Stone, cu. ft.	Depth in box, ft.	Volume, cu. ft.
1	16	0.46	16.56
2	16	0.48	17.28
3	24	0.67	24.12
4	24	0.68	24.48
5	21.5	0.60	21.60
6	21.5	0.62	22.32

One sample of each mixture was broken, and the sections showed in each case that the concrete was thoroughly homogeneous and all voids filled. It was Mr. Souther's opinion that the concrete was mixed a little too dry, and that if about 20 gallons of water had been used, the concrete would have been even better. These tests show that the volume of concrete exceeded that of the stone only slightly in samples 3 and 5 and 7 per cent. in sample 2. Major Fisk states, in the report already referred to, that it required 24 cubic feet of crushed rock, 11 cubic feet of sand and 3 cubic feet of cement to make 1 cubic yard of concrete. This gives an increase of bulk of concrete over stone of 12½ per cent. Major (now Lieutenant Colonel) Henry M. Adams reports on work at the entrance to New York harbor that it required as the mean of 4,360 cubic yards of concrete, 0.90 cubic yards of stone, 0.45 cubic yards of sand and 1.10 barrels of cement to make a cubic yard of concrete, and for 8,736 cubic yards of concrete the cement was increased to 1⅓ barrels per cubic yard. At Staten Island, in placing 5,873 cubic yards of concrete, he averaged 0.90 cubic yards of stone, 0.40 cubic yards of sand and 1.125 barrels of cement. The increase of concrete over stone was 11.1 per cent. on this work, therefore.

Two specifications that varied greatly in regard to definiteness in stating the proportions were mentioned. One was for some important work in New York State, in which the mixture for the predominating portion of the work was stated as follows, the proportions for the other parts only varying in the amounts of aggregate to be used: "Concrete for massive construction, such as retaining walls, column foundations and inverts will usually be proportioned as 1 part by volume of Portland cement, and 8 parts by volume of aggregate of stone, gravel and sand"; and again: "The proportion of stone, gravel and sand will be varied from time to time by the engineer as he may require, in order to secure an aggregate as nearly as possible free from voids, taking into account the sizes and qualities of the materials furnished." In this specification there is nothing to show what the engineer intended to use as his base unit. Mr. Graves has measured barrels as small as 3.24 cubic feet, and Mr. Souther has placed the loose volume of a barrel of cement at 4.16 cubic feet. The comparative cost of the ingredients only, in one cubic yard of concrete at the price in force when this contract was let, and with voids of 45 per cent. in the broken stone will, according to Mr. Crawford, be: With a base unit of 3.24 cubic feet, $4.39, and with a unit of 4.16 cubic feet only $3.92, showing a possible extreme divergence of opinion equal to 47 cents, surely worth considering, as the concrete amounted to 90,000 cubic yards. The other specification referred to was for work in Virginia, in which the engineer specified exactly the number of cubic feet of both sand and stone required per barrel of cement for each class of concrete. The Aurora, Elgin & Chicago specifications already quoted accomplish the same result by defining the volume of a sack of Portland cement.

In the "Transactions" of the American Society of Civil Engineers, volume 42, page 125, Mr. Allen Hazen describes a convenient method of determining the voids by first determining the specific gravity of the material as a whole, including the voids. The percentage of space occupied by the particles is then obtained by dividing the specific gravity of the mass, including the voids, by the specific gravity of the solid particles, and the voids are represented by the difference between the whole volume and the space occupied by the solid particles. Mr. Hazen called attention to the necessity for determining the amount of water in the material after the test, if any considerable amount were present, and further stated that the specific gravity of the solid particles could usually be assumed as close to 2.65. Wishing to verify this value of 2.65 for the sand and broken stone used in the neighborhood of Hartford, Mr. Crawford had investigations made of samples of sand from Burnside, Conn. One of these samples, marked damp sand, was an average specimen of the sand as it comes from the bank, and is ordinarily used in concrete. The other specimen, marked dry sand, had been artificially dried for use in the sprinklers of the cars of the Hartford Street Railway Company. The stone was trap rock from the quarry of the Hartford Trap Rock & Supply Company.

Tests of three pieces of the trap rock gave 2.993, 2.984, and 2.974, or an average of 2.984. On this basis, assuming water at 62.36 pounds, the weight per cubic foot of the trap rock is 186.1 pounds. In testing the dry sand a clean glass bottle of known volume was weighed empty, the dry sand poured in a slow stream into the bottle, the latter being hit lightly with a pencil a few times to settle it, then struck off flat, and weighed. The apparent specific gravity of the sand was 1.48, equivalent to a weight of 92.3 pounds per cubic foot. Water was then carefully added to the sand, and the weight of the bottle plus the sand plus the water to fill the voids was found. The voids filled with water amounted to 37.8 per cent. of the



FURENS DAM.
View of Down-Stream Face Showing Shape of Gorge.

total, and the actual volume of the sand particles was 62.2 per cent. The specific gravity of the sand particles was found to be 2.37, equivalent to a weight of 147.8 pounds per cubic foot. The percentage of voids was 37.6.

The moist sand was examined in exactly the same way. Owing to the moisture the sand did not flow as readily into the bottle as the dry sand had done, but the filling was obtained as nearly as possible like the first case. The apparent specific gravity was found to be 1.13, giving a weight per cubic foot of 70.47 pounds. The bottle was then filled with water as before, and the real specific gravity of the sand particles was found to be 2.38, corresponding to a weight per cubic foot of 148.5 pounds. The percentage of voids was 52.5. Another test of the damp sand showed the percentage of voids to be 49.

For a concrete bridge of three arches having a 2-foot rise, 15-foot span, a thickness at the crown of 1 foot 10 inches, and thickness of the center piers of 3 feet, built under Mr. Crawford's directions, the concrete was proportioned as follows: For the arches, 8 and 16 cubic feet of sand and stone respectively to each barrel of Portland cement, and for all other parts, 12 and 24 cubic feet respectively.

Mr. Crawford concludes: First, it is desirable to fill the voids in the broken stone with just as good a mortar as the nature of the work and the available cash will warrant, but it is not desirable to use an amount of mortar very much in excess of the voids. This excess is limited in the 1901 specifications for concrete on the middle division of the New York State canals to from 1 to 2 per cent. Second, avoid ambiguity in specifications by stating clearly either the number of cubic feet of both sand and broken stone to be used to each barrel of cement, or the volume assumed for the barrel of cement in proportioning the mixture.

In the discussion following this paper Major Charles F. Powell, Corps of Engineers, U. S. A., referred to some work under his charge many years ago on the Columbia River, Oregon, where he made some experiments with a concrete using the run of the crusher. The rock used was basalt, and briquettes made with the sand from the crusher gave results equal to those obtained by the use of the natural sand. Ultimately he obtained a mixture of the natural and crusher sand that gave results 20, 30, and even 40 per cent. better than those obtained with the natural sand of that region. Mention was made of the use of broken stone with no sand at all for sidewalks in St. Louis. Major Powell also spoke of some work on the Monongahela River where the concrete was specified to be 1 part by volume of cement, 3 parts sand, and 5 to 8 parts broken stone or a mixture of broken stone and gravel, the requirement being that all voids should be filled. At first it was necessary to use 1:3:5, but finally by the use of a fine gravel the contractor was enabled to use the proportion 1:3:7½. Speaking of the use of granulated slag instead of sand at Pittsburg, he stated that briquettes made with the slag gave better results than those made with the best Allegheny sand except at first, when the values were about equal. At the end of a month or so the slag briquettes showed fine cracks, and it was thought that the slag could not be depended on. However, throwing out four defective specimens from ten tested, the other six briquettes made from slag sand gave values much above those obtained by the use of the Allegheny sand.

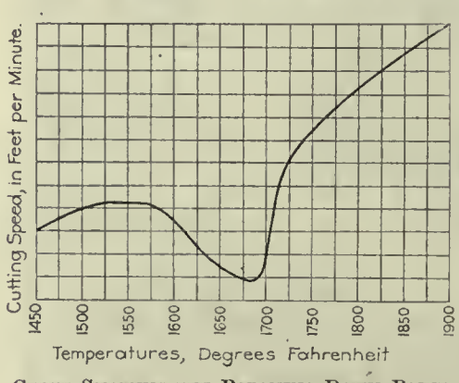
The American Foundrymen's Association will hold its annual meeting in Milwaukee, June 9 to 11. Dr. Richard Moldenke, secretary, address, P. O. box 432, New York City.

The Taylor-White Process of Treating Tool-Steel.

Abstract of the report of the Committee of the Franklin Institute on the Invention of Maunsel White and Fred W. Taylor. Sub-Committee: Charles Day, James Christie, Coleman Sellers, Arthur Falkenau, Wilfred Lewis.

About three years ago an extensive series of experiments were undertaken at the Bethlehem Steel Works, by Messrs. Taylor and White, in order to determine the relative efficiency of various brands of tool-steel on the market at that time. There are two distinct classes of tool-steel, namely, carbon and air or self-hardening. The latter brand, the result of Mushet's work, has completely replaced the carbon steel for roughing, its comparative efficiency approximately being 1.5 to 1.0. Mushet discovered that by the addition of manganese and tungsten to tool-steel it maintained its cutting edge at much higher temperatures and consequently much higher speeds were possible. The general introduction of this steel did not, however, take place as rapidly as one would suppose, the manufacturers failing to appreciate the great economy realized by using it. In fact, very few of the shops that did use it obtained the greatest efficiency possible, as no knowledge of cutting speeds and feeds was at hand.

In the experiments referred to it was found that the results obtained from different tools made from the same steel varied greatly, and it was accounted for by variations in the process of hardening. It was found that those



Curve Showing the Breaking Down Point.

cooled from a very high temperature gave remarkable results far surpassing anything yet accomplished. It must be understood at this point, that all air-hardening steel, manufactured up to this time, was hardened by heating to a cherry-red and either allowed to cool gradually or in a blast of air. Users were invariably cautioned against overheating, cherry-red being specified as the desired temperature. In carrying out the experiments a 66-inch Bement-Miles lathe was belted to an Evans friction-cone countershaft, it in turn being geared to a 40-horse-hower Westinghouse motor. By this means any desired speed could be obtained. A depth of cut of 3/16 inch and feed of 1/16 inch with a duration of test of twenty minutes was adopted as standard. Two hundred tons of forgings were cut up in carrying out this work, the total cost aggregating $100,000.

In the patent specifications Messrs. Taylor and White say in part: "Our invention relates to the manufacture of tools for cutting metals or similar uses where the tool is highly heated in performing its work, the object of our invention being to provide a tool capable of working at higher temperature, and consequently doing more work in a given time than the tools as heretofore made." The above statements make it very clear that the tool is adapted to roughing work only, and unless sufficient speed can be obtained, no gain in output can be had. We wish to make this point perfectly clear.

Again, in the patent papers, we find a general statement of the invention: "Our invention is based on our discovery that, while it is true tools made of air-hardening steels all deteriorate at temperatures in excess of a bright cherry-red (though it must be understood, not all at the same temperature), it is also true that when air-hardening steels are made with certain constituents in ascertained proportions this deterioration only prevails during a limited range of temperatures above the bright cherry-red; that is to say, from about 1,550 degrees Fahr. to about 1,700 degrees (corresponding to a light salmon color), and on our further discovery that above this range of temperature, which we will call the "breaking-down point," and from 1,725 degrees up to a temperature at which the steel softens or crumbles when touched with a rod (approximately 1,900 or 2,000 degrees) the efficiency of tools of such special steels; that is to say, their cutting speeds, and also their uniformity in efficiency, is greatly increased and largely so in proportion to the degree of heat to which they are raised. This is so much the case that their cutting speed may be stated to be from 1¼ to 2½ times that of the tool heated as heretofore, to a temperature below the breaking-down point. The accompanying curve of temperature and cutting speed shows in a graphical manner the principle of the Taylor-White discovery, and also the reason why a cherry-red was deemed best heretofore, as the curve falls off at this point.

When treated with the higher heats and to obtain the best results, the steel of the tools shows under the microscope a distinctly large-grained structure, in many cases intercepted with austenite or microconstituent of steel discovered by Osmond, the chemical composition of which is unknown, and which, according to the best authorities, has never been met with in the industrial treatment of steel. The tool is cooled rapidly from the high heat to a point below the breaking-down temperature in a lead bath, then slowly in the air or lime, etc., as the case may be. It is very essential that at no time the temperature should rise, as in such a case the tool would be seriously impaired. After the tool has cooled off, its efficiency is found to be further increased by subjecting it to what is termed the low heat for about ten minutes, this temperature ranging from 700 to 1,200 degrees.

The tool, after being forged, is placed in a coke furnace, where it is heated gradually to a high heat, the latter being designated as the point at which the steel crumbles when tapped

Tests of Tool Steel on Three Forgings with 1/16-inch Feed and 3/16-inch Depth of Cut.

Tool-steel tested.	Duration of cut, ins.	Cutting speed, ft. per min.	Condition of tool.
Forging A—			
T. W. H. 2313...	20	11	Fair
Mushet	13½	5	Point gone
Mushet	12½	3½	Completely gone
Sanderson	20	3½	Completely gone
Boreas	20	4½	Completely gone
Mushet	4	3	Completely gone
Baeburn	20	3	Fair
Mushet	20	3	Gone
Forging B—			
T. W. M. E. 2806.	20	140	Good
Sanderson	20	72	Fair
Mushet	1¾	72	Gone
Boreas	3.8	..	Gone
Mushet	19	60	Gone
Sanderson	19¼	82	Gone
Benj. Atha.....	13	82	Gone
T. W. M. E. 2757.	20	156	Good
Forging C—			
T. W. B. 0.3.....	20	70	Gone
Boreas	20	55	Good
Boreas	3.8	..	Gone
Mushet	20	50	Gone
Benj. Atha.....	20	50	Good
T. W. B. 0.3.....	20	70	Good
Benj. Atha.....	3½	..	Gone

Chemical Composition of the Forgings.

	A	B	C
Carbon	0.876	0.105	*3.854
Manganese	0.62	0.36	0.43
Silicon	0.24	0.025	0.98
Phosphorus	0.025	0.023	0.298
Sulphur	0.028	0.035	0.055

*Combined, 0.906; graphite, 2.948.

with a rod. As the tool is incandescent at this point, it is necessary that the operator wear colored glasses while testing for heat. After heating, the tool is rapidly drawn from the furnace and plunged into a lead bath, in a cast iron retort heated from below by means of a coke fire, the intensity of which may be increased at will by means of a blast of air. If the temperature rises too high, a closed pipe, which has cold water circulating in it, can be lowered into the bath.

Three different test-pieces were experimented on, two of steel and one of cast iron. All the tools tested were brands on the market at the time the Taylor-White patents were granted. An examination of the accompanying tables show for the 86 C. forging or test-piece that the relative efficiency of the treated tool and best untreated tool is 11 to 3 or more than 3.5 to 1, for the soft forging (10 carbon) 156 to 70 or 2.2 to 1, and for the cast iron 70 to 55 or slightly less than 1.3 to 1. These figures show that for steel the efficiency is much greater for hard forgings than for soft, but even in the latter case exceeds two to one, while as we might expect the saving on cast iron is much less, being about 1¼ to 1. On hard castings, however, the gain is much more, often reaching 2 to 1, and on this account it is well adapted to certain work. In proof of the latter statement we might add that at the Link-Belt Engineering Company's works, Nicetown, hard-sprocket wheels can be bored at more than double the speed with Taylor-White tools.

Reference to the table shows a cutting speed of 156 feet per minute, with 3/16-inch depth of cut and 1/16-inch feed. This tool was removing metal at the rate of 353 pounds per hour and was red-hot 5/16 inch from the point. The color was distinctly visible in the daylight, no stronger proof being needed of the high heat at which these tools maintain their cutting edge. At the end of twenty minutes the edge of the tool was carefully examined with a magnifying glass and found to be perfect. In fact, the original grinding-marks could still be detected.

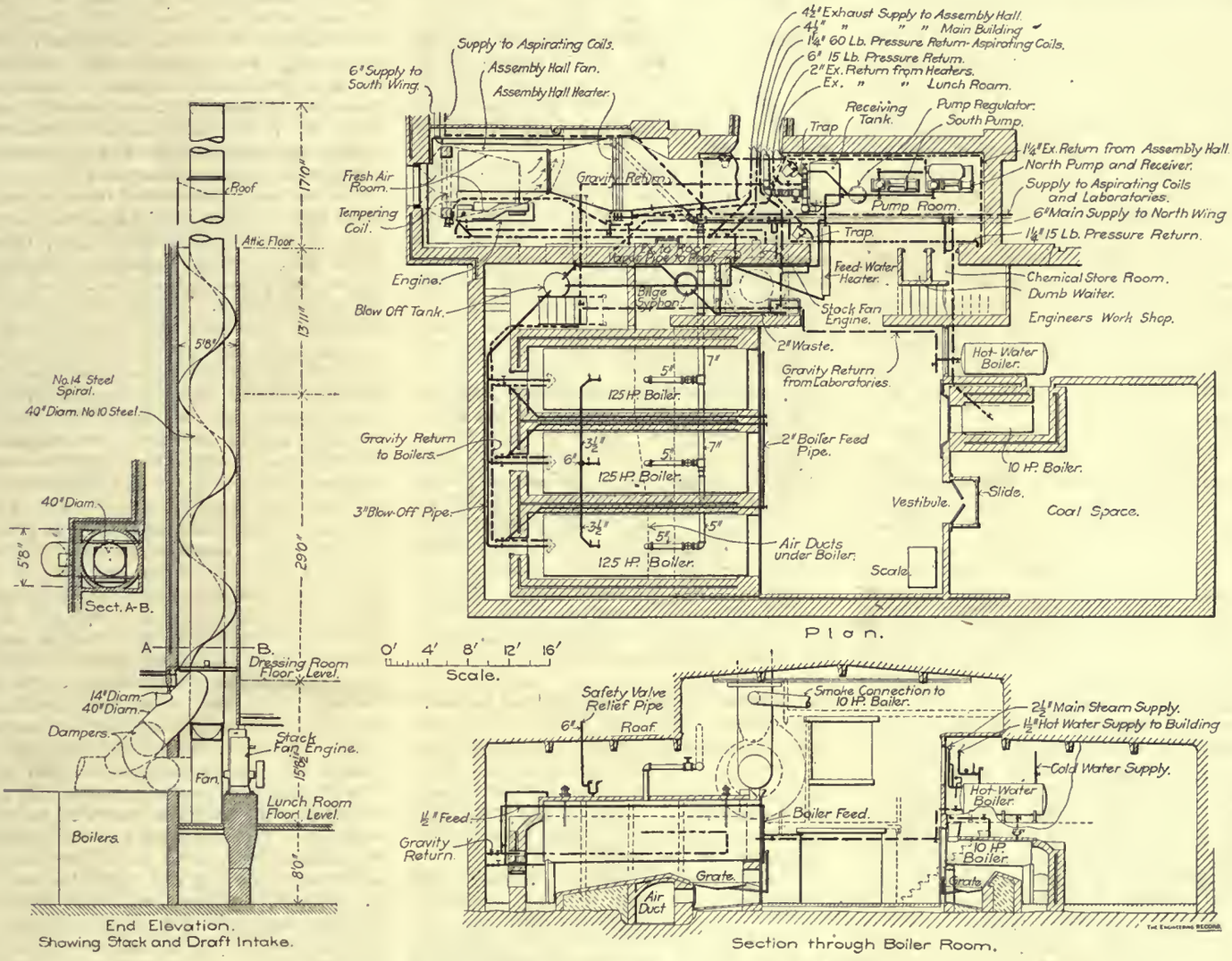
Ventilation and Heating in the East High School, Rochester, N. Y.—II.

The mechanical plant furnishing the power and steam for the ventilating and heating has some special features. Under ordinary working conditions when the school is occupied for five four-hour sessions per week the boilers are run under 60 pounds pressure with all steam engines and pumps in operation. During the balance of the day and nights and holidays when no ventilation is needed, the fans are stopped. This reduces the consumption of steam and less draft is needed so the stack fan may be shut down. The boiler pressure may be reduced to 5 pounds, that ordinarily used for heating, and the steam supplied directly by by-passing the reducing valves. The feed pumps may also be stopped as the boilers are so equipped that under the above conditions they may be fed by gravity with the returns of the heating system. It will be seen that all of this will greatly lighten the work of the fireman and night attendant, there being practically nothing to watch but the water level and the fires.

The stopping of the fans does not preclude all air circulation as by a special provision a moderate flow is still maintained. The heaters are also arranged to run on a gravity low pressure steam system during the periods when the fans are not in operation. The fresh air inlets and the foul air outlets in the attic are closed from the basement by the pneumatic device previously described and the warm air circulates through the rooms and into the attic, returning to the fan through the fresh air duct and shaft.

The boiler equipment and a detail of the stack are given in plan and elevation in an accompanying cut. The boilers include one battery of three 125-horse-power horizontal tubular boilers manufactured by the Atlas Engine Works, of Indianapolis, and a similar 10-horse-power boiler of the same make. The larger boilers are 20 feet long, 72 inches in diameter and contain twenty-six 6-inch tubes. They each have a total heating surface of 1,066 square feet and a grate surface of 30 square feet. The 10-horse-power boiler is 7 feet long and 36 inches in diameter. The grates of all of the boilers are of the shaking and dumping pattern, supplied by Neemes Bros., Troy, N. Y.

Each 125-horse-power boiler has a 3-inch blow-off pipe leading into the main connecting with the blow-off tank in the floor at the rear of the boilers. All piping exposed to fire is wrapped with ⅝-inch asbestos rope and the fittings are of malleable iron. The blow-off tank is 30 inches in diameter at the top and 31 inches high. It has a trapped overflow and a 3-inch vapor pipe carried up in one of the spaces at the angles of the brick work around the boiler stack. The blow-off pipe of the



BOILER PLANT, SHOWING STACK ECONOMIZER.

small boiler is 2 inches in diameter and being below the sewer connects with a bilge siphon crock perforated with small holes and set in the space under the stack fan. A Braender automatic bilge siphon with a differential piston valve which will raise the water 6 feet, is placed in the crock and is supplied with steam from the high pressure main. A branch is also taken from the nearest water main so that the siphon may be run by water pressure when steam is not available. The discharge from the siphon connects with the blow-off pipe back of the boilers. A 2-inch vapor pipe runs from the bilge siphon crock and connects with the vapor pipe from the blow-off tank. In case of emergency the crock may be emptied by a steam jet siphon having a 2-inch discharge and operated at full boiler pressure.

The 125-horse-power boilers are installed to operate by either natural of mechanical draft. A 110-inch Sturtevant blower is placed with its suction covering the end of the smoke breeching and its top discharge connecting into the base of the stack. A 45-degree by-pass containing a balanced damper operated by a Lawrence damper regulator, short-circuits the fan when natural draft is wanted. In the horizontal pipe to the stack fan a hand-operated balanced damper is placed. Both dampers may be worked from the floor. In the 14-inch smoke pipe from the small boiler, which is for summer use, is a balanced damper controlled by a Clark damper regulator. Two hydraulic air compressors for the operation of the damper regulators and all other pneumatic devices are installed in the boiler room. The smoke outlet of each boiler is equipped with a damper which may be reached from the front of the boiler and locked in any position.

The smoke pipes and stack are of No. 10 sheet steel and are 40 inches in diameter. Around all smoke pipes and connections exposed in the boiler room, a ¾-inch air space is formed with metal lath over small angles and covered with 1-inch of magnesia plaster. The brick chimney is square and contains a circular lining 5 feet 8 inches in diameter concentric with the steel stack. A helical vane or partition winds down the space between the stack and the lining, forming a passage through which the air supply for the furnaces is drawn down around the stack. Above the roof a copper flashing encircles the stack and stops off the surrounding air passage. The inlet to the passage is in the attic where, as has been shown, the vents of all rooms are discharged except those from locker rooms and toilets. This arrangement not only assists the removal of vitiated air from the building, but also supplies the initial air to the stack economizer at a higher temperature than if it were taken directly from out of doors.

In the basement the air passage communicates with an underground duct excavated back of the ash pits and opening into them. A heavy cast iron damper controlled from the front of the boiler is provided for the regulation of the air to each one. The 10-horse-power boiler is not equipped for induced draft. It receives its air in the ordinary manner through the doors of the ash pit and discharges its waste gases into the stack above the fan. The stack fan has a wheel 66 inches in diameter and 36 inches wide, direct-driven by a 6x5-inch double-enclosed vertical engine at speeds varying according to the demands on the boilers. The operation is automatic by means of a Foster fan-engine regulator valve.

A speed of about 57 revolutions per minute at which the fan will discharge about 3,800 cubic feet of air in one minute, is figured to be sufficient to supply two of the large boilers under full load. The helical path of the air has a cross section of 12 square feet, hence the velocity through it is 320 feet per minute. The length of the path being 60 feet, the air is in the passage only about 1/5 of a minute. Assuming that the stack will give off 1,500 British thermal units per square foot of surface per hour, or 25 per minute, then its 293 square feet will emit 7,325 heat units in one minute, and this would mean that the 3,800 cubic feet of air passed in one minute will be raised 106 degrees. With the air in the attic at 70 degrees initially, it will be delivered to the furnaces at nearly 176 degrees. The object of the apparatus is to allow for the use of cheap fuel and to effect the saving of part of the heat, which would be lost in the heating of the air in the combustion chamber, through the utilization of heat otherwise lost in the waste gases.

The coal storage space shown on the plan of the boiler house has a capacity of about 180 tons. The coal is taken from the bin to the furnaces in a four-wheeled truck and may be weighed on a platform scale located near the bin. Ashes are stored in the space under the engineer's shop, whence they are raised to the ground level by a hand power ash lift and removed by carts.

Each boiler is provided with two pop safety valves on a Y fitting; one is of the ordinary type set at 68 pounds, the other of the lock-up type set at 70 pounds. A wire rope from each valve, by which it may be unseated, extends down the face of the boiler. Pipes are run from the lower pressure valves uniting in a 6-inch riser to the atmosphere over the middle boiler. The 5-inch steam outlets from the boilers are connected by 5-inch branches to the 7-inch main, from which the steam supplies are taken for the stack fan engine and the assembly hall fan engine. After the main passes through the boiler room wall into the main building it divides, one 6-inch branch leading in each direction for the supply of the fan engines and all live steam heating in the north and south wings respectively, the latter being done at a reduced pressure of 15 pounds or less through a Kieley regulating valve. An Ashton pop valve set at 15 pounds guards any failure of the reducing valve and a gauge shows the pressure at all times. The two main supplies extend along the ceiling of the lobbies and the north and south corridors in the basement with branches each way to all risers. The risers are anchored midway in their height and are allowed to expand in both directions. Each contains a valve at the base by which the system it supplies may be cut out. The 6-inch main to the north wing is also tapped for the steam supplies to the feed pumps.

All high pressure and low pressure lines throughout have suitable relief pipes wherever a trap or pocket occurs, connected to the nearest returns on the same pressure. The headers at the heaters are relieved where there is any likelihood of a collection of condensation. In the supply of each of the north and south fan engines a 3-inch Baldwin separator is inserted, each being provided with a Kieley high pressure steam trap. The drips from separators connect with the nearest drip relief pipe. The 10-horse-power boiler has a 2½-inch outlet and through a main of that size supplies the hot water boiler with high pressure steam, and also the aspirating coils at the bases of the locker and toilet vent shafts and the steam used in the laboratories for experimental purposes. A short branch from the 2½-inch main ties into the 6-inch main supply to the north wing and affords a supply to the hot water boiler when the 10-horse-power boiler is not working. The laboratories may also be supplied from the 6-inch main.

A Baldwin oil separator is placed in the exhaust of each of the four engines. The exhaust steam from the assembly hall fan and the stack fan engines is used in the tempering coil of the assembly fan or exhausted to the atmosphere. The exhausts of the fan engines of the north and south wings are similarly arranged to supply their own tempering coils. On occasion one section of all the heater coils may also be supplied with exhaust steam, though ordinarily they use the live steam. To equalize the various exhaust steam systems they are all connected and their combined excess over the demands previously mentioned is used in the heating of the lunch room and the assembly hall by direct radiation, or may even be turned into the direct radiation for the entire building. The other heating in the basement employs the low pressure live steam.

The returns from all systems except those from the assembly hall are passed to a receiving tank or may go directly to the pump. The receiving tank is 36 inches in diameter and 56 inches long. When desired it may be drained to the blow-off tank through a 2-inch pipe. From the receiving tank the water is drawn by an M. T. Davidson pump, operated by a Mueller automatic regulator and forced through a feed water heater to the boilers.

The feed heater, suspended from the ceiling, has a shell of 8-inch pipe, 7 feet long and contains 21 feet of 1-inch brass pipe, through which the feed water is passed. A second Davidson pump, provided with a receiver, takes the returns from the assembly hall heater and discharges them into the receiving tank or into the boiler feed system as desired, and is so connected that its suction may also draw from the receiving tank. The exhaust from the pumps connects into the exhaust pipe from the stack fan engine. When the returns are not sufficient for the boiler feed additional water is taken directly from the cold water supply to the receiving tank or may be first passed through the feed heater. The water is introduced into the receiving tank through a loop extending nearly its length and back, so that it is nearly the temperature of the contained liquid before it is allowed to mix with it.

A complete system of high pressure and exhaust drip lines relieves all engines, pumps and other apparatus of condensations. The high pressure drips from separators connect into the nearest exhaust return from a heater and thence to the receiving tank. The drips from the exhaust side being greasy, are returned to the blow-off tank. The feed water main runs along the front of the boilers as shown on the boiler room plan. From this main which contains a Worthington hot water meter, a branch is taken for each boiler and continuing over the top of the same passes down behind it into the gravity return pipe. A 1½-inch pipe is also provided from the top of each boiler down into the blow-off pipe to establish a circulation. The feed water connections for the small boiler are run in the same manner. Connections to the main feed water pipe are so arranged and valved as to provide each boiler with city water direct when necessary.

From the 6-inch main low pressure return pipe, near the receiving tank, a drop is made to a 5-inch gravity return pipe which runs to the back of the boilers, with a 4-inch branch to each boiler. Where the gravity returns enter the boilers, a special connection is made, as shown on the elevation of the boiler room, which continues inside the boiler as a 2-inch heavy brass feed pipe, extending from the rear head to within 2 feet of the front, then rising and returning between the tubes to within 2 feet of the rear head. These pipes are run within the boilers beneath the water line and are held in position by copper stays.

The apparatus for the combined heating and ventilating was furnished by the B. F. Sturtevant Company, of Boston, Mass., and the Johnson thermostats, damper regulators and hydraulic air compressors were supplied by the Electric Service Company, of Buffalo, N. Y. All pipe covering on steam and hot water pipes is of the Magna Bestos or air cell type manufactured by the Keasbey & Mattison Company, of Ambler, Pa. The contract price for the heating and ventilating plant complete, supplied by Mr. R. T. Ford, of Rochester, was $35,000.

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Dinner of the Boston Society of Civil Engineers.

The twenty-first annual dinner of the Boston Society of Civil Engineers was held on the evening of March 3 at Hotel Vendome, Boston, with 146 members and guests present. President George A. Kimball introduced the after-dinner speakers: Attorney-General of Massachusetts Herbert Parker; Mr. James M. Dodge, president American Society of Mechanical Engineers; Representative Robert Luce, of Somerville; Mr. Charles F. Scott, of Pittsburg, Pa., president American Institute of Electrical Engineers; Prof. George F. Swain, of the Massachusetts Institute of Technology; Mr. S. H. Kinnealey, ex-president of the Engineering Club of St. Louis; and Captain William E. McKay, president of the New England Association of Gas Engineers. In his address, President Kimball called attention to the fact that the society, formed in 1848, is the oldest engineering society in America, that it has a membership of 512, is financially in good condition and has set aside $1,500 as a permanent fund.

Attorney-General Parker, son of Mr. George A. Parker, a founder of the society, made a characteristic speech and paid tribute to the monuments of the engineers. He said, in part, that he looked upon the achievements of the profession as a mark of the progress of human intelligence and genius. He sometimes thought that lawyers do not leave much to remind posterity that they have lived, but he has seen monuments that civil engineers have built. Speaking of the construction of the Wachusett dam and reservoir, he said: "When I see in the central part of the State where I live hills moved away, valleys filled up, rivers directed and a vast structure rising in the valley, behind which a vast lake will be confined, I ask, What monument can the lawyer leave behind that will compare with this? People fear that this large dam, in ponding the water, threatens the lives of dwellers in the valley night and day; but the issue has been tried, and the valley below the dam is found to be as safe hereafter as it was before. However, the legal profession has lasting monuments; for time may overtake and destroy these structures, but there will always be a law in the land."

Mr. Dodge, after reviewing the history of the guilds which all trades once had, pointed out the importance of the trade schools to young men, and the need of such schools in the present condition of industry. He said that they should be encouraged and thereby would be improved the intelligence of the workingman; all professions should employ the best of skilled labor. Mr. Luce spoke on the increased co-operation among men, the large public works that modern legislatures undertake for the good of the public, and the reliance which the legislature places on the technical advice of engineering associations. He pleaded that learned bodies keep Massachusetts a center of intelligence and skill, and set the standards of work high and keep them high. Mr. Scott indorsed the idea of cooperation, and said that its influence would be shown on the members of the societies and on the community. He said that the days of narrow specialism were past and that the modern idea of mutual intercourse, evidenced in the formation of local societies, would enable engineers to better undertake the problems of progress. He suggested the establishment of engineering buildings in large centers, where, by a cooperation of societies, men of various professions could benefit by coming together. Prof. Swain, as a director of the American Society of Civil Engineers, mentioned the great influence and prestige of the American Society, which, he said, should include all engineers who are competent to join, and especially urged all young men to become members. He laid stress on the great importance of the meetings of the national society.

Personal Notes.

Mr. S. C. Stallings has been elected city engineer of Cordele, Ga.

Mr. E. H. Bailey has been appointed city engineer of Whittier, Cal.

Mr. C. T. Wilson, of St. Paul, Minn., has been appointed city engineer of Waterloo, Ia.

Mr. F. Walter Toms has resigned as chief engineer of the Camden (N. J.) water department.

Mr. S. Cameron Corson has been reelected for his fifth term as borough engineer at Norristown, Pa.

Mr. Charles F. McKim, of McKim, Mead & White, of New York, has been awarded a gold medal by the Royal Institute of British Architects.

Mr. W. L. Stevenson has resigned as general manager of the Union Terminal Railway of Sioux City, Ia., and will be succeeded by Mr. B. S. Josslyn.

Mr. I. F. Stern has been appointed general inspector of bridges of the Chicago & Northwestern Railway at Chicago, succeeding Mr. W. H. Lawrence, and Mr. H. M. Trippe has been made assistant bridge inspector.

Mr. H. J. Hardenbergh, of New York, designer of the Waldorf-Astoria Hotel, in Manhattan, was presented with a bronze medal, March 3, by the Architectural League of New York and the National Sculptors' Society.

Mr. George S. Morison, M. Am. Soc. C. E. has been asked to pass upon the questions at issue in the controversy between the Michigan Central Railroad and the Grand Trunk Railway over the location of a bridge across the Detroit River.

August Freihoff and J. Leonard Wieland, consulting mechanical and electrical engineers, of Milwaukee, Wis., dissolved their partnership on February 18. Mr. Wieland requests that the statement be made that he is now not responsible for the acts of his former partner.

Mr. Arthur W. Tidd, assistant engineer of the Metropolitan Water and Sewerage Board of Boston since August, 1895, and Mr. Franklin H. Robbins, draftsman of the board since January, 1898, have resigned to accept positions with the New York Commission for the Investigation of an Additional Water Supply.

Major Thomas L. Casey, Corps of Engineers, U. S. A., has been appointed engineer of the Fifteenth Lighthouse District, at St. Louis, Mo., succeeding Col. Amos Stickney, who, as stated in this column February 21, has been ordered to New York to assume the duties recently performed by Brigadier-General Samuel M. Mansfield, now retired.

Obituary Notes.

Joel Foster, superintendent of the water works of Montpelier, Vt., since they were completed in 1884, died in that city February 19, aged 77 years.

N. W. Thompson, for thirty-one years superintendent of bridges for the northwest system of the Pennsylvania Lines West of Pittsburg, died suddenly in Ft. Wayne, Ind., of heart disease, February 23.

Col. Alfred L. Rives, for a number of years general manager of the Panama Canal Co., died at his home in Cobham, Albemarle county, Va., February 27. He was about 71 years of age and had been a member of the American Society of Civil Engineers since 1872.

William W. Upp died at his home in Columbia, Pa., February 24, aged 72 years. As a railroad contractor, he constructed a large amount of the masonry work in connection with the elevation of the Pennsylvania Railroad in Philadelphia and built a number of railroad bridges over the meadows at Newark, N. J.

Dr. Richard J. Gatling, the well known inventor, died in New York February 26. He was born in Hertford, N. C., in 1818 and began his career of invention while yet a boy. He started life as a clerk and school teacher and then went into business for himself, but since 1845 he has devoted himself entirely to his inventions. The Gatling gun, for which he is best known, was brought out in 1862.

The Failure of a Culvert under a high railroad embankment near Schenectady, N. Y., recently caused the impounding of water in the gully back of the embankment to the depth of 30 feet, resulting in the breaking of the embankment and extensive damage to property.

A Mechanical Oil Cup which comprises a small ratchet-driven oil pump for use in connection with an oil cup to secure positive mechanical lubrication has recently been brought out by the Lunkenheimer Company, of Cincinnati, O. To the ratchet mechanism is directly attached a crank-pin device which actuates the piston of the pump, and the ratchet clutches are operated by a rod which can be connected to the eccentric rod or other moving parts of the engine with an arrangement to change the stroke of the pump and consequently the amount of lubrication as desired.

Trade Publications.

The De Laval Steam Turbine Co., 74 Cortlandt Street, New York, has issued a second edition of its catalogue on turbines and turbine machinery. It has 52 pages and now includes reports on the tests made last year on the 300 horse-power turbine both with and without superheated steam.

Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., has issued a circular relating to some new plumbing goods it manufactures.

An interesting catalogue of ore and rock crushing machinery, including revolving screens, elevators, conveyors, etc., manufactured by the Farrel Foundry & Machine Co., has been brought out by Earle C. Bacon, engineer, Havemeyer Building, New York. The book has a large number of views of machines and plants.

Any one desiring a comprehensive, brief and practically non-technical account of iron making will find an interesting illustrated article on the subject written by Elisha Walker, with special reference to the Buffalo & Susquehanna Iron Co., in a paper-covered book published by Fisk & Robinson, 35 Cedar Street, New York.

The Herron & Bury Mfg. Co., Erie, Pa., is now distributing bulletin No. 18 on air compressors, describing duplex and compound types driven either by belt or steam.

The following subjects are treated in flyers 31 to 34 and 50 to 54, inclusive, received from the Crocker-Wheeler Co., Ampere, N. J. Type D motors and dynamos, motor-driven linotype machines, motors for elevator duty, motor-driven rotary planers, increased cutting speeds, motor-driven printing presses, motor-driven grinders, motor-driven compressors and countershaft motors. The flyers are arranged for binding.

A new catalogue on spray pumps has recently been issued by the Goulds Mfg. Co., Seneca Falls, N. Y. It calls attention to a power spraying outfit and pumps for handling lime, salt and sulphur solutions.

Aberthaw cast stone is described in an illustrated pamphlet issued by the Aberthaw Construction Co., 8 Beacon St., Boston. It is formed of Portland cement concrete, mixed wet in porous molds, and can be treated to represent different classes of stones and reinforced when desired with embedded twisted steel.

The Newton Machine Tool Works, Inc., 24th and Vine Sts., Philadelphia, has published in pamphlet No. 35 an illustrated description of a double spindle milling machine for cutting keyways in shafts. It is designed to secure the same results as obtained with a cotter drilling machine, but in much quicker time.

Salamanderite is a fire and waterproof substance composed chiefly of compressed asbestos and furnished in sheets or panels ⅛ to ½ inch thick for covering walls and ceilings. Its use in imitation of wood finishing and for decorative effects is the subject of a circular distributed by the H. W. Johns-Manville Co., 100 William St., New York. The company is furnishing an asbestos torch for destroying insects in trees. The Sayre-Newton Lumber Co., Denver, Colo., is distributing a circular describing the Johns-Manville Keystone hair insulator for interlining buildings.

The Fort Wayne Electric Works, Inc., Fort Wayne, Ind., has issued a catalogue of fan motors, No. 5,001. They are manufactured for both direct and alternating currents and are of the revolving and desk type. The revolving motor is suspended from a ball bearing so as to revolve around a vertical axis.

The Herringbone expanded steel lath, in its application to cementine, or exterior concrete, construction, is illustrated in a circular prepared by The General Fireproofing Co., Youngstown, O. Some fifteen views of houses sheathed in this way in Asheville and Biltmore, N. C., are given.

The Steam Boiler Equipment Co., 20 West Houston St., New York, has issued a catalogue showing the application of its Hydro-Carbon system for economical, smokeless, coal combustion to different types of boilers in the plants of several well-known establishments.

The Publication Bureau of the General Electric Co., Schenectady, N. Y., has issued Bulletin No. 4289, devoted to small alternating-current motors, No. 4304 covering induction motors, No. 4305 describing in some detail the series alternating system of electric lighting and No. 4305 relating to rotary converters for systems of 60 cycles per second. An index to bulletins has been prepared, and a flyer regarding street lamp brackets for series incandescent systems and the following catalogues and price lists are being distributed: No. 7569, fuse boxes, blocks and cut outs; 7570, repair parts of 52-A railway motors; 7571, enclosed arc lamps for alternating current multiple circuits.

The Allis-Chalmers Co., Chicago, has published the sixth edition of catalogue No. 15 devoted to cement machinery, comprising rock crushers, elevators, revolving screens, fine breakers, crushing rolls, ball and tube mills, rotary dryers, rotary kilns and clinker coolers. The Harris system for marl pumping is described.

The Drake Standard Machine Works, 298 W. Jackson Boulevard, Chicago, describes in a 98-page catalogue by the aid of a large number of interesting photographic reproductions of actual work, the different types of concrete, asphalt and mortar mixing machinery it manufactures. Most of the mixers shown are of the portable type.

The Plunger Elevator Co., Worcester, Mass., which makes the direct-lifting plunger elevator mounted on the end of a plunger set vertically in the ground, has issued a catalogue describing it in some detail. It has been installed with a lift of over 200 feet and speeds of 500 to 600 feet per minute.

The Barney brick conveyor system is discussed in a catalogue received from the Jeffrey Mfg. Co., Columbus, O. The pamphlet tells its story mainly by pictures of brick plants in which it is in use and which show the operation in various phases.

The Kelly-Springfield Road Roller Co., Springfield, O., has issued an illustrated circular describing a 20,000-pound steam roller, especially designed for park and boulevard work and claimed to be the lightest of the macadam type ever built.

Bulletin No. 1, Series C, from the D'Olier Engineering Co., 119 S. 11th St., Philadelphia, contains an exhaustive description of an electric driven cement plant. A folder from the same concern deals with the De Laval steam turbine and its adaptation to the driving of dynamos and pumps.

The Webster & Perks Tool Co., Springfield, O., is distributing a catalogue on solid die automatic bolt-threading and special tapping machines, a pamphlet on grinding and polishing machinery and one on an aluminum reducing wheel for engine indicators.

The 1903 catalogue of Jenkins Bros., 71 John St., New York, contains 80 pages of cuts and descriptive matter pertaining to their many styles of valves and packing for steam, water, gas and acid service and calling particular attention to recent improvements in many of the different types.

R. D. Lillibridge, 170 Broadway, New York, is distributing on request a reprint of a paper read by Mr. Charles Day before the New York Electrical Society on "Requirements of Machine Tool Operation with Special Reference to the Motor Drive."

"Conduit Comments," a booklet from the Standard Vitrified Conduit Co., 39 Cortlandt St., New York, illustrates single and multiple clay ducts, a mandrel to facilitate the centering of the former, and a method of joining the latter by keys instead of dowel pins. The Manhattan third rail insulator is also shown together with a record of tests of its durability, electrically and mechanically. It broke down under about 16,000 volts and a weight of 51,000 pounds.

Filter presses and driers for the reduction of garbage or the refuse of distilleries, refineries, etc., to a marketable form such as grease, fertilizer or feed are instructively discussed in a booklet issued by the Turney Drier Co., Louisville, Ky. The driers are made in two forms to heat directly by hot air from furnaces or indirectly by steam and may also be used for the drying of sand, gravel or phosphate.

A catalogue on steam boilers and general plate iron work has been received from the Hodge Boiler Works, East Boston, Mass. Among the subjects treated are horizontal return-tubular, locomotive, vertical, Manning and marine boilers; smoke flues; tanks of all sorts; exhaust heads; and stand pipes for water works.

A circular that will be of interest from the business man's standpoint is being distributed by the National Conduit & Cable Co., Times Bldg., New York. It is confined to copper market statistics, here and abroad, and recent mining developments in this country.

The Weber Gas & Gasoline Engine Co., Kansas City, Mo., manufacturers of an extensive line of engines, hoists, pumps, mining locomotives, etc., describes its product in catalogue No. 17, of 70 pages, giving detailed construction of four types of engines, and illustrations of notable installations and adaptations.

A booklet, entitled "A Comprehensive Engine Test," is being circulated by the Buffalo Forge Co., Buffalo. It gives data, curves, photographs and a complete description of a test made on a Buffalo horizontal center-crank Class A engine at the laboratory of the Worcester Polytechnic Institute under the direction of Profs. S. A. Reeve and C. M. Allen.

The advantages of electric hoists over those driven by steam and some desirable qualifications in a good electric hoist are given in catalogue 0225 and pamphlet 0228 issued by the C. W. Hunt Co., West New Brighton, New York. Several types for shipping and mining and a few installations are illustrated. Folder 224 gives a description and prices of "Stevedore" rope for hoisting and transmission.

Bulletin No. 35 of the Browning Mfg. Co., Milwaukee, describes the several forms of the Browning dynamos and motors, giving a cut of each and a brief note calling attention to its constructional merits and the particular class of work it is designed for.

The Vulcanite Portland Cement Co., Real Estate Trust Building, Philadelphia, has prepared a paper covered book devoted to Portland cement and its uses, in 44 pages of non-technical language. Some 65 or 70 full-page reproductions of photographs are given, including some excellent views of construction work at the plant of the Consolidated Lake Superior Power Co., at Sault Ste. Marie, Mich., and of the East Boston tunnel.

Notes.

Buildings Along the Water Front of Milwaukee are being menaced by attacks upon the piles supporting them, made by limnoria terebrans and teredo navalis, according to local papers. Such experiences emphasize some of the advantages claimed for the various forms of concrete piles described in recent issues of The Engineering Record.

The Necessity for Careful Covering of Submerged Pipes is shown by an accident described in the report of the Cambridge, Mass., water board for the year ending November 30, 1902. A schooner grounded while coming through the draw at the Third Street bridge, and as the tide went out it settled on a 12-inch water pipe and broke it.

The Calorific Power of Coal can be obtained by the use of the following formula, with an error not greater than 1 per cent., according to M. Goutal in the transactions of l'Académie des Sciences of Paris: $P = 147.5\ C + a\ V$. The coefficients have been evaluated to give English units and P is the calorific value sought in British thermal units per pound; C, the proportion in hundredths of the fixed carbon; V, the proportion in hundredths of the volatile matter; and a, a factor which for anthracite has a value of 180.

The Vibrations of a Steam Engine resting on a concrete foundation set on a thick bed of clay with chalk underlying were suppressed in the following manner, according to Mr. John Young, town surveyor of Ayr, Scotland, in a paper which he presented recently before the Scottish Association of Municipal Engineers and Surveyors. Shafts 4 feet in diameter were sunk into the subsoil for a distance of 30 to 40 feet. At the bottom of the shafts enlargements were made and concrete foundations put in. Cast-iron pipes, 2 feet 6 inches in diameter, in 12-foot lengths, were reared on these foundations to the under-side of the concrete engine bed. The pipes were then filled solid inside with Portland cement concrete and sand packed around the outside of the pipes, filling up the shafts. The whole engine bed was supported in this way, isolated from the surface soil.

A New Form of Pressure Gauge capable of measuring pressures to 10 tons per square inch has been constructed for the National Physical Laboratory of England, for general experimental work. The apparatus, a view of which is given in a recent issue of "Engineering," makes use of weights for the direct measurement of the resultant pressure on two pistons of slightly different diameters placed at opposite ends of a cylinder, the fluid pressure being exerted in the cylinder between the pistons. The cylinder is supported vertically in a fixed position. Each piston is attached at its outer end to a plate, and the two plates are connected together by vertical columns, so that the pistons are rigidly joined and move vertically together as the pressure changes. The larger piston is placed uppermost, and the total pressure tending to force up the upper piston is greater than that tending to force down the lower piston, and the two pistons thus rise together, moving relatively to the cylinder. The vertical movement is limited to 1/50 inch, and a lubricant is used for the fluid under pressure. The difference in area of the two pistons is 0.01304 square inch, so that 29.21 pounds of weights on the apparatus represent a pressure of 1 ton of 2,240 pounds per square inch in the cylinder.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 264, 23, 25 and 26.

WATER.

Redding, Cal.—A press report states that the La Grange Hydraulic Mining Co. is about to construct a reservoir on the divide above the mine, which will be connected with a portion of the large pipe line of the Sweepstake Co.

San Francisco, Cal.—See "Power Plants, Gas and Electricity."

Oceanside, Cal.—H. D. Brodie, City Clk., writes that it was voted Feb. 16 to issue $15,000 bonds for constructing a reservoir and larger mains, and $10,000 for wharf extensions.

San Francisco, Cal.—The Central Canal & Irrigation Co., of San Francisco, has been incorporated, with a capital of $1,000,000, by Willard M. Sheldon and C. M. Wooster, of San Francisco.

Santa Barbara, Cal.—E. L. Sheffield, Water Comr., is reported to be in Los Angeles, conferring with Engr. J. B. Lippincott in regard to an extension of the water works of Santa Barbara.

Woodland, Cal.—The Yolo County Consolidated Water Co. has been incorporated, with a capital of $1,000,000, to conduct a general system of irrigation in Yolo County, to own land and irrigation canals and water rights, as may be necessary in the business. Principal place of business will be Woodland. Directors: Jos. Craig, Lawrence D. Stephens, and others.

Sacramento, Cal.—The Trus. have adopted the report of the Com. to which was referred the bids opened for a ten million gal. pump. It recommends the bid of the Snow Steam Pump Works for a vertical three-crank triple expansion, high duty, crank and fly wheel condensing engine for the sum of $42,219, including a surface condenser and oil separator. The time of delivery to be 7 months from date of contract.

Ft. Collins, Colo.—The Com. of Business Men recently appointed by City Council have reported recommending that the city build a new water system, beginning at a point above the mouth of the north fork of Poudre River; that a 20-in. wood pipe be used to the city limits, and that the proposition of bonding the city for $200,000 to build the proposed water system be submitted at the next city election. The proposed system will be a gravity one.

Washington, D. C.—The conferees of the Senate and House on the District appropriation bill are stated to have agreed to an amendment to increase the limited cost of the filtration plant to the extent of $700,000.

Shoshone, Idaho.—The Twin Falls Land & Water Co., of Salt Lake City, Utah, is stated to have awarded contracts for constructing a canal system; also a dam across Snake River near Shoshone (bids opened Feb. 14) as follows, to Farris & Kese, of Boise, Idaho, for the first section of the work, which consists of the construction of a dam 900 ft. long, 50 ft. high and 30 ft. wide at the top, with 2 miles of canal on either side of Snake River, and for sections 2 and 3, which call for the excavation of 40 miles of canal to the Springville Construction Co.: contracts reported to amount to about $1,000,000.

Holdenville, Ind. Ter.—The following bids for furnishing material and constructing water works, including 3 miles of pipe, 26 hydrants, 80 ft. steel tower and a 70,000-gal. steel tank, were received by T. E. Neal, Recorder, Feb. 25—*a*, for plant complete; *b*, for plant not including steel tower and tank, and *c*, for steel tower and tank: W. W. Cook & Son, Junction City, Kan., *a*, $24,974 (awarded contract). Dunnegan & Sykes, Muskogee, I. T., *a*, $25,614; *c*, $3,890. American Light & Water Co., Indianapolis, Ind., *a*, $25,783. O. J. Gorman, Dallas, Tex., *a*, $28,630; *c*, $3,990. General Municipal Construction Co., Dallas, Tex., *b*, $22,085. Jas. Cotter, Kansas City, Mo., *b*, $23,374. Allan Black Co., St. Paul, Minn., *b*, $24,350. C. T. Bartlett, Evanston, Ill., *b*, $24,650. Spradling & Jones, Farmington, Mo., *b*, $29,480. Des Moines Bridge & Iron Wks., Des Moines, Ia., *c*, $3,945. Midland Bridge Co., Kansas City, Mo., *c*, $4,131. Engineer's estimate, $25,000. Burns & McDonnell, Consulting Engrs., Kansas City, Mo.

Ottumwa, Ia.—The Iowa Construction Co. is reported to have been formed and seeks a franchise for water works and a gas and electric light plant.

Storm Lake, Ia.—W. C. Edson, City Clk., writes that he desires to correspond with engineers in regard to the construction of a large filter. The water supply is taken direct from the lake.

Donaldsville, La.—An engineer is reported to have been engaged to prepare plans and specifications for the proposed extension and improvement of the water works.

Opelousas, La.—An irrigation company is reported formed under the laws of New Jersey, with a capital of $6,000,000, by H. Bird Castle, of Marietta, Pa.; Dr. R. C. Webb, of Rayne, La., and E. Sears, of Crowley, La. The canal will be 250 ft. wide. It will irrigate 500,000 acres of land known as the Hayes and Marmon prairies.

Ridgely, Md.—C. W. Jackson and A. G. Saulsburg are reported to have been appointed to investigate the question of constructing water works.

Oakland, Md.—A charter is stated to have been granted to the Oakland Water Co. with a capital of $50,000. M. G. Martin and W. R. Offnutt are among the incorporators.

Williamsburg, Mass.—Bids will be received by A. S. Hills, for the Water Com. until Mar. 24, for furnishing pipe, gates, hydrants, etc.; also on same date for building 2 dams, cleaning reservoir bed and laying pipe, as advertised in The Engineering Record.

Hudson, Mass.—W. F. Halleubeck, City Clk., writes a bill to authorize the issue of $255,000 bonds for water works is before the Legislature.

Mexico, Mex.—The Colorado Delta Canal Co. was incorporated at Trenton, N. J., Feb. 27, with a capital of $2,200,000, to construct waterways and to supply water, particularly in the Republic of Mexico. Incorporators: H. E. Filipe, Beverly L. Hodgehead, and others, all of San Francisco, Cal.

Grand Rapids, Mich.—The Bd. of Pub. Wks. is stated to have adopted a resolution authorizing the disposal of the old boilers and the installation of a new system, at a total cost of about $4,000.

Minneapolis, Minn.—The Council Water Works Com. is stated to have recommended the issue of $100,000 bonds for extension of water mains during the coming year.

Billings, Mont.—H. P. Varmilia, of Tacoma, Wash., and Engr. Marvin Chase, of Wenatchee, Wash., is reported interested in an irrigation project, which has for its object the reclamation of 25,000 acres of land near Billings. It is proposed to construct a ditch about 35 miles in length to tap Yellowstone River, just south of Laurel and across the Canyon ditch. A tunnel about 800 ft. in length will conduct the waters through a small range.

Chinook, Mont.—It is stated that bids are wanted about Apr. 1 for constructing a water works, estimated to cost about $24,000. Loweth & Wolff, Engrs., First Natl. Bank Building, St. Paul, Minn.

Newark, N. J.—The Bd. of Wks. is reported to have authorized the issue of $30,000 bonds for extending the city water mains.

Buffalo, N. Y.—Separate bids will be received Mar. 12 on the following: 10 boilers, to be installed and erected complete; mechanical stokers for 10 boilers; induced draft equipment for 16 boilers; a coal and ash handling equipment for 16 boilers; new steam main for 16 boilers and 9 engines. Francis G. Ward, Comr. Pub. Wks.

Oswego, N. Y.—The estimated cost of taking water from Lake Ontario is $210,000. An election to vote on the issue of bonds for same will take place on Mar. 10. Engineers, Hering & Fuller, of New York.

Ithaca, N. Y.—The citizens are reported to have voted on Mar. 2 for municipal control of water works.

Jamestown, N. Y.—The Legislature has passed the bill to authorize this city to issue $600,000 bonds with which to buy a private water plant. The city and the company are under contract to make the exchange the last of March.

Quogue, L. I., N. Y.—D. Cuozzo & Bro., 150 Nassau St., New York, are stated to have secured the contract for laying about 10 miles of pipe for the Water Works Co.

Cincinnati, O.—Local press reports state that plans for the filtration plant of the new water works are about to be prepared by Ch. Engr. G. Bouscaren.

The Bd. of Water Wks. Trus. are stated to have awarded the contract for constructing the new western pumping station to the United States Construction Co., of Milwaukee, Wis., for $379,635.

Ashland, O.—Water bonds amounting to $8,000 are reported sold.

Lancaster, O.—Bids are wanted Mar. 25 for furnishing cast iron pipe and special castings, building pump and power house, drilling 8 6-in. wells, furnishing and installing 1 gas engine and 1 power pump. Geo. Cunningham, Secy. Bd. of Water Wks. Trus.

Shinglehouse, Pa.—The citizens are reported to have voted to construct water works.

Meadville, Pa.—The citizens are stated to have voted Feb. 17 to issue $35,000 to complete the water system already under consideration.

Pittsburg, Pa.—Local press reports state that the engineering department of the Pittsburg & Lake Erie R. R. is about to close contracts with the Kennicott Water Softening Co., of Chicago, Ill., for the building of 8 water softening plants, of capacity ranging from 20,000 to 40,000 gals. hourly. All will be of the continuous flow type.

Butler, Pa.—The Butler Water Co. is stated to have purchased a site in Oakland Township on which a reservoir will be constructed this summer.

Lebanon, Pa.—The Hebron Water Co. has been incorporated, with a capital of $5,000, to supply South Lebanon Township with water. Isaac Sherman, Danl. Weaver, Jacob G. Abrams, of Lebanon, are directors of the company.

Clinton, S. C.—See "Power Plants, Gas and Electricity."

Lancaster, S. C.—W. B. Moore, of Yorkville, estimates the cost of constructing water works for Lancaster, at $17,970.

Georgetown, S. C.—Engr. J. L. Ludlow, of Winston-Salem, N. C., writes that owing to the fact that serious opposition has arisen to any work of excavation in Georgetown during the summer months after the first of June, it has been decided to postpone the letting of contracts for water works and a sewerage system until Sept. next.

Nashville, Tenn.—The City Council is stated to have passed the bill appropriating $20,000 to purchase water pipe, valves, lead, etc.

Mt. Pleasant, Tex.—Bids will be received Mar. 23 by S. P. Pounders, Mayor, for furnishing material and constructing a water works system including a power house, stand pipe, reservoir, 2 miles of pipe, 12 fire hydrants, valves, etc. Geo. M. Roberts, City Secy.

Tacoma, Wash.—The Council is stated to have adopted the report of the Water Com., which provides for the installation of a pumping station in South Tacoma, the laying of a large main from South Tacoma connecting at S. 54th and J Sts., the construction of a 4,000,000 gal. reservoir in the South End, the enlargement of Station B, and the construction of feed mains through the city; the total estimated cost is $112,880. Of this, work to the amount of $86,540 is recommended for this year.

Seattle, Wash.—The following are reported to be the lowest bids received on Feb. 21 for water mains: 22d St., F. McLellan, for cast iron, $32,893; all wood, $21,105, and wood and iron, $24,053. 19th St., Jas. Markey, $7,415; and Dexter Ave., for machine wound, $9,432, and for wood stave, $10,243.

Charlestown, W. Va.—See "Power Plants, Gas and Electricity."

Benwood, W. Va.—The Benwood Water Co. is stated to have completed surveys and plans for a new system of water works and the necessary reservoir. Engineer Saver, of Canton, O., is reported to be in the city completing arrangements for this work.

Verona, Wis.—City Engr. Kirchoffer, of Baraboo, is reported to be preparing plans for the water works to be built at the Dane County Poor Farm and Insane Asylum at Verona. About $5,000 will be expended.

Chetek, Wis.—The citizens are stated to have voted Feb. 24 to bond the village for the construction of water works.

Winnipeg, Man.—C. J. Brown, City Clk., writes that contracts for 6, 10 and 12-in. valves have been awarded to the Kerr Engine Co. of Walkerville, Ont., at $10.80, $27 and $37.25, respectively.

Richmond, Que.—E. F. Cleveland, City Secy., writes that the citizens voted Feb. 17 to purchase the water works.

SEWERAGE AND SEWAGE DISPOSAL.

Ft. Apache, Ariz.—The following bids for sewer work at this post were received by Col. J. W. Pope, Q. M., Denver, Colo., Feb. 26: P. H. Balfe, Denver, Colo., $14,500; Albuquerque Hardware Co., Albuquerque, N. M., $8,920; Whitney Co., Albuquerque, N. M., $8,022. This work includes about 6,000 ft. of pipe sewers from 6 to 8 in. diameter, 12 manholes. The trench is expected to average about 6 feet in depth, and will be excavated in gravel and rock.

Los Angeles, Col.—City Engr. Stafford is reported to be preparing plans for storm sewers, which will cost about $400,000.

Peru, Ind.—Borke & Co., of Peru, have secured the contract of 3,000 ft. of tile sewers at $2.89 per ft. for 20 in., $1.37 for 10 in., and 57 cts. for 12 in.

Des Moines, Ia.—Bids will be received Mar. 23 by the Bd. of Pub. Wks. for constructing 3,423 lin. ft. 12-in. vitrified clay pipe sewer in portions of Park and E. 15th Sts. J. E. Stout, Chmn.

Manchester, Ia.—Bids are wanted Mar. 16 for constructing a vitrified tile sewer. R. R. Robinson, City Clk.

Webster City, Ia.—Surveys are now being made by Edw. E. Fox, Hamilton Co. State Bank Bldg., for the Farley Ditch. It starts at the Iowa River near Alden, Ia., runs through Hardin, Franklin and Wright Counties, and heads at Blairsburg in Hamilton County. Length, 26 miles.

New Orleans, La.—The following bids for some 97.9 miles of sewer work were received Feb. 2; and in the accompanying tables are given, in detail as to the important items, the tenders of the lowest biddera for six contracts which have been recommended for award by Geo. G. Earl, Gen. Supt. Sewerage & Water Bd.—the prices of two contracts, H and I, being deemed too high. Contract A, in addition to lowest bidder, U. S. Constn. Co., Milwaukee, $419,903. Contract B, Dowdle & Windett, $318,288. C, Dowdle & Windett, $390,988. E, Dowdle & Windett, $122,650; T. J. Shea, $102,655; Municipal Eng. & Cont. Co., Chicago, $108,537; Jos. A. Craven & Co., New Orleans, $127,154; Jno. McCoy, New Orleans, $113,509. F, Dowdle & Windett, $154,851; Irwin Bros., $125,053; Municipal Eng. & Cont. Co., $146,295; Grasser Contg. Co., New Orleans, $170,292. G, Dowdle & Windett, $226,474; U. S. Constn. Co., $197,545; A. L. Patterson & Co., Macon, Ga., $184,579. H, which includes 99,000 lin. ft. pipe sewer, of which 86,200 is 8-in., and 1,900 ft. 24-in.—Dowdle & Windett (lowest bid), $234,992; Guild & Co., $258,679. I, which includes 142,285 lin. ft. pipe sewer, 126,820 of 8-in.; Dowdle & Windett (lowest bid), $246,733; Guild & Co., $271,435; F. Howard, $264,256:

Contract A—Dowdle & Windett, New Orleans.

Sewers; brick, concrete and pipe—	
7 ft. br., 25—26 ft. deep, 260 ft.	$45.00
5 ft. 2 in.x6 ft. 5½ in br., 22.5—23.5 ft. deep, 300 ft.	34.60
5 ft.x6 ft. 3 in. br., 22—23 ft. deep, 170 ft.	34.00
5 ft. 9 in. br., 20—22 ft. deep, 1,275 ft.	31.00
5 ft. 9 in. conc., 20—22 ft. deep, 1,275 ft.	27.00
5 ft. 6 in. br., 19—21 ft. deep, 875 ft.	32.00
5 ft. 6 in. conc., 19—21 ft. deep, 875 ft.	28.90
3 ft. 9 in. br., 20—22 ft. deep, 785 ft.	19.10
3 ft. 9 in. conc., 20—22 ft. deep, 785 ft.	17.00
3 ft. 6 in. br., 18—22 ft. deep, 1,075 ft.	17.50
3 ft. 6 in. conc., 18—22 ft. deep, 1,075 ft.	15.00
27 in. br., 16—18 ft. deep, 525 ft.	12.50
27 in. br., 18—20 ft. deep, 750 ft.	13.30
27 in. dbl. str. p., 16—18 ft. deep, 525 ft.	10.25
27 in. dbl. str. p., 18—20 ft. deep, 750 ft.	11.30
24 in. p., 6—8 ft. deep, 710 ft.	3.30
24 in. p., 8—10 ft. deep, 1,540 ft.	5.40
24 in. p., 10—12 ft. deep, 2,280 ft.	4.90
24 in. p., 12—14 ft. deep, 1,420 ft.	5.30
24 in. dbl. str. p., 14—16 ft. deep, 1,180 ft.	7.55
6 in. standpipe, 1,500 ft.	.10
Manholes under 8 ft. deep, 2	60.00
8—10 ft. deep, 6	65.00
10—12 ft. deep, 8	80.00
12 ft. deep, 36	80.00
Conc., 12 ft. deep, 13	85.00
Concrete, A, 400 cu. yds.	8.25
B, 50 cu. yds.	7.25
C, 700 cu. yds.	5.00
Brickwork, in Port. cement, 200 cu. yds.	13.50
Excavation, over 16 ft. deep, 300 cu. yds.	1.00
Under 16 ft. deep, 200 cu. yds.	.85
Excavation, pumping station, 2,000 cu. yds.	1.00
Round piling, 10,000 lin. ft.	.50
Capping and decking, 34 M ft.	37.00
Lumber under br. or conc. sewers, 230 M ft.	37.00
Under pipe sewers, 10 M ft.	18.00
Sheeting left in trench, 100 M ft.	13.00
Cast iron pipe laid, 20 tons	70.00
3 duct cond. conc. sewer, 4,000 lin. ft.	.90
Concrete sewer, 4,000 lin. ft.	.90
2 duct conduit, with pipe sewer, 3,200 lin. ft.	1.40
Force main excav. under 9 ft., 10,900 cu. yds.	.80
Exceeds 9 ft., 7,400 cu. yds.	1.27
36-in. C. I. force main (haul. & lay.), 5,700 ft.	2.50
48-in., 4,600 ft.	3.00
Lumber under force main, 30 M ft.	22.00
Piling at pumping station, 20 M ft.	40.00
Total	$390,749

Contract B—T. J. Shea, Quincy, Ill.

Sewers; brick concrete and pipe—	
5 ft. 6 in. br., 18—20 ft. deep, 450 ft.	$19.95
5 ft. 6 in. conc., 18—20 ft. deep, 450 ft.	19.95
5 ft. 3 in. br., 18—19 ft. deep, 145 ft.	19.00
5 ft. 3 in. conc., 18—19 ft. deep, 145 ft.	19.00
5 ft. br., 17—18 ft. deep, 370 ft.	18.55
5 ft. conc., 17—18 ft. deep, 370 ft.	18.55
4 ft. 9 in. br., 15—17 ft. deep, 860 ft.	13.55
4 ft. 9 in. conc., 15—17 ft. deep, 860 ft.	13.55
4 ft. 6 in. br., 13—14 ft. deep, 640 ft.	13.20
4 ft. 6 in. conc., 13—14 ft. deep, 635 ft.	13.20
4 ft. 3 in. br., 12—13 ft. deep, 525 ft.	12.45
4 ft. 3 in. conc., 12—13 ft. deep, 525 ft.	12.45
4 ft. br., 19—20 ft. deep, 345 ft.	13.55
4 ft. conc., 19—20 ft. deep, 345 ft.	13.55
3 ft. 9 in. br., 19—20 ft. deep, 760 ft.	12.25
3 ft. 9 in. conc., 19—20 ft. deep, 760 ft.	12.25
3 ft. 6 in. br., 18—19 ft. deep, 595 ft.	11.50
3 ft. 6 in. conc., 18—19 ft. deep, 590 ft.	11.50
3 ft. 3 in. br., 16—18 ft. deep, 765 ft.	10.80
3 ft. 3 in. conc., 16—18 ft. deep, 760 ft.	10.80
36 in. br., 14—16 ft. deep, 1,380 ft.	9.90
27 in. br., 12—14 ft. deep, 1,180 ft.	8.30
27 in. br., 14—16 ft. deep, 200 ft.	8.65
27 in. br., 16—18 ft. deep, 200 ft.	9.05
27 in. br., 18—20 ft. deep, 400 ft.	9.40
36 in. dbl. str. p., 14—16 ft. deep, 1,380 ft.	10.35
27 in. pipe, 12—14 ft. deep, 1,180 ft.	7.40
27 in. dbl. str. p., 14—16 ft. deep, 200 ft.	8.00
27 in. dbl. str. p., 16—18 ft. deep, 200 ft.	8.35
27 in. dbl. str. p., 18—20 ft. deep, 400 ft.	8.70
24 in. dbl. str. p., 14—16 ft. deep, 1,500 ft.	7.25
6 in. standpipe, 1,000 ft.	.10
Br. manhole, 12 ft. deep, 48	62.00
Concrete manhole, 12 ft. deep, 18	62.00
Concrete, A, 275 cu. yds.	11.00
B, 50 cu. yds.	9.00
C, 1,200 cu. yds.	5.00
Brickwork in Portland cement, 350 cu. yds.	11.00
Excavation, over 16 ft. deep, 100 cu. yds.	1.50
Under 16 ft. deep, 100 cu. yds.	1.00
For pumping stations, 2,000 cu. yds.	1.00
Round piling, 3,500 lin. ft.	.50
Capping and decking, 19 M ft.	30.00
Lumber under br. or conc. sewers, 250 M ft.	25.00
Under pipe sewers, 20 M ft.	18.00
Sheeting in trench, 75 M ft.	13.00
Sheet piling, pumping station, 60 M ft.	25.00
Cast iron pipe, laid, 8 tons	60.00
3 duct conduit, br. sewers, 8,200 lin. ft.	.30
Concrete sewers, 5,400 lin. ft.	.30
With pipe sewers, 2,800 lin. ft.	1.20
Crossing, 3d St. canal	3,000.00
Total	$264,087

Contract C—T. J. Shea, Quincy, Ill.

Sewers; brick, concrete and pipe—	
2 ft. 9 in.x4 ft. 1½ in. egg shape br. sewers, 14—16 ft. deep, 1,070 ft.	$11.75
2 ft. 9 in.x4 ft. 1½ in. egg shape br., 16—18 ft. deep, 2,150 ft.	12.15
2 ft. 3½ in.x3 ft. 5½ in. br., 14—16 ft. deep, 1,460 ft.	10.50
2 ft. 1 in.x3 ft. 1½ in. br., 12—14 ft. deep, 1,200 ft.	9.10
2 ft. 1 in.x3 ft. 1½ in. br., 14—16 ft. deep, 240 ft.	9.70
36 in. br., 14—16 ft. deep, 1,250 ft.	10.20
36 in. br., 16—18 ft. deep, 775 ft.	10.65
36 in. br., 18—20 ft. deep, 150 ft.	11.00
33 in. br., 18—20 ft. deep, 790 ft.	10.50
30 in. br., 8—10 ft. deep, 320 ft.	7.20
30 in. br., 10—12 ft. deep, 600 ft.	7.90
30 in. br., 12—14 ft. deep, 200 ft.	8.60
30 in. br., 14—16 ft. deep, 1,610 ft.	9.25
30 in. br., 16—18 ft. deep, 700 ft.	9.65
27 in. br., 14—16 ft. deep, 350 ft.	9.12
36 in. dbl. str. p., 14—16 ft. deep, 1,250 ft.	10.90
36 in. dbl. str. p., 16—18 ft. deep, 775 ft.	11.20
36 in. dbl. str. p., 18—20 ft. deep, 150 ft.	11.50
33 in. dbl. str. p., 18—20 ft. deep, 790 ft.	9.85
30 in. pipe sewers, 8—10 ft. deep, 320 ft.	6.25
30 in. pipe, 10—12 ft. deep, 600 ft.	6.95
30 in. pipe, 12—14 ft. deep, 200 ft.	7.65
30 in. dbl. str. p., 14—16 ft. deep, 1,610 ft.	8.60
30 in. dbl. str. p., 16—18 ft. deep, 700 ft.	9.00
27 in. pipe sew., 8—10 ft. deep, 1,280 ft.	5.90
27 in. pipe sew., 10—12 ft. deep, 1,320 ft.	6.65
27 in. pipe sew., 12—14 ft. deep, 570 ft.	7.35
27 in. dbl. str. p., 14—16 ft. deep, 350 ft.	8.20
24 in. pipe sew., 10—12 ft. deep, 1,090 ft.	5.75
24 in. pipe sew., 12—14 ft. deep, 750 ft.	6.40
24 in. dbl. str. p., 14—16 ft. deep, 2,315 ft.	7.65
24 in. dbl. str. p., 16—18 ft. deep, 700 ft.	8.00
24 in. dbl. str. p., 18—20 ft. deep, 900 ft.	8.65
21 in. pipe sew., 10—12 ft. deep, 400 ft.	5.25
21 in. pipe sew., 12—14 ft. deep, 1,220 ft.	5.90
21 in. dbl. str. p., 14—16 ft. deep, 1,230 ft.	6.75
21 in. dbl. str. p., 16—18 ft. deep, 860 ft.	7.00
18 in. pipe sewers, 10—12 ft. deep, 920 ft.	4.65
6 in. standpipe, 3,000 ft.	.10
Manhole, 8—10 ft. deep, 7	45.00
10—12 ft. deep, 15	55.00
Concrete, A, 500 cu. yds.	12.00
B, 100 cu. yds.	10.00
C, 1,300 cu. yds.	5.00
Brick masonry, Portland cement, 800 cu. yds.	12.00
Excavation, over 16 ft. deep, 100 cu. yds.	1.50
Under 16 ft. deep, 100 cu. yds.	1.00
For pumping stations, 4,000 cu. yds.	1.00
Round piling, 8,000 lin. ft.	.50
Capping and decking, 45 M ft.	30.00
Lumber under brick sewers, 210 M ft.	25.00
Under pipe sewers, 20 M ft.	18.00
Sheeting in trench, 20 M ft.	13.00
Sheet piling, 120 M ft.	25.00
Rolled steel, in place, 4 tons	100.00
Cast iron pipe, laid, 25 tons	60.00
2 duct conduit in br. sew., 12,900 lin. ft.	.30
With pipe sewer, 15,100 ft.	1.00
Independent trench, 300 ft.	1.30
Excav., force main, under 6 ft., 1,800 cu. yds.	.75
Over 6 ft., 200 cu. yds.	1.00
Haul. & lay. 20 in. C. I. force main, 2,500 ft.	.60
Lumber under force main, 2 M ft.	22.00
Total	$360,865

Contract E—Irwin Bros., Greenville, O.

Sewers; brick, concrete and pipe—	
24 in. pipe sewers, 12—14 ft. deep, 1,200 ft.	$5.50
24 in. dbl. str. p., 14—16 ft. deep, 200 ft.	6.50
21 in. pipe sewers, 12—14 ft. deep, 850 ft.	5.00
21 in. dbl. str. p., 14—16 ft. deep, 200 ft.	5.50
18 in. pipe sewers, 10—12 ft. deep, 600 ft.	3.80
18 in. pipe sewers, 12—14 ft. deep, 2,900 ft.	4.20
18 in. dbl. str. p., 14—16 ft. deep, 200 ft.	5.00
15 in. pipe sewers, 10—12 ft. deep, 2,350 ft.	3.20
15 in. pipe sewers, 12—14 ft. deep, 400 ft.	4.00
12 in. pipe sewers, 6—8 ft. deep, 100 ft.	1.50
12 in. pipe sewers, 8—10 ft. deep, 550 ft.	1.80
12 in. pipe sewers, 10—12 ft. deep, 1,400 ft.	2.40
10 in. pipe sewers, 6—8 ft. deep, 100 ft.	1.00
10 in. pipe sewers, 8—10 ft. deep, 550 ft.	1.50
10 in. pipe sewers, 10—12 ft. deep, 650 ft.	2.00
8 in. pipe sewers, 0—6 ft. deep, 6,400	.60
8 in. pipe sewers, 6—8 ft. deep, 33,300 ft.	.70
8 in. pipe sewers, 8—10 ft. deep, 10,100 ft.	1.00
8 in. pipe sewers, 10—12 ft. deep, 1,000 ft.	1.50
6 in. standpipe, 2,000 ft.	.10
Manhole, under 8 ft. deep, 84	40.00
8—10 ft. deep, 22	55.00
10—12 ft. deep, 12	75.00
12 ft. deep, 12	90.00
Flush tank, 53	60.00
Concrete, 25 cu. yds.	10.00
Brickwork, in Portland cement, 25 cu. yds.	15.00
Excavation, under 16 ft., 100 cu. yds.	1.50
Lumber under pipe sewers, 30 M ft.	18.00
Sheeting and bracing, 20 M ft.	13.00
Dirt bucket, in place, 53	2.00
5 in. flushing siphon, 53	15.00
Total	$101,437

Contract F—Thomas J. Shea.

Sewers; brick, concrete and pipe—	
24 in. pipe sewers, 10—12 ft. deep, 2,000 ft.	$4.00
24 in. pipe sewers, 12—14 ft. deep, 200 ft.	4.85
21 in. pipe sewers, 10—12 ft. deep, 3,000 ft.	3.80
21 in. pipe sewers, 12—14 ft. deep, 250 ft.	4.35
18 in. pipe sewers, 10—12 ft. deep, 700 ft.	3.40
18 in. pipe sewers, 12—14 ft. deep, 200 ft.	3.95
15 in. pipe sewers, 8—10 ft. deep, 1,500 ft.	2.55
15 in. pipe sewers, 10—12 ft. deep, 200 ft.	2.90
12 in. pipe sewers, 8—10 ft. deep, 1,700 ft.	1.75
12 in. pipe sewers, 10—12 ft. deep, 200 ft.	2.30
10 in. pipe sewers, 8—10 ft. deep, 700 ft.	1.45
10 in. pipe sewers, 10—12 ft. deep, 200 ft.	2.15
8 in. pipe sewers, 0—6 ft. deep, 21,800 ft.	.56
8 in. pipe sewers, 6—8 ft. deep, 41,600 ft.	.80
8 in. pipe sewers, 8—10 ft. deep, 10,000 ft.	1.20
8 in. pipe sewers, 10—12 ft. deep, 550 ft.	1.75
6 in. standpipe, 2,000 ft.	.10
Manhole, under 8 ft. deep, 115	38.00
8—10 ft. deep, 26	43.00
10—12 ft. deep, 15	48.00
12 ft. deep, 4	58.00
Flush tank, 80	65.00
Concrete, 25 cu. yds.	12.00
Brickwork, in Portland cement, 50 cu. yds.	12.00
Excavation under 16 ft., 100 cu. yds.	1.45
Lumber under pipe sewers, 15 M ft.	18.00
Sheeting in trench, 25 M ft.	13.00
Dirt bucket, in place, 80	3.00
5 in. flushing siphon, 80	18.00
Total	$120,157

Contract G—Irwin Bros.

Sewers; brick, concrete and pipe—	
30 in. br. sewers, 16—18 ft. deep, 500 ft.	$12.50
30 in. br. sewers, 18—20 ft. deep, 160 ft.	14.00
30 in. dbl. str. p., 16—18 ft. deep, 500 ft.	11.00
30 in. dbl. str. p., 18—20 ft. deep, 160 ft.	12.50
21 in. pipe sewers, 10—12 ft. deep, 1,100 ft.	6.50
21 in. pipe sewers, 12—14 ft. deep, 350 ft.	7.50
21 in. dbl. str. p., 14—16 ft. deep, 350 ft.	9.60
18 in. pipe sewers, 8—10 ft. deep, 350 ft.	4.00
18 in. pipe sewers, 10—12 ft. deep, 2,100 ft.	5.00
18 in. pipe sewers, 12—14 ft. deep, 110 ft.	6.50
15 in. pipe sewers, 6—8 ft. deep, 350 ft.	2.60
15 in. pipe sewers, 8—10 ft. deep, 2,650 ft.	3.00
15 in. pipe sewers, 10—12 ft. deep, 810 ft.	4.00
12 in. pipe sewers, 6—8 ft. deep, 750 ft.	1.80
12 in. pipe sewers, 8—10 ft. deep, 3,600 ft.	2.40
12 in. pipe sewers, 10—12 ft. deep, 900 ft.	3.00
10 in. pipe sewers, 6—8 ft. deep, 12,400 ft.	1.50
10 in. pipe sewers, 8—10 ft. deep, 7,500 ft.	1.80
10 in. pipe sewers, 10—12 ft. deep, 400 ft.	2.60
8 in. pipe sewers, 0—6 ft. deep, 2,350 ft.	.90
8 in. pipe sewers, 6—8 ft. deep, 19,000 ft.	1.40
8 in. pipe sewers, 8—10 ft. deep, 1,050 ft.	1.70
6 in. standpipe, 2,000 ft.	.10
Manhole, under 8 ft. deep, 74	50.00
8—10 ft. deep, 31	65.00
10—12 ft. deep, 12	85.00
12 ft. deep, 5	100.00
Flush tank, 68	60.00
Concrete, Grade A, 50 cu. yds.	10.00
Brickwork, in Portland cement, 75 cu. yds.	12.50
Excavation, over 16 ft. deep, 100 cu. yds.	2.00
Under 16 ft. deep, 100 cu. yds.	1.75
Lumber under br. sewers, 10 M ft.	30.00
Under pipe sewers, 13.5 M ft.	18.00
Sheeting in trench, 50 M ft.	13.00
Dirt bucket, in place, 68	2.50
5 in. flushing siphon, 68	15.00
Total	$178,119

Salem, Mass.—The Council is stated to have adopted an ordinance providing for a sewerage system which will cost $750,000. An order is also reported adopted appropriating $100,000 for surveys and plans with which to begin work.

Fairfield, Me.—At the annual Town Meeting, Mar. 2, it was voted to build a main sewer on Railroad St.

St. Paul, Minn.—Bids will be received Mar. 9 by the Bd. of Pub. Wks. for constructing sewers in portions of several streets. R. L. Gorman, Clk.

St. Paul, Minn.—Bids will be received Mar. 12 by the Bd. of Pub. Wks. for constructing a sewer in portions of Portland Ave. R. L. Gorman, Clk.

St. Louis, Mo.—L. A. Pratte, 6200 Delmar Ave., submitted the lowest bid on Feb. 27 for 2,000 ft. of pipe sewers, 12 to 15 inches in diameter, at $4,080.

Manchester, N. H.—The Council has granted appropriations to the Street and Park Comn., as follows: for new sewers, $20,000, and for repairs and relaying old sewers, $5,000.

Guttenberg, N. J.—The Town Council is reported to be considering the advisability of constructing a sewerage system, at a cost of $30,000.

Cape May, N. J.—The City Council has passed to second reading an ordinance appropriating $120,000 for the building of a sewerage system to convey all sewage to Delaware Bay. A land company will contribute $60,000 for this purpose. Another ordinance has passed second reading appropriating $100,000 for building a sea wall, drive and boardwalk along the sea front to Sewell's Point for the protection of the property to be improved.

Trenton, N. J.—It is stated that the bill providing for a trunk sewer to drain the Passaic Valley Dist. at an estimated cost of $9,000,000, was passed by the House on Mar. 2.

New York, N. Y.—Bids will be received Mar. 10 by Jacob A. Cantor, Pres. Boro. Manhattan, for furnishing material for constructing sewers in portions of Audubon Ave. Engineer's estimate as follows: 1,617 lin. ft. 3 ft. 6 in. by 2 ft. 4 in. brick sewers, 2,185 lin. ft. 12 to 15 in. vitrified stoneware pipe sewer, 16 receiving basins, 6,825 cu. yds. of rock excavated and removed, etc.

Albany, N. Y.—Mayor Gaus has approved an ordinance authorizing the construction of a vitrified pipe sewer from a point about 2,400 ft. west of Watervliet Ave. to the lands of the city of Albany.

Port Chester, N. Y.—J. A. Peck, City Clk., writes that no definite action has yet been taken by the Trus. for the construction of a sewerage system.

Lakewood, O.—Bids will be received Mar. 28 by the Bd. of Trus. for constructing a storm conduit between Belle and St. Charles Aves. John French, Hamlet, Clk.

Cleveland, O.—The following are reported to be the lowest bids received Feb. 16 for sewer work: Aetna St., Wm. Lehmann & Son, $10,951; Guthrie St., Christian Burkhardt, $6,208, and Herald St., A. F. Helm, $5,823.

St. Bernard, O.—Geo. Meyer, Village Clk., writes that it was voted Feb. 28 to issue $150,000 bonds for sewers and street improvements.

Warren, O.—Bids are wanted Mar. 14 for furnishing material and constructing sewers on portions of several streets. A. L. Jameson, City Clk.

Cincinnati, O.—Bids are wanted Mar. 10 for constructing sewers and drains with necessary appurtenances in portions of Rice, Thill and Loth Sts. Robt. Allison, Pres. Bd. Pub. Service.

Bids are wanted Mar. 26 for improving portions of Tennyson St. by constructing trunk sewer and drains with appurtenances. Robt. Allison, Pres. Bd. of Pub. Service.

Wayne, Pa.—Geo. M. Bunting, of Chester, with other capitalists are reported to have purchased the Wayne Sewerage Co.'s interests at Wayne, formerly owned by the Childs-Drexel estate. The price paid is said to have been $99,900.

Phoenixville, Pa.—A press report states that the borough has refused to grant a franchise to a Sewerage Co., and will probably construct a municipal sewerage system.

Erie, Pa.—V. D. Elchenlaub, Erie, has been awarded a contract for constructing 2,950 ft. 18-in. tile sewer in 8½-ft. trench excavated in clay and shale, at $1.65 per ft., bidding for 9-in. pipe, 45 cts. per ft.; 6-in. pipe, 35 cts.; 10 manholes, $40 each, and 3 catchbasins, $35 each—bids opened Feb. 19. B. E. Briggs, City Engr. Riblet & Blenner, Erie, were lowest for 300 ft. 40-in. concrete sewer, at $3.15 per ft. and for 840 ft. 36-in. concrete sewer, at $3.20.

Harrisburg, Pa.—Sewer bonds amounting to $362,000 have been sold. Part of the work for which these bonds are issued is already let. Chas. A. Miller, City Clk.

Georgetown, S. C.—See "Water."

Austin, Tex.—The City Council has adopted a resolution providing for the construction of a system of sewers on Congress Ave.

Ft. Monroe, Va.—See "Government Work."

Seattle, Wash.—Plans for a big sewer system for the Lake Dell district in Lake Washington is reported to have been approved by the Bd. of Pub. Wks. The trunk sewer is to be an 18-in. Kalamine pipe, which is to follow down the old Fleaburg Road. The Lake Dell system is the beginning of the series of sewers that will drain the lake front north of Yesler Way and back for half a mile or so.

BRIDGES.

Huntsville, Ala.—A bill has passed both the House and Senate authorizing the construction of a railroad and toll bridge across the Tennessee River near Hobb's Island.

Guntersville, Ala.—A bill has passed the Senate authorizing the construction of a bridge across the Tennessee River between Lewis Bluff and Guntersville, Ala.

Mena, Ark.—Bids are wanted Mar. 21 for $15,000 bridge bonds. John H. Hamilton, Secy.

Denver, Colo.—McCreary and Willard, of Spokane, Wash., have, according to reports, secured a contract for work on the Denver & Rio Grande Ry., between Denver and Grand Junction, at a cost of about $35,000. It is stated that about 2,400 tons of steel will be required, and 3 bridges built across Grand River, one at Grand Junction, another at Glenwood, and a third at Buena Vista. Also a railroad crossing bridge and a street crossing at Colorado Springs.

Jacksonville, Fla.—An agreement has been reached between the officials of the various railroads and the city officials whereby a 12-arch combination concrete and steel bridge is to be built in this city. It is to be 243 ft. long, 58 ft. clear between the hand rails, to have a 40-ft. driveway, and a walk 9 ft. wide on either side.

Atlanta, Ga.—According to local press reports the Seaboard Air Line Ry. Co. contemplates building a bridge across Chattahoochee River in this city. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

Chicago, Ill.—The South Park Comrs. will until Mar. 18 receive designs for a bridge to be built in Jackson Park, cost not to exceed $35,000. E. G. Shumway, Secy.

Kankakee, Ill.—It is reported that the Illinois Central R. R. Co. will build this year a 3-track concrete bridge, 700 ft. long, across Kankakee River, at Kankakee, to cost about $150,000. H. U. Wallace, Ch. Engr., Chicago.

Dubuque, Ia.—The Bd. of Superv. and the officials of the Illinois Central R. R. are reported to be considering the building of a viaduct in Rockdale.

Springfield, Mass.—The City Council has authorized the mayor to enter into an agreement with the New York, New Haven & Hartford R. R. Co. or other interested parties by which the city will pay the additional expense connected with changing the South-end bridge to meet the requirement of the war department, estimated at about $7,000.

Grosse Ile, Mich.—It is stated that the Pere Marquette International Bridge Co. is being organized to build a bridge across the Detroit River somewhere in the neighborhood of Grosae Ile, which is about 20 miles below Detroit.

Oneida, N. Y.—On Feb. 25 the Common Council approved the action taken by the Bd. of Pub. Wks. in rejecting the bid received for a bridge across the canal feeder at the foot of Furnace Ave., and a resolution was adopted giving the Bd. the authority to construct the bridge without advertising for further proposals.

Bucyrus, O.—It is stated that a stone bridge is to be built by the Pennsylvania R. R. Co. over the Sandusky River at this point on its Columbus and Sandusky Short Line, at a probable cost of $50,000.

Cleveland, O.—According to local press reports E. E. Hart, Ch. Engr. of the Nickel Plate R. R., reports to the city officials that the Nickel Plate R. R. Co. is willing to co-operate with the city in the abolition of the 31 grade crossings between Pearl and Detroit Sts. The city intends to lower the roadbed of the Nickel Plate and to convey all the thoroughfares over the right of way by steel bridges. This plan was received favorably by Mr. Hart.

Oregon City, Ore.—The Senate has passed a bill authorizing the construction of a suspension bridge in this city.

Portland, Ore.—A bill has passed both the House and Senate authorizing the construction of a bridge across Willamette River at Morrison St. in Portland.

McKeesport, Pa.—Press reports state that the officials of the Wabash R. R. Co. are having surveys made for a bridge which it is proposed to construct across Monongahela River from Duquesne to McKeesport.

Pine Grove, Pa.—R. A. Bowman, of Mahanoy, has been appointed, according to reports, to prepare plans for the new State bridge to cross the Schuylkill River at Qualls from Auburn borough.

Pittsburg, Pa.—The bill authorizing the construction of a bridge across Allegheny River from the Brilliant station to the West Penn tracks by the Pennsylvania R. R. has passed the Senate. The structure will be the means of connecting the West Penn and the Allegheny Valley divisions of the Pennsylvania R. R.

Uniontown, Pa.—The Comrs. of Fayette and Westmoreland Counties have reached an agreement to construct an iron bridge, 65 ft. long, at Keister's Mill. M. E. Townsend, Comr., Fayette Co.

Providence, R. I.—Local press reports state that the Gorham Co. will in the near future construct a trestle bridge across Earl St., at a cost of about $25,000.

The Board of Aldermen has accepted the proposition made by the officials of the Consolidated R. R., to build and maintain a steel bridge at Adelaide Ave., providing that the city build the abutments, and has directed the City Engr. to build the abutments at a cost not to exceed $6,000.

Knoxville, Tenn.—It is stated that the Louisville & Nashville R. R. Co. has had plans prepared for a viaduct on Church Ave., over its terminal tracks, to cost $94,690, and has asked the city to bear $35,841 of the expense. R. Montfort, Ch. Engr., Louisville, Ky.

Nashville, Tenn.—Bids are wanted Mar. 16 for constructing a 40-ft. span steel bridge, 12 ft. wide, over Clear Lake Creek. R. D. Marshall, Chmn. Com.

Tacoma, Wash.—The City Council has adopted a report by the Puyallup Bridge Com. recommending that the Comr. of Pub. Wks be authorized to receive bids for constructing the bridge at 21st St. and authorizing the appropriating of $14,000 for said purpose.

Benwood, W. Va.—Bids will be received Mar. 21 by the Bellaire, Benwood and Wheeling Bridge Co. for constructing a steel bridge over the Ohio River between Benwood, W. Va., and Bellaire, O. Address James H. McCrady, Pres., 301 6th St., Braddock, Pa.

Congo, W. Va.—Press reports state that the Wellsville Bridge Co., of Congo, W. Va., has been incorporated to build, equip and operate a toll bridge. Capital, $5,000. Incorporators: Jas. H. Newell, Chester, W. Va.; Perle Howard, Congo, W. Va.; Frank J. Wells, Wellsville, O., and others.

PAVING AND ROADMAKING.

Rock Island, Ill.—The City Council has adopted an ordinance for the paving of 15th St. from Third to Twelfth Ave. with brick, 30 ft. in width, and the estimated cost is $27,960.

Sycamore, Ill.—M. G. Stolp, of Aurora, has prepared an estimate for about 10,000 sq. yds. of asphalt paving and 5,600 lin. ft. of combined curb and gutter for Sycamore, to be laid this spring.

Peoria, Ill.—The following bids were opened Feb. 28 for paving Chambers Ave. (8,809 sq. yds.) with asphalt: Barber Asphalt Co., $22,605, and Western Const. Co., $25,206. H. E. Beasley, City Engr.

An ordinance has been adopted by the City Council to pave with brick on a portion of Glen Oak Ave. Also an ordinance to pave on Hamilton St. with brick at a cost of $8,592.

The Park Bd. has secured the right of way for the proposed boulevard from Madison Ave. to Prospect Heights.

Chicago, Ill.—Bids will be received Mar. 11 by the Bd. of Local Improv. for grading, curbing and paving with brick and granite on portions of several streets. Andrew M. Lynch, Pres.

Wilmette, Ill.—Bids will be received Mar. 14 by the Bd. of Local Improv. for grading, filling, curbing, guttering, paving with brick and otherwise improving a portion of Central Ave. Vertis B. Roberts, Engr., Reaper Blk., Chicago. Henry B. Gates, Chmn.

Belleville, Ill.—The Local Bd. of Improve. has decided to recommend to the City Council the paving of South Rsce St., from Main to Fifth Sts., with asphaltum.

Indianapolis, Ind.—The Bd. of Pub. Wks. has passed an order authorizing the curbing and paving with brick on a portion of 19th and Shelby Sts., estimated to cost $25,000 and $18,750 respectively.

Muncie, Ind.—Bids will be received Mar. 23 by the Common Council for improving a portion of Penn St. by grading and macadamizing the roadway and constructing a 5-ft. cement sidewalk; also for grading and constructing 5-ft. cement sidewalks on a portion of Grant St. R. G. Hickok, City Clk.

Maquoketa, Ia.—Press reports state that the paving with brick, in the business district, is contemplated.

Iowa City, Ia.—Wm. Horrabin, Iowa City, has been awarded a contract for brick paving on Linn St., for $20,075. B. R. Moore, Iowa City, bid $24,231; Crowley, Toback & Co., Iowa City, $22,469 and $21,075; and Snouffer & Ford, Cedar Rapids, $22,190. The successful bid in detail is as follows, according to Chas. S. Magowan, City Engr.: 3,238 cu. yd. earth excav., 30 cts. per cu. yd.; 4,413 lin. ft. new curb, 60 cts. per ft. for Bedford or Cleveland curb, 5x22 in.; 190 ft. old curb reset, 15 cts.; 16 3-ft. radius curb corners, $6 per corner; 23 18-in. curb corners, $2.50; 11,090 sq. yds. brick pavg. on broken stone 6 in. when compacted, $1,464 for Purlington or Des Moines flint blocks; setting 7 stormwater inlets, $5 per inlet; setting 6 manhole heads, 50 cts. per head.

Burlington, Ia.—Emmet Steece, City Engr., writes that the Burlington Constn. Co. bid 65 cts. per cu. yd. for grading, 60 cts. per ft. for 1,000 ft. curb and $1.65 per sq. yd. for 8,300 sq. yds. paving on Main St.; total, $14,295. For the improvement of Foster St., Cameron, McManus & Joyce, Keokuk, Ia., bid 49 cts. per cu. yd. for grading, 70 cts. per ft. for stone curb, 83 cts. per ft. for cement curb and gutter and $1.69 per sq. yd. for paving; total, $10,582. For improving Valley St., bids were received as follows—A, Frank Buescher & Geo. Young, Burlington; B, Geo. Kriechbaum, Burlington; C, Cameron, McManus & Joyce; D, J. B. McAuley, Galesburg, Ill.; E, Peoples Constn. Co., Davenport, Ia.; F, Burlington Constn. Co.:

	Excavation, cu. yds. Street, 1,600.	Wall, 600.	Piers, 200.	Curb, 3,000 lin. ft.	Paving, 9,460 sq. yds.	Concrete, cu. yds. Wall, 921.	Piers, 200.	Handrail, 560 lin. ft.	Total.
A	$0.35	$1.25	$1.25	$0.60	$1.88	$10.75	$11.00	$0.60	$33,732
B	.40	1.00	1.00	.75	1.80	7.90	6.00	.70	29,586
C	.50	.50	.60	.65	1.99	6.44	3.33	.50	28,873
D	.40	.50	1.00	.65	1.80	7.00	4.00	1.25	28,065
E	.45	.65	.55	.58	1.81	6.25	6.00	.60	27,375
F	.45	.58	.90	.72	1.79	7.97	5.70	.99	28,913

Richmond, Va.—It is stated that bids will soon be asked by the Virginia Passenger & Power Co. for a bridge to be built across James River, connecting Richmond and Manchester. Calvin Whiteley, Jr., Ch. Engr., 1222 Carey St.

Berryville, Va.—The Co. Bd. of Superv. have, according to reports, employed Col. R. A. Marr, Prof. of Engineering at the Virginia Military Institute, as the engineer in charge of the erection of the proposed new bridges over the Shenandoah River at Castleman's and Berry's Ferries, in this county. In accordance with the question submitted to the people at the election held to decide whether or not bridges should be built, if after his preliminary survey and examination the engineer advises that they can be built with the sum voted for, $40,000, work will be commenced at once; if he reports otherwise no action can be taken without another vote.

Argo, Wash.—The Co. Comrs. have granted the Northern Pacific Ry. Co. permission to erect an overhead crossing on Valley St., in Argo. The structure will be of steel, 22 ft. high, from 600 to 800 ft. long, and 44 ft. wide. W. L. Darling, Ch. Engr., St. Paul, Minn.

Spokane, Wash.—Local press reports state that the new approach at the south end of the Monroe St. bridge, will cost about $24,000, according to the estimate of City Engr., A. F. Gill. The plans call for the replacing of the present wooden piles and trestle work by 154 ft. of steel work. One 54-ft. span now in use will be retained, the rest of the material will be new.

Wichita, Kan.—Bids are wanted Mar. 16 for paving portions of Douglas Ave.; approximately 12,400 cu. yds. excavating, 6,150 lin. ft. cement curbing, 23,800 sq. yds. sheet or rock asphalt or brick pavement. J. L. Leland, City Clk.

Louisville, Ky.—Local press reports state that bids will be received Mar. 10 by the Bd. of Wks. for paving with asphalt portions of several streets.

Louisville, Ky.—The Bd. of Pub. Wks. has ordered the construction with asphalt of Von Borries Ave. from Beechwood to Edenside, a distance of three blocks. Probable cost, $25,000.

Shreveport, La.—T. G. Hayes, City Aud., writes that from $150,000 to $225,000 will be expended on street paving. Asphalt or brick will be used. W. Woodward, City Engr.

Baltimore, Md.—The Bd. Pub. Improv. has passed the following paving ordinances: North Ave., from Broadway to Washington St., with asphalt blocks; McComas St., from Hanover to Creek Alley, with asphalt blocks; Lombard, Gilmor, Hollins and Stricker Sts., around Union Sq., with asphalt blocks, and Montford Ave., from Townsend to Gay Sts. Probable total cost, $49,458.

Boston, Mass.—Capt. A. M. Palmer, Q. M., U. S. A., writes that the contract for constructing roads and walks at Ft. Revere, Nantasket Head, Boston Harbor, Mass. (bids opened Feb. 21), has been awarded to J. J. Callahan, Box 55, Atlantic, Msss., for $8,340.

Grand Rapids, Mich.—Bids will be received on Mar. 13 for paving, with asphalt blocks on a gravel and cobble stone foundation, of Wealthy Ave. Length, 5,181 ft.; 23,010 sq. yds. L. W. Anderson, City Engr.

Bay City, Mich.—The paving of Cass Ave., probably with tar macadam, is being considered.

Minneapolis, Minn.—The Council Paving Com. has decided to receive bids on the following materials: Cedar block, 20,000 yds.; sandstone, 60,000 yds.; crushed slate, 4,000 cu. yds.; brick block, 40,000 sq. yds.; creosoted block, 40,000 sq. yds.; asphalt, 20,000 sq. yds.; crushed granite, 4,000 cu. yds.; crushed limestone, 10,000 cu. yds.; Portland cement, 10,000 bbls.; native cement, 40,000 bbls. Curbing, bids will also be received on 5,000 ft. of granite, and 20,000 ft. of sandstone.

Crookston, Minn.—Bids are wanted Mar. 10 for grading and constructing certain macadam roadways; also for constructing vitrified brick crosswalks on portions of 2 alleys. Geo. A. Ralph, City Engr.

Manchester, N. H.—The Council has appropriated for the use of the Street and Park Comn.: $6,000 for granite block paving, concrete foundation; $25,000 for repairing highways (resurfacing); $5,000 for building new streets, and $6,000 for macadamizing.

Toms River, N. J.—Bids will be received by the Co. Bd. of Chosen Freeholders until Mar. 31 for constructing a gravel road, about 10½ miles long, from Manchester to Plumstead Townships. Edmund Bennett, Dir.; Wm. Segoine, Engr., Point Pleasant, N. J.

Cape May, N. J.—The City Council has adopted an ordinance and an agreement by which this resort and a syndicate of Pittsburg capitalists are to make municipal and private improvements which will aggregate within the next two years more than $2,000,000. These improvements will include an extension to the beach boulevard along the ocean front for 2 miles east of Madison Ave. to Sewell's Point, to cost $120,000, of which the syndicate is to pay $50,000.

Newark, N. J.—According to local press reports the Street Com. intends to pave with asphalt or brick on portions of Elliott St., Saybrook Pl. and Elwood Ave.

Dunkirk, N. Y.—J. P. Morrissey, City Engr., writes that it is proposed to pave 2 streets, each about ¾ of a mile in length, with telford macadam, brick or asphalt.

Rome, N. Y.—The Council has ordered plans and specifications for paving Madison St. (about 20,000 sq. yds.). Asphalt has been petitioned for.

New York, N. Y.—The lowest of 6 bids opened Mar. 3 by J. A. Cantor, Boro. Pres., for macadam paving on 7th Ave. from 120th to 145th Sts., was that of the Century Const. Co., 13 Park Row, for $22,755, the items being: Macadam, 56,200 sq. yds. at 41 cts.; new bridgestone, 4,740 sq. ft. at 55 cts.; old bridgestone redressed and relaid, 10,240 sq. ft. at 8 cts.; new curb, 4,310 ft. at 83 cts.; old curb redressed and relaid, 7,960 ft. at 27 cts.

Brooklyn, N. Y.—The Bay Ridge Local Bd. has approved the resolution to repave Coney Island Ave., from Parade Pl. to Manhattan Beach, at a cost of about $200,000.

Brooklyn, N. Y.—The following bids were opened Mar. 4 by W. C. Redfield, Comr. Pub. Wks., for granite paving on sand foundation on Nostrand Ave. from Flatbush Ave. to Malbone St.—*a*, J. Chas. Weschler; *b*, Dennis Norton; *c*, Geo. M. Farrell; *d*, Murphy Bros.; *e*, Jas. Quinn; *f*, John J. Hickey; *g*, Edw. Rocbe; *h*, Michael Fitzgerald; *i*, Sterling Constr. Co.:

Bidders.	Granite, 37,120 sq. yds.	New curb, 20,370 ft.	Old curb, 400 ft.	Earth exc., 10,020 cu. yds.	Filling, 1,400 cu. yds.	Cem. walk, 67,900 sq. ft.
a.....	$2.50	$0.90	$0.40	$0.50	$0.50	$0.22
b.....	2.59	.93	.30	.48	.02	.23
c.....	2.60	.88	.20	.75	.10	.21
d.....	2.60	1.00	.30	.55	.75	.24
e.....	2.39	.85	.25	.35	.15	.16½
f.....	2.57	.90	.40	.40	.40	.20
g.....	2.35	.78	.20	.33	.05	.18
h.....	2.63	.50	.30	.25	.20	.20
i.....	2.52	.85	.30	.30	.30	.19

Brooklyn, N. Y.—The lowest of 5 bids opened Mar. 4 by W. C. Redfield, Comr. Pub. Wks., for grading and asphalt paving on Albemarle Road from Flatbush Ave. to Brighton Beach R. R., was that of the Uvalde Asphalt Paving Co., 1 Bway., N. Y., for $18,668, the items being: Asphalt, 6,260 sq. yds., at $1.40; concrete, 870 cu. yds., at $4.90; earth exc., 4,070 cu. yds., at $.30; concrete curb, 3,020 ft., at $.50; cement walks, 14,500 sq. ft., at $.18; concr. for retaining walls, 60 cu. yds., at $5.

The following bids were opened Mar. 4 by W. C. Redfield, Comr. Pub. Wks., for asphalt paving on Powell St., from East New York to Dumont Aves.—*a*, Uvalde Asphalt Paving Co.; *b*, Eastern Bermudez Asphalt Paving Co.; *c*, Crawford Co.; *d*, Interstate Paving Co.:

Bidders.	Asph., 11,493 sq. yds.	Concr., 1,975 cu. yds.	New curb, 6,579 ft.	Manhole covers, 25	Earth exc., 3,800 cu. yds.	Cem. walk, 26,372 sq. ft.
a.....	$1.50	$5.25	$0.90	$5.00	$0.40	$0.18
b.....	1.21	5.40	.90	5.00	.40	.23
c.....	1.48	5.75	.90	5.00	.40	.22
d.....	1.42	5.25	.90	5.00	.25	.18

St. Bernard, O.—See "Sewerage and Sewage Disposal."

Watertown, N. Y.—City Engr. McComb estimates the cost of paving on State St. with bituminous macadam at $47,332.

Brooklyn, N. Y.—Bids will be received Mar. 14 by J. Edw. Swanstrom, Boro. Pres., for regulating and repaving with asphalt on a concrete foundation portions of numerous streets; also for regulating, grading, curbing, and laying sidewalks on portions of 1st Ave. Engineer's estimate: 351,013 sq. yds. asphalt pavement, 54,402 cu. yds. concrete, 159,840 lin. ft. new curbstone, 68,280 sq. ft. cement sidewalk, 30,676 lin. ft. concrete curb, etc.

Schenectady, N. Y.—Local press reports state that bids will be received Mar. 10 for paving portions of Paige St. with block asphalt and portions of Carrie St. with sheet asphalt. Alexander Fenwick, City Clk.

Port Chester, N. Y.—J. A. Peck, Village Clk., writes that bids will be received on Mar. 16 for paving with Mack brick and macadamizing Irving Ave.

Lakewood, O.—Bids will be received Mar. 28 by the Bd. of Trus. for paving and improving portions of Lake Ave. John French, Hamlet, Clk.

Massillon, O.—Local press reports state that an ordinance has been passed by the City Council appropriating $26,000 to provide for the paving of a portion of So. Erie St., with brick.

Toledo, O.—O'Sullivan & O'Sullivan are stated to have secured the contract for paving with stone on a portion of Orange St., at $5,715.

Toledo, O.—Bids are wanted Mar. 30 for furnishing material and improving by paving with either blocks or asphalt on an 8-in. gravel or 6-in. concrete, gravel or broken stone foundation portions of Starr Ave. Chas. H. Nauta, City Clk.

Sandusky, O.—J. W. Miller, City Engr., writes that the Ayers Asphalt Paving Co., of Zanesville, has secured the contract for paving Hayes Ave. with Trinidad Pitch Lake asphalt (bids opened Feb. 4) for $32,768.

Portland, Ore.—Resolutions have been adopted by the Councils directing the City Engr. to prepare plans for about 10 miles of street work on the West Side. The pavement is to be of bituminous macadam, vitrified brick, asphalt, wood and stone blocks and macadam.

Harrisburg, Pa.—Bids are wanted Mar. 14 for curbing and paving on a portion of 2d St. with either asphaltum, asphaltum blocks, vitrified brick, on a concrete base, Warren's bituminous macadam waterproof pavement or any other approved paving material. According to local press reports about 39,000 sq. yds. of paving will be needed and about 16,000 lin. ft. curbing. Chas. B. McConkey, Highway Comr.

New Castle, Pa.—The Councils have adopted ordinances to pave with asphalt block on portions of Clayton, No. Cedar, Cedar and Liberty Sts.

Mauch Chunk, Pa.—Robt. A. Heberling, Boro. Clk., writes that the Warren Bros. Co., of Boston, Mass., have secured the contract for paving Main St. with Warren's Patent Bituminous Macadam at $2 per sq. yd.; total cost, $20,000.

Dandridge, Tenn.—A bill has passed the Legislature authorizing Jefferson County to issue bonds to the amount of $20,000, for the purpose of building macadamized roads. The proposition must be submitted to a vote of the people of the county, and receive a majority of the votes cast.

Nashville, Tenn.—Ordinances have been passed by the City Council appropriating $20,300 for the paving with granite on a portion of Front St.; also $26,700 for similar work on a portion of Woodland Ave.

Greenville, Tex.—At the Good Roads Convention held in this city, the voters and tax payers of Hunt County adopted resolutions petitioning the Commissioners' Court to order an election for the purpose of determining whether they shall issue bonds to the amount of $400,000. The proceeds from the sale of said bonds to be used for the purpose of constructing and bettering the road conditions of Hunt County.

Houston, Tex.—The paving with brick or asphalt on a portion of Chartres St. is being considered; the cost with brick pavement has been estimated at $12,500 for a 35-ft. street.

Ballard, Wash.—An ordinance has been adopted by the City Council for the improvement of Ballard Ave. between First and Third Aves., by paving with brick, curbing with granite and constructing cement walks, at an estimated cost of $40,399.

Fond du Lac, Wis.—E. B. Parsons, City Engr., writes that the contract for 19,442 sq. yds. vitrified block pavement (bids opened Feb. 23) has been awarded to John O. Jones, of Racine, Wis., for $49,500, using Metropolitan Block.

Milwaukee, Wis.—The Bd. of Pub. Wks. has recommended to the Common Council that asphalt pavement be laid on Farwell Ave., from Franklin Pl. to Brady St., in the First Ward. The Bd. has advised paving the following Seventh Ward streets with brick; Market St., from Johnson St. to Juneau Ave.; River St., from Oneida to Martin Sts.; Johnson St., from Market St. to Broadway.

Baraboo, Wis.—City Engr. Kirchoffer estimates the cost of the proposed paving of Oak St. from 4th to 11th and of 2d St. from Oak to Elizabeth, at $13,874.

Chippewa Falls, Wis.—P. McDonnell, of Duluth, Minn., is stated to have secured the contract for paving 26,000 sq. yds. of street in this city with brick, at about $55,000.

POWER PLANTS, GAS AND ELECTRICITY.

De Queen, Ark.—The De Queen Light, Ice & Cold Storage Co. has been incorporated, with a capital of $50,000. J. S. Lake, Pres.; I. O. Bunyon, Secy.

San Francisco, Cal.—The Water & Power Co., of California, has been incorporated, with a capital of $4,000,000, to develop water sources in the mountains for the purpose of supplying power for irrigation, and for the use of the places throughout the northern part of the State. Incorporators: Henry F. Allen, W. B. Bourn, E. J. McCutchen, and others.

Placerville, Col.—W. N. Muffley, City Clk., writes that S. P. Jewett, of Placerville, has secured a franchise to construct and maintain poles and wires for electric transmission; also for laying gas pipes.

Corona, Cal.—H. A. Wood, City Clk., writes that it is proposed to construct a municipal electric light plant, at a cost of $60,000.

Petaluma, Col.—The California Central Gas & Electric Co. is stated to have secured permission from the Trustees to erect poles and maintain a line for the transmission of electricity.

Red Bluff, Cal.—It is reported that the Northern California Power Co. will construct a line from the sub-station in this city through Berrendos to the old Copeland Place.

Victor, Colo.—A press report states that extensive improvements will be made to the dam of the Pike's Peak Power Co. A second dam will also be constructed below the present breakwaters. H. M. Jones, Ch. Engr., Victor.

Chanute, Kan.—It is stated that bids are wanted Mar. 12 for proposed city electric plant. The plant is to be operated by steam and to have a capacity of 100 arc and 5,000 incandescent lights, and is estimated to cost $30,000. E. H. Ricksecker, of Coffeyville, Kan., is Des. Engr.

Bowling Green, Ky.—The City Council is reported to have adopted a resolution authorizing the establishment of an incandescent plant, in connection with its arc light system.

Nezperce, Idaho.—Z. A. Johnson is reported to have engineers at work on Lolo Creek surveying his water right with a view of its immediate development for electrical and power purposes.

Sterling, Ill.—It is reported that the Sterling Gas & Electric Light Co. will expend about $25,000 in improvements.

Byron, Ill.—John Whitaker is reported interested in the construction of an electric light plant.

East Peoria, Ill.—A press report states that the East Peoria Heat, Light & Power Co. is to construct a plant, to cost about $50,000.

Lafayette, Ind.—The Wabash Oil & Gas Co., in connection with Lafayette and Chicago capitalists will, it is reported, begin this month to construct dams and a $250,000 electric light plant at Horseshoe Bend on Tippecanoe River.

Marion, Ind.—The Citizens' Electric Light Co. is reported organized, with a capital of $50,000.

Hartford City, Ind.—Geo. Mayer, and others, of Chicago, Ill., are stated to have purchased the plant of the Hartford City Light Co., and will improve the plant.

Tahlequah, Ind. Ter.—C. W. Turner, owner of the electric light plant at Muskogee, is stated to have made a proposition to Tahlequah for an electric light plant. If accepted he will probably move the plant at Muskogee to Tahlequah and construct a larger plant at Muskogee.

Ottumwa, Ia.—See "Water."

Holyoke, Mass.—The General Electric Co. is stated to have secured a contract from this city for 400 series inclosed arc lights and 150 multiple inclosed arc lights, for about $13,500.

Lake Linden, Mich.—The Council is stated to have granted Mercer & Ingersoll, a franchise for a gas plant. They are reported to have recently secured a franchise in Laurium.

Detroit, Mich.—Bingley R. Fales, of Detroit; W. C. Kerr, of the Westinghouse, Church, Kerr & Co.; Elphat Potter and Franklin A. Plummer, all of New York, N. Y., are reported interested in the Central Htg. Co. about to be formed here to construct a heating plant.

Monroe, Mich.—The Monroe Htg. & Lighting Co. is reported as about to be organized with Chas. Flowers, of Detroit, and Fred C. Nadeau, of Monroe, as incorporators. They are reported to have petitioned Council for a franchise to furnish electricity for lighting and installing a hot water heating system.

Negaunee, Mich.—It is stated that improvements are to be made to the electric light plant, at a cost of about $10,000.

Mankato, Minn.—A press report states that the City Council has voted to construct a municipal electric light plant, and will receive bids for $40,000 electric light bonds on Mar. 19.

Verndale, Minn.—Bids will be received Mar. 14 by the Village Council for $7,000 bonds to be used for constructing an electric lighting plant. H. Lyons, Village Recorder.

Spring Grove, Minn.—The question of constructing an electric light plant, to cost from $4,000 to $5,000, is reported under consideration.

Boyhead, N. J.—The Boro. Council is stated to have adopted a resolution to light the streets and beach front by electricity. A committee was appointed to make a contract with the Point Pleasant Electric Light & Power Co., the lighting to begin June 1.

Pitman Grove, N. J.—The New Jersey Southern Gas & Electric Co., of Pitman Grove, has been incorporated, with a capital of $500,000, by J. H. McNeal, R. M. Anderson and A. M. Worstall.

Sodus, N. Y.—B. H. Shepard, of Syracuse, is reported interested in the construction of an electric light plant.

Watervile, N. Y.—It is reported that the capacity of the plant of the Electric Light & Power Co. will be increased so as to provide steam for Marshall and Augusta. Horace B. Sweet, Pres., Utica.

Dansville, N. Y.—The Mill Creek Electric Light & Power Co., of Dansville, has been incorporated, with a capital of $200,000, by F. A. Owen, Walter A. Beecher, and others, all of Dansville.

Dickinson, N. D.—It is reported that the Northern Electric Co. will enlarge its power station, and add another dynamo and boiler.

Urbana, O.—The Urbana Electric Light & Power Co. has petitioned the Council for a franchise for a hot water heating system.

Paulding, O.—The Paulding Gas Light & Fuel Co. is reported incorporated, with a capital of $30,000, by Jas. Lynn and others.

Tiffin, O.—Kerlin Bros., of Toledo, proprietors of the plant of the Consolidated Gas & Light Co., which has the contract for lighting the east half of Tiffin, are stated to have decided to expend about $30,000 in improvements, which will include the adoption of a newly improved street lamp and dynamos.

Findlay, O.—The only bid received on Feb. 14 for lighting the city by electricity was submitted by the City Light, Heat & Power Co., a newly organized company. This company agrees to furnish arc lights at $80 per light per yr.

Piqua, O.—The Miami Light, Heat & Power Co., of Piqua, is reported incorporated, with a capital of $100,000, by S. B. Hartman and F. W. C. Bailey, of Columbus, and others.

Chambersburg, Pa.—W. H. Brown, Boro. Clk., writes that the citizens have voted to issue $25,000 bonds, $9,000 of which are to be used for improving the electric light plant.

Sellersville, Pa.—A charter has been granted to the Sellersville Electric Light & Power Co. Morris A. Clymer, of Sellersville, and Henry J. Wambold, of Telford, Pa., are among the incorportaors.

Union, S. C.—Bids will be received by the Union Power & Mfg. Co. until Mar. 21 for constructing a rubble masonry dam, containing about 9,000 cu. yds.; a concrete masonry power house, containing about 4,000 cu. yds. and 2 earth dams containing about 19,000 cu. yds.

Clinton, S. C.—The Bd. of Aldermen are reported to have under consideration the construction of an electric light plant and water works.

Spartanburg, S. C.—The Electric Mfg. & Power Co. is about to be formed here, with a capital of $100,000, by local capitalists, to develop the water power on French Broad River, 35 miles from this city and near Tyron, N. C. John B. Cleveland and J. N. Cudd are reported interested.

Austin, Tex.—It is reported that the purpose of the Austin Light, Heat & Power Co., recently incorporated under the laws of Delaware with a capital of $2,500,000, is to rebuild the great dam across Colorado River at Austin, and to supply the city and private concerns with light, heat and power. Incorporators: Edw. C. Dowling and Harry U. Spence, of Brooklyn, N. Y., and Millard H. France, of N. Y. City, N. Y.

Beaumont, Tex.—Hal W. Greer, Walter J. Crawford, and others, are stated to have petitioned the Council for a franchise for an electric light and power plant.

Richmond, Va.—Wm. B. Newell, 8 S. Plum St., has secured the contract for erecting the addition to the power house of the Virginia Passenger & Power Co., for $25,000. The capacity of the plant will be increased from 4,000 to 10,000-H.-P.

Kalama, Wash.—Atkins & Watson are stated to have secured a franchise for an electric light plant.

Walla Walla, Wash.—The Walla Walla Gas & Electric Co. is preparing preliminary plans for the construction of a power plant on Walla Walla River. Will not be prepared to let contracts for some time.

Charlestown, W. Va.—Stephen B. Elkins, Chas. Swisher, and others, are stated to have purchased the gas, water and electric light plants at Charlestown, and will operate them from a single power station under the name of the Kanawha Water & Light Co.; the capital stock of the new company is $600,000.

Sheboygan, Wis.—It is stated that the Sheboygan-Elkhart Lake Ry. & Electric Co. is about to petition the Council for the privilege of doing an electric lighting business in this city. John M. Seamann, Gen. Mgr., Sheboygan.

Watertown, Wis.—Local press reports state that the Watertown Electric Light Co. will make alterations at its two power houses, and will soon install new machinery. Wm. Scott, Secy.

Milwaukee, Wis.—The Com. on County Hospital of Bd. of Superv. is stated to have recommended the bid of Chas. F. Rohn for the installation of the electric lighting plant at the County Hospital for $7,141.

Marinette, Wis.—C. B. Pride, of Appleton, is reported to have commenced a survey of the water power at the mouth of Escanaba River for the I. Stephenson Co., of Wells, Mich. He is also reported to be surveying for the same company another water power, known as Cataract at the headwaters of Escanaba River.

Rapid City, Man.—See "Industrial Plants."

Winnipeg, Man.—It is stated that the Canadian Pacific Ry. Co. will use electric lighting instead of gasoline at all important stations in the mountains. Plants will be constructed at Banff, Field, Glacier, Lake Louise, Emerald Lake and at the hotel at Vancouver; total cost of work will be about $75,000. Edwin H. McHenry, Ch. Engr., Montreal, Que.

ELECTRIC RAILWAYS.

Oakland, Cal.—It is stated that J. H. Macdonald has applied for a franchise to construct a street railway along Pleasant Valley Ave., and bids for said franchise will be received Mar. 30.

Watsonville, Cal.—The Watsonville Transportation Co. has been incorporated, with a capital of $1,000,000, to build an electric railway from Watsonville to Monterey Bay, a distance of 5 miles. F. A. Kilburn and H. H. Main are among the incorporators.

Naugatuck, Conn.—The Senate has passed the bill granting a charter to the Naugatuck Valley Ry. Co., which plans to build an electric railway from Naugatuck to Seymour, running through Beacon Falls.

New Castle, Del.—It is said that surveys have been completed for the Elkton, New Castle & Eastern Shore R. R. This line is to extend from Elkton to Delaware City, via Newark.

Coeur d'Alene, Idaho.—It is stated that the entire right of way has been secured by the Coeur d'Alene & Spokane Ry. for its proposed line to Post Falls and Coeur d'Alene.

Vandalia, Ill.—The St. Louis, Vandalia & Eastern Electric Railway Co. has been incorporated, with a capital of $50,000, by Wm. M. Folger, Chas. G. Sonneman and Geo. D. Steinhauer.

Decatur, Ill.—The interests identified with the Decatur Traction & Electric Co. (W. L. Shellabarger, Secy., Decatur) are interested in the plan to build an electric railway from Decatur to Springfield. The right of way between Riverton and Niantic has been secured.

Dixon, Ill.—The City Council has granted a franchise to G. H. T. Shaw to build an electric railway into the city from DeKalb and Lee Center.

St. Elmo, Ill.—The St. Louis & Eastern Electric Ry. is seeking incorporation. The plan of the company is to build from St. Louis to St. Elmo, though the ultimate object is to build to Terre Haute, Ind. Johnson Bros., of St. Elmo, are interested.

Ft. Wayne, Ind.—The work of securing the right of way for the Ft. Wayne, Van Wert & Lima Traction Co. has been begun.

Danville, Ind.—W. F. Churchman and Everett Wagoner, incorporators of the Indianapolis, Danville & Rockville Electric Ry., have made a tour of inspection of the proposed route and announce that the line will be constructed at once. Estimates of the cost are now being prepared. It has been decided to construct the power house at Danville.

Kokomo, Ind.—The Kokomo, Converse & Marion Traction Co. has been incorporated, with a capital of $10,000, to build a line from Kokomo to Marion via Converse. O. V. Darby, of Kokomo; J. E. Kenney, of Converse, and H. D. Thomas, of Marion, are among the incorporators.

Greensburg, Ind.—The stockholders of the Indianapolis, Shelbyville & Southeastern Traction Co. have voted to extend the line on to Greensburg and Batesville. Edw. Buchanan, Ch. Engr., Indianapolis.

Terre Haute, Ind.—The Engineers and Electricians who are to build the interurban lines for Stone & Webster, of Boston, are stated to have arrived in this city. A line from West Terre Haute to the Wabash River and a line from Terre Haute to Clinton will be built.

Hobart, Ind.—The City Council has granted a franchise to the Hobart & Western Electric Ry. Co. The line is to run from Valparaiso to Chicago via this city. Samuel A. Wright, of Chicago, Ill., Pres.

Knox, Ind.—The Knox, Chicago & Northern Traction Co. has been incorporated, with a capital of $150,000, to construct and operate an interurban system to connect Logansport, Rochester, Bass Lake and other northern Indiana cities with Laporte as the northern terminal. J. C. Fletcher, of Knox, Pres.

Rushville, Ind.—C. L. Henry, Pres. of the Indianapolis & Cincinnati Traction Co., is reported to be here this week for the purpose of locating a power house. The building will be 600x800 ft. and with equipments will cost $200,000.

Chickasha, Ind. Ter.—The Chickasha Warehouse & Terminal Co. has been incorporated to build steam and electric railways, telephone lines, etc. It is said that the immediate plan of the company is to build a 10-mile electric railway from Chickasha. M. M. Beavers and L. P. Stone, of Chickasha, are interested.

Sioux City, Ia.—It is understood that the new owners of the Sioux City Traction Co. plan to rebuild the entire system.

Frederick, Md.—It is reported that the Baltimore & Frederick Electric Ry. Co. has awarded the Westinghouse Co. a $400,000 contract for equipment. The plan of the company is to build from Baltimore to Frederick, a distance of about 45 miles.

Northbridge, Mass.—The Blackstone Valley St. Ry. Co., now operating between Worcester and Whitinsville, is considering the advisability of extending its line through Northbridge to South Sutton, Manchaug and East Douglas.

Attleboro, Mass.—The Selectmen have granted a franchise to the Attleboro & Mansfield St. Ry. Co. on Bany St.

Fall River, Mass.—It is stated that a deal has been closed by the Old Colony St. Ry. Co. for the purchase of a site here on which to erect a power plant. E. C. Foster, Gen. Mgr., Boston.

Battle Creek, Mich.—Plans have been completed for double-tracking the line of the Michigan Traction Co. between this city and Lake Goguac; also between Battle Creek and Lansing. A new depot, 100 ft. by 40 ft., is to be erected at the Lake. It is said that the plans for the company's new car-barn on River St., Battle Creek, have been completed. A. D. Marhoff, Ch. Engr., Kalamazoo.

Hubbardstown, Mich.—The Alma Sugar Co. is said to be interested in the construction of an electric railway from Hubbardstown to Alma.

Kasota, Minn.—Hord & Keator, of Mankato, have secured a franchise through Kasota. It is said that this franchise closes all rights for the construction of a line from Mankato to St. Peter.

St. Paul, Minn.—It is reported that the St. Paul City Ry. Co. will expend about $250,000 this year in improvements.

St. Peter, Minn.—Hord & Keator, of Mankato, who propose constructing an electric railway from Mankato to St. Peter, have secured a franchise in St. Peter.

Pleasantville, N. J.—The Atlantic City & Suburban Traction Co. has secured a franchise in Pleasantville. The company now has right of way for a line from Atlantic City to Absecon, Somers Point, Linwood and Egg Harbor.

Camden, N. J.—It is announced that the proposed line of the South Jersey Gas, Electric & Traction Co. from Mantau to Clayton will be built through Barnsboro, Pitman, Alcyon Park, Glassboro and Clayton.

Union, N. Y.—The Binghamton St. Ry. Co. has submitted to the Citizens' Com. of Union and Maine, N. Y., a proposition for extending its line to Maine. This proposition deals with the right of way, sites for a terminal at Maine, and a pleasure resort in that locality. J. P. E. Clark, Gen. Mgr., Binghamton.

Riverhead, N. Y.—Wm. J. Martin is reported interested in the building of an electric railway to connect Riverhead, Quogue and other south side villages on the east end of the island.

Hamburg, N. Y.—The Hamburg Ry. Co. has secured the franchise to extend its line along Hamburg Turnpike from north line of the township to the south line of Big Tree Road.

Jamestown, N. Y.—Right of way is about secured for the Jamestown & Warren Electric Ry., and the application for permission to build the line will be heard by the R. R. Comrs. at once. The line will pass through Ackley, Russell and North Warren. The length of the line is 19 miles. D. H. Siggins, Pres.

New York, N. Y.—The U. S. Senate has passed the bill granting to the New York & Jersey R. R. Co. the right to construct and operate an underground railway under and along Greenwich St.

Oyster Bay, L. I., N. Y.—Application has been made to the Bd. of Superv. at Mineola by Edw. B. Fiske for a franchise to construct an electric railway over and along Main St., in Oyster Bay.

Freeport, L. I., N. Y.—The New York & Long Island Traction Co., now operating between Mineola, Hempstead and Freeport, and making connections for New York, has been granted a franchise for an extension of its lines from Freeport to Rockville Center.

Springfield, O.—The Springfield Southern & Cincinnati R. R. Co. has been incorporated, with a capital of $25,000, by Geo. H. Frey, Jr., Jas. Johnson, and others. The company proposes to build electric railways from Springfield to Hillsboro by way of Xenia and Jamestown.

Salem, O.—Bids will be received Mar. 16 by Geo. Holmes, City Clk., for constructing and operating a street railroad on certain streets.

Sidney, O.—H. S. Alles, City Clk., writes that the Bellefontaine & Sidney Electric Ry. Co. of Bellefontaine, has secured a franchise to construct and operate St. Ry. Route No. 3.

Shawnee, Okla.—Plans are being discussed for building an electric railway from Shawnee to Tecumseh. Wm. Edwards, Attorney for the Orient Railroad, is reported interested.

Chester, Pa.—The Chester Traction Co. has secured a new franchise on the Providence Road, and will build an extension from 24th St., Chester, to Palmer's Corner.

Latrobe, Pa.—The contract for building the Latrobe, Pleasant Unity & Greensburg St. Ry. is to be let soon. The company will build from Latrobe to Greensburg via Pleasant Unity, a distance of 18 miles. John B. Keenan, Pres.; Jas. L. Freehle, Secy.

Pittsburg, Pa.—The Pittsburg & Allegheny St. Ry. Co., which was incorporated to build an electric railway connecting the towns of Kiskiminetas and Allegheny valleys, has awarded the contract for the construction of the portion between Apollo and Leechburg to Jones & Willard, of Apollo; contract price is reported to be $400,000.

York, Pa.—Resolutions providing for extensions of the York Haven St. Ry. and the York & Gettysburg St. Ry. have been entered for record at the Court House in this city. The former will build from near Emigsville northwardly, a distance of 2,888 ft.; the latter from East Berlin, through Bigmount, Admire, Krones, Welgiestown to York.

Monaca, Pa.—James H. Welch has applied to the Boro. Council for a franchise.

Pascoag, R. I.—The Pascoag & Providence St. Ry. Co. is seeking incorporation. It proposes to build an electric railway to connect Burrillville, Glocester, Smithfield, Johnston and North Providence. Waldo A. Hopkins, of Pascoag, is reported interested in the company.

Providence, R. I.—The South Shore St. Ry. Co. is seeking incorporation. The plan of the company is to build an electric railway from Tiverton to Seaconnett Point, with a branch to Adamsville. The new company is to be capitalized at $100,000, and the incorporators are: A. Manchester, J. McKenzie and E. A. Cornell.

Everett, Wash.—W. L. Johnson, of Seattle, Wash., is to apply to the Council for a franchise for the construction of an electric railway here.

Spokane, Wash.—The City Council has granted a street railway franchise to the Washington Water Power Co.

Charlestown, W. Va.—The Charlestown Traction Co. is reported to be considering a plan to build an extension to Montgomery, a distance of about 20 miles.

Moundsville, W. Va.—Plans are being made for an electric railway from Moundsville to Williamstown. Guy A. Wagner, of Wheeling, is said to be interested.

Huntington, W. Va.—The work of securing the right of way for an electric railway from Washington to the Falls of the Potomac, a distance of 20 miles, has been begun. It is said that Jos. S. Miller, President John Graham, of the Camden Interstate Ry., and Geo. F. Miller, Pres. of the First Natl. Bank, of Huntington, are interested.

Janesville, Wis.—The Southern Wisconsin Interurban Ry. Co. has filed a petition for a 50-year franchise. The company proposes building an electric railway to connect Janesville, Milton, Milton Junction, Newville, Edgerton, Stoughton and Madison. Dennis Hayes and C. S. Jackson, of Janesville, are reported interested.

Sheboygan, Wis.—The Sheboygan Light, Power & Railway Co. is said to be negotiating a loan of $1,000,000 to provide for the refunding of outstanding bonds and for the improvement of the company's property in general. It is said that a new power house is to be built, and that the road is to be extended to Plymouth. J. C. Liggett, Gen. Mgr., Sheboygan.

Winnipeg, Man.—The Winnipeg St. Ry. Co. plans to build several extensions within the city during the summer. W. Phillips, Supt., Winnipeg.

Charlottetown, P. E. I.—A. F. Gerald, of Fairfield, Me., is reported interested in the building of an electric railway in this vicinity.

RAILROADS.

Buffalo, Ark.—A charter is stated to have been granted to the Boston Mountain Ry. Co., which proposes constructing a railroad 50 miles long on the north bank of Buffalo River in Searcy, Baxter and Marion Counties; capital, $500,000. Incorporators: P. H. Gehr, of Mountain Home; H. L. Ponder, of Walnut Ridge, and others.

Piggott, Ark.—A charter has been granted to the Northeastern Arkansas R. R. Co., with a capital of $100,000. The road is to be 9 miles long, in Clay County, with Piggott as headquarters. Judge Felix G. Taylor, of Piggott, one of the directors.

Los Angeles, Cal.—The Los Angeles, Daggett & Tonopah Ry. Co. is reported incorporated, with a capital of $5,000,000, to construct a railroad from Los Angeles to Tonopah.

Humboldt, Cal.—A press report states that the Santa Fe R. R. (W. B. Storey, Jr., Ch. Engr., Topeka, Kan.) will construct a line from Humboldt to Mendocino and the Southern Pacific R. R. (Wm. Hood, Ch. Engr., San Francisco) will extend the California & Northwestern line to Humboldt.

St. Anthony, Idaho.—It is stated that the Union Pacific R. R. Co. will construct a line from St. Anthony to Yellowstone Park. J. B. Berry, Ch. Engr., Omaha, Neb.

Chicago, Ill.—The Chicago & Illinois Western R. R. Co., of Chicago, has been incorporated, with a capital of $25,000, to construct a line from Cook County to the south line of Kankakee County. Incorporators: E. T. Evans, H. S. Duncombe, and others.

Hammond, Ind.—A press report states that the Monon has arranged to build a yard a short distance south of Hammond. It will have a capacity of 6,000 cars. With it will be built a 15-stall roundhouse and a repair shop. L. H. Parker, Supt., Lafayette.

Indianapolis, Ind.—The Chicago, Indianapolis & Louisville R. R. Co. is stated to have perfected plans for building an extension from Indianapolis to the southwest, passing through the coal fields of Indiana to Evansville. Most of the right of way has been secured for what will be practically an air line from Indianapolis to Evansville. L. H. Parker, Supt., Lafayette.

Des Moines, Ia.—The Des Moines, Iowa Falls & Northern R. R. Co. is stated to have decided to construct a line about 40 miles north from Iowa Falls. R. C. Young, Ch. Engr., Iowa Falls.

Jennings, La.—The Jennings Northern Ry. Co. is reported organized, with F. C. Hubbell, of Des Moines, Ia.; G. H. Courtney, of Iowa Falls, Ia., and E. F. Rowson, of Jennings, as directors. The proposed line is to run north and south from Jennings.

Pentwater, Mich.—It is stated that the Pere Marquette R. R. Co. will extend its line from Pentwater, north to Manistee, by way of Ludington. The extension will be 30 miles in length. F. H. Alfred, Ch. Engr., Detroit.

Springfield, Mo.—The Springfield & Southwestern Ry. Co. has been incorporated, with a capital of $1,600,000, to connect Jefferson City and Springfield with the White River Railroad in Arkansas. Directors: C. G. Warner, Russell Harding, and others.

St. Louis, Mo.—A press report states that preliminary engineering work on the Wabash R. R. is about completed, and will soon be ready for the letting of contracts aggregating over $10,000,000. This new work is mainly on the seaboard extension of the Wabash, through Ohio, W. Va. and Md. West of Cumberland two gaps yet remain to be closed. The cost of this work is expected to be close to $6,000,000. From Cumberland to Cherry Run a 65-mile link is to be made, connecting the West Virginia Central and the Western Maryland. This gap will be closed by a railroad to be built in the most modern way. The cost will be about $4,000,000. Jos. Ramsey, Jr., Pres., St. Louis.

It is stated that the St. Louis, Iron Mountain & Southern R. R. is to secure additional terminal facilities at St. Louis and Memphis. E. A. Gould, Gen. Supt., St. Louis.

Trenton, N. J.—Charters have been granted to the New Jersey & Delaware River R. R. Co., with a capital of $100,000, to construct and operate a railroad ¾ of a mile in length from Martin's Creek, on the Belvidere Division of the Pennsylvania R. R. to a point in the middle of the Delaware River and to the Delaware & Northampton R. R. Co., with a capital of $5,000,000, to construct and operate a railroad from the point where the other road leaves off, in the middle of the Delaware River, to points outside the State. Incorporators of both companies are John R. Hageman, of New York, N. Y.; Jas. P. Northrop, of North Plainfield; Howard C. Griffiths, of Jersey City, and others.

Albuquerque, N. M.—A press report states that the Santa Fe R. R. Co. will construct a 300-mile extension during the present year to connect Albuquerque with Galveston. Jas. Dun, Ch. Engr., Chicago, Ill.

Chama, N. M.—Articles of incorporation have been filed by the Rio Grande & Southwestern R. R. Co., with a capital of $150,000. This line will be 42 miles in length, and will be constructed from a junction with the Denver & Rio Grande, in Rio Arriba County, N. M., and extend in a south and southeasterly direction until the Jicarilla-Apache Indian Reservation is reached. Directors: Edgar M. Biggs, of Edith, Colo.; Chas. D. McPhee, of Denver, Colo., and Wilmot E. Broad, of Chama.

Raleigh, N. C.—A charter is reported to have been granted to the Raleigh & Eastern North Carolina R. R. Co. Capt. J. J. Thomas and C. B. Barbee are reported to be among the incorporators.

Sandusky, O.—The Sandusky, Huron, Vermillion, Lorain & Loudonville Ry. Co., has been incorporated, with a capital of $10,000, by Albert E. Boone, J. W. Marquard, and others to construct a steam line between Sandusky and Loudonville.

Cleveland, O.—The Chicago Short Line Ry. Co. promoted by C. W. French, of Mansfield, will open offices in the Electric Bldg. of Cleveland. It proposes constructing new roads from Youngstown to Cleveland, Akron and Canton. It will rebuild the road from Akron to Delphos, and will include the Big Four branch from Carey to Findlay, and the line from Findlay to Ft. Wayne, connecting there with the Nickel-plate to Chicago. A new line from Sandusky to Norwalk, Ashland, Massillon, Canton and to Beaver, Pa., will be built.

Carnegie, Pa.—The Pittsburg, Chartiers & Youghiogheny R. R. Co. (Jas. B. Safford, Supt., Pittsburg) is stated to have secured permission to double track its line from Duffs Junction to Carnegie. It will also build 2 large yards at McKees Rocks, with a total capacity of 749 cars, and develop a wharf frontage and extend its line to Neville Island.

Williamsport, Pa.—A company represented by Reilly & Shale, of Williamsport, has acquired the charter of the old Eastern & Lehigh R. R. They are organizing a construction company, with $500,000 capital, to build a railroad from this city to Port Jervis, N. Y., by way of Wilkesbarre, where it will connect with the Ontario & Western.

Oliver Springs, Tenn.—The Louisville & Nashville R. R. Co. is reported to be considering the construction of a railroad from Oliver Springs to Harriman, Rockwood and Chattanooga. R. Montfort, Ch. Engr., Louisville, Ky.

Farmville, Va.—Engineers are reported to be surveying the route for the Farmville & James River Valley Ry., which will have its starting point at Rosney, and its terminus at Danville.

Winnipeg, Man.—The agreement between the City Council and the Canadian Pacific Ry. (Edwin H. McHenry, Ch. Engr., Montreal, Que.), in connection with the proposed improvements and additions to the company's property in Winnipeg is now settled. As the company requires 8 tracks along Point Douglas Ave., the city will close up and dedicate to the company portions of the streets adjacent to the track east and west of Main St. The company agrees to erect suitable freight sheds, a station and a hotel, also to build and maintain free from any cost to the city the proposed Main St. subway, 100 ft. wide, and a subway for Gladstone St., midway between Main St. and the river. The cost of the improvements proposed will be about $1,500,000.

PUBLIC BUILDINGS.

Fayetteville, Ark.—Chas. L. Thompson, of Little Rock, is reported to have prepared plans for the erection of the Washington County Court House, at a cost of $75,000.

Denver, Colo.—The St. Francis de Sales Catholic Society will erect a $25,000 church at Alamada & Sheridan Aves. Rev. Wm. Morrin, Pastor.

Augusta, Ga.—It is stated that plans will soon be received for a $25,000 edifice for the Second Presbyterian Society.

New Castle, Ind.—The Congregation of the Methodist Church of this city will erect an edifice, to cost $30,000.

Lafayette, Ind.—The State Legislature has authorized the appropriation of $35,000 for a heating plant at the State Soldiers' Home near here.

Franklin, Ind.—A $20,000 memorial library is to be erected here, as a gift from E. H. Sharp.

Des Moines, Ia.—The contract for erecting the Iowa building at La. Purchase Exposition Grounds, St. Louis, Mo. (bids opened Feb. 25), has been awarded to E. W. Nichols & Co., of Des Moines, for $35,000. Proudfoot & Bird, Archts., Des Moines.

C. L. Linley, of Boston, Mass., is stated to have been selected to prepare plans for the mechanical equipment, including the remodeling of the heating and ventilation system and the electrical equipment of the Capitol; probable cost, $71,000.

Cherokee, Ia.—Bids will be received Mar. 24 by E. Hornibrook for erecting a hospital, including heating, plumbing, lighting plant, etc. C. F. Lueder, Archt., Cherokee.

Topeka, Kan.—A stone Baptist Church is to be erected here, at a cost of $40,000.

Lawrence, Kan.—Cuthbert & Sargent, of Topeka, are stated to have submitted the lowest bid for the erection of the $80,000 Douglas County Court House.

Alexandria, La.—Bids are wanted Mar. 31 for erecting 2 3-story main brick buildings 36x180 ft. and several 1, 2, 3-story brick buildings for the Colored Insane Asylum. W. W. Whittington, Jr., Secy. Bd. of Administrators of the Insane Asylum for the Colored People of State of Louisiana.

Pikesville, Md.—C. R. Parlett is stated to have received the contract for the erection of the armory for Troop A; probable cost, $40,000.

Albert Lea, Minn.—Bids will be received Mar. 11 by the Pub. Library Bd. for furnishing material and erecting a library. Schick & Roth, Archts., La Crosse, Wis. Clint L. Luce, Pres.

St. Louis, Mo.—Caldwell & Drake, of Columbus, Ind., are stated to have secured the contract for the erection of the Agricultural building at the Exposition Grounds for $529,940.

It is stated that the contract will soon be let for the erection of the St. Francis Hospital; estimated cost, $100,000.

Omaha, Neb.—It is stated that St. Patrick's Catholic Society will erect an edifice, to cost $30,000. Rev. P. J. Smith, Pastor.

Camden, N. J.—Rankin & Kellogg, of Philadelphia, Pa., have been selected as architects for the Camden County Court House. The Fin. Com. and the County Collector will make preparations to create the authorized bond issue of $630,000, which sum is to be used in building the new structure.

New York, N. Y.—Bids will be received Mar. 12 by Thos. Sturgis, Fire Comr., for furnishing material for building the foundation for the new repair shops of the Fire Dept., 12th Ave. and 56th St.

Corning, N. Y.—York & Sawyer, of New York, N. Y., are stated to have prepared plans for a building for the Corning Hospital Assoc.; estimated cost, $20,000.

Syracuse, N. Y.—Averill & Gregory, proprietors of the Yates Hotel, are stated to have had plans prepared for a sanitarium, to be erected on Bway, and cost $2,000,000.

Long Island City, L. I., N. Y.—The lowest of 8 bids opened Mar. 4 by Thos. Sturgis, Fire Comr., N. Y. City, for a building for engine company 158 on E. 8th St., was that of Herman F. Lippe & Bro., for $49,500.

Canton, O.—The Congregation of the Church of Christ is reported to be considering the erection of an edifice, to cost $25,000.

Springfield, O.—It is stated that bids are wanted Mar. 14 for erecting St. Paul's M. E. Church. Reed & Heckenlively, Archts., 302 College St.

Xenia, O.—Bids will be received Apr. 9 by the Trus. of Ohio Soldiers' and Sailors' Orphans' Home for furnishing, erecting and installing hot water circulating pumps, condenser, expansion tank, vacuum pumps, pipe and fittings, pipe covering, etc. Orin C. Baker, Financial Officer.

Condon, Ore.—Bids will be received Mar. 21 by the Co. Court for erecting a brick court house. Chas. H. Burggraf, Archt., Albany, Ore. Edw. Dum, Co. Judge.

Scranton, Pa.—The contract for the erection of the almshouse, at the Hillside Home, is stated to have been awarded to Conrad Schroeder, 10 Comwith St., for $144,375.

Pittsburg, Pa.—Bids are wanted Mar. 11 for erecting an engine house at Center Ave. and Devilliers St. A. H. Leslie, Dir. Dept. Pub. Safety.

Sewickley, Pa.—The plans of Elmer E. Miller, of Sewickley, are stated to have been adopted for the municipal building to be erected here, at a cost of $35,000.

McKeesport, Pa.—The contract for the erection of the $40,000 edifice for the First Baptist Congregation is stated to have been awarded to P. F. Finn, of Altoona.

North Yakima, Wash.—The Congregation of the Catholic Church is reported to have decided to erect a 50x120-ft. brick edifice, to cost about $30,000.

Clinton, Ont.—It is stated that bids will be received until Mar. 11 for installing a hot water system in the post office at Clinton. Fred. Gelinas, Secy. Pub. Wks., Ottawa, Ont.

BUSINESS BUILDINGS AND DWELLINGS.

Mobile, Ala.—City National Bank will erect a 5-story bank and office building.

New Decatur, Ala.—It is stated that a Y. M. C. A. building will be erected here, to cost $20,000.

New Britain, Conn.—The North & Judd Mfg. Co. is about to erect a packing, shipping and office building 50x125, 5 stories high, brick construction. There will be no power plant installed. E. W. Wightman, Secy.

Washington, D. C.—The Kenesaw Ave. Apartment House Co. is reported incorporated, with a capital of $175,000, to erect an apartment house at 16th St. and Kenesaw Ave., N. W.

Atlanta, Ga.—The Piedmont Hotel Co. (Geo. W. Parrott, Pres.) is reported to be considering the erection of an addition to the Piedmont Hotel, to cost about $300,000.

Chicago, Ill.—It is stated that E. B. Butler will erect an 8-story, 172x105 ft. brick building, at Franklin and Congress Sts., at a cost of $200,000.

Holabird & Roche, 1618 Monadnock Blk., are reported to have prepared plans for a brick building to be erected at 551 Wabash Ave., at a cost of $75,000. Owner, Mary A. Ryerson.

The building at 350 Wabash Ave. is reported destroyed by fire Mar. 2. Owner, Swan & Smith estate of San Francisco, Cal.

Pekin, Ill.—It is stated that Jas. Edds will erect a $25,000 business building. Architect, Robt. J. Hotchkiss, of Peoria.

Muncie, Ind.—The contract for the erection of the Muncie Commercial Club building is reported to have been awarded to Fred Ellingsworth, of this city, for $31,000.

South Bend, Ind.—Geo. Metzger will erect a flat bldg. containing 12 apartments.

Logansport, Ind.—The Elks are having plans prepared for a $40,000 structure.

Terre Haute, Ind.—The building of the U. S. Trust Co. will be 2 stories high, stone front, and cost $25,000.

Des Moines, Ia.—The Elks of this city are reported to have decided to erect a club house here, to cost $40,000.

The contract for the erection of the Rumley building at W. 4th and Vine Sts. is stated to have been awarded to the Capital City Brick and Pipe Co., W. S. 12th St., for $43,000.

Arkansas City, Kan.—The Ranney-Davis Mercantile Co.'s warehouse is reported destroyed by fire.

Louisville, Ky.—It is stated that Dr. W. H. Netherland will remodel the buildings at 416 and 418 W. Main St., at a cost of from $50,000 to $75,000.

Melrose, Mass.—The Boston & Maine R. R. (H. Bissell, Ch. Engr., Boston), is reported to have decided to erect a depot at Melrose Highlands; probable cost, $30,000.

Lowell, Mass.—The Burbank Blk., on Prospect St., is reported destroyed by fire Feb. 27.

Ishpeming, Mich.—A $25,000 opera house will be erected here. Address Fred Branstad, Ishpeming.

Detroit, Mich.—Baxter & O'Dell are stated to be preparing plans for a 4-story brick apartment house to be erected at Hancock and 2d Aves.; estimated cost, $30,000.

Harman & Tufts are stated to have decided to erect an 8-story, 180x100-ft. addition to the Madison Apartment House.

St. Louis, Mo.—Eames & Young, Columbia Bldg., are stated to be preparing plans for a 7-story, 231x150 ft. building at Washington Ave. and St. Charles St.

St. Louis, Mo.—L. T. Burnham is reported interested in the erection of a building to cost $29,000. Architect, Isaac S. Taylor, 318 N. 8th St.

Omaha, Neb.—The Omaha Real Estate Exchange proposes to erect an office building, to cost $200,000.

J. C. Barnard will probably erect an apartment house containing 18 apartments.

Newark, N. J.—The Elks of this city are stated to have decided to erect a brick building, at Washington and Bleecker Sts.; probable cost, $75,000.

New York, N. Y.—The Roosevelt Bldg. at 13th St. and Bway. is reported destroyed by fire Feb. 20.

Lancaster, O.—Lincoln Fritter is reported to have had plans prepared for a 3-story brick building to be erected at High St. and 1st Ave.; probable cost, $50,000.

Cincinnati, O.—The American Book Co.'s Publication House, the Woodrow Printing Works and the Zumbriel Box Factory and other buildings in the vicinity are reported destroyed by fire Feb. 27.

Toledo, O.—Isaac Kander is reported to be having plans prepared for a 3-story brick warehouse, to be erected at Short and Huron Sts., at a cost of $20,000.

Wallick Bros. are reported to be considering the erection of a 6-story addition to the Jefferson Hotel; probable cost, $130,000.

Chillicothe, O.—Bids will be received Mar. 20 by D. H. Roche, Pres. Masonic Temple Co., for furnishing material and erecting a Masonic Temple, including heating, plumbing, electrical work, sewer, iron work, etc.

Portland, Ore.—It is stated that Meier & Frank Co. will erect an 8-story, 100x75-ft. addition to their building at 6th and Alder Sts.

L. B. Stearns is stated to be having plans prepared for a 3-story brick building, to be erected at Morrison and 6th Sts., to cost from $40,000 to $50,000.

Eugene, Ore.—L. N. Roney, of Eugene, has secured the contract for erecting a theater (bids opened Feb. 14) for $21,800. F. L. Chambers, Pres.

Erie, Pa.—It is stated that C. F. Adams will erect an 82x160-ft. stone and brick office building at 6th and French Sts.

Wilkinsburg, Pa.—It is stated that A. A. Quinnette will erect a 4-story flat, at a cost of $25,000. Architect, A. Dudgeon & Sons.

Pittsburg, Pa.—Geo. A. Fuller Co., of New York, N. Y., is reported to have received the contract for the erection of the station in this city for the Wabash R. R. Co.; probable cost, $1,000,000.

Pittsburg, Pa.—D. L. Clark Co. is reported to be considering the erection of a 12-story building at 5th Ave. and Huey St., at a cost of $100,000.

It is stated that Jacob Weiskircher will erect a hotel at 5th Ave. and Locust St.; probable cost, $50,000.

Carnegie, Pa.—John S. Robb is reported to be considering the erection of a brick residence in Washington St., to cost $30,000.

Philadelphia, Pa.—It is stated that the Equitable Warehousing Co., recently incorporated with a capital of $250,000, will erect a 5-story brick warehouse at 5th and Willow Sts.

Allegheny, Pa.—S. B. Eisendrath, of Chicago, Ill., is stated to have prepared plans for an 8-story hotel, to be erected at Montgomery and Sherman Aves., at a cost of $200,000.

Deadwood, S. D.—The Deadwood Opera House Co. is reported incorporated, with a capital of $300,000, to erect an Opera House here. Incorporators: N. E. Franklin, Jas. Munn, and others.

Dallas, Tex.—The Dallas Scottish Rite Cathedral Assoc. is reported organized, with a capital of $50,000, to erect a Masonic Temple at Harwood and Wood Sts.; probable cost, from $75,000 to $100,000.

Richmond, Va.—Wyatt & Nolting, of Baltimore, Md., are preparing plans for a 7-story bank and office building for the American Natl. Bank (O. J. Sands, Pres.) to be erected on 10th and Main Sts. Geo. W. Parsons, 417 E. Canal St., will supervise the construction.

Andrew and Lewis Pizzini will erect a large flat here, to cost about $100,000.

Seattle, Wash.—Hastie & Dougan, of Spokane, are stated to have received the contract for the erection of the Hotel Stander. The building will be a 4-story brick structure and cost $120,000.

Wheeling, W. Va.—Giesey & Farris, 45 12th St., are stated to have prepared plans for a 4-story apartment house to be erected at Market and 9th Sts.

Milwaukee, Wis.—The Milwaukee Electric Ry. & Light Co. is stated to have selected a site for the erection of a car barn.

It is stated that Henry Herman will erect an office building at 264 W. Water St., at a cost of $100,000.

Cheyenne, Wyo.—The Masonic Temple is reported destroyed by fire.

SCHOOLS.

Waterville, Conn.—Bids will be received Mar. 10 by H. M. Rigney, Chmn., for alterations and additions, including ventilating, heating, plumbing, mason work, etc., to Waterville School. Freney & Jackson, Archts., 51 Leavenworth St., Waterbury.

Goodhope, D. C.—Osterman & Butler are stated to have submitted the lowest bid for the erection of the school, for $20,187.

Washington, D. C.—J. S. Larcombe is reported to have received the contract for the erection of the parochial school and hall, at 10th and G Sts., for the St. Patrick's R. C. Church; estimated cost, $100,000.

Chicago, Ill.—It is stated that plans are being prepared for an 8-room addition to the Cooper School at W. 19th St. and Ashland Ave.; estimated cost, $50,000.

Grinnell, Ia.—Andrew Carnegie is stated to have given Iowa College $50,000 toward the erection of a library.

Eaton, Ind.—Wing & Mahurin, of Ft. Wayne, have prepared plans for a $25,000 high school to be erected here.

Bloomington, Ind.—The Indiana Univ. will erect 2 students' halls, at a cost of $60,000. Nat. U. Hill, Pres. Bldg. Com.

Ames, Ia.—Bids will be received Mar. 26 by the Bd. of Trus. of the Iowa State College for erecting, except heating, plumbing and electric work, a 4-story stone central building, a judging pavilion, 3 greenhouses and an addition to agricultural hall. Proudfoot & Bird, Archts., 712 Crocker Bldg., Des Moines.

Lexington, Ky.—Press reports state that bids are wanted Apr. 15 for $75,000 school bonds.

Augusta, Me.—The Village School District has instructed its directors to obtain plans for a new Primary and Sub-Primary School. C. E. Nash, F. W. Plaisted, and W. G. Boothby, are the directors.

Ishpeming, Mich.—It is proposed to erect a school here, to cost about $30,000.

Brainerd, Minn.—The citizens are stated to have voted to issue $40,000 for erecting additions to the schools.

Hannibal, Mo.—The Bd. of Educ. is stated to have selected a site at Bway. and 11th St., for the erection of the $25,000 high school.

Plymouth, N. H.—It is stated that the School Bd. has decided to build a $40,000 high school.

New York, N. Y.—Bids will be received Mar. 16 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary work in School No. 70; also for installing electric light wiring, fixtures and electric bell system in School No. 92.

Valley City, N. D.—Bids are wanted Mar. 12 for erecting a 4-story brick and stone Science Hall for the State Normal School, to be 56x88 ft., and to have a connecting corridor 40x40 ft. Hancock Bros., Archts., Fargo. Geo. A. McFarland, Secy. of Bd. of Management in State Normal School.

Grand Forks, N. D.—It is stated that bids are wanted Apr. 1 for erecting a school. J. B. De Remer, Herald Bldg.

Cleveland, O.—The School Bd. is reported to have decided to erect 2 schools, one at Brandon St. near Paul, and the other at Harvard St. and Marcelline Ave.; probable cost, $40,000 each.

Bids are wanted Mar. 30 for furnishing material for erecting a school on Sumner St., including plumbing, gasfitting, sewers, etc. Starr Cadwallader, School Dir., Bd. of Educ.

The Bd. of Educ. is stated to have decided to erect the following structures: A 2-story school on Doan St., at a cost of $65,000; a 2-story brick school on Mound St., estimated cost, $60,000; a 2-story brick school on Locust St., estimated cost, $34,000; an 18-room school at Willson and White Aves., at a cost of $89,000; and an addition to the Sackett School, estimated cost, $36,000.

The plans of Milton Dyer are stated to have been selected for the Mill St. School; estimated cost, $60,000.

Philadelphia, Pa.—The contract for the erection of the school at Clearfield and D Sts. is stated to have been awarded to Wm. J. Smith, 622 Mifflin St., for $80,883.

Reading, Pa.—The School Bd. is making arrangements for the erection of a stone and brick high school, to cost $225,000.

Spokane, Wash.—The contract for the erection of an addition to the Academy of Holy Names is stated to have been awarded to J. E. Cunningham, for $40,000.

Seymour, Wis.—Bids are wanted Mar. 16 for erecting an 8-room school. F. R. Dittmer, Clk. Bd. of Educ.

STREET CLEANING AND GARBAGE DISPOSAL.

Kansas City, Mo.—The special Com. of City Council on Garbage has decided to recommend the proposition of R. H. Thorne, of El Paso, Tex. The Thorne system contemplates eventually the collection of garbage, refuse and trash in the city and transforming it into fuel.

Lincoln, Neb.—The City Garbage Co. has been incorporated, with a capital of $50,000, by Chas. L. Meyers and Chas. T. Hill, to do a general garbage business and desires the right to buy real estate and build a crematory.

Manchester, N. H.—The Council is stated to have appropriated $15,000 for collecting and disposing of garbage waste and refuse.

New York, N. Y.—The only bid received Feb. 27 for furnishing 200 ash carts to Dept. of St. Cleaning was that of Thos. Hill, of Jersey City, N. J., for $110 each.

Rochester, N. Y.—The following bids are stated to have been received by the Bd. of Contract & Supply for sprinkling the streets of the city: Thos. Holahan, $42,177; Conway & Bantel, $44,455; Burns & Grape, $46,411; Jacob Stein, $46,918.

GOVERNMENT WORK.

Mobile, Ala.—Capt. Spencer Cosby, Corps Engrs., U. S. A., writes that M. T. Lewman & Co., of Louisville, Ky., bid $286,414, $215,641 and $235,436 respectively for building Locks and Dams Nos. 1, 2 and 3 Warrior and Tombigbee Rivers, Ala., bids for which were opened Feb. 28.

Little Rock, Ark.—Robt. W. Earnheart, of Batesville, Ark., has secured the contract for furnishing 10,000 cu. yds. of large riprap stone for lock and dam, Upper White River, Ark., which were received by Capt. Graham D. Fitch, Corps Engrs., U. S. A., Feb. 9, for $14,300.

San Francisco, Cal.—Bids will be received Mar. 24 at the Bureau of Supplies and Accounts, Navy Dept. Washington, D. C., for furnishing at the Navy Yard, Mare Island, Cal., a quantity of pipe, pipe fittings, cement, valves, etc. A. S. Kenny, Paymaster Gen., U. S. Navy.

Pensacola, Fla.—Bids are wanted Mar. 14 for a 100-ton railroad track scale at the Navy Yard. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. McRee, Fla.—Bids are wanted Mar. 21 for constructing, including heating, plumbing and electric wiring 1 lavatory; also plumbing 1 set officers' quarters and 1 barrack building at this post. W. E. Cole, Q. M., Ft. Barrancas, Fla.

Michigan City, Ind.—Robt. Millen & Co., of Muskegon, are stated to have secured the contract for removing an old Government pier at the east side of the harbor entrance, and building a new one, for about $45,788.

Boston, Mass.—The bids of the following 4 contracting companies are stated to have been accepted by the Ch. of Engrs, Brig. Gen. Gillespie, of Washington, D. C., for dredging the 35-ft. channel extending from Chelsea bridge, past the navy yard out to the open sea: Breymann Bros., Toledo, O.; Morris & Cummings, New York, N. Y.; G. H. Breymann Bros., Toledo, O., and the Eastern and New England Dredging Cos., Consolidated, of Boston. The 4 contracts are reported to amount to $2,600,000.

Bids will be received Mar. 10 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard a quantity of bar iron, pipe, pipe fittings, valves, cocks, wire, steel, crushed stone, bricks, etc. A. S. Kenny, Paymaster Gen., U. S. Navy.

Bids are wanted Mar. 26 for furnishing and delivering granite for the light and fog signal tower on The Graves, entrance to the new Broad Sound Channel in Boston Harbor. Lieut.-Col. W. S. Stanton, Engr., Second Light House Dist., U. S. A.

Detroit, Mich.—The contract for furnishing material and labor necessary for removing the wooden superstructure of the foundation pier of Cheboygan Crib Light Station, Mich., and rebuilding same in concrete and masonry, bids for which were received by Capt. Lansing H. Beach, Corps Engrs., U. S. A., on Mar. 2, has been awarded to A. J. Dupreis Co., of Detroit, Mich., for $6,850.

Helena, Mont.—The following bids were opened on Mar. 3 at the Treas. Dept., Washington, D. C., for the low pressure, steam heating and mechanical ventilating apparatus, etc., for the U. S. Public Building at Helena, Mont.—*a*, exclusive of coverings; *b*, pipe coverings: Hurley & Co., St. Paul, Minn., *a*, $23,727; *b*, $3,097. Allen, Black & Co., St. Paul, Minn., *a*, $18,118; *b*, $672. Kosmeyer Co., Lincoln, Neb., *a*, $16,971; *b*, $800. C. B. Kruse Htg. Co., Milwaukee, Wis., *a*, $14,640; *b*, $850.

Jamestown, N. Y.—The following are the 3 lowest bids opened in Washington, D. C., on Mar. 2 for heating apparatus for U. S. Post Office at Jamestown, N. Y.—*a*, without pipe covering; *b*, pipe covering: W. N. Tobin, Syracuae, *a*, $3,100; *b*, $309. Chatfield & Armitage, Jamestown, *a*, $2,900; *b*, $320. L. L. Lord, Meadville, Pa., *a*, $2,981; *b*, $198.

New York, N. Y.—Bids are wanted Mar. 28 for constructing a brick and steel addition to building No. 41 at the Navy Yard. Estimated cost, $25,000. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

New York, N. Y.—The lowest bid for dredging in Raritan and South Rivers, N. J., received by Lieut. Col. C. W. Raymond, Corps Engrs., U. S. A., on Mar. 4 was submitted by Rogers & O'Brien, of Buffalo, at 25 cts. per cu. yd: prism measurement, and 30 cts. per cu. yd. scow measurement.

Ft. Caswell, N. C.—Lieut. Philip Yost, Q. M., writes that all bids received Jan. 28 for constructing roads at this post and on Jan. 31 for constructing, including heating, plumbing and wiring, the Guard House and Administration Bldg. have been rejected. New bids will be called for.

Philadelphia, Pa.—Snare & Triest, of New York, N. Y., are stated to have secured the contract for constructing the machine shops, etc., at League Island Navy Yard, for about $335,700.

Newport, R. I.—Capt. Thos. H. Slavens, Q. M., U. S. A., writes that all bids received on Jan. 7 for the erection of a brick hospital at Ft. Greble, R. I., have been rejected, and new bids will be received later on.

Ft. Monroe, Va.—Bids are wanted Mar. 26 for constructing 12-in. cast iron sewer discharge pipe at this post. Address C. P. Townsley, Q. M.

Alexandria, Va.—The following bids were opened on Mar. 4 at Treas. Dept., Washington, D. C., for the construction (including plumbing, heating apparatus, electric conduits and wiring) of the extension of the U. S. Custom House and Post Office, at Alexandria, Va.: Congress Construction Co., Chicago, Ill., $64,387; King Lumber Co., Charlottesville, Va., $78,748; S. J. Prescott & Co., Washington, D. C., $67,895; J. H. Carter, Baltimore, Md., $69,800; Paverini & Greer, Washington, D. C., $61,200; W. P. Leyescomb, Washington, D. C., $72,981; Richardson & Burgess, Washington, D. C., $68,000; W. E. Spier, Washington, D. C., $65,489; J. C. Loutber, Washington, D. C., $69,500.

Ashland, Wis.—The lowest bid opened at Duluth, Minn., on Feb. 24, by Capt. D. D. Gaillard, Corps Engrs., U. S. A., for furnishing 26,000 tons of riprap for pier covering at Ashland is reported to be that of A. Donald & Co., of Ashland, at 85 cts., or a total of $18,220.

Cheyenne, Wyo.—The following are the 3 lowest bids opened Mar. 2 by the Superv. Archt., Treas. Dept., Washington, D. C., for a low pressure steam heating and ventilating apparatus for the U. S. Public Bldg. at Cheyenne—*a*, without pipe covering; *b*, pipe covering: Davenport Htg. & Plumbing Co., Davenport, Ia., *a*, $8,983; *b*, $443. Drexel Htg. & Plumbing Co., Chicago, Ill., *a*, $9,689; *b*, $862. Allen, Black & Co., St. Paul, Minn., *a*, $10,024; *b*, $582.

NEW INDUSTRIAL PLANTS.

W. Y. Foster, Hope, Ark., writes that the Little River Cotton Oil Co., Ashdown, Ark., will erect a 60-ton mill and install an 18x42-in. engine and two 100-H.-P. boilers.

The Rapid City, Man., Power, Light & Woolen Mfg. Co., Ltd., will develop water power of 200-H.-P., to be transmitted 1½ miles, and used to light the town, run a woolen mill, and be sold for other purposes. The company is in the market for a 200-H.-P. water wheel, a generator of about 75-Kw. capacity and shoddy machinery.

Cass & Daley, Salem, Mass., expect to install a 75 or 100-H.-P. engine in their new shoe factory.

MISCELLANEOUS.

Mobile, Ala.—The Gulf Dry Dock Co. is reported to have perfected arrangements to build additional docks at its plant of a capacity of 3,500 tons, capable of hauling out vessels 400 ft. long.

Rockwell City, Ia.—It is stated that bids are wanted Mar. 24 for constructing a drainage ditch in Lake Creek Township. Ditch is to be about 3½ miles long, and contain about 40,700 cu. yds. B. E. Stonebroker, Co. Aud.

Shreveport, La.—The Caddo Levee Bd. is stated to have awarded a contract for building 140,000 cu. yds. of new levee to M. L. Linman, at 16.25 cts. per cu. yd., or $24,000 for the entire contract.

Estherwood, La.—Orillan Clements is reported to be making preparations to put in a new canal and pumping plant north of Estherwood.

Cape May, N. J.—See "Sewerage and Sewage Disposal."

New York, N. Y.—Bids will be received Mar. 13 by McDougall Hawkes, Comr. of Docks, for furnishing material for erecting a recreation building with appurtenances on pier No. 30, E. R.

Syracuse, N. Y.—Bids are wanted Mar. 11 for $171,000 local improvement bonds. E. J. Mack, City Compt.

Buffalo, N. Y.—The following are lowest biddera for straightening Buffalo River, according to bids received Feb. 24: Section 1, Buffalo Dredglug Co., Morgan Bldg., completion in 2 yrs., $72,460; in 3 yrs., $70,810. Sec. 2, Ily. P. Burgard, 560 Walder Ave., 2 or 3 yrs., $282,225. Sec. 3, McDonough & Stahell, 1135 Niagara St., $176,300, for 2 or 3 yrs. Sec. 4, McDonough & Stabell, $62,565, for 2 or 3 yrs.

Cincinnati, O.—Ch. Engr. Perkins and Messrs. Goddard, Kirtley and Johnston, of the State Bd. of Pub. Wks., on Feb. 20 are stated to have awarded contracts for the construction of the walls of the canal above Liberty St. to F. H. Kirchner & Co., 8th and Ilium Sts., for about $61,000. Part of the wall is to be of concrete and will be constructed while the water is in the canal. That part between 14th and 15th Sts. will be of stone.

Lorain, O.—It is reported that this city will expend about $200,000 on the river, now that the Lorain Steel Co. has decided to construct its plant here.

Brandon, Ont.—It is stated that bids are wanted Mar. 20 for supplying from 2,000 to 3,000 bbls. of Portland cement. J. B. Whitehead, City Clk.

Montreal, Que.—Acting Ch. Engr. of the Harbor Bd. estimates the cost of constructing permanent freight sheds on the high level wharves as follows: Wood, $1,517,300, and of steel, $2,382,000.

BUSINESS NOTES.

The Superior Portland Cement Co., with principal office at 525 Main St., East Orange, N. J., has been incorporated with a capital of $600,000. The incorporators are Frank P. Serles, C. Fred Smith and Gerald A. Griffin.

The Ball Engine Co., Erie, Pa., reports the following among recent sales: R. T. White, Bayonne, N. J., 160-H.-P. direct-connected electrical outfit; engine for 80-H.-P. direct-connected outfit for the Bijou Bldg., Pittsburg; four 350-H.-P. vertical cross compound, direct-connected engines for the new First National Bank Bldg., Chicago; two 200-H.-P. horizontal tandem compound, direct-connected engines for the Mercantile Library, Cincinnati.

Dodge & Day, engineers, of Philadelphia, have been commissioned by the Ingersoll-Sergeant Drill Co. to report on variable speed motor equipment for the new Phillipsburg plant, and have been awarded the contract to equip with motor drives a number of the large machine tools.

The Otis Elevator Co. has been awarded the John Scott Legacy Medal and Premium by the Franklin Institute for its electric elevator for private residences, which dispenses with the services of an attendant, and is operated by merely pushing buttons at the various landings and in the car. The Committee on Science and the Arts, which recommended the award, made a thorough inspection of several existing installations and their report is highly commendatory of the ingenuity of design, the safety of operation and the substantial construction of this elevator.

The Burt Mfg. Co., Akron, O., has just made a shipment of 11 exhaust heads to one party in Philadelphia.

The American Mfg. Co. sold during 1902 about 1,000,000 lbs. rope, an increase of 40 per cent. over business done during 1901. To the Sharon Steel Co. it sold 15 mi. of 2-in. diam. American transmission rope, amounting to 130,000 lbs., for use largely in rope drives. Some of these amount to 3,500-H.-P., requiring 60 2-in. ropes.

Pawling & Harnischfeger, Milwaukee, Wis., makers of electric traveling cranes, advise that the sales of their products continue very satisfactory, 55 cranes being sold from Jan. 1 to Feb. 25. Among the orders booked within this time are the following: Chicago & Eastern Illinois R. R. Co., Danville, Ill., 3 cranes; Western Tube Co., Kewanee, Ill.; The Westinghouse Machine Co., East Pittsburg, Pa.; South Penn. Oil Co., Folsom, W. Va.; The Pittsburg Plate Glass Co., Ford City, Pa.; Ansonia Brass & Copper Co., Torrington, Conn.; Fairbanks, Morse & Co., Beloit, Wis.; St. Paul Foundry Co.; Ingersoll-Sergeant Drill Co., Phillipsburg, N. J., 14 cranes; American Bridge Co., Ambridge Works, Economy, Pa., 5 cranes; Standard Steel Works, Burnham, Pa.; City of Boston, Water Dept.; Beloit, Wis., Iron Works; International Steam Pump Co., Laidlaw-Dunn-Gordon Works, Elmwood Place, O.; Wheeling Steel & Iron Co., Benwood, W. Va.; The Coe Brass Mfg. Co., Torrington, Conn.; The McConway & Torley Co., Pittsburg; The Ironton, O., Engine Co., 2 cranes; Joseph T. Ryerson & Son, Chicago; Hammond Iron Works, Struthers, Pa.; Cambria Steel Co., Johnstown, Pa.; American Bridge Co., Pencoyd, Pa.; C. A. Lawton & Co., De Pere, Wis.; Perry-Mathews-Buskirk Stone Co., Bedford, Ind., 2 cranes; The Toledo Machine & Tool Co.; American Sheet Steel Co., Wellsville, O.; Landis Tool Co., Waynesboro Pa., 3 cranes; Goodman Mfg. Co., Chicago.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Mar. 10.	Findlay, O.	Feb. 28
Mar. 12.	Buffalo, N. Y.	Mar. 7
Mar. 12.	Hydrants, Cleveland, O.	Feb. 28
Mar. 12.	Pipe, etc., Cleveland, O. Adv. Feb. 21 to Mar. 7.	Feb. 21
Mar. 13.	Boone, Ia.	Feb. 28
Mar. 13.	Cleveland, O.	Feb. 28
Mar. 14.	Washington, D. C., Adv. Feb. 28.	Feb. 28
Mar. 14.	Dillon, Mont.	Jan. 10
Mar. 16.	Lake Park, Minn., Adv. Feb. 28.	Feb. 28
Mar. 16.	Pumping Engine, Winnipeg, Man. Adv. Jan. 17 to Feb. 14.	Jan. 17
Mar. 17.	Cincinnati, O., Adv. Feb. 21, Mar. 7.	Feb. 21
Mar. 18.	Tower, Marshall, Tex., Adv. Feb. 28.	Feb. 28
Mar. 23.	Mt. Pleasant, Tex.	Mar. 7
Mar. 24.	Pipe, etc., Williamsburg, Mass. Adv. Mar. 7.	Mar. 7
Mar. 24.	Dams, etc., Williamsburg, Mass. Adv. Mar. 7.	Mar. 7
Mar. 25.	Lancaster, O.	Mar. 7
Mar. —	Alcester, S. D.	Feb. 21
Apr. 1.	Toronto, Ont., Adv. Feb. 28, Mar. 7.	Feb. 28
Apr. 1.	Chinook, Mont.	Mar. 7
May 1.	Chinook, Mont.	Feb. 7
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Mar. 9.	St. Paul, Minn.	Mar. 7
Mar. 10.	New York, N. Y.	Mar. 7
Mar. 10.	Cincinnati, O.	Mar. 7
Mar. 10.	Cleveland, O.	Feb. 28
Mar. 10.	Crookston, Minn.	Feb. 28
Mar. 11.	Brooklyn, N. Y.	Feb. 28
Mar. 12.	St. Paul, Minn.	Mar. 7
Mar. 12.	Easton, Pa.	Feb. 28
Mar. 14.	Warren, O.	Mar. 7
Mar. 14.	Bowling Green, O.	Feb. 21
Mar. 16.	Manchester, Ia.	Mar. 7
Mar. 17.	Dayton, O.	Feb. 21
Mar. 18.	Brooklyn, N. Y., Adv. Mar. 7.	Mar. 7
Mar. 19.	Cleveland, O.	Feb. 28
Mar. 23.	Des Moines, Ia.	Mar. 7
Mar. 24.	New Britain, Conn., Adv. Mar. 7.	Mar. 7
Mar. 26.	Cincinnati, O.	Mar. 7
Mar. 28.	Lakewood, O.	Mar. 7
Mar. 30.	South Bethlehem, Pa. Adv. Feb. 28, Mar. 7.	Feb. 28
Mar. 30.	Marshfield, Wis.	Feb. 21
Apr. 6.	Canton, O.	Feb. 28
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. —	Crookston, Minn.	Feb. 21
	BRIDGES.	
Mar. 10.	Plainwell, Mich.	Feb. 28
Mar. 11.	Columbia City, Ind.	Feb. 28
Mar. 16.	Nashville, Tenn.	Mar. 7
Mar. 17.	Kearney, Neb.	Feb. 14
Mar. 18.	Chicago, Ill.	Mar. 7
Mar. 21.	Benwood, W. Va.	Mar. 7
Mar. 25.	Plymouth, Wis.	Feb. 14
Mar. 26.	Chatham, Ont.	Feb. 21
Mar. 27.	Washington, D. C., Adv. Feb. 7 to 28.	Feb. 7
Mar. 30.	Washington, D. C., Adv. Mar. 7.	Mar. 7
	PAVING AND ROADMAKING.	
Mar. 10.	Crookston, Minn.	Mar. 7
Mar. 10.	Louisville, Ky.	Mar. 7
Mar. 10.	Schenectady, N. Y.	Mar. 7
Mar. 10.	Cheshire, Conn.	Feb. 28
Mar. 10.	Des Moines, Ia.	Feb. 28
Mar. 10.	St. Louis, Mo.	Feb. 28
Mar. 11.	Chicago, Ill.	Mar. 7
Mar. 11.	Tiffin, O.	Feb. 21
Mar. 13.	Grand Rapids, Mich.	Mar. 7
Mar. 13.	South Bend, Ind., Adv. Feb. 28.	Feb. 28
Mar. 13.	Lima, O.	Feb. 28
Mar. 13.	Boone, Ia.	Feb. 28
Mar. 14.	Harrisburg, Pa.	Mar. 7
Mar. 14.	Willimette, Ill.	Mar. 7
Mar. 14.	Brooklyn, N. Y.	Mar. 7
Mar. 16.	Port Chester, N. Y.	Mar. 7
Mar. 16.	Wichita, Kan.	Mar. 7
Mar. 16.	Menominee, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 17.	Cleveland, O.	Feb. 28
Mar. 19.	Cincinnati, O.	Feb. 28
Mar. 19.	Wapakoneta, O.	Feb. 28
Mar. 23.	Muncie, Ind.	Mar. 7
Mar. 23.	Newburgh, N. Y., Adv. Feb. 7 to Mar. 7.	Jan. 31
Mar. 28.	Lakewood, O.	Mar. 7
Mar. 30.	Toledo, O.	Mar. 7
Mar. 31.	Toms River, N. J.	Mar. 7
Mar. —	San Diego, Cal.	Jan. 31
Apr. 6.	New Bedford, Mass., Adv. Mar. 7.	Mar. 7
Apr. 6.	Vallejo, Cal.	Feb. 21
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Mar. 10.	Muscatine, Ia.	Feb. 21
Mar. 12.	Channte, Kan.	Mar. 7
Mar. 16.	Corry, Pa.	Feb. 28
Mar. 16.	St. Paul, Minn.	Feb. 21
Mar. 16.	Prince Albert, N. W. Ter.	Feb. 21
Mar. 21.	Union, S. C.	Mar. 7
Mar. 31.	Binghamton, N. Y.	Feb. 28
Apr. 7.	Copenhagen, Denmark	Feb. 28
Apr. 7.	Oneida, N. Y.	Feb. 7
———	Hyattaville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Mar. 9.	Duluth, Minn., Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 9.	Wilmington, Del. Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 9.	Jamestown, N. Y.	Feb. 7
Mar. 10.	Boston, Mass.	Mar. 7
Mar. 10.	Washington, D. C.	Feb. 21
Mar. 10.	Ft. Mott, N. J.	Feb. 21
Mar. 10.	St. Augustine, Fla. Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 10.	Well, Ft. Morgan, Ala., Adv. Feb. 14.	Feb. 14
Mar. 10.	Ft. Smith, Ark., Adv. Feb. 7, 14.	Feb. 7
Mar. 11.	Hlg. Post Office, Clinton, Ont.	Mar. 7
Mar. 11.	Ft. Wright, Wash.	Feb. 21
Mar. 11.	Grand Rapids, Mich.	Feb. 21
Mar. 11.	Chattanooga, Tenn. Adv. Feb. 28, Mar. 7.	Feb. 14
Mar. 11.	Wilkesbarre, Pa., Adv. Jan. 31, Feb. 7.	Jan. 31
Mar. 12.	Jefferson Barracks, Mo.	Feb. 21
Mar. 12.	Portland, Me., Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 12.	Janesville, Wis.	Feb. 7
Mar. 14.	Pensacola, Fla.	Mar. 7
Mar. 14.	Bldg., Ft. Morgan, Ala., Adv. Feb. 14.	Feb. 14
Mar. 14.	Dry dock, Cavite, P. I.	Dec. 20
Mar. 16.	Portland, Ore.	Feb. 21
Mar. 16.	Burlington, Vt.	Feb. 21
Mar. 16.	Harbor Work, Boston, Mass.	Feb. 21
Mar. 16.	Wilmington, Del.	Feb. 21
Mar. 16.	Granite, Boston, Mass.	Feb. 21
Mar. 16.	Wiring, P. O., Wilkesbarre, Pa. Adv. Feb. 14, 21.	Feb. 14
Mar. 17.	Cincinnati, O., Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 18.	Buffalo, N. Y., Adv. Feb. 21, 28.	Feb. 21
Mar. 19.	Wilmington, Del. Adv. Feb. 21 to Mar. 7.	Feb. 21
Mar. 19.	Minneapolis, Minn.	Feb. 21
Mar. 20.	Richmond, Ky.	Feb. 21
Mar. 20.	Ft. Howard, Md.	Feb. 21
Mar. 21.	Ft. McRee, Fla.	Mar. 7
Mar. 21.	Newport, R. I.	Feb. 28
Mar. 23.	Wheeling, W. Va., Adv. Feb. 21, 28.	Feb. 21
Mar. 23.	Ft. Lincoln, N. D.	Feb. 28
Mar. 24.	San Francisco, Cal.	Mar. 7
Mar. 24.	Kalamazoo, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 25.	New York, N. Y., Adv. Feb. 28, Mar. 7.	Feb. 28
Mar. 25.	Galveston, Tex.	Feb. 28
Mar. 26.	Boston, Mass.	Mar. 7
Mar. 26.	Ft. Monroe, Va.	Mar. 7
Mar. 27.	Wheeling, W. Va., Adv. Feb. 28, Mar. 7.	Feb. 28
Mar. 27.	Sioux City, Ia., Adv. Feb. 28.	Feb. 28
Mar. 28.	New York, N. Y.	Mar. 7
Mar. 28.	Boston, Mass.	Feb. 28
Apr. 1	Grand Rapids, Mich., Adv. Mar. 7.	Mar. 7
Apr. 2.	Philadelphia, Pa., Adv. Mar. 7.	Mar. 7
Apr. 4.	Montgomery, Ala., Adv. Mar. 7.	Mar. 7
Apr. 4.	Charleston, S. C.	Feb. 28
Apr. 11.	Chattanooga, Tenn., Adv. Mar. 7.	Mar. 7
Apr. 17.	St. Augustine, Fla. Adv. Feb. 21, Mar. 7.	Feb. 21
	BUILDINGS.	
Mar. 9.	School, Long Island City, N. Y.	Feb. 28
Mar. 9.	School, New York, N. Y.	Feb. 28
Mar. 10.	School, Des Moines, Ia.	Feb. 21
Mar. 10.	School, Waterville, Conn.	Mar. 7
Mar. 11.	Engine house, Pittsburg, Pa.	Mar. 7
Mar. 11.	Library, Albert Lea, Minn.	Mar. 7
Mar. 11.	School, Columbus, O.	Feb. 14
Mar. 12.	Repair shop, New York, N. Y.	Mar. 7
Mar. 12.	Masonic Temple, Toledo, O.	Feb. 28
Mar. 12.	School, Valley City, N. D.	Mar. 7
Mar. 12.	Gateway & Lodge, Dayton, O.	Feb. 21
Mar. 12.	Pub. Bldg., Johnson City, Tenn. Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 13.	School, Sac City, Ia.	Feb. 28
Mar. 14.	Church, Springfield, Mo.	Mar. 7
Mar. 16.	School, Seymour, Wis.	Mar. 7
Mar. 16.	School, New York, N. Y.	Mar. 7
Mar. 16.	School, Cleveland, O.	Feb. 28
Mar. 16.	Pub. Bldg., Albert Lea, Minn.	Feb. 28
Mar. 16.	Library, Portsmouth, O.	Feb. 14
Mar. 18.	Pub. Bldg., Mansfield, O.	Feb. 21
Mar. 19.	Hospital, Athens, O.	Feb. 28
Mar. 19.	Church, Columbus, O.	Feb. 28
Mar. 20.	Masonic Temple, Chillicothe, O.	Mar. 7
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
Mar. 21.	Court house, Condon, Ore.	Mar. 7
Mar. 24.	Hospital, Cheroke, Ia.	Mar. 7
Mar. 26.	School, Ames, Ia.	Mar. 7
Mar. 30.	School, Cleveland, O.	Mar. 7
Mar. 31.	Pub. Budg., Alexandria, La.	Mar. 7
Apr. 1.	School, Grand Forks, N. D.	Mar. 7
Apr. 1.	Hospital, Muskegon, Mich.	Feb. 28
Apr. 1.	Elevators in bus. bldgs., Tacoma, Wash.	Feb. 21
Apr. 2.	Hotel, Bemidji, Minn.	Feb. 21
Apr. 7.	Jail, Morristown, Tenn.	Feb. 28
Apr. 9.	Pub. Bldg., Xenia, O.	Mar. 7
	MISCELLANEOUS.	
Mar. 10.	R. R. Work, McComb, Miss.	Feb. 28
Mar. 13.	Pier, New York, N. Y.	Mar. 7
Mar. 16.	St. R. R., Salem, O.	Mar. 7
Mar. 16.	El. Ry. Work, Philadelphia, Pa.	Feb. 28
Mar. 16.	El. Ry. franchise, Modesto, Cal.	Feb. 28
Mar. 20.	Cement, Brandon, Ont.	Mar. 7
Mar. 23.	St. Ry. franchise, Somerset, Ky.	Feb. 28
Mar. 24.	Ditch, Rockwell City, Ia.	Mar. 7
Mar. 30.	Ry. franchise, Oakland, Cal.	Mar. 7
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
———	Cement, Ill.	Feb. 21
———	R. R. work, Cincinnati, O.	Dec. 20
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21

PROPOSALS.

Sewerage System.

led proposals will be received until 4 , March 24 1903, for the construction tions two, three and four of the New n Sewerage System. Section two consof a tunnel 1,048 feet long and apes 680 feet of 24 inch pipe complete. n 3 consists of nbont 1,300 feet of 24 sewer and abont 300 feet of smaller together with manholes complete. Secconsists of abont 9,000 feet of 24 inch and about 400 feet of small sizes with les complete. All as set forth in the and specifications for said work. A ed check for $1,000.00 must accompany d for each section and a Surety Com- for $5,000.00 will be required for the sful bidder for each section or one of equal amount covering all the sec-

PROPOSALS.

Plans, specifications and blank form of proposals may be obtained at the office of W. H. Cadwell, Engineer, 213 Main St., New Britain, Conn., after March 5, 1903.

The right is reserved to reject any and all bids as may appear to be for the best interest of the city.

S. H. STEARNS, Chairman.
E. H. BEACH,
J. HEALY,
Board of Sewer Commissioners.

Address W. H. CADWELL, C. E.

U. S. ENGINEER OFFICE, MONTGOMERY, Ala., March 5, 1903.—Sealed proposals for dredging at West Pass entrance to Apalachicola Bay, Fla., and East Pass entrance to Carrabelle Harbor, Fla., will be received here until April 4, 1903, and then publicly opened. All information furnished on application. R. R. RAYMOND, 1st Lieut., Engineers.

PROPOSALS.

IMPROVEMENT OF DELAWARE RIVER.—U. S. Engineer Office, Philadelphia, Pa., March 2, 1903.—Sealed proposals for removing rock and overlying and adjacent material in Delaware River at Schooner Ledge will be received here until 12 o'clock, noon, April 2, 1903, and then publicly opened. Information furnished on application. C. W. RAYMOND, Lieut. Col., Engrs.

OFFICE CONSTRUCTING QUARTERMASTER, 209 Thames St., Newport, R. I., March 6, 1903.—Sealed proposals, in triplicate, will be received here until 12 M., April 6, 1903, for constructing granolithic walks and macadam roads at Fort Rodman, New Bedford, Mass. Information furnished on application. U. S. reserves right to accept or reject any or all bids or any part thereof. Envelopes containing proposals to be indorsed "Proposals for Roads and Walks, Fort Rodman, Mass." Capt. THOMAS H. SLAVENS, Qr. Mr.

PROPOSALS.

U. S. ENGINEER OFFICE, GRAND RAPIDS, Mich., March 2, 1903.—Sealed proposals for Repair of South Pier at Portage Lake, Mich., and Extension and Repair of Piers at Frankfort, Mich., will be received here until 3 P. M., April 1, 1903, and then publicly opened. Information furnished on application. CHARLES KELLER, Capt., Engrs.

U. S. ENGINEER OFFICE, MILWAUKEE, Wis., Jan. 31, 1903.—Sealed proposals for furnishing Oregon fir timber and plank will be received here until 3 o'clock P. M., March 2, 1903, and then publicly opened. Specifications, blank forms, and all available information will be furnished on application to this office. J. G. WARREN, Major, Engineers.

U. S. ENGINEER OFFICE, 2001 I ST., N. W., Washington, D. C., Feb. 27, 1903.—Sealed proposals for reconstruction of Pier No. 5 of Aqueduct Bridge across Potomac River, at Georgetown, D. C., will be received here until 12 M., March 30, 1903, and then publicly opened. Information furnished on application. CHAS. J. ALLEN, Lieut. Col.

THE ENGINEERING RECORD

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Advances in Tunneling Methods.

Tunneling is one of the most ancient of the engineering arts and in some parts of the work the methods used are not very different from the primitive ones. Accurate instruments for alignment, power drills, improved explosives, and better means for lighting and ventilating have greatly reduced the cost while increasing the accuracy, rapidity and safety of the more ordinary tunnel operations; and these improvements, together with compressed air appliances, movable shields and metal linings have made possible undertakings formerly far beyond possibility. Mining has, of course, had an important influence upon tunneling; but in this class of engineering operations, as in many others, among the most important incentives to more daring achievement have been the demands for transportation. It has become necessary to go through rather than around or over mountains, and to pass beneath bodies of water which it has been impracticable to bridge.

In two branches of tunneling especially have notable advances been made—in tunneling beneath city streets for subways, of which Europe and America have both furnished excellent examples in recent years, and in difficult subaqueous tunneling. In the latter field the endeavors of the Pennsylvania and other railroads to gain direct access to the heart of New York City, on Manhattan Island, are calling forth the best thought of a number of experienced and able consulting and contracting engineers; and the North River tunnel, abandoned some twelve years ago, is now being successfully prosecuted. Elsewhere in this issue some of the methods proposed for the new tunnels are briefly outlined and in succeeding issues other methods may also be described.

The roof shield method, devised within a few years and successfully used in a number of cases, supports the superincumbent earth by a shield which, forced forward by jacks, travels on side walls constructed in advance in preliminary small drifts. Under the protection of the shield the excavation is completed and the arch turned. But this scheme cannot be used advantageously in very soft ground. In connection with the full shield, efforts have been directed to the prevention of subsequent settlement over the completed tunnel and the settlement of the shield itself by restricting the excavation to the space absolutely filled by the shield and the tunnel structure. In very soft material the long and heavy shield projecting from, and partly supported by, the end of the tunnel lining has caused settlement and unexpected stresses in the structures. To remedy this evil it is proposed to so construct the shield that piles may be driven inside it in advance of the lining, thus providing a firm foundation, which may further be useful in assisting to prevent the floating of the tubes, which may be anchored to it. The weight of a single-track tube tunnel complete with a train of cars is less per linear foot than its maximum theoretical buoyancy due to displacement.

Improved jacks operated by powerful pumps in or near the shield, driven by compressed air piped in from a compressor conveniently located outside the tunnel make it possible to force the shield forward more surely and rapidly while keeping more closely to line and grade. Important advantage has also been gained by the concentration of the machinery at the head of the tunnel. One of the most serious difficulties is to prevent sand from caving in at the vertical open face of the shield. This has been practically accomplished in the Chicago subway tunnel by filling the end of the shield with horizontal inclined boards arranged like the slats in a louver. Excavation can be made through the narrow openings to the slopes controlled by the inclination of the boards. Some such method or a system of forward bulkheads with excavating shutters will be needed where there is nothing but air pressure to hold a high vertical face of soft material. The Baker Street tunnel, London, has a cast-iron lining, and was driven with a shield and pneumatic pressure, through the Thames ballast, which consists of broken stone and large gravel. The excavation was very difficult, and was finally accomplished by extending a hood from the front of the shield and underneath it building a vertical transverse bulkhead of horizontal planks, thoroughly plastered with clay and braced against the completed lining, through the shield. Excavation was made by removing the planks successively from the top, advancing them a short distance and bracing them back to the lining, thus gradually shifting the bulkhead to the new position, when the shield was again advanced, and so on.

Rock reaching part way from the lower to the upper side of the shield has been removed by the aid of a hood projecting from the cutting edge to form a roof beyond the shield, supporting the soft material above and protecting the working space below so that drilling and blasting could be carried on in advance of the cutting edge. This method has been used in the North River tunnel and a tunnel under the East River. Another trouble in deep subaqueous work, the physiological difficulty of laboring in compressed air, has been largely overcome. Investigation and experience have shown that with properly selected men, by the observance of precautions now pretty well understood, it may be practicable to work under a pressure of 50 pounds per square inch. The practice regarding design and construction of cast-iron lining and masonry inner lining, and the building and operation of air locks for tunnels remains much the same as for a number of years past.

The tunnels now contemplated at New York will necessarily depart from conditions and methods of design and construction previously used; will be notably different in many important respects from the famous tunnels in London, and will vary materially from the East and North River tunnel work done several years ago. The plans proposed have many strong features, but some questions arise concerning details. If the miners are subjected to the severe cold developed in the freezing process, will not their work in the cold, damp air entail serious difficulties; and will it not be difficult to quarry the frozen material around the pilot tunnel with such accuracy as to avoid cracking the outside crust intended to serve as a protecting shield? Will not any method involving even small temporary piers and the temporary presence of very large floating sections of tunnel in the midst of a busy harbor call forth strenuous objections from those interested in navigation? An improved shield would, probably, be successful in homogeneous soft material or where rocks or other obstructions do not project much above the bottom of the forward bulkhead. In mud it might be possible to secure a flow over an inclined interior bulkhead as the shield is forced forward, but with sand direct excavation would seem to be necessary. The method of tunneling beneath a sunken roof is virtually the same as that now in use under the Harlem River for one of the tunnels of the Rapid Transit Railroad, but differs, in that the roof at the Harlem tunnel is seated on a thoroughly braced cofferdam while in the proposed tunnel the trench must be dug and braced as the work advances. On the other hand, the freezing method has successfully overcome difficulties in vertical excavations in places where all other methods tried had failed; and it seems reasonable to believe that, in resourceful hands, it may be applied with equal success to horizontal excavations. The caisson method, although involving slight obstructions in the waterway, makes use of means long tried and sure, applies compressed air in the most advantageous way: namely, on horizontal planes, and provides favorable conditions for the work of excavation.

It will thus be seen that methods of tunneling have been, or are being, so improved that it is probable that there are few if any conditions, however difficult, through which it would be impossible to construct a tunnel within the limits of time and expense which can be afforded for the great enterprises of these times.

Ozone as a Water Purifier is being used in Wiesbaden, Germany, where a plant supplying 1,400,000 gallons per 24 hours is installed. The ozone passes upward through coarse gravel while the water to be purified flows downward. The plant is divided into two independent units, each with its own machinery, ozone apparatus, and towers.

The Machine Shop run in connection with the water works department of Atlanta, Ga., appears to be organized along very efficient lines, judging from the 1902 report of Mr. Park Woodward, superintendent of water works. To illustrate its usefulness, it is stated that when repairs for some old Hyatt filters were being considered, the manufacturers were found to charge $1,450 for the parts alone. As this was thought to be excessive, it was determined to do all the work possible in the shop, and to get outside parties to make to order all springs, rubber valves, etc., that were needed. The result was that the materials cost $512.37, and the labor $277.85, giving as the total cost of repairs, $790.22.

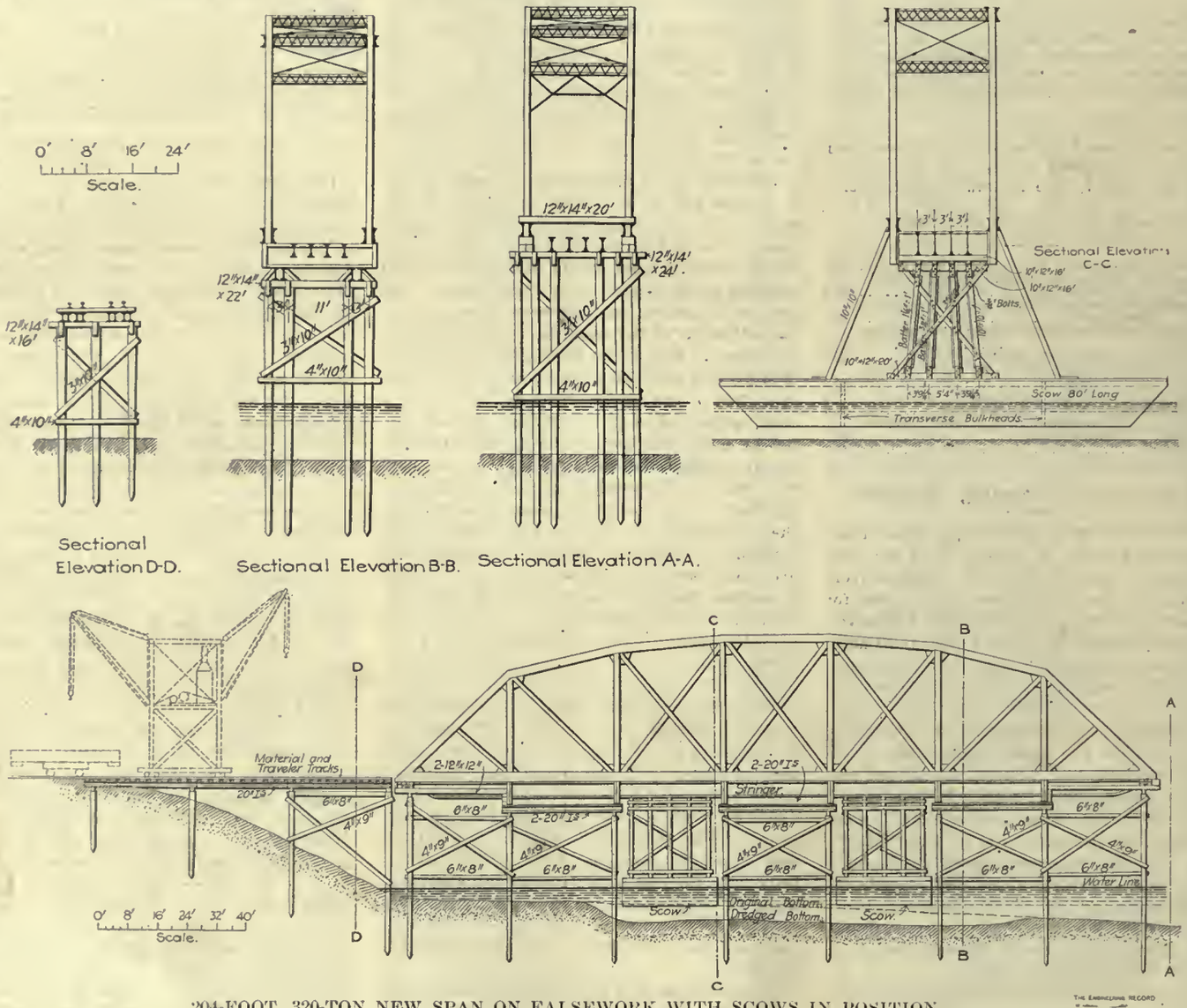
The Erection of the Miramichi Bridge.

The Intercolonial Railway crosses the northwest and southwest branches of the Miramichi River about a mile above New Castle, New Brunswick, on a single track bridge which was built from 1870 to 1874 with through spans of about 204 feet, having double-intersecting pin-connected Whipple trusses with the horizontal top chords and vertical posts made with Phoenix columns. The panels were about 14½ feet long and the 24-inch suspended plate-girder floor beams were queen-post trussed with pairs of pin-connected rods and cast iron struts. There were two lines of plate girder stringers 16 inches deep with shelf angle connections and ⅞-inch bolts through the floor beam webs. The trusses were braced transversely by slender portals and light top lateral struts and diagonals. The piers are all sand-stone with granite-faced cut waters, and foundations of concrete, or of alternate layers of concrete and rubble stone built on gravel in open caissons and cofferdams.

Recently it was determined to replace the light superstructure with heavier modern riveted steel spans on the old piers, and to remove the original superstructure for use at another location, all without materially interrupting the train service. The new spans had about the same length, height and width as the old ones, but weighed about 540,000 pounds each, while the old spans weighed 448,000 pounds. The new spans were designed in accordance with the Intercolonial Railway specifications of 1901, for live loads per linear foot of 5,900 pounds for the trusses, 6,750 pounds for the floor beams and 9,100 pounds for the main stringers. The floor beams are plate girders 6 feet deep riveted to the vertical posts below the lower chords, and there are four lines of 4-foot plate girder stringers. The specifications provided for the new spans to be erected on falsework near the bridge, and to be transferred on boats to their permanent positions simultaneously with the removal of the old spans and the subsequent shipment of the latter, fully assembled, by barge to Prince Edward Island. This plan was carried out by the contractors, excepting that the old spans were temporarily deposited complete on shore and taken apart before shipment.

The new spans were erected in the usual manner, two at a time, on pile trestle falseworks, which extended at ground level into the river nearly parallel to the old bridge. There were twin falseworks close together just long enough to receive one span each, and having extensions at the shore ends carrying their upper platforms horizontally to ground level, as shown in the elevation. The transverse bents each contained four piles, except the two end ones, which had six piles each. All piles were vertical and were X-braced transversely and capped with 12x14-inch timbers 22 feet long connected to them by scabs on each side. One panel adjacent to the center on each side was left open and all of the other panels of falsework were X-braced longitudinally, so as to form three towers, one in the middle and one of double width at each end of the bridge. These towers had two lines of 20-inch I-beam longitudinal stringers in the plane of each truss, from which the floor beams were wedged up and the truss supported during erection. I-beam stringers were thus used because they were easily secured from the contractor's stock and suitable timber was difficult to get. There were no floor beams at the ends of the trusses, and at these points the bottom chords were blocked up directly from the falsework and the ends of the stringers were supported on its caps.

The trusses were erected by a traveler running between them on a track of 10-foot gauge. It had a small tower carrying two boom-derricks above the engine platform, which had a vertical clearance of 10 feet over the standard gauge service track between the traveler rails.



204-FOOT, 320-TON NEW SPAN ON FALSEWORK WITH SCOWS IN POSITION.

timber deck. For removing the old trusses, two of them, spaced 87½ feet apart, were connected by a pair of Howe trusses about 197 feet long, 17½ feet deep over all and 17 feet apart on centers, braced together by light horizontal Howe trusses forming top and bottom lateral systems with panels 14½ feet long running midway between those of the vertical trusses. These trusses formed a complete span which was seated on the transverse center line of the symmetrically arranged scows so as to overhang them about three panels at each end. The bearings of this span were on timbers transverse to its axis and parallel to the longitudinal axis of the scows which were placed at three panel points of each bottom chord so as to engage at each end three 12-inch I-beams 29 feet long blocked up from the stiffening trusses of the scows, thus affording the span two long transverse bases on each scow, or twelve separate bearings for its lower chords. The top and bottom chords of the main Howe trusses had uniform 12x24-inch gross cross-section throughout and were built up of eight layers of 3x12-inch planks in vertical planes bolted together, breaking joints so as to give a 10x18-inch net cross-section calculated for a maximum stress of 136,000 pounds. The planks were arranged with clearances between the ends of some of them at panel points, leaving square vertical holes through which the truss rods passed without the necessity of boring, as indicated by the detail drawing. The top chords were braced by eight inclined posts bearing cleats spiked to the deck of each scow.

Very careful assumptions were made for the loadings and reactions of both old and new spans, the strength of the falsework trusses and scows, and the displacements of the latter under different loads were carefully calculated. It was assumed that each new span would develop an equal pressure of 16,000 pounds on each of the five tower posts under each track stringer in that panel, thus carrying the weight equally on the forty tower posts for the two scows. These reactions developed a calculated flange stress of 89,000 pounds, due to bending moment in the stringers, and well within the capacity of the net sections of 80 square inches for the outer stringers and of 105 inches for the inner stringers. The old spans were assumed to weigh 16,000 pounds per panel per truss, and the falsework Howe trusses which supported them to weigh 6,000 pounds per panel per truss, making a total load of 616,000 pounds which was carried at two points on each of the ten longitudinal trusses which stiffened the scows and were proportioned for loads of 32,000 pounds at two points, each 8½ feet from the center.

The empty scows weighed about 68 tons each and had a corresponding draft of 14 inches. The Howe trusses and blocking together weighed about 96 tons, so that the total weight of one scow and its falsework was 116 tons, giving it a draft of 24 inches. When fully loaded with 112 tons more of old bridge weight, it had a calculated draft of 3 feet 10 inches, which left a freeboard of 4 feet 2 inches and allowed 2 feet more of water to be safely admitted for ballast. The maximum chord stress in the Howe trusses was figured at 158,000 pounds, and loads imposed by the Howe trusses on the transverse distributing girders bearing on the scow trusses were assumed at 92,400 pounds in the center and 30,800 pounds at each end. This corresponded to reactions of 30,000 pounds at their bearings on the five scow trusses.

When one of the new spans was ready to be placed on the old piers, the scows were floated under one span of the old structure at low tide with their overhanging trusses in the planes of the bridge trusses above. They were partly filled with water admitted at the rate of about 1 foot in depth per hour through a 6-inch gate valve near the bottom of each controlled from the deck. Wooden floor blocks had been bolted to the under sides of the floor beams so as to clear projections, as shown in the detail, and wedges were driven between them and the top chords of the scow trusses so as to support the bridge span from the latter at every panel point. When there was not too much wind and other conditions were favorable, a suitable tide was selected, and about two hours before its flood the track was disconnected and the wedges driven to bearing, just enough water being simultaneously admitted to the scows to keep the bridge span from rising. Meantime the new span was being loaded on scows, and as soon as it was safely afloat the scows under the old span were quickly emptied at the rate of ½ inch per minute by two 6-inch centrifugal pumps operated by steam from a boiler on one of the scows. The old span being then free was towed away from its piers, swung around 90 degrees parallel with the shore and deposited on two landing platforms about 24 feet apart, 150 feet long and 20 feet high above water level.

Each platform consisted of a pile trestle with bents 8 feet apart. When the scows were between the platforms with the old bridge span parallel to the shore line and overhanging them at both ends, their valves were opened and the ebbing tide and the water ballast lowered the span until its ends rested on a truck on each platform and the scows were freed from it and towed away. These trucks were 24 feet long transverse to the bridge axis and had, at each end, four double flange 24-inch wheels symmetrical with the bed plate for the truss bearings on the piers. The axles were 3 feet 8 inches apart in each pair and all the eight wheels for



RIVETING AND ERECTING NEW SPANS ON FALSEWORK.



ADJUSTING SCOWS UNDER NEW SPANS ON FALSEWORK.



NEW SPAN FLOATING.



REMOVING OLD SPAN AND PLACING NEW SPAN.

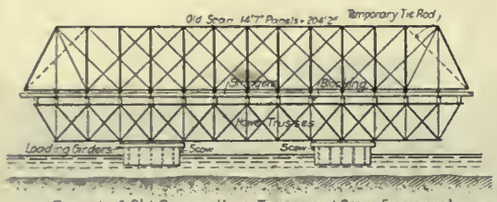
each truck traveled on a 24-inch gauge track extended to shore. Over the trestle each rail had two 12x12-inch wooden stringers one on top of the other, breaking joints over the bents. The trucks were each made with two 12x12-inch longitudinal timbers at right angles to the bridge axis, reinforced by full length 12-inch channels bolted on each side and by a heavy cast iron bent plate on the under side, which took bearing over the axles. Heavy transverse timbers about 6 feet long were set across the tops of these longitudinal pieces between the axles in the planes of the bridge trusses and acted as bolsters to receive the bed plates at the feet of the end posts of the bridge trusses. After the scows were removed the span was rolled across the trestle to the required position on shore and was jacked up a few inches above the trucks, which were removed, and blocking was placed under the bolster timbers, which were then lowered to bearing.

The two scows for handling the new spans were not connected by transverse trusses. In the center of each there was built a timber tower about 20 feet high with five vertical bents transverse to the axis of the scow, each containing four battered posts scabbed to sills and caps and X-braced in both directions, as shown in the elevations. The scows were partly filled with water admitted to a depth of 18 inches through two 6-inch gate valves in each, and were towed into the open spaces through the falsework on each side of its center piers. They were moored transverse to the span so that their towers were centered on its axis. Transverse and longitudinal bearing timbers of different thicknesses to correspond with varying tides were provided to build up on top of the tower, and at low tide these were wedged against the under sides of the bottom flanges of the four track stringers in each panel adjacent to the center of the new span. An ordinary tide lifted the span about 2 inches clear of the falsework, or about 26 inches above its required level on the piers. Each scow had a freeboard of 4 feet under its total load of about 320,000 pounds which was carried by twenty 10x10-inch posts loaded to 160 pounds per square inch of cross-section.

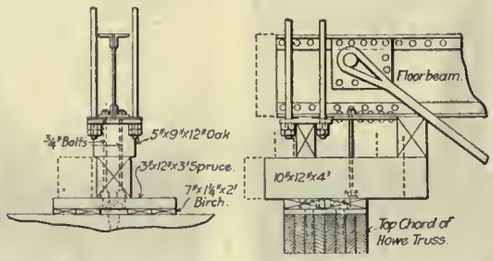
The bearing under the track stringers affords as a base only 9 feet wide additional stability for the top-heavy structure was secured by bracing the bottom chords of the span with three inclined posts on each side of each scow with their feet bearing against cleats bolted to the deck. As the shore ends of the end stringers were lower than the bridge seats on the piers, they were raised to clear them and supported temporarily by loose bolts to the second panel floor beams and by lashing at the other ends to transverse timbers across the tops of the lower chords at the ends of the span. This arrangement reduced the height to which the span was raised by about 14 inches, and expedited the lowering of it to final position, which was accomplished on a falling tide and assisted by the admission of water ballast which sunk the scows 30 inches until only 18 inches of freeboard remained. The scows were towed from the falsework to the required positions between the old piers and were held by anchor lines in addition to the cross tackles at each end of the span. Five spans were erected and put in position at the rate of about nine days each in the fall of 1902. The river was then closed with ice, and it was decided to leave the sixth span on the falsework and to put it in position this season when the contractors force resume similar operations for the erection of the bridge across the Southwest River.

The first new span was towed into deep water ready to be transferred to its piers, on Thursday, October 9. The railroad officials would not allow the old span to be removed until the following Sunday, and so the contractors ventured to keep the span floating in the channel during a very high wind on Friday. This did no damage and the span was seated on the piers at noon on Sunday and the first train crossed it at 4:15 in the afternoon.

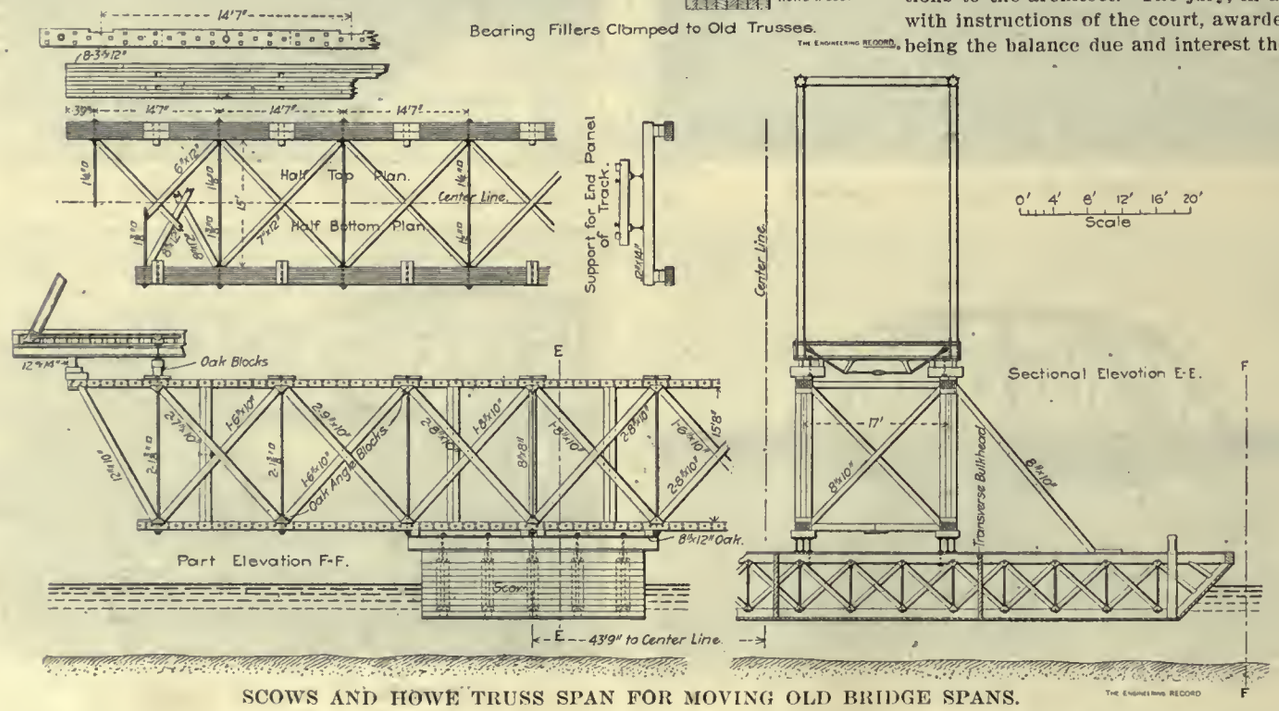
Mr. Wm. B. Mackenzie was chief engineer of the Intercolonial Railway Company. The Dominion Bridge Company, Mr. Phelps Johnson, president, was the contractor for building and erecting the bridge, and the work was in charge of Mr. H. D. Bush, resident engineer, who presented a paper on its erection to the Canadian Society of Civil Engineers, from which part of the data for this description was secured.



Support of Old Span on Howe Trusses and Scows for removal.



Bearing Fillers Clamped to Old Trusses.



SCOWS AND HOWE TRUSS SPAN FOR MOVING OLD BRIDGE SPANS.

The College of Engineering of the University of Illinois now has over 600 students; attendance has more than doubled in three years.

An Architect Obtained a Verdict recently in a United States Circuit Court for balance due on plans for a proposed courthouse. Nearly eight years ago Mr. Elijah Meyers, of Detroit, entered into an agreement with the commissioners of Luzerne County, Pa., according to which he was to receive $5,000 on signing the contract for the plans, $5,000 on delivery of preliminary drawings, and $10,000 on delivery of completed plans. The third payment was kept back although the plans and specifications were delivered, the erection of the building having been enjoined by the taxpayers The plans were said to call for a more expensive building than was intended in the instructions to the architect. The jury, in accordance with instructions of the court, awarded $14,750, being the balance due and interest thereon.

The Seven Meter Readers of the water department of Atlanta, Ga., are required to read each meter on their route monthly, commencing on the 20th of each month. They also personally serve about 1,500 notices during the first three days of each month, and deliver about 100 delinquent notices. According to the annual report of Superintendent Park Woodward, from 75 to 100 delinquents are shut off every month by the meter readers, who also have to turn on the water again when the bills are paid. Over 16 miles a day are covered by each man in doing this work, and the same territory has to be gone over about four times. In addition to the above work they each write about 1,500 bills, with three stubs to each bill, making 4,500 entries by each man during the month. From the 4th to the 10th of each month the meter readers are required to assist in the office, as the office force is much overcrowded with work.

Slow Sand Filtration Plant for Washington, D. C.

By J. S. Schultz, C. E.

Bids were opened January 28 at the office of the Washington Aqueduct for the construction of a slow sand filtering plant for the District of Columbia. Separate bids were invited for the cement and for the construction, for it was thought that better results could be secured if the Government selected and furnished the cement. There were only three bids and all were rejected as being too high. (See the Engineering Record of February 7). The specifications were, consequently, revised and the work readvertised, but the plans were not modified in the least.

In order to obtain more reasonable figures, the work was divided into the following classes, upon any or all of which bids could be submitted: A, Excavation, embankment, puddle, seeding and sodding; B, Concrete masonry, granolithic paving, placing materials in masonry and drainage of roofs; C, Furnishing and laying steel pipes and appurtenances; D, Furnishing cast-iron pipes and special castings; E, Furnishing wrought-iron pipe; F, Constructing exterior drainage system and manholes; G, Furnishing vitrified pipe; H, Furnishing and placing filter sand and filter gravel. It is not the intention to contract for the pumping plant, the sand cleaning apparatus, the pressure regulating houses or the bacteriological laboratory until after the main portion of the system is under way. Under the second advertisement only two firms submitted estimates, both of which were considered excessive; but, since Congress has authorized $700,000 additional, the contract will be placed with one of those who have already submitted estimates in order to avoid the delay incident to re-advertising this work.

The principal quantities involved in the construction of the entire plant are, approximately: Excavation, 88,000 cubic yards; embankments beneath and over filters, 234,000 cubic yards; puddle, 2,000 cubic yards; filter sand, 140,000 cubic yards; filter gravel, 42,000 cubic yards; Portland cement, 135,000 barrels; concrete in walls, floors, vaulting and piers, 111,200 cubic yards; granolithic paving, 35,000 square yards. For these and a few other items unit prices were requested in the specifications, but for each of the pipe and drainage systems lump sums.

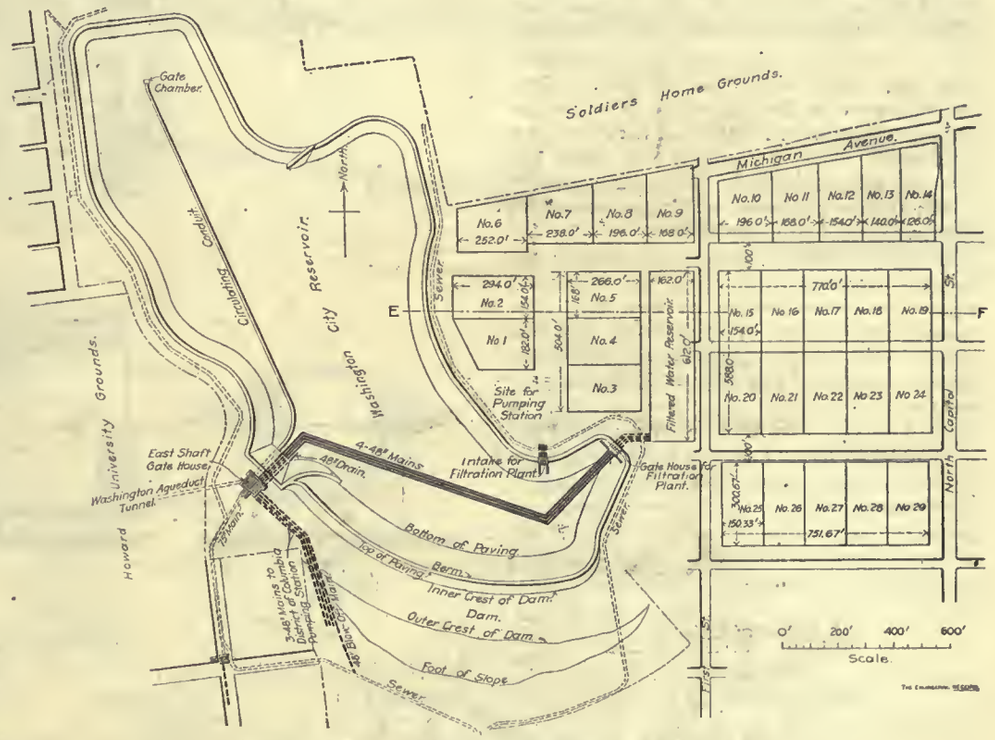
The water supplied to the District has been carefully examined by experts. The two principal reports on the subject were reviewed in The Engineering Record of May 12, 1900, and February 23 and March 2, 1901; and in the issue of July 29, 1899, was a description of Washington's water-works. The supply is taken directly from the Potomac, a river subject to frequent and sudden floods and contaminated throughout its length by surface drainage. The intake is at Great Falls, 17 miles above the city, at which point there can be drawn, according to a recent ruling of the Supreme Court, only 153,000,000 gallons daily. The water is conducted to the receiving reservoir through the Washington Aqueduct, the maximum capacity of which is only about one-half of the above. The proposed filtration plant will be installed near the Washington City Reservoir, the largest in the city, containing when full 300,000,000 gallons, which, together with the aqueduct 4 miles in length supplying it, was placed in service January 8, 1902.

As long ago as 1878 the turbid condition alone was considered sufficient grounds for demanding the filtration of the Potomac water for the supply of the National Capital; and the large number of bacteria contained, together with the high typhoid fever rate prevailing, has been observed with alarm for at least 15 years.

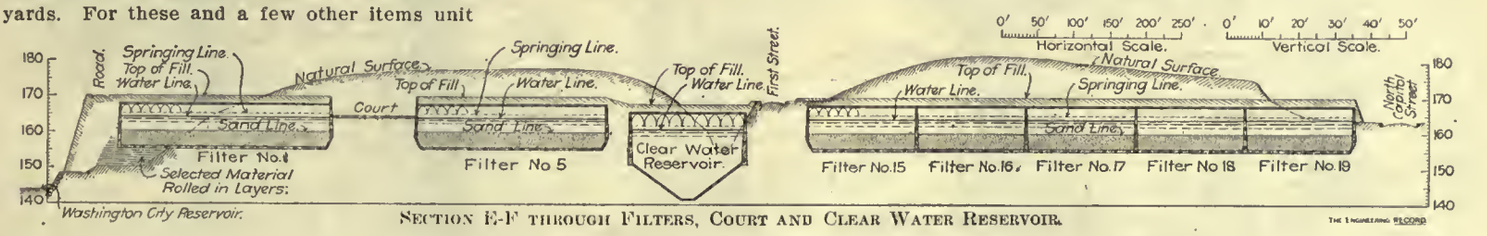
It was not, however, until 1894 that Colonel George H. Elliott, then in charge of the Washington Aqueduct, first conveyed to Congress the advisability of filtering the water for the District. On June 30, 1898, and March 3, 1899, sums aggregating $8,000 were appropriated for "investigating the feasibility and propriety of filtering the water supply of Washington." This investigation was conducted by Lieut. Col. Miller, who succeeded to the charge of the Washington Aqueduct and to whose effort is largely due the final carrying out of the filtration scheme, for it was upon his recommendation that Congress on June 6, 1900, made available $200,000 "for establishing those portions of a filtration plant which are essential to the operation of either system of filtration, including necessary land, grading and appurtenances." Col. Miller's investigation was exhaustive and his conclusion was strongly in favor of the mechanical method, owing to the peculiar character of the Potomac River.

On December 20, 1900, however, the Senate directed the Committee of District Affairs to investigate and report the relative advantages of the mechanical and slow sand systems of water filtration. The conclusion reached was that wherever the slow sand method had been installed uniformly good results were produced in removing the turbidity and the bacteria; but it was also shown that different classes of water require different treatment, and that while the slow sand method is preferable for waters simply polluted there are some cases of extreme turbidity with finely divided suspended particles that require the use of a coagulant, and it was for this latter class that it was deemed the American method would be better. The final cost for the City of Washington was proved to be the same for either system.

To settle the question as to whether Potomac water requires a coagulant, a report was requested from Messrs. Rudolph Hering, George W. Fuller and Allen Hazen, members of the American Society of Civil Engineers, which was presented to Senator McMillan, chairman of the Committee of District Affairs, on February 18, 1901, and printed in full in The Engineering Record of March 2, 1901. The conclusion of this report is: "In consideration of the full evidence, we recommend the construction of a complete system of slow sand filters, with such auxiliary works as may be necessary for preliminary sedimentation and the use of a coagulant for a part of the time. There is no reason to believe that the use of this coagulant will in any degree affect the wholesomeness of the water." This report, together with the united protests by the Medical Society, the Board of Trade and the Business Men's Association of the District of Columbia against the use of a mechanical system, influenced the Senate committee to conclude their report in the following terms: "The committee recommends for use in the District of Columbia the adoption of the slow sand system of water filtration, modified by the use of coagulants whenever the waters of the Potomac are so turbid or turbid for so long a time as to make the use of a coagulant desirable." On March 1, 1901, $500,000 was appropriated "towards estab-



GENERAL PLAN OF WASHINGTON FILTRATION PLANT.



SECTION E-F THROUGH FILTERS, COURT AND CLEAR WATER RESERVOIR.

lishing a slow sand filtration plant, and for each and every purpose connected therewith, including the preparation of plans."

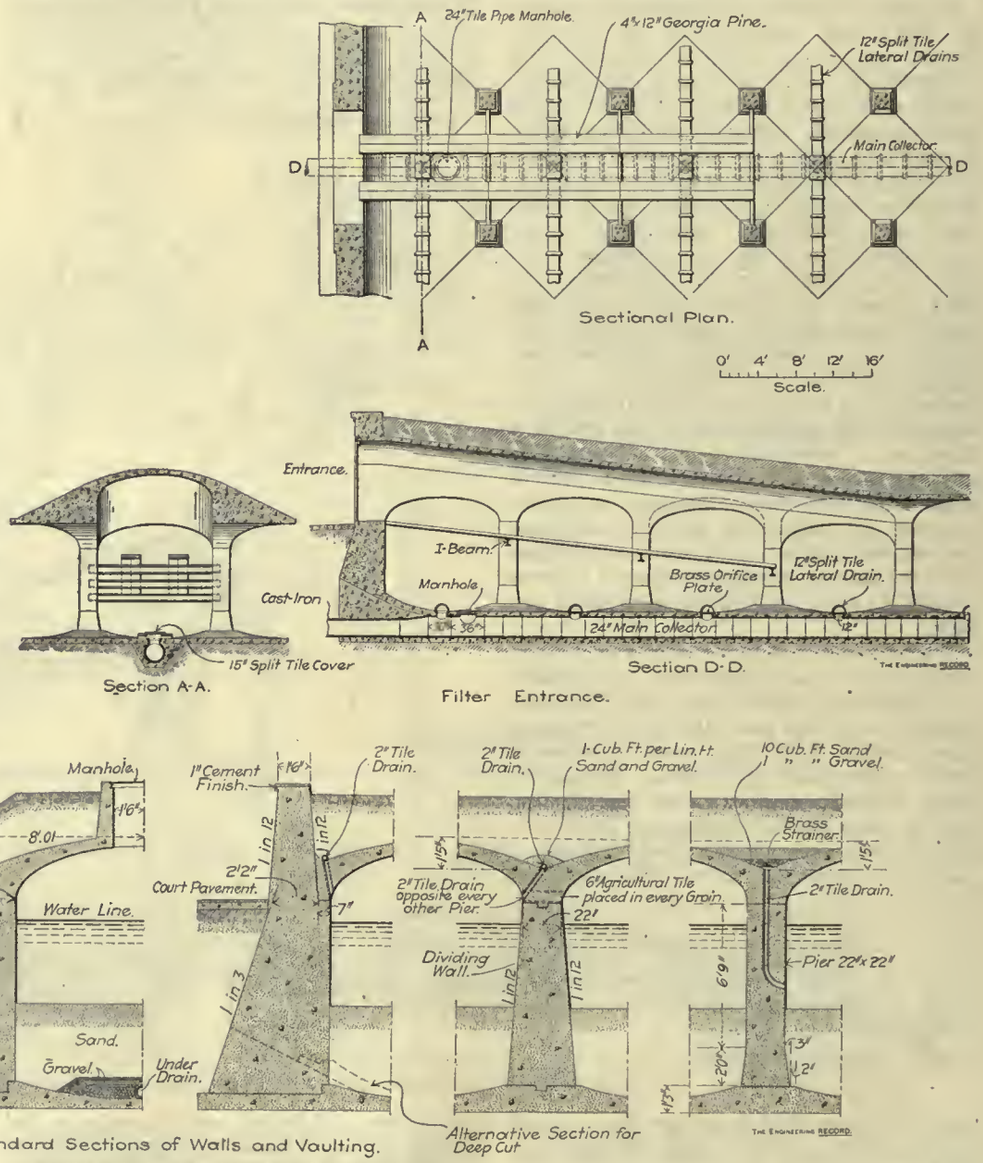
As the preference of Congress was thus made manifest preparations were immediately begun by Col. Miller to install a slow sand plant for a supply of 75,000,000 gallons daily. Upon his recommendation, 31.6 acres of land were acquired at a cost of $619,937.30; and the small balance available was expended in adapting the new reservoir to auxiliary use in connection with the filter plant. On July 1, 1902, Congress inserted the following item in the appropriation for the expenses of the District government: "Toward establishing a slow sand filtration plant . . . . . $600,000, to be available immediately and until expended:—Provided, that a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary for prosecuting the work to final completion within the shortest practicable time, or the materials may be purchased and work done otherwise than by contract, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $2,768,405, including the amount herein and heretofore appropriated." The preparation of plans was promptly begun, and they were soon submitted to Mr. Hazen, who was retained as consulting engineer.

The accompanying general plan shows the relative sizes and locations of the component parts of the plant and its environment. It is thought that sufficient sedimentation will take place in the receiving reservoir, of 150,000,000 gallons capacity, and the Washington City reservoir. From the latter the water will be pumped to the filter beds, with a normal lift of twenty-two feet. Each bed has approximately an acre of net filtering area, and the total of twenty-nine comprise the area on which was based the calculation of a daily supply of 75,000,000 gallons. Only filters Nos. 1 to 24 are to be built at first, but the embankments under the other filters are to be completed in connection with the first part of the work. The construction of filters Nos. 25 to 29 may, however, be ordered under the original contract (provided written notice be given at least two months before the first twenty-four filters are finished); but in that event nine months' additional time will be allowed for the completion of the work.

The water will be supplied to the filters through two steel rising mains, one 72 inches in diameter connected with the first nineteen beds and the other 54 inches in diameter, to the remaining ten. After passing through the 3 feet of sand and 1 foot of gravel, the clear water will be collected by the underdrainage system, shown in some detail in the illustrations. This system will consist of transverse rows of terra-cotta upper drains, spaced about 14 feet on centers, leading in each bed to a central embedded vitrified pipe collector. Each row of upper drains will be placed directly on the filter floor and laid with ¾-inch joints, and will be composed of from 50 to 92 feet of 12-inch split terra-cotta pipes 2 feet in length, and 44 feet of whole 6-inch terra-cotta pipes 1 foot and 2 feet in length. The entrance to the collector will be through a brass plate set by the government, and serving as a compensating orifice, in principle like that designed for the Pittsburg plant, described and illustrated in The Engineering Record of January 25, 1902. A 20-inch cast-iron pipe will convey the water thus collected from each bed to the pressure-regulating houses, which will control groups of about five beds, and which are substantially the same as those designed for Pittsburg. There are seven of these houses for the complete plant, from which two 48-inch, one 36-inch and one 30-inch mains will finally deliver the water to the clear water basin, designed for a capacity of 14,000,000 gallons.

Four lines of 48-inch pipe, already placed by the Government, will carry the water from this basin, under the Washington reservoir, and thence to the city mains. The mains for the filtration plant were in general made large so as to decrease the loss of head by friction and to provide for higher carrying power in case the rate of filtration should be increased at any subsequent time.

Cross-sections herewith of the filter beds, the clear water basin and the courts show the relative elevations of these and the streets, the present surface of the ground and the new reservoir; and indicate their construction. It is seen that the filter beds and clear water basin are roofed over with the usual concrete groined vaulting covered by earth embankments carefully sodded and drained by a well-planned system of terra-cotta drains. Two reasons operated to determine this procedure: First, a beautiful addition will thus be made to the already unsurpassed parking system of the city, at the same time in harmony with the Howard University campus and the grounds of the Soldiers' Home, which flank the filter plant on either side; Second. The beds will be kept free from ice, although the only material advantage secured thereby will be the elimination of the expense for removing the ice, which, however, in the latitude of Washington, would be small. Only about one-half of the clear water basin has the hopper-shaped bottom indicated in the cross-section on line E-F; the bottom of the other portion is flat. This peculiar construction was resorted to in order to economize excavation and masonry, and it does not decrease the capacity of the upper part of the reservoir, which is the only part which can be used in ordinary service. The arrangement of the regulator houses and the inlets to the filters are clearly shown in the cuts. There is a Venturi meter in each effluent pipe just outside the regulator house.



DETAILS OF WASHINGTON FILTERS.

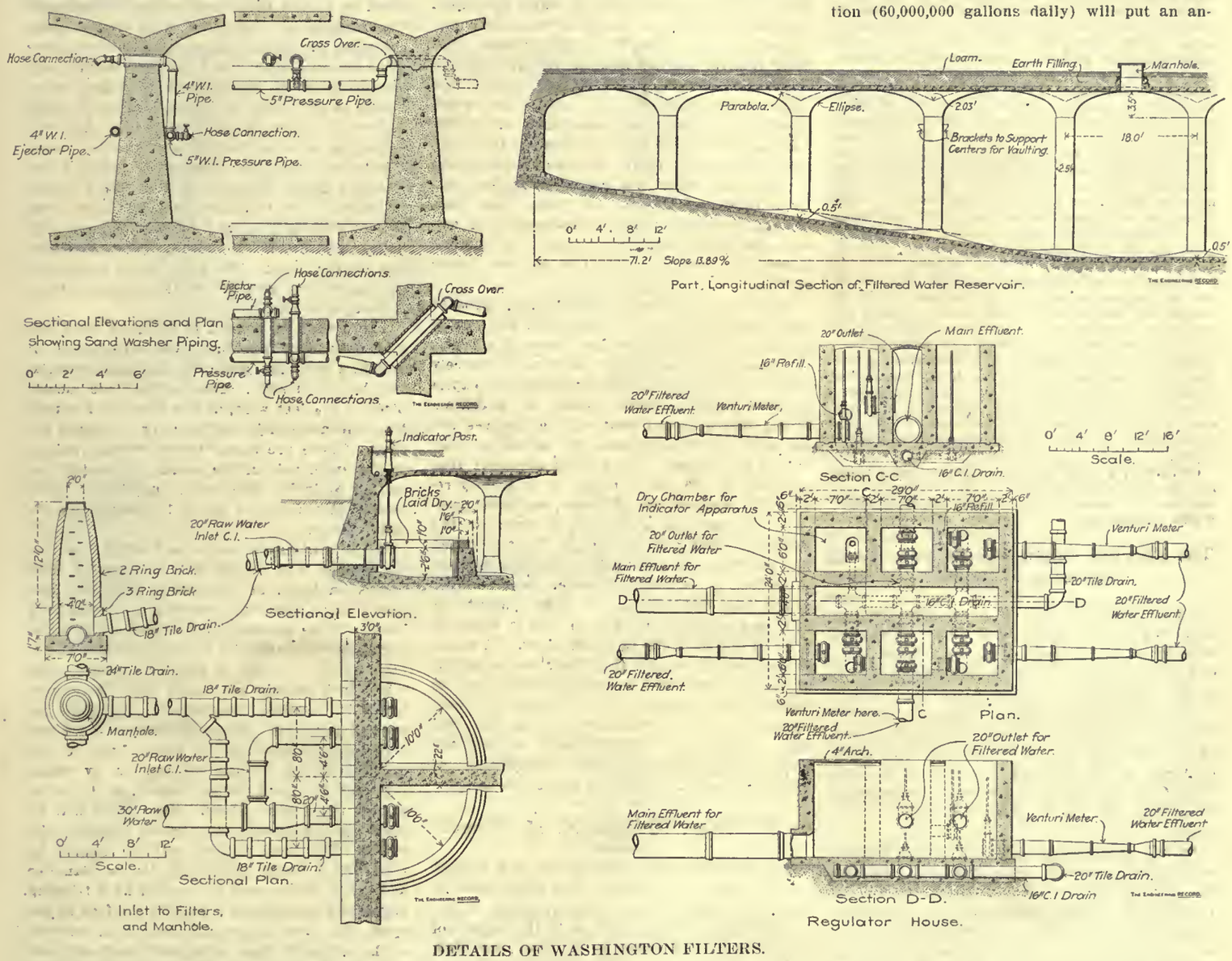
The piping system will be located on or beneath the two main and one connecting courts, which are open and will be paved with granolithic paving after the underground pipes shall have been laid. In these courts there will be located also the system of sand washing apparatus, similar to that described for Pittsburg.

The clear height of the filters from floor to vaulting will be about 12 feet, the normal depth of filtering materials a little over 4 feet, and the usual depth of water above the surface of the sand, 4 feet. In the walls, floors, vaulting and piers the concrete will be of the following proportions: 1 barrel of Portland cement, weighing 380 pounds net, 11 cubic feet of sand, loosely packed in boxes before mixing, and 19 cubic feet of ballast, similarly measured, the ballast to be of gravel, broken stone or both. more cost in masonry, was the reason for this. All piers will be 22 inches square.

The arrangement of the underdrainage system is shown, and also a standard water inlet to the filter bed from the large main and the exterior tile drainage system through which the water may be conveyed directly to the sewer when it is desired. Two adjacent filters are served by one 30-inch raw water inlet, it being divided into two 20-inch branches, one each side of the division wall between the beds, as shown.

Bidders were required to describe in full the plant proposed for excavation and to give the dates on which the several parts would be put to work. The capacity demanded is at least 6,000 cubic yards per day, and on no account will the average for any month be permitted to fall below 3,000 cubic yards per day. Three classes of embankment are made: (1) under filters, (2) about the walls of filters and in courts, (3) over filters. Excavated materials otherwise disposed of are not paid for as embankment. Embankments under filters are to be placed in 3-inch layers and have a grooved roller weighing at least 10 tons passed not less than six times over each layer; they are to be built 6 inches above grade and then trimmed down just before the placing of the concrete. Materials for embankments of class 2 need not be so carefully selected and may be deposited in 6-inch layers. Filling over filters will not be rolled. Puddle made of equal parts of selected plastic clay (free from loam and mica) and of sandy gravel will be used to such extent as may be found necessary beneath the bottoms and on the sides of the filters and clear water basin, to decrease the permeability.

It is expected to have the filtration plant completed and in active operation by December 1, 1904, unless unforeseen delays occur. The specifications, from which a few extracts are given below, are similar to those for the Pittsburg filters printed in the issue of January 25, 1902. The requirements for the cement are, with the exception of a few minor points, the uniform specifications for Portland cement adopted by the U. S. Corps of Engineers. It is estimated that the cost of filtration after the plant is completed will be about $6 per million gallons, which at the present rate of consumption (60,000,000 gallons daily) will put an annual expense of $131,400 on the residents of the District. At the above rate the water used per capita daily is 205 gallons, an amount more than twice what is absolutely necessary, and it is therefore apparent that the above expense could be reduced more than half if proper means were used to guard against undue waste. The only resort apparently for the District authorities is to install meters in all public buildings and gradually extend their use as the people become convinced of their efficiency.



DETAILS OF WASHINGTON FILTERS.

It is to be noticed that no metal reinforcement is used and that the loads carried by the vaults are made as small as possible by thorough drainage. The extrados of the vaulting will be parabolic, the intrados ellipsoidal and the floors parabolic. The height of the crown above the springing line of the vaults will be about 2½ feet and the thickness at the crown 6 inches, which will also be the depth of the floors at the thinnest places. Exterior and interior walls will in general be 2 feet thick at the top, with a one in twelve batter. A somewhat unusual feature is the exposure of some of the side walls of the filters along the courts. Economy of space, by saving embankments, at the expense of a little

Portland Cement—Quality.—By a Portland cement is meant the product obtained from the heating or calcining up to incipient fusion of intimate mixtures, either natural or artificial, of argillaceous with calcareous substances, the calcined product to contain at least 1.7 times as much of lime, by weight, as of the

materials which give the lime its hydraulic properties and to be finely pulverized after said calcination, and thereafter additions or substitutions for the purpose only of regulating certain properties of technical importance to be allowable to not exceeding two (2) per cent. of the calcined product.

Unnecessary Use and Waste.—The amount of cement unnecessarily used or wasted and damaged shall be computed as follows:

Deduction for Excess.—If any concrete structures are built larger than ordered, so that in the aggregate the volume of concrete in any part of the work exceeds that contained within the lines given, by more than 5 per cent., the Engineer Officer in charge shall make an estimate of the amount of cement contained in the concrete in excess of the volume contained within the lines given for the work or that part thereof built larger than ordered, and shall charge it to the contractor; but otherwise no deduction shall be made for cement used in masonry built larger than ordered.

Cement Charged to Contractor.—The contractor shall further be charged with the cement required for making concrete to replace any and all concrete rejected, removed and replaced with new concrete under these specifications. The contractor shall also be charged with all cement in concrete abandoned before being placed, when work is stopped at noon or at night, or on account of rain or otherwise; with cement in concrete spoiled or lost, in mixing and in transmission; with cement spoiled or wasted in transit from the storehouse to the work or on the work, and cement spilled or spoiled in the storehouse for any reason whatever, and for all losses of cement of every description in connection with the work; provided, however, that if the work is handled with due care to prevent such waste and loss, and if all such losses in the aggregate amount to 2 per cent. or less of the gross amount of cement used under these specifications, no deduction shall be made therefor.

Striking Centers.—No centers shall be struck without the express consent of the Engineer Officer in charge, and subject to such conditions as will secure the safety of the work, nor until the adjacent walls are completely secured. Outside walls shall be considered as secured when the embankments against them have been completed to the satisfaction of the Engineer Officer in charge. Cross walls shall be considered as secured when the concrete vaulting on the other side of the cross wall for at least two sections is in position and set, whether supported by centers or not.

Cast-Iron Pipe and Specials.—The cast-iron pipes and specials shall conform to the dimensions and specifications adopted by the New England Water Works Association.

The Effect of Water Meters Upon Consumption of Water.

On February 26 and 27 a national convention was held in New York City, under the auspices of the Reform Club, to discuss various topics relating to municipal ownership and public franchises. From a paper, entitled "City Ownership of Water Supply, a Successful Contest for Good Water," presented at one of the meetings by Mr. William R. Hill, chief engineer of the Aqueduct Commission, of New York City, the following statistical paragraphs relating to the use of water meters have been taken.

In one hundred cities in the United States, having an aggregate population of 11,000,000, the average consumption of water per day is 1,457,000,000 gallons, equivalent to 132½ gallons per day for each person. In these cities there are 1,531,500 taps or service pipes and 283,554 meters in use; hence 18½ per cent. of these service pipes are metered. In order to show the effect of the use of meters on the quantity of water consumed per person per day, the one hundred cities have been divided into five classes.

In Class A are forty-one cities, of an aggregate population of 6,150,000, having less than 10 per cent. of their services metered. Their average consumption of water per capita per day is 162 gallons, and their total consumption of water per day, 996,400,000 gallons. The total number of services is 930,000 and the number of meters, 31,000, 3⅓ per cent. of the services being metered. In Class B are twenty cities of an aggregate population of 1,461,000 having from 10 to 30 per cent. of their services metered. Their average consumption of water per capita per day is 127 gallons, and their total consumption of water per day, 185,000,000 gallons. The total number of services is 190,067 and the number of meters, 22,502, 11.8 per cent. of the services being metered. In Class C are eighteen cities of an aggregate population of 1,759,000, having from 30 to 50 per cent. of their service metered. Their average consumption of water per capita per day is 96 gallons, and their total consumption of water per day, 168,000,000 gallons. The total number of services is 220,714 and the number of meters, 78,700, 35.6 per cent. of the services being metered. In Class D are nine cities of an aggregate population of 768,000 having from 50 to 75 per cent. of their services metered. Their average consumption of water per capita per day is 75 gallons, and their total consumption of water per day, 57,600,000 gallons. The total number of services is 110,119 and the number of meters, 68,352, 68 per cent. of the services being metered. In Class E are twelve cities of an aggregate population of 862,000 having from 75 to 100 per cent. of their services metered. Their average consumption of water per capita per day is 58 gallons, and their total consumption of water per day, 50,000,000 gallons. The total number of services is 90,600 and the number of meters, 83,000, 91.6 per cent. of the services being metered.

Ninety of the above named cities procure their supply of water by pumping, the cost of which is one of the principal items of expense. In Allegheny, Pa., where they have scarcely any meters in use, the consumption per capita per day is 300 gallons, while in Brockton, Mass., where 83 per cent. of the services are metered, the consumption per capita per day is but 30 gallons. Thus it is apparent that the effect of the use of meters is to greatly reduce the consumption of water, or, more properly, the waste of water. In a report of the Bureau of Water of Buffalo, N. Y., it is stated that on February 10th, 1899, when a zero wave prevailed, the amount of water delivered per capita was 440 gallons. A large quantity of this was evidently allowed to run to waste to prevent it from freezing in the pipes. It might be interesting to note that their entire supply of water is obtained by pumping and that no record was presented of the amount of coal consumed at the pumping station on that cold day. About 2 per cent. of their services are metered and their average consumption of water per capita per day is about 265 gallons.

U. S. Dredge "General H. M. Robert."

The following description of the new dredge, The General H. M. Robert, now being used by the Government on the improvement of the Brazos River, Texas, is given in the Report of the Chief of Engineers, U. S. Army, for 1902. The H. M. Robert is a light-draft, self-propelling, twin-screw, hydraulic dredge. The hull is 132 feet long, 32 feet wide and 7½ feet deep, and draws 4 feet when loaded and ready for work.

Her runner is 72 inches in diameter, inclosed type. Suctions enter on both sides of pump and discharge through a 20-inch pipe from either side of the dredge, as desired. The outboard delivery pipes are suspended from shear legs and can handle the pipe as occasion may require, for depositing the spoil on shore or to form banks alongside the cut as the channel advances. If necessary, a pontoon pipe line can be rigged to deposit at a long distance from the cut.

The pump is driven by a vertical triple-expansion, four-cylinder engine arranged in two units, the shafts being connected to the pump shafts by flanged couplings. The high-pressure cylinder is 14 inches in diameter, the intermediate is 21 inches, and the two low-pressure cylinders are each 23½ inches in diameter, with a common stroke of 18 inches. The engines will run at 150 revolutions per minute, giving the pump a peripheral velocity of 47 feet per second, which will maintain a head of 34½ feet with a pump efficiency of 60 per cent.

The dredge is propelled by twin-screws 4 feet 9 inches in diameter and 5 feet 9 inches pitch, fitted with removable blades. Owing to the shallow draft of the boat, the propellers project 12 inches above the water line, and are covered with hoods, which will give the same effect as though they were entirely submerged. The engines are compound, with high-pressure cylinders 12 inches, and low-pressure cylinders 22 inches in diameter and 12 inches stroke, and are located at the after end of the engine room. Steam is furnished by three boilers of locomotive type, but having combustion chambers extending between the furnace and the tubes. The boilers are 5 feet diameter of barrel, 7 feet 3 inches height in front, and 18 feet 6 inches in length. The furnaces are 5 feet long, combustion chambers 3 feet 3 inches long, and each boiler contains 104 tubes 2½ inches diameter and 10 feet long. The total grate surface is 75 square feet and the total heating surface 2,400 square feet.

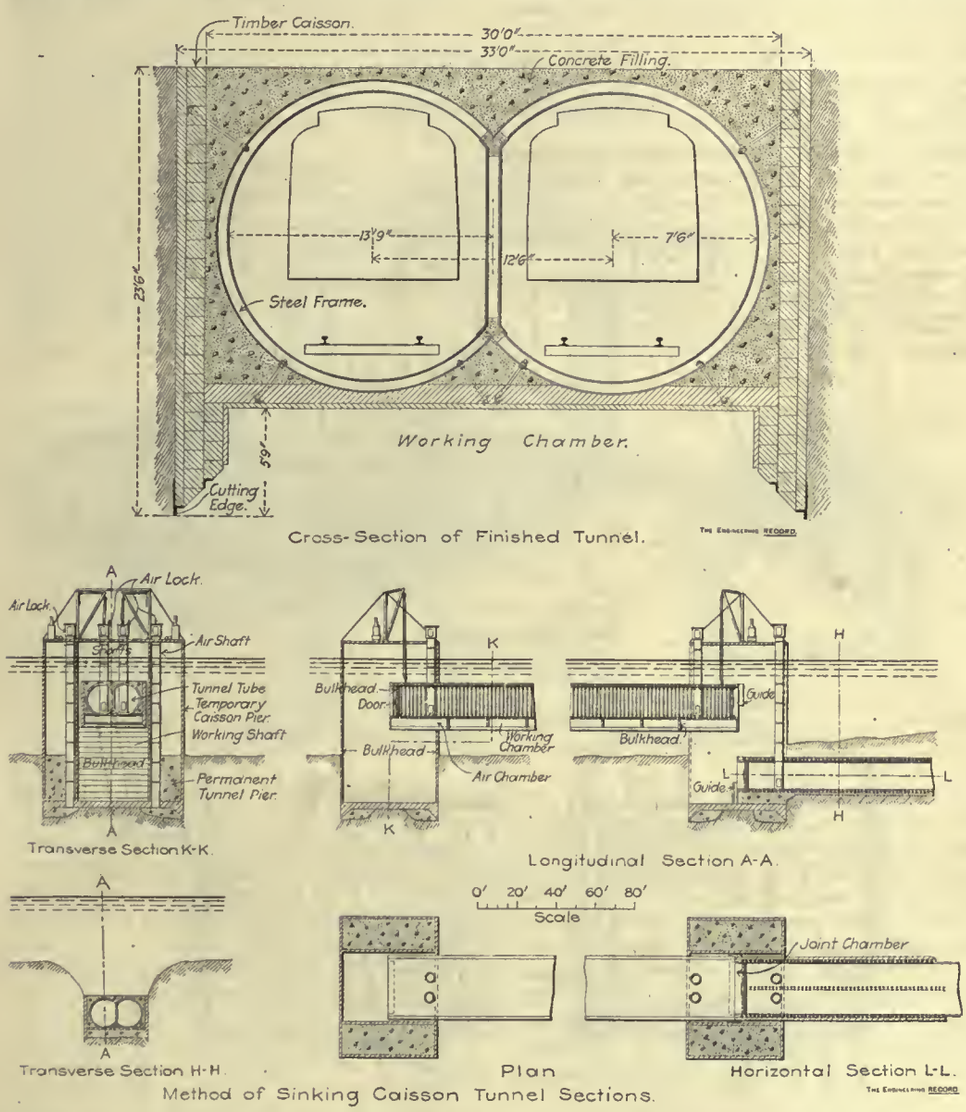
The dredge at present is fitted for sand digging only. The machinery and cutter head for handling stiff clay, and other compact material will be added later. The suction head mouthpiece is 9½ feet wide, and is fitted with screen bars and a water-jet agitator for loosening the sand. There are seven pipes leading radially to the under side of the mouth, reduced at the end to ⅝ inch. The water supplied at those jets is at a pressure up to 100 pounds to the square inch.

When working in soft, free-flowing material, the dredge will be fed into the cut by head cables anchored at convenient distance and hauled in by the steam capstans on the forward deck. These capstans are driven by pairs of horizontal engines with 6-inch cylinders and 8-inch stroke. A pair of smaller capstans with 5 by 7-inch engines are placed abaft the engine house for handling the discharge pipes and for general purposes. When dredging in hard material, which requires the cutter head to disintegrate it, the feeding will be done by swinging from the spud anchor located at the after end of the engine house. Head lines will be used for the advance and breast lines for the swing. The spud anchor will be raised by means of a steam cylinder 15 inches diameter and 6 feet stroke, and is dropped by a tripping dog, which engages on a rack in the face of the spud. The bow sheers are made from selected sticks of yellow pine 10 inches square, and are intended for use in clearing the channel from snags as well as for handling the suction head.

In addition to the foregoing machinery, the boat is fitted with electric-light plant, evaporating and refrigerating plant, machine and blacksmith shops, and machine tools. The cabins have accommodations for a crew of thirty men, besides an office and stateroom for the inspecting officer. There are also bath-rooms for officers and crews, a cold-storage room, and kitchen and mess-room. The hull and various parts of the machinery were purchased under separate contracts, and the installation of machinery and completion of the dredge was done by hired labor. The total cost was about $65,000.

Improved Methods for Difficult Subaqueous Tunneling—I.

The new transit systems planned for Greater New York involve the construction of a number of very important tunnels under the East and North rivers, which will have lengths of several thousand feet and dimensions sufficient for one or two railroad trains. These tunnels must be placed at a considerable depth in the ground, involving in some cases great difficulties in construction. In various places they will have to be driven through rock, hard pan, clay, gravel, boulders, sand, mud and very soft silt, and sometimes very dissimilar strata, like rock and silt, will be intersected by the tunnel at the same point. No material obstruction to navigation can be permitted at any time.



Where the tunnels cross the rivers the tide has a range of several feet and a maximum current of more than four miles an hour. The ordinary methods of construction will not satisfactorily meet these difficulties.

Recognizing these facts, prominent engineers and contractors have devoted special effort to devising new and improved solutions for the problems of design and construction, which will be applicable to difficult tunnel work in general and, in most cases, suited to the assumed requirements of one or more of the tunnels projected for New York. Several of these plans have had their essential features patented, and have been submitted for consideration in connection with the different projects. While it has not been officially announced that any scheme has been accepted, it is probable that some of the methods suggested may be adopted in the near future, and, as they represent the most advanced thought and careful design of engineers experienced and successful in important constructions, The Engineering Record has prepared the following concise descriptions of those plans which have come under its notice.

The system proposed by Mr. John F. O'Rourke, contracting engineer, provides for a finished structure consisting of piers, sunk below the bottom of the river, connected by submerged tubular spans supported uniformly throughout the whole lower surface on the solid bottom, with no projections above the river bottom or obstructions to navigation. The construction will comprise four principal processes: the construction of temporary working shafts about 500 feet apart in the line of the tunnel; the building on shore, launching and floating to position of sections of the tunnel which will reach from shaft to shaft; the sinking of these sections to sub-grade between the shafts; the alignment and connection of the sections in final position, the removal of the shafts or piers above them, and such back-filling as may be required. The method is a new and ingenious combination of operations and principles which have for years been standard in pneumatic caisson work for bridge piers, is believed to be conservative and positive, and to permit minimum depths and grades and rapid execution.

The tunnel shown is designed to be a twin structure having a cross-section composed of two intersecting circles, each having clearance for a train of steam cars. The tunnel shell will have a steel framework of transverse bents of curved I-beams covered with a riveted steel plate and enclosed in a monolithic protecting mass of concrete filled between the steel work and a timber caisson, as shown in the general cross-section. The lower part of the caisson will be decked over solid, and the walls will be extended a few feet below to form the sides of an air-tight working chamber for use in sinking the tunnel. These sections will normally be about 500 feet long, but other lengths may be used when circumstances permit. They will be fully or partly constructed on shore at any convenient place, launched, concreted and towed to position. On the line of the tunnel a trench will be dredged wide enough to receive the tube and extending down to sub-grade, or the sections may be sunk to place by doing all the excavating from the air chamber. Along the center line pneumatic timber caissons about 50x72 feet will be sunk by ordinary methods until their cutting edges are sufficiently below sub-grade of the tunnel. Then the working chambers will be sealed and concreted and the caissons, being thoroughly fixed to a considerable depth in the river bottom, will afford sufficient stability to resist the force of the current and the pressure from the tunnel sections; but will be so far apart and of such moderate dimensions that they will not seriously obstruct navigation. The sides of the caissons, which are transverse to the tunnel axis, will be removable bulkheads easily displaced to allow the ends of the tunnel sections to be inserted through them, as shown in the general plan and elevation.

Two adjacent pier caissons having been sunk and a tunnel section inserted between them, the ends of the tubes will be temporarily closed by bulkheads and the end compartments at least of the working chamber underneath will be filled with air. The buoyancy of the tunnel section will be overcome by admitting sufficient water to the tubes to sink them, and the bulkheads in the sides of the pier caissons will be cut away under pneumatic pressure, so as to let the ends of the tubes, which rest between them, sink rapidly under control, the ends being carried on jacks while the cutting of the timber proceeds and then lowered at will. When the cutting edge of the tube caisson reaches the bottom of the river, the excavating will be carried on as in ordinary caisson work, and the tubes will descend under perfect control to their required level or grade, after which the working chamber will be sealed and concreted solid to the deck of the pier caisson and to the bottom of the excavation between piers. A third caisson pier having been placed, another tunnel tube will be floated into position and entered in it and in the second pier, and sunk as already described. Guide pieces will probably be attached to the ends of the tubes so that the second tube will engage the first and be guided to its approximate alignment, where it can easily be closely adjusted by hydraulic jacks or other devices which can move it in any direction, while the weight to be overcome will be reduced by the approximate equilibrium between the ballast and the buoyancy. The tube caissons will be fitted with air shafts and air locks at both ends, and the end bulkheads of adjacent sections will be separated a few feet so as to leave small chambers between them which can be pumped out and made accessible for caulking and splicing. In this way the successive lengths of the tunnel between piers can be put in position and finished, after which those portions of the caisson piers which are above the tunnel roof will be detached and removed.

Calculations have been made which, on an assumption of a current of four miles an hour, give an hydraulic pressure of 375 tons against

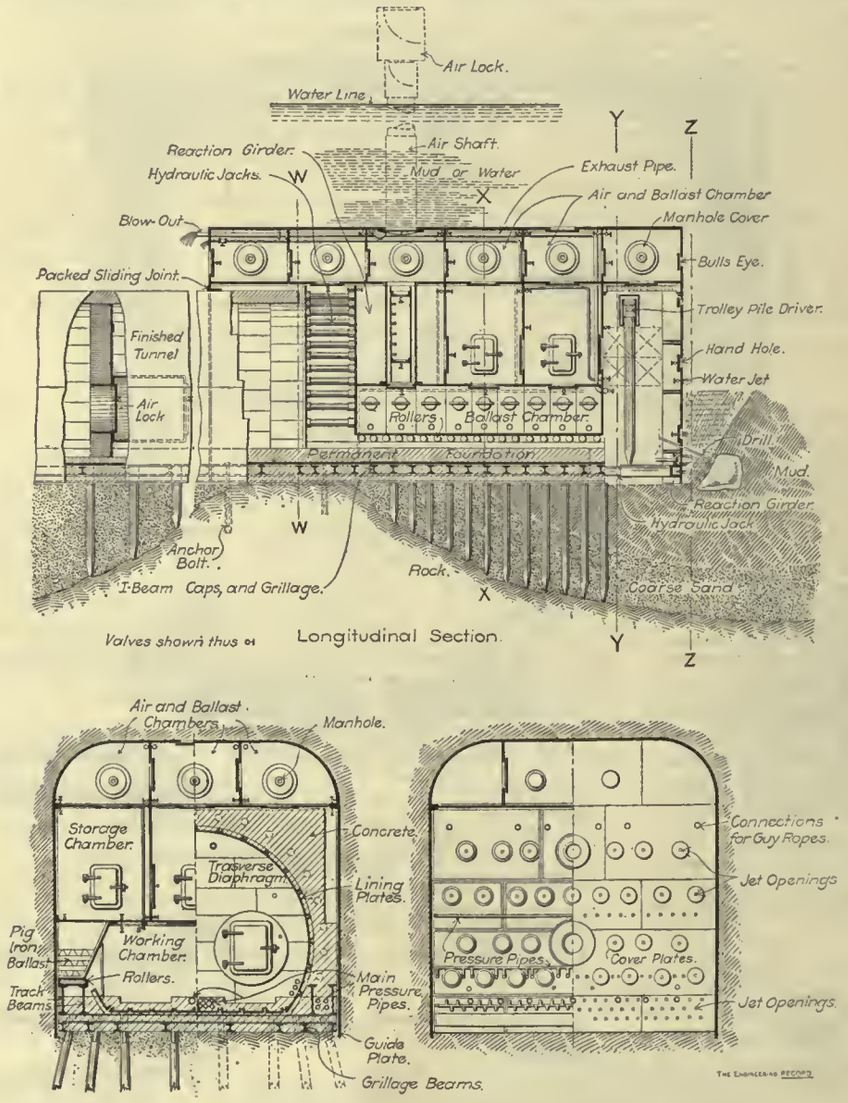
one tunnel section and of 86 tons against one of the caisson piers, making a total transverse pressure of about 460 tons against one pier, which will have a stability due to its own dead weight of 2,500 tons, besides being embedded to a considerable depth in the hard bottom, thus giving it a large factor of safety against overturning under the worst circumstances, when the tunnel tubes are floating at the surface of the river. After completion, the tunnel tubes will have continuous bearings over wide bases, so as to be thoroughly supported and not be in danger of sinking, even on soft material. The steel and concrete construction will have great transverse and longitudinal strength so as to distribute concentrated loads over large areas of the supporting ground, which, it is believed, will have ample bearing power, even if of silt, which, however, is not the case to the same degree in ordinary driven tunnels with cast iron or masonry lining.

A large part of the construction work will be done on shore where the tubes can be made as strong as desired and perfectly water-tight. The sinking will be unrestricted and simple, and air pressure will be used to exclude mud and water in the only perfect way, on horizontal planes. As the construction is independent of a natural roof, the depth and the attendant peril is diminished and the conditions of working are comparatively safe. This method is adapted to construction of pile foundations, where necessary, and provides for separate tunnels, although switches can be arranged to transfer trains if necessary from one tube to the other, and doors can be placed at intervals between the two tubes so that in case of accident, particularly fire in a train, the passengers can escape the flames and deadly fumes by entering the other tube and closing the door. It is not thought that this method will differ much in cost from driven tunnels where conditions are favorable to the latter method. In cases of mixed rock and earth in the same cross-section it is much cheaper, while the time required is less than in either case. The material advantage, however, lies in the stronger tunnel and better grades.

The method of tunnel construction proposed by Mr. Jules Breuchaud, C. E., provides for the preliminary construction of a pile foundation or solid footing in successive portions made just in advance of the tunnel walls and roof and all built within the protection of a shield. This shield, which may be considered as a movable pneumatic caisson, is designed to be sunk at any point in the alignment of the tunnel and to move forward on the natural or artificial bottom of any trench or tunnel, excavating the material in advance. Several shields may be placed at intermediate points, be simultaneously operated so as to construct adjacent sections at the same time, and thus greatly diminish the duration of the work. The shields may move through water, silt or mud while the excavation of soft or hard material progresses on the under side, and are primarily adapted to the construction of tunnels without natural roofs; but they may be modified for the construction of submerged foundations, piers, pipe lines or conduits. The shields are rectangular with vertical sides and ends, horizontal top and rounded corners, and are made with double walls enclosing space around the sides and roof, which is divided into numerous air-tight chambers by transverse vertical and horizontal partition plates. These chambers are connected and are accessible from the interior of the shield by covered manholes and doors, as shown in the sections.

The shield has only four sides, being open at the rear and bottom, and is braced by the interior solid plate diaphragms between the air chambers. Its lower part is an unobstructed working chamber corresponding to that of an ordinary pneumatic caisson. There is a transverse vertical bulkhead near the forward end enclosing a chamber reaching to the roof and affording an unobstructed space for the driving of foundation piles, which may be supported in a traveling carriage, handling also the driving apparatus. The front end of the shield is a solid plate diaphragm, which may be stiffened by longitudinal bracing to the transverse bulkhead, as indicated by dotted lines. It is pierced with horizontal rows of small holes through which pneumatic and hydraulic jets can be played to loosen the material in front. There are other small holes, provided with stuffing boxes, for the insertion of drills to attack rock, boulders, hardpan, etc. Larger holes are also provided and covered with water-tight inside plates, which may be removed to reach external objects.

The excavating jets are supplied by nozzles or flexible connections branched to horizontal pipes running across the inner face of the end of the shield, connected with large mains permanently built into the concrete floor of the tunnel. The compartments in the roof and sides are independent and can be filled with water ballast or emptied by a system of pressure pipes operated from the power plant in the shaft or on shore. The lower chambers in the sides are tapered at the bottom to give more space in the working chamber, and can receive pig iron ballast to increase the stability of the shield. One of the interior center chambers is provided with vertical, telescopic, cylindrical shafts which may be projected through the roof and carried above the surface of the water, so as to terminate there with an air lock and afford independent access. The shield is seated on horizontal transverse rollers under its parallel sides, which take bearing on the tops of special pairs of deep I-beams permanently embedded in the concrete footing of the tunnel. The side plates of the tunnel project below the rollers and enclose the full depth of the sides of the concrete footing, thus guiding the tunnel in its alignment and serving to prevent the escape of compressed air, excepting under the higher front edge where its action would be beneficial rather than harmful in loosening the material about to be excavated.



Half Section X-X. Half Section W-W. Half Section Y-Y. Half Elevation Z-Z.
Shield Constructing Permanent Tunnel Foundation in Advance.

The longitudinal movement of the shield is effected in the usual way by means of hydraulic jacks placed horizontally to bear between the forward end of the last finished section of tunnel lining and a girder of corresponding outline in the rear of the shield. Besides, there is a horizontal row of jacks in the lower part of the front end of the shield which bear between a girder across the lower edge of the front diaphragm and the end of the completed floor platform. This latter set of screws, not ordinarily used in shields, is designed to give a balanced pressure and provide more regular and positive motion. The rear end of the shield is made to overhang the completed tunnel lining for a considerable distance and to slide upon it with a close joint. In operation the shield may be constructed at any conven-

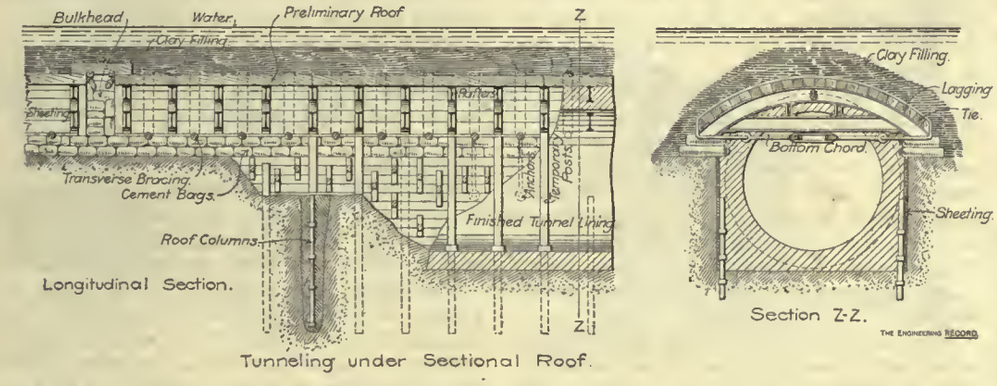
ient place on shore with a temporary air-tight bulkhead closing the rear end. It may be launched, floated to position and sunk as required, adjusted like a foundation caisson and connected to the end of the tunnel before removing the bulkhead, or the bulkhead may be attached to the walls of a tunnel lining built inside the shield and left to close it while the shield moves forward constructing a section of the tunnel.

In operation, at any given position, several rows of piles will first be driven inside the shield and capped with a grillage of longitudinal and transverse I-beams filled in with a solid bed of concrete, or the surface of the rock will be prepared to receive the tunnel floor which may be anchor-bolted to it, or the invert may be laid on a bed excavated in hard material. Then a section of the lining for the walls and roof will be built in the rear end of the shield and the material in front excavated through the orifices for that purpose. The jacks will then force the shield forward, another section of the floor and walls will be built, and so on.

Important features of this method are the ability to construct the foundation in advance from within the shield, to use the shield as a pneumatic caisson, and to build sections of the tunnel at intermediate points, and the safety for the workmen afforded by the closed forward end of the shield, which prevents any possible caving in or entrance of water while the air pressure is maintained. The framework of the shield is rigidly braced with heavy trusses, stiffened by deep flange plates and provided with lateral connections for outside guy lines which may be used to anchor it. The front end is provided with suction pipes through which soft material may be drawn into the shield and with bull's-eyes through which the character of the material in advance may be observed.

A process for building submerged tunnels in open trench through soft earth has been designed by Mr. Jas. C. Meem, who proposes to use a pitched or arched timber roof, built on shore in long sections, launched, floated to position and sunk on to longitudinal foundations previously laid in a dredged trench parallel to the side walls. Underneath this roof the excavation will be made in open trench, suitable foundations constructed and the invert, walls and roof of the tunnel built. The essentials of the process are the special roof and the method of supporting it and excavating and building beneath it. Two types of roof are proposed—one having double pitched I-beam rafters and horizontal cross-beams forming A-shaped trusses, and the other having segmental arch-shaped I-beams with horizontal ties connecting their lower ends, both types being covered with longitudinal timber lagging secured by straps on the upper side which are bent around the lower ends of the rafters and securely joined by tension bars with tightening adjustments. The roof sections are sunk so that their edges rest on the longitudinal walls, preferably built with concrete bags placed by divers. The abutting joints at the adjacent ends are covered with felt or steel aprons and the entire shield is well covered with a bed of clay and sand to exclude water from above and prevent the escape of compressed air from below. At intervals of several sections, short spaces may be left between the ends of the roofs and filled in with solid bulkheads to divide the tunnel into shorter sections, if necessary, for excavation and construction.

If additional stability is required, the roof may be temporarily secured by sinking on it loaded barges. After the roof is in position, excavation is commenced under it and, if necessary, air pressure is used there. The excavation is made in open trench with sheeting and bracing for the sides if necessary. In very soft material, short transverse drifts may be made in advance of the main excavation and sectional pipes sunk in them and filled with concrete to the roof, after which the excavation can be completed in short sections and the concrete invert laid and vertical posts set upon it, to which the weight of the roof may be transferred. It is designed to complete the permanent masonry roof arch underneath the roof shield and to leave the latter permanently above it. In order to anchor the buoyant wooden shield to the heavy tunnel masonry, the middle sections of the horizontal tie-bars may be revolved into vertical positions and built into the side walls, as indicated in the drawings. The method provides for preliminary roof protection, and, while it would be less economical than a shield for sub-aqueous tunneling in ordinary soft ground, the inventor believes that it will be especially suitable where the rock is overlaid with soft material and the tunnel cross-section is intersected by both strata. It is claimed that in a tunnel built by this method the approach grades could be materially lightened because the roof of the tunnel would not have to be depressed below the bottom of the river.



Tunneling under Sectional Roof.

The Use of the Public Streets as a Catch-all is thus commented on by Street Commissioner James Donovan, of Boston, in his 1901 report: "The public demands clean streets, but in a great many cases the individual is to blame for the unsightly appearance, and perhaps unconsciously so; however, the fact remains that surface your streets with the most modern paving, and place your patrol sweepers where you will, if the public persist in throwing papers, fruit parings, store sweepings, etc., into the streets, the surface cannot be kept in a clean condition." This is evidently in line with the opinions of Commissioner Woodbury, of New York, who has been known to put his views into actual use by compelling offenders in this respect to pick up the banana peels or other refuse they have thrown into the street and put it in their pockets.

Protection of Steel and Iron.

On March 6, Mr. Maximilian Toch delivered a lecture before the American Chemical Society, on the "Permanent Protection of Steel and Iron," and demonstrated by means of photographs and photo-micrographs that steel and iron are corroded in some cases slowly, and in others rapidly even when embedded in masonry. The microscopic structure of several cements was shown, and the speaker prophesied that in the future, oil paint will in a great many instances be displaced by cement paints. From chemical investigation it was concluded that the cements as used for building purposes are unfit for coating steel, because most of them are carriers of oxygen, and instead of liberating pure lime in their setting, they liberate a calcium ferrite which produces rust when in contact with a clean steel. The speaker mentioned novel experiments which he had made with cement preparations, by changing the specific gravity of the cement, ridding it completely of iron, and diluting it in such a way that it can be used as a paint. It is made to set quickly so that it not only adheres to the steel and iron but it has the same coefficient of expansion. It is anticipated that Mr. Toch's method, on which he has worked for years, will cause extensive changes in the preservative coating of steel structures. He believes that unless the masonry of some of the new sky-scrapers will support the floors and ceilings it is doubtful whether some of them will stand fifty years. Moisture alone will not rust steel or iron, but carbonic acid, ammonia and sulphurous acid are violent producers of rust. Continued oxidation is bound to weaken a steel member. It was stated that steel embedded in some kinds of cement would not oxidize, but that in other kinds it would oxidize rapidly.

Four Ice Water Drinking Fountains in Cambridge, Mass., were supplied with ice from June 14 to September 30, last, at a cost of $461.47, according to the annual report of Mr. E. C. Brooks, superintendent of water works. The cost was divided as follows: Central Square fountain, $119.70; East Cambridge fountain, $153.00; Harvard Square fountain, $90.15; North Cambridge fountain, $98.62. An appropriation of $500 was made by the City Council for this expenditure.

Third Rail Troubles from Sleet adhering to the rail has been overcome on the line of the Aurora, Elgin & Chicago Railway, the power plant of which was described in The Engineering Record of February 7. A solution of brine, stored in a tank on the front platform of the car, is fed upon the rail through a ¼-inch rubber tube. It is applied 5 to 10 feet in front of the first contact shoe and acts so quickly that the first shoe, it is said, will get current, this treatment apparently rendering the ice a good conductor. Eight gallons of brine sufficed for a run of 24 miles.

The Electrical Laboratory Commission of New York State, which was appointed by the Legislature of last year to investigate the necessity of establishing a state laboratory for electrical measuring instruments, apparatus and standards, has issued its report. The commission, which consists of Mr. Edward A. Bond, state engineer; Mr. Charles P. Steinmetz and Mr. Harold W. Buck, has recommended among other things that $275,000 be appropriated for the erection and equipment of the laboratory which is to comprise five buildings, as follows: administration building, electro-chemical building, machinery building, power house and storage building.

Hydrated Lime and Cement Mixtures.

Although recent improvements in cement-making machinery and great increase in the number and capacity of cement mills have much reduced the cost of Portland cement in this country, efforts are still being made to obtain economies in its use and extensions of its applications. The manufacture of improved hydrated limes has opened up several possibilities along these lines. Mixtures of the two in various proportions can be used for hard wall plasters and in many places in which the cheaper cements are now employed. As a hard wall plaster the mixture does not set so quickly under the trowel, as is sometimes objectionably the case with mixtures containing gypsum, and it can be mixed dry with sand and hair for immediate use, as can be done with plasters now in use. It is claimed that mortar made of the mixture works more easily in masonry and that the slightly greater cost is more than offset by the economy of labor resulting.

Recently a series of tests were made to determine the strength of a number of mixtures of Portland cement and hydrated lime, and some of the results are given below. The mortars used contained one part of the mixture and two parts of sand. The mixture of equal parts of lime and cement reported in the fifth column of the table was made by grinding the ingredients together in a ball mill for one hour.

Tensile Strength of Portland Cement and Hydrated Lime Mortars, in Pounds per Square Inch.

	1½ parts Hyd. lime, 1 part Port. cement.	1¼ parts Hyd. lime, 1 part Port. cement.	¾ part Hyd. lime, 1 part Port. cement.	½ part Hyd. lime, 1 part Port. cement.	1 part Hyd. lime, 1 part Port. cem. ground together.
	74	94	92	122	124
	84	110	122	140	145
7 days.....	88	98	140	168	140
	70	100	146	102	148
	92	106	98	116	132
Average ...	81	101	119	129	137
	144	128	178	172	158
	128	160	160	180	174
28 days.....	138	140	156	162	182
	130	146	180	194	170
	128	154	192	186	162
Average ...	134	144	173	179	169
	148	130	194	174	180
	168	172	235	...	166
3 months.....	140	160	246	188	174
	128	184	214	190	174
	155	124	194	170	170
Average ...	148	154	217	181	174

Tests on Portland cement alone—the same sample as used in above mixture tests: 7 days, 1 part cement, 2 sand—340, 345, 360, 354, 336; average, 347.

The hydrated lime had the following chemical analysis:

Insoluble matter	2.52	per cent.
Oxide of iron and alumina	0.56	"
Calcium hydrate	63.84	"
Magnesium oxide	32.20	"
Carbonic acid	0.59	"

On the 7-day test it is quite uniformly shown that as the percentage of hydrated lime increased, the strength decreased, which, of course, is a natural result as the strength of lime is naturally much less than that of Portland cement. This proportional increase is also shown on the 28-day test of all the samples mixed by hand, but on the 3-month test a change is noted, as the mixture containing the smallest percentage did not do so well as the ¾ to one. It is further noted that the increase in strength between the 28-day test and the 3-month test is comparatively small, showing that the material had practically reached its full strength in 28 days.

The difference in the 3-month test between the 1½ to 1 and ½ to 1 mixtures, 33 pounds, shows the increase in strength in the latter sample to be only 23 per cent., whereas, the additional per cent. of cement is about 70, showing that the hydrated lime does not merely act as a filler, but has strong adhesive properties in addition.

It should be pointed out that several hydrated limes hold water in excess of that required in chemical combination with the lime, and such uncombined moisture is detrimental. When the hydrated lime is mixed with cement in a dry condition, prior to making the mortar, the cement takes up the uncombined moisture, and a portion of the cement is rendered inert. As about 1 part of water will usually set 5 parts of cement in such mixture, from 3 to 6 per cent. of excess moisture in a hydrated lime would be dangerous within the limits shown by the above tests. There are, of course, methods of making hydrated lime which fully preclude the possibility of excess moisture. It is evident from this that the percentage of water used in hydration must be carefully proportioned for each lime, and worked continuously within narrow limits.

The tests were made in the laboratory of Booth, Garrett & Blair, of Philadelphia. The hydrated lime used was the brand known as Limoid and the cement was Nazareth Portland, both furnished by the Charles Warner Company, of Wilmington, Delaware.

Block Signals on an Elevated Railway.

At the meeting of the Boston Society of Civil Engineers February 25, Mr. Frank C. Stowell, roadmaster of the Boston Elevated Railway Company, gave an informal talk on the electro-pneumatic block signal system used in operating the elevated trains. There is probably no better example of the value of automatic signalling in expediting train movements. Here a block system was necessary because of the frequent service, the crookedness of the lines and the speed to be maintained, which is faster than anywhere else in the country. It is the only automatic block signal system for electric lines that insures control of the block signal by a train within the block.

The first problem considered was whether or not one of the rails of each track should be given up for signalling purposes. Surface electric railways could not give up one of the rails for this purpose, for, by so doing, they would practically double the resistance of their power return, but, in the case of the Boston Elevated, the structure itself was adequate as a return conductor. In the subway copper cable was laid to assist in the return. [Elevated trains pass through the subway.] Another problem, the possibility of the high voltage of the propulsion system—550 volts—getting into the signalling apparatus, which might cause a dangerous operation of the signal or destroy the apparatus, was satisfactorily solved. First, the block instruments were made of an electrical capacity equal to the full electro-motive force of the power circuit and, secondly, they were polarized so as to respond only to currents counter to those for the power. To secure these benefits the positive pole of the power generator was connected to the power or third rail and the negative pole to the return, while in the circuit for the signal apparatus, the negative pole was connected to the feed wire and the positive pole to the return.

The signals, actuated by compressed air cylinders under electrical control, are heavily counterweighted and each, in addition to overcoming the normal friction of its parts, has to operate an automatic stop shaft or trip. Each signal goes from danger to safety in about two seconds and is operated by a cylinder 3 inches in diameter, having a piston stroke of 4 inches under an average pressure of 70 pounds, representing approximately, 1/7 horse-power. It takes about ¼ watt to operate the signal valve. The compressed air is furnished by a 2 inch main extending the length of the road with ½ inch connections for the operation of the signals. The compressed air is furnished by two Ingersoll-Sergeant duplex, Class J compressors, located at each terminal, geared direct to a 40 horse-power Westinghouse 4-pole, 550-volt direct current motor which is operated from the power mains. Either one of these compressors is capable of maintaining the air supply, and each is provided with an automatic unloading device permitting the motor to run continuously, yet economically, when compression ceases.

At each terminal and at two junctions of the road a motor-generator is located, having a capacity of 50 amperes at 110 volts (5.5 kilowatts) —generating normally 40 amperes at 90 volts each—any two of which in parallel will generate enough power to operate the block system. This power is applied to the operation of 175 signals, 65 switches and 40 or 50 indicators of various types, each of which operates about 600 times a day. The signal generators are directly connected to the main feed wire of the propulsion system, so that any interruption in the current for the signal system will also stop the cars. The trip, mentioned above, is an attachment which operates with the signal, and sets the air brakes of a train should it pass the signal while at danger. By experiments made it was found that this trip could be relied upon, and that, with a fairly good speed, it will stop a train from 50 to 90 feet from the trip. At junctions the signals are semi-automatic and interlocking, being controlled from towers.

To keep ice and snow from the power rail two stiff brushes are fitted to each car. Within ten minutes the brushes on the different cars all over the line can be put in operation by telephoning to the station agents, who set levers which engage and set the brushes on the trains as they pass. A flat car, equipped with eight stiff brushes is held ready for emergency cases.

The Charles River drawbridge called for a number of novel devices for its operation. In opening the draw, before the draw-lock can be released, all signals governing movements over the structure must be set at danger. This act releases mechanically the lever controlling the draw-lock, which when withdrawn closes a local circuit and releases the gearing for the operation of the draw. When the draw is closed a circuit controller establishes a contact controlling the draw signalling device only when the draw is in its proper alignment, both vertically and horizontally. In series with this contact is another which insures the proper position of the wedges supporting the draw ends before the closure of the contact is possible. When these contacts are established, an indicator in the tower gives notice, whereupon signals governing movements over the draw are freed.

A Manufacturer's Right to His Name has again been upheld, this time in the U. S. Circuit Court for the Southern District of New York, which issued a perpetual injunction on December 23, enjoining a competitor of the Babcock & Wilcox Company, from selling, as of the B. & W. or of the Babcock & Wilcox type, boilers not made by the Babcock & Wilcox Company. The court rules that the trade name does not describe or distinguish any type or form of boiler or other apparatus, but that it identifies exclusively the product of the method, tools and materials employed in the manufacture, irrespective of the form of such product. It decides that the trade name cannot be truthfully or lawfully used in relation to any apparatus manufactured by any other than the owner of the name.

Ventilating and Heating in the Cornell Medical Building.

Among the several new buildings for Cornell University, at Ithaca, N. Y., the latest to be completed is the Medical Building, Stimson Hall, which occupies a prominent position near the center of the campus. Mr. William H. Miller, of Ithaca, was the architect for the structure, and it shows careful planning, especially in interior arrangement, to meet conveniently and sanitarily its intended uses. While not as large as Cornell's New York Medical Building, which was described in The Engineering Record of March 5, 1901, it is very complete and modern in all of its appointments. In common with all other University buildings, it is heated by steam from a central station on the campus. Ventilation is provided by a plenum fresh air system independently of the heating by direct radiation. Ventilation is accomplished mostly by depending on the pressure of the fresh air supply, but in certain locations where materials of an offensive nature are handled it is assisted by induced draft systems having two exhaust fans in the attic. As far as possible all this work has been confined to the third floor and as a result, when one enters the building, the peculiar odors so characteristic of hospitals and medical schools, are scarcely, if at all, perceptible.



CORNELL MEDICAL BUILDING, ITHACA, N. Y.

To match the Library and Law School buildings, gray canyon Ohio stone has been used for facing the walls, and half the roof is of glazed Spanish tile. The other half of the roof extending to both sides of the ridges is glass-skylighted as may be seen on the accompanying cut of the architect's perspective. The building is three stories in height with an attic above, a basement beneath and in some parts a sub-basement. In plan it has the form of an E with the front facing north and the three wings extending to the rear. The middle wing contains the stairways from floor to floor and an elevator upon which bodies or other specimens are taken to the various desired points, the arrangement being such that it is not necessary to pass these articles through the hallways except on the top floor. The frontage of the building is 157 feet and the ground area about 12,250 square feet. The main entrance is at the middle of the front and two smaller entrances are provided at the ends. On all floors a corridor extends east and west along the rear wall of the main part of the building. All ceilings and sub-floors are covered with tarred paper and 1¼ inches of furring with all air spaces cut off, and all walls are lathed with expanded metal and plastered with King's Windsor cement. The building is finished in chestnut throughout; base, casings, chair rails and picture moulding. The sanitary shoe at the bottom of the base is made with a small cove and all angles in the plastering are coved.

The basement, given in plan herewith, contains most of the mechanical equipment including the ventilating apparatus, two transformers for the lighting, the refrigerating plant for the cold storage and a hot water boiler for the supply of the plumbing fixtures, which may be heated by steam in the winter and by a stove in the summer. Part of the basement is excavated to a greater depth than the rest to accommodate the ice-machine room, cold storage, embalming and crematory rooms. A cellar is also formed under the two recitation rooms at the west end of the basement and contains a dark room and storage for frogs and other live specimens. An amphitheatre occupies the east wing of the basement extending up through the first floor, the stage end being on the court side and having an outward extension in the form of a skylighted alcove. The seats are placed on stepped platforms at a considerable pitch and the space under the rear portion is utilized as a store room. An exterior room is built at the outer corner of the alcove for the storage of alcohol and other combustibles and at the inner corner there is a preparation room used in connection with the amphitheatre. Both are made thoroughly fireproof, and by their isolated location reduce to a minimum the possibility of communicating fire to the main building. The Crocker-Wheeler motor and driving mechanism for the elevator in the middle wing is contained in a sub-basement portion directly under this preparation room.

The first floor, in addition to the upper part of the auditorium, includes a museum, faculty room, library, office, two recitation rooms, study and two coat rooms containing toilets. The second floor has been built, as the perspective shows, with an abnormal amount of window surface and contains probably the best lighted laboratories for microscopic work in the world. Along the front, where they receive the most light are two general laboratories and at each front corner a private laboratory. The four laboratories are separated by light paneled partitions which can be removed so as to form one large room, or otherwise divided as desired. The two end wings each contain a research laboratory and three rooms for special students or instructors, and at the ends of the main hallway are two preparation or work rooms. At the inner angles of the middle wing and extending over the court two triangular fireproof rooms have been built for the safe disposal of incubators.

All dissecting is done on the third floor. There is one large room for this purpose, a smaller one for special dissecting, a general work room with an adjacent cold storage for temporarily storing bodies or parts, an assistant's room, two toilets, a small amphitheatre, and a large work room and office for the head of that department. The floor is of special construction to make it water-tight on account of the frequent scrubbings necessary in the dissecting rooms. The sub-floor is covered with a layer of heavy tarred paper well coated with asphaltum, then another layer of tarred paper turned up six inches on the side walls, and on this is laid the furring and the maple floor. The attic at the top of the middle wing contains a maceration room to be used for cleaning skeletons, and has a balcony projecting from it where the bones may be dried and aired. The main part of the attic is used for photographic work, being particularly well adapted for it on account of the profuse lighting afforded by the large skylights. The attic also contains the two sets of apparatus for assisting the ventilating.

The warm fresh air supply to the building is provided by a fan and heater of the Buffalo Forge Company's make. The cold air inlet is placed at a window on the east end of the first floor, the opening being about 5½x8½ feet. Through a short duct the air passes to a 5x6 foot vertical shaft to the basement, thence through a galvanized iron duct, containing a regulating damper and the heater, into the air chamber. The heater consists of six sections of 1-inch pipe coils and is 7 feet long by 8 feet 10 inches high, having a total of 3,798 square feet of heating surface. The steam supplied to the heaters is automatically controlled by a Johnson thermostat, hence it was unnecessary in this case to install the usual cold air by-pass around the heater. The air passage, or plenum chamber, is 5 feet wide, 12 feet high and 106 feet long, and continues as a 48x36 inch galvanized iron duct to the west end of the building. The centrifugal fan is 8 feet in diameter and 42 inches wide at the periphery, and is placed without casing within the air passage near one end of a shaft 18½ feet long, extending through the galvanized heater duct and belted at its outer end to a 15 horse power General Electric motor, running at 1,200 revolutions per minute. The fan runs at 180 revolutions, and has a capacity, as given by the makers, of 42,000 cubic feet of air per minute, making the average velocity of the air in the passage about 700 feet per minute. At the ceiling of the basement the connections are made from the air passage to the base of the flue risers, one riser being run for each register and all contained in the wall which forms the north side of the hallways. With a few exceptions, which will be noted later, but one fresh air and one vent register is allowed to a single room, the former being placed 8 feet above the floor and the latter 3 inches above. The velocity of the air entering the rooms is in most cases 300 to 350 feet per minute and is roughly the same at its discharge. The sizes of the registers are proportioned to pass, at about the above velocity, a sufficient quantity of air to change the contents of most rooms once every 10 minutes, and twice as often in the coat, embalming and dissecting rooms.

The lecture room in the west wing of the basement is one of the exceptions to the general rule. The air is admitted through two 24x24 inch registers in the front wall near the ceiling at about 200 feet per minute and is removed at nearly the same velocity through three registers in the face of the speaker's platform, having a total area of 7¾ square feet. The supply registers are connected by a Y-branched duct to the main air passage and the exhaust registers, through a 24x36-inch shaft and a 30x12-inch wood duct in the cellar, deliver into the

base of a 24x28-inch flue up through the roof.

The amphitheatre in the east wing will seat 122 persons and has the most involved ventilating scheme. The fresh air is taken from the air passage through a 44x32-inch brick tunnel below the basement corridor extending at right angles to the passage. The extension of the brick duct under the room is increased in height to meet the plenum chamber enclosed between the seat platforms and a false inclined floor beneath. From the plenum chamber thirty-eight 4x24-inch registers, placed vertically in the seat rises, discharge the air at but 140 feet per minute. Two 20x30-inch registers near the floor at either side of the stage alcove remove the foul air at a velocity of somewhat over 300 feet per minute and are connected to a 20x24-inch shaft to the attic.

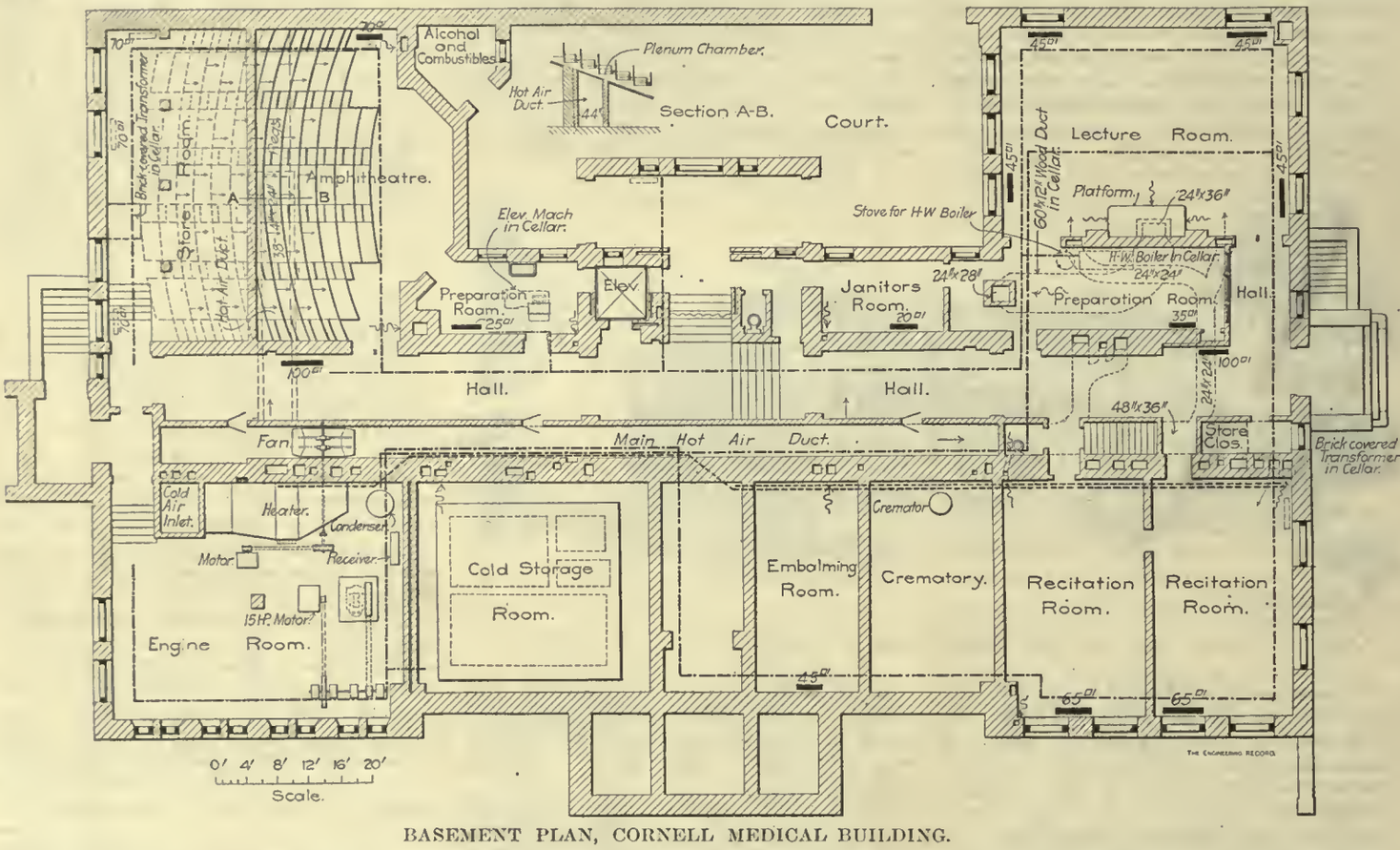
For its size the small amphitheatre on the third floor is designed to hold more people at one time than any other room. It is capable of seating 90 persons and has a capacity of only 19,600 cubic feet, the air supplied in a minute being therefore 1/10, or 1,960 cubic feet. It is unlikely that the room will ever be taxed to its full seating capacity, but even in such an event each person would be supplied with 22 cubic feet of air per minute, which is a fair amount, 30 being considered the best practice.

As before stated, it was calculated to replace the air in the dissecting rooms once every five minutes. This has been accomplished by making the ratio of register capacities to cubical contents of the rooms greater though not double that used elsewhere, and by providing a higher velocity of discharge through the use of an exhaust fan in connection with the vent flues. The large laboratory has four supply and four discharge registers, three of each being 16x32 inches in area and the fourth 24x30. All are placed in the south wall at approximately equal intervals, the vent registers alternating with the supply. By a test made in this room since the building was completed it was shown that the required conditions were fulfilled. The greatest velocity was 558 feet per minute and was found at an inlet register, and the lowest, 287, through a vent. The special dissecting laboratory has one register for supplying and one for exhausting, both being 16x32 inches, the required velocity figuring a trifle over 400 feet per minute. The small rooms for special students or instructors in the wings of the second and third floors receive fresh air through ducts from the larger adjoining inlets and have vent openings near the floor to communicate with the main ducts.

The rooms whose ventilation is augmented by exhaust fans are in the basement and third floors only. The amphitheatre, cold storage, embalming room, crematory, two toilets and the cellar have their vent flues combined in the attic into a duct system that connects to a disk fan discharging through the roof about half way between the middle and the east end. It is interesting to notice that the cold storage is included in this arrangement. Naturally no warm fresh air register is allowable there and an exhaust on its vent will therefore tend to produce a vacuum within the containing room which insures an indraft when the door is opened and keeps the stench from escaping any way but up the flue. The embalming room and crematory also have vent registers only, so that there the same desirable results are achieved. A second induced draft system connects the five vent flues from the dissecting rooms to a fan discharging through a shaft near the west end of the ridge of the roof. Both fans are 48 inches in diameter, of the Buffalo Forge Company's make, and are belt driven at a speed of 265 revolutions per minute by two 2-horse-power General Electric motors. They each have a capacity when run at .5 ounce pressure of 8,000 cubic feet of air per minute, which in the case of the second system would allow a velocity of 525 feet per minute through the five registers that it embraces. The remainder of the vent flues from the building are connected by galvanized iron ducts in the attic into twelve groups and discharge through openings of various sizes in the ridge of the roof.

The direct radiation used in the building is obliged to counteract the heat lost through the walls and is therefore disposed only along the outside walls. The radiators are of the cast iron sectional type, 82 in all, and are connected on a one-pipe system with separate return main in the basement, and automatic air valves in nearly all cases. The sizes and number used are proportioned according to the amount of exposed wall surface and the direction of its exposure, the smallest containing 10 square feet of surface, the largest 110, and the entire number 5,740 square feet. The steam is supplied, as stated before, from the central heating station and is reduced where it enters near the southwest corner of the building to a pressure at or below 5 pounds. The 5-inch main supply pipe extends in the form of a loop around the cellar with branches to the heater coils, the cellar and basement radiators, and to the bases of the various risers, which are run in chases in the walls for the supply of the upper floors. The 2-inch return main follows a similar course, all returns and drips from steam risers being trapped before entering it, and contains a Bundy pump for raising the water up into the main return to the central station. The guarantee for the direct radiation declares that a pressure of 5 pounds will heat every room in the building to 70 degrees with the outside temperature at zero and the wind in any direction, and further promises a perfect and noiseless circulation throughout the system with a pressure as low as 1 pound.

The electric installation includes a power service using direct current at 550 volts, also used for lighting five "lanterns" in series, on the third floor, and an incandescent lighting service from the University plant, using alternating current transformed from 1,000 to 100 volts after entering the building. The latter is connected to the city current, transformed from 2,000 to 100 volts, to be used in case of emergency. In all there are 10 motors with an aggregate of 50 horse-power, of which the 15-horse-power motor for the refrigerating plant

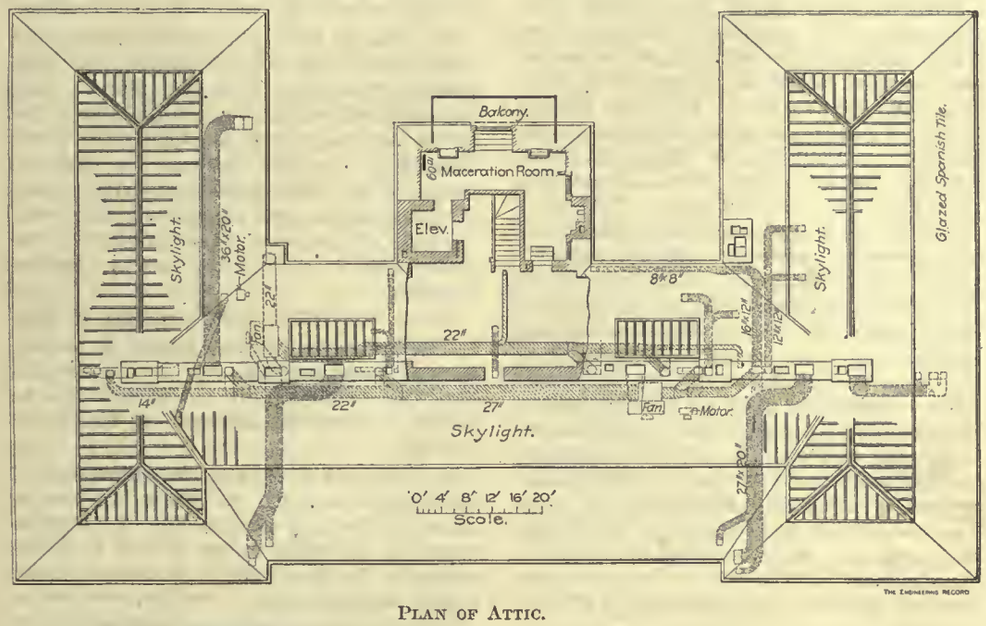


BASEMENT PLAN, CORNELL MEDICAL BUILDING.

and one 15 and two 2-horse-power motors for the ventilating apparatus have already been mentioned. In addition to these there is one of 10-horse-power for the elevator, and four more 2-horse-power motors; two in preparation rooms on the second floor, one in the general laboratory on the same floor and one in the special dissecting room on the third floor. All are provided with switchboards or starting boxes located about 4 feet from the outlet boxes.

and 51 outlets on the third floor, using some 116 double pole snap switches.

The lighting of the amphitheatre is specially divided in switch control so that almost any desired degree of brilliancy is available. There are four clusters of 6 lights each, one of 10 lights, and 12 separate lights are placed at the back of the arch in front of the stage alcove. The 10-light cluster is operated by one switch, three other switches each light two lights in each of the 6-light clusters and three more con-

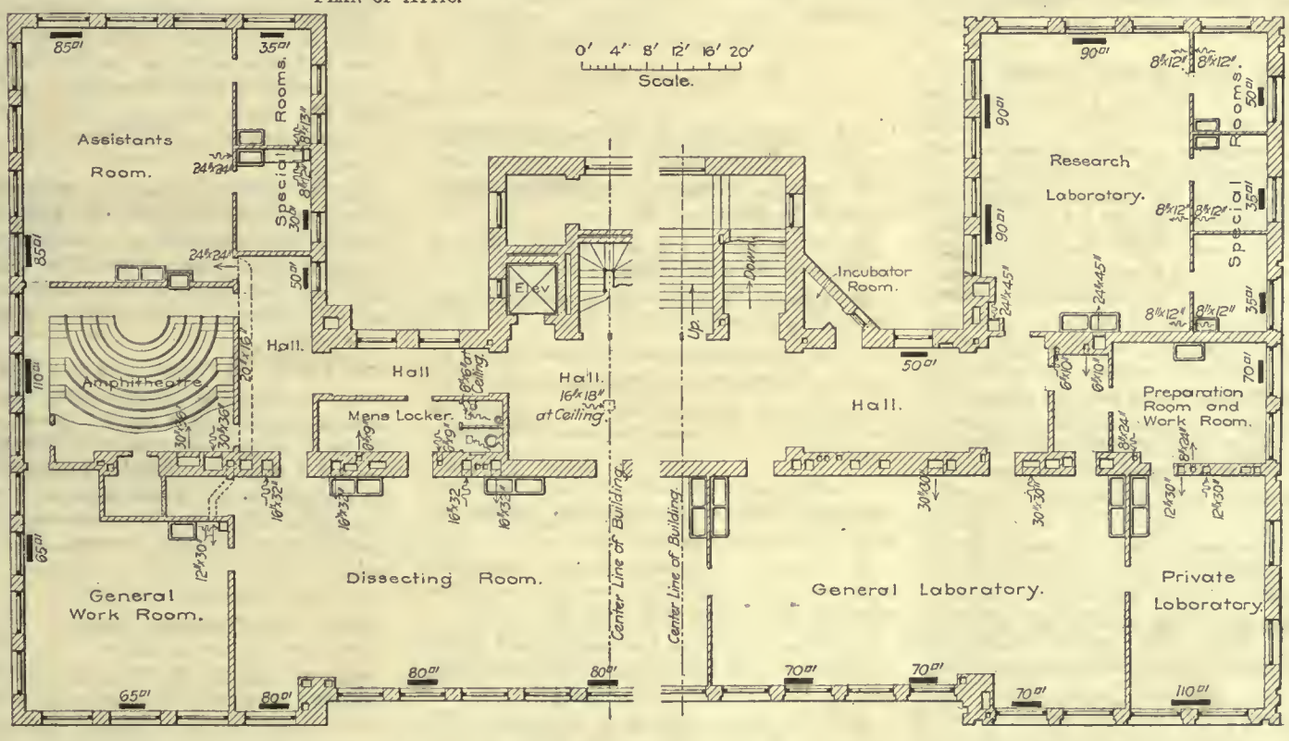


PLAN OF ATTIC.

Buffalo Forge Company; the electric elevator by the Howard Iron Works; and the refrigerating plant by the Case Refrigerating Machine Company, all of Buffalo, N. Y. The electric wiring for the power and lighting was done by Messrs. Treman, King & Company, of Ithaca.

The Engineers' Society of Western Pennsylvania held its annual banquet at Hotel Schenley, Pittsburg, on February 27. Dr. Walter Riddle was toastmaster; President Joseph Ramsey, Jr., of the Wabash Railroad, and Mr. James Mapes Dodge, president of the American Society of Mechanical Engineers, were among the prominent speakers. The society now has 831 members. Recently a structural section was organized; chemical and mechanical sections have been formed previously.

Tests of a Buffalo Forge Company's engine, conducted recently at the Worcester Polytechnic Institute by Professors Sidney A. Reeve and C. M. Allen, gave the following results: 31.3 pounds of steam per indicated horse-power per hour when developing 71.55 indicated horse-power; 33.3 pounds per horse-power when developing 56 indicated horse-power; 35.3 pounds with 37.2 horse-power; 49.9 pounds with 16.9 horse-power; 33.1 pounds with 89.3 horse-power; 3 horse-power, or 4.3 per cent. of rating, when run light. The engine is a 12x12-inch horizontal, center-crank, shaft governor engine, running 300 revolutions per minute. The cut-off was maintained normal and the steam pressure was 80 pounds gauge.



HALF PLAN OF THIRD FLOOR.

HALF PLAN OF SECOND FLOOR.

For the electric lighting a transformer is installed at each end of the basement, with a 200-ampere switch and cut-out on the mains where they leave the transformers. Each transformer has a capacity of 400 lights and supplies one-half of the building, the mains being run in chases in the walls to the separate floors. To provide for a disablement of either transformer, the two sets of risers may be connected together by the closing of an emergency switch at the base of the riser conduit at the west end of the basement, so that either transformer can furnish current to any part of the building. The building is wired for 701 incandescent lights

trol the lights on the arch; Nos. 1, 4, 7 and 10 being on one circuit; 2, 5, 8 and 11 on the second, and 3, 6, 9 and 12 on the third. The lights in the cellar and cold storage have water-proof sockets and those in the inner storage have vapor-proof globes; otherwise the lamps are of the usual variety and are mounted in common fixtures or suspended as drops, there being 365 of the latter.

The contractors for the building were Messrs. Driscoll Brothers & Company, of Ithaca, N. Y., and for the steam heating and plumbing, Messrs. Jamieson & McKinney, also of Ithaca. The ventilating apparatus was supplied by the

The Numbering of Houses in Halifax, N. S., is referred to as follows in the last annual report of City Engineer F. W. W. Doane: The numbering has been done without any regard for method or system except that it runs from south to north and from east to west, the odd numbers being on the east and north sides, and the even numbers on the west and south. In one street number 38 is opposite number 293. In others there are more doors than numbers and ¼, ½ and ¾ are used. In one street there are four sets of numbers; in others no numbers at all; and yet property owners protest against any change.

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers.. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Book Notes.

Lime and Cement Industries of New York. By Heinrich Ries, Ph.D. Chapters on the Cement Industries in New York. By Edwin C. Eckel, C.E. Bulletin of the New York State Museum, No. 44, Vol. 8. Albany: University of the State of New York. 968 pages, illustrated.

This volume, which is number eight of the Bulletins issued by the New York State Museum, of which Mr. Frederick J. H. Merrill is director, was compiled by Mr. Heinrich Ries, Ph.D. It contains chapters on the cement industry in New York by Edwin C. Eckel, C.E. The book was written to inform quarry owners concerning the uses of limestone and the character which the stone should possess to make it of value for different applications, also to supply consumers with information concerning the limestone formations in New York State. The opening chapter describes the limestone and the uses to which it is put, and methods of burning it in various types of kilns are shown. Rosendale cement is then taken up, a considerable number of analyses given, and various kinds of machinery used in its manufacture described and illustrated. A brief history of the manufacture of Portland cement is given, also a great deal regarding the chemistry of cements, various types of kilns, methods for grinding, and methods of testing cement and specifications for the same. The cement industry in New York State is described in detail, and data regarding the different plants given. Mr. Eckel's chapter gives the early history of Portland cement manufacture and a brief description of each plant, usually accompanied with an analysis of the raw material. The result of a number of tests made by Mr. Edward A. Bond, New York State engineer, are reproduced. The book has an excellent map showing the locations of limestone quarries, marl deposits and Portland cement plants, and should be of value and interest to anyone identified with the cement industry.

How to Become a Competent Motorman; being a practical treatise on the proper method of operating a street railway motor-car; also giving details of how to overcome certain defects. By Virgil B. Livermore, chief instructor with Brooklyn Rapid Transit Company, and James Williams, shop foreman with Brooklyn Rapid Transit Company. New York: D. Van Nostrand Company. 232 pages, illustrated. Price, $1.00.

This book, as its title indicates, gives information about street railway motors, controllers and other parts of a car's equipment and tells how to meet emergencies. It includes much practical instruction stated in a clear and concise manner.

Engineering Contracts and Specifications, including a brief synopsis of the law of contracts and illustrative examples of the general and technical clauses of various kinds of engineering specifications. By J. B. Johnson, C. E., late dean of the College of Mechanics and Engineering, University of Wisconsin. Third Edition, revised. New York: Engineering News Publishing Co. 566 pages. Price, $3.

This edition represents an enlargement over those previously issued of some 114 pages. A general revision has been made of part IV., illustrative examples of complete contracts and specifications. Several specifications in early editions have been entirely changed, or replaced, and a number of new ones have been added. Among the latter are specifications for riveted steel water pipe, railroad concrete work, bridges and viaducts, filter gravel and sand, also the specifications for testing hydraulic cement adopted by the Corps of Engineers, U. S. Army. The changes made add considerably to the value of a work the good reputation of which has already been established. It is regrettable, however, that the paper used was not of a better grade.

Personal Notes.

Mr. Luther Dean has been elected city engineer of Taunton, Mass.

Mr. Thomas White has been elected borough engineer, at Glassport, Pa.

Mr. W. A. Gould has been elected highway surveyor of Southboro, Mass.

Mr. Edward E. Howe has been elected highway surveyor of Lunenburg, Mass.

Mr. H. A. Holstein has been reappointed assistant city engineer of Dunkirk, N. Y.

Maj. John C. Broatch has been re-elected superintendent of the water-works of Middletown, Conn.

Chief Engineer D. Smith, U. S. N., has been appointed chief engineer on the retired list with the rank of rear admiral.

Mr. Samuel R. Kennedy has been appointed superintendent of the St. Louis division of the Southern Railway at Princeton, Ind.

Mr. Frank T. Dodge has been elected superintendent of the water-works of Portland, Ore., and Mr. D. D. Clarke, chief engineer.

Mr. T. K. Seburn has been appointed superintendent of streets of Riverside, Cal., succeeding Mr. G. F. Seger, who has resigned.

Mr. Thomas S. Adams has been appointed assistant engineer of signals of the New York Central & Hudson River Railroad, with office in New York City.

Mr. Frank E. Ward, general superintendent of the Great Northern Railway, has been made general manager, at St. Paul, Minn., succeeding Mr. John F. Stevens.

Mr. A. H. Holder has been appointed division superintendent of the Missouri Pacific Railway, at Concordia, Kan., succeeding Mr. J. F. Simms, who has been transferred.

Mr. Thomas Tait, manager of transportation of the Canadian Pacific Railway, has been appointed general manager of the government railways of the colony of Victoria, Australia.

Mr. Joseph Langlois has been appointed division superintendent of the Chicago Great Western Railway at Fort Dodge, Ia., and it is stated that he will have charge of the new line from Ft. Dodge to Omaha.

Mr. Michael Day has been appointed supervisor of bridges and buildings of the Illinois Central Railroad, with headquarters at New Orleans, succeeding his brother, Mr. W. G. Day, who has resigned to engage in other business.

Mr. John E. Field has been appointed chief engineer in charge of the irrigation work to be done in Wyoming. It is said that the first project to receive attention will probably be the Devil's Gate reservoir on the Sweetwater River.

Mr. Burdett Moody, assistant to chief engineer of the Homestake Mining Co., Lead., S. D., has resigned and associated himself with Mr. Henry Schnitzel, of Lead, to supervise the development of mineral territory in western Wyoming.

Messrs. Nelson P. Lewis, Nicholas S. Hill, Jr., Henry A. La Chicotte, Samuel C. Thompson and Lazarus White have been appointed a committee to prepare the constitution for the Society of Municipal Engineers of the city of New York.

Mr. Theodore D. Faulks, superintendent of the West Orange (N. J.) Water Co., has resigned to accept a position with the Neptune Meter Co., at Chicago, and he has been succeeded by Mr. Benjamin F. Williams, Jr., assistant superintendent for the past two years.

Through a false report it was incorrectly stated in this column three weeks ago that there had been a change in the mechanical superintendency of the Minneapolis, St. Paul & Sault Ste. Marie Railway. Mr. T. A. Foque still holds that office, with headquarters at Minneapolis.

Prof. H. E. Clifford has been promoted to an associate professorship in the Massachusetts Institute of Technology in the Department of Electrical Engineering, of which Dr. Louis Duncan is the head, and Mr. Harrison W. Hayward has been appointed instructor in mechanical engineering.

Mr. Charles S. Powell, who has been associated with the Westinghouse electric interests since 1893, and for the past six years manager of the Cleveland office of the Westinghouse Electric & Mfg. Co., has been appointed assistant manager of the British Westinghouse Electric & Mfg. Co., Ltd., Westinghouse Building, Norfolk Street, Strand, London, W. C., England.

Obituary Notes.

Mark L. Deering, an inventor of machines for manufacturing hollow ware from wood pulp, and of hoop drivers, riveting, painting and paper-bag and many other machines, died in New York, March 5, aged 59 years.

William Nolan, founder and head of the firm of Nolan Brothers, best known as railroad and bridge contractors, died in Reading, Pa., February 28, aged 62 years. In addition to his railroad work, he was identified with several public corporations of Reading, including the street railway and the lighting company.

Richard M. Upjohn, an architect of many of the older prominent buildings in New York and Boston, died in Brooklyn, March 3. He was born in England in 1828, but was educated in this country. His chief work was probably the Hartford, Conn., Capitol. In his later active years he served as an expert on a number of

commissions and was a fellow of the American Institute of Architects.

Robert Blum Olney, superintendent for the American Pipe Mfg. Co., at Charleston, S. C., died March 4 at San Antonio, Tex., where he had gone in quest of health. He was born in 1870 and was graduated from Lehigh University in 1892. For four years he was assistant city surveyor of Charleston and for the past eight years was engaged almost entirely in sewer work in that city.

Benjamin H. Flynn, Jun. Am. Soc. C. E., engineer of the Ohio State Board of Health, died March 8 at his home in Columbus, of scarlet fever. He was but 27 years of age and since July, 1898, on his graduation from Ohio State University, he had been engaged in gauging streams, water supplies, sewer systems and watersheds. He was also state hydrographer of the U. S. Geological Survey. He will be remembered as the author of a valuable letter relating to residential septic tanks, printed a short time ago in these columns.

Walter A. Scott, since 1896 general manager of the Chicago, St. Paul, Minneapolis & Omaha Railway, died March 4, in St. Paul, aged 63 years. His career is another example of the reward of industry and perseverance. When 17 years of age he obtained employment as apprentice in a roundhouse of the Chicago, Iowa & Nebraska Railway, and rose gradually until in 1885 he became assistant general superintendent of motive power of the Chicago & Northwestern Railway. For the nine years previous to 1896 he was general superintendent of the Chicago, St. Paul, Minneapolis & Omaha Railway.

Notes.

Bricks in Cape Town, South Africa, are reported to cost from $22.50 to $27.50 per thousand. It is stated in "Consular Reports" for February that they are so poorly made that they have to be plastered with stucco to keep them from being destroyed by the action of the weather. These bricks are usually 2½x4½x9 inches in size.

Telegraph, Telephone and Trolley line pole expense is being subjected to a considerable economy at Battle Creek, Mich., where, it is reported, the poles are ordered 5 feet short and are doweled and strapped to Portland cement concrete bases, which extend down to their required depth below the surface of the ground and thus prevent decay in that part of the pole where it is likely to be the most rapid and troublesome. The base has an octagonal cross-section with four vertical strips of scrap iron projecting from its sides and anchored to the bottom so as to receive the flattened sides of the pole to which they are bolted. The saving is said to be from 35 to 50 per cent.

The Cost of the Siberian Railroad up to October last is stated is an extract from the "Russian Economical Review" to be $401,700,000. In 1899, the expenses averaged $3,870 per mile. As faster train service becomes necessary the cost will be increased; so that it is estimated that for the entire 5,146 miles of road an annual expense of $41,200,000 will be incurred to cover interest and maintenance charges. To meet this expense the traffic should reach 400,000 metric tons of freight per year. In 1899 the traffic amounted to 40,000 metric tons, and in 1900 to 45,000 tons. It is thought that the small increase in traffic has been due in part to Chinese riots and bad harvests for two consecutive years.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 288, 21, 23 and 30.

SUNDRY CIVIL APPROPRIATIONS.

Public Document No. 157, as passed by Congress, provides for the following appropriations and continuations of appropriations for public buildings, for the year ending June 30, 1904—P. O., Post Office; C. H., Custom House; Ct. H., Court House:

Alabama.—Anniston, P. O., $25,000; Montgomery, Ct. H. and P. O., $40,000.

Arkansas.—Ft. Smith, Ct. H., P. O., etc., $75,000.

California.—Fresno, P. O. and Ct. H., $25,000; Los Angeles, P. O. and Ct. H., $212,500; San Francisco, C. H., $125,000.

Colorado.—Colorado Springs, P. O. and Ct. H., $33,750; Leadville, P. O., $35,000.

Connecticut.—Hartford, C. H. and P. O., $190,000; Meriden, P. O., $25,000; Waterbury, P. O., $33,750.

District of Columbia.—Laboratory, National Bureau of Standards, $150,000; Treasury, Butler and Winder Bldgs., $25,000; Ventilating Appar., Treasury Bldg., $175,000; Freedmen's Hospital Bldg., $50,000; Repairs to Capitol, $295,950; Bldg. for Dept. Agriculture, $250,000 ($100,000 at once, and limit of cost, $1,500,000).

Florida.—Jacksonville, P. O., C. H., etc., $30,000; Tampa, Ct. H., P. O., and C. H., $115,000.

Georgia.—Macon, Ct. H. and P. O., $48,000; Athens, P. O. and Ct. H., $25,000.

Illinois.—Chicago, P. O. and Ct. H., $570,000; Springfield, Ct. H. and P. O., $125,000.

Indiana.—Hammond, P. O. and Ct. H., $35,000; Indianapolis, P. O., Ct. H., and C. H., $600,000.

Iowa.—Boone, P. O., $25,000; Waterloo, P. O. and Ct. H., $37,500.

Kansas.—Emporia, P. O., $26,000.

Kentucky.—Paducah, P. O., Ct. H., etc., $45,000.

Maine.—Augusta, P. O., Ct. H., etc., $125,000.

Maryland.—Baltimore, C. H., $400,000; Cumberland, Ct. H. and P. O., $50,000.

Massachusetts.—Holyoke, P. O., $33,750.

Michigan.—Battle Creek, P. O., $25,000; Kalamazoo, P. O., $30,000.

Minnesota.—Minneapolis, P. O., $225,000.

Mississippi.—Biloxi, P. O., Ct. H. and C. H., $31,250.

Missouri.—Joplin, P. O., $75,000; Kirksville, P. O., $30,000; St. Louis, P. O., $137,500.

Montana.—Butte, P. O., $175,000.

Nebraska.—Hastings, P. O., $60,000; Lincoln, Ct. H. and P. O., $175,000; Norfolk, P. O., $85,000.

New Jersey.—Atlantic City, P. O., $31,250; Elizabeth, P. O., $33,750.

New York.—Ellis Isl., N. Y. City, additions to hospital, $100,000; construction new island near Ellis Isl., $150,500 (in all, $380,500); Jamestown, P. O., $35,000; Lockport, P. O., $30,000; New York, C. H., $300,000, and appraisers' warehouse, for elevators, $30,000.

North Carolina.—Greensboro, Ct. H., P. O., etc., $41,650.

North Dakota.—Grand Forks, P. O. and Ct. H., $41,250.

Ohio.—Cleveland, P. O., C. H., and Ct. H., $400,000; Zanesville, P. O., $27,500.

Oklahoma.—Guthrie, P. O. and Ct. H., $35,000; Oklahoma City, P. O., $35,000.

Oregon.—Portland, P. O. and Ct. H., $175,000.

Pennsylvania.—Allentown, P. O., $25,000; McKeesport, P. O., $25,000; New Castle, P. O., $31,250; Scranton, P. O., etc., $70,000; Wilkesbarre, P. O., $25,000.

Rhode Island.—Providence P. O., Ct. H., and C. H., $125,000.

So. Carolina.—Florence, P. O. and Ct. H., $25,000.

So. Dakota.—Aberdeen, P. O., $75,000; Deadwood, P. O. and Ct. H., $50,000.

Tennessee.—Greenville, P. O. and Ct. H., $27,500; Memphis, C. H., Ct. H., and P. O., $175,000; Nashville, C. H. and P. O., $75,000.

Texas.—Beaumont, P. O. and Ct. H., $70,000; Dallas, Ct. H. and P. O., $125,000; Laredo, P. O., Ct. H., and C. H., $37,500; Sherman, P. O. and Ct. H., $31,250; Waco, Ct. H. and P. O., $75,000.

Utah.—Ogden, P. O. and Ct. H., $50,000; Salt Lake City, Ct. H. and P. O., $225,000.

Vermont.—Burlington, P. O. and C. H., $145,000; Newport, Ct. H., P. O. and C. H., $25,000.

Virginia.—Alexandria, C. H. and P. O., $40,000; Charlottesville, P. O. and Ct. H., $25,000; Newport News, C. H. and P. O., $100,000.

West Virginia.—Huntington, P. O. and Ct. H., $31,250; Wheeling, P. O., Ct. H., and C. H., $100,000.

Wisconsin.—Eau Claire, Ct. H. and P. O., $80,000; Green Bay, P. O. and Ct. H., $35,000; Superior, P. O., Ct. H., and C. H., $56,250.

Wyoming.—Evanston, P. O. and Ct. H., $25,000; Laramie, P. O., $25,000.

Hawaii.—Honolulu, immigrant sta., $30,000.

Harbor and River Work.

Alabama.—Mobile Harbor, $200,000; constr. locks and dams No. 1, 2 and 3 in Tombigbee and Warrior Rivs., $200,000.

Arkansas.—Improv. Ouachita and Black Rivers, Ark., and Louisiana, by constr. lock No. 4 near Monroe, La., and lock No. 6 near Roland Raft, Ark., $250,000.

California.—Removal Blossam Rock, San Francisco Harbor, $50,000; Oakland Harbor, $31,000; San Diego Harbor, $92,850; constr. channel, San Pablo Bay, $200,000; dredging and constr. canal, Stockton and Mormon channels, $50,000; constr. breakwater, San Pedro Harbor, $500,000.

Connecticut.—New Haven Harbor, $63,074; New London Harbor, $60,000.

Florida.—Channel in Tampa Bay from Gulf of Mexico to Port Tampa, $180,338; Biscayne Bay, $250,000; St. John's Riv., from Jacksonville to ocean, $350,000.

Georgia.—Cumberland Sound, $400,000; Savannah Harbor, $720,000.

Illinois.—Calumet Harbor, $204,480, Waukegan, Ill., $240,000.

Kentucky.—Kentucky Riv., $200,000; locks and dams, Big Sandy Riv., West Virginia and Ky., $50,000.

Maryland.—Harbor at Southwest Baltimore, $221,000; channel of Curtis Bay, Baltimore, $146,000.

Massachusetts.—Boston Harbor, 35-ft. channels from Navy Yard, and Chelsea and Charles Riv. bridges to President Roads through Broad Sound to ocean, $150,000; Fall River Harbor, $117,412; Gloucester, Mass., $60,000.

Michigan.—Ludington Harbor, $165,000; Marquette Harbor, $80,000; Saugatuck and Kalamazoo Riv., $100,000; Sturgeon Bay and Lake Michigan Ship Canal, $178,000; Detroit Riv., from Detroit to Lake Erie (Plan A), $450,000; Middle and West Neebish channels, St. Mary's Riv., $800,000.

Mississippi.—Pascagoula Riv., from 3 mi. above Dog Riv. to 17-ft. contour, Miss. Sound, $100,000.

Mississippi River.—Between St. Paul and Minneapolis, $223,579; Southwest Pass, $1,000,000; from Ohio Riv. to Missouri Riv., $650,000; from Missouri Riv. to St. Paul, $400,000; under Miss. Riv. Comn., from Head of Passes to Ohio Riv., $2,000,000.

New Jersey.—Arthur Kill, channel from Kill von Kull to Raritan Bay, N. Y. and N. J., $150,000; Passaic Riv., Montclair bridge to Staten Isl. Sound, $100,000; Delaware Riv., Christian St., Phila., to Delaware Bay, $1,400,000.

New York.—New York: Bay Ridge and Red Hook channels, $272,000; and Ambrose channel, $733,000. Buffalo: Lake Erie entrance to Black Rock Harbor, $200,000.

Ohio.—Ashtabula Harbor, $118,000; Toledo Harbor, $190,000; Cleveland Harbor, $227,500.

Ohio River.—Below Pittsburg, dams No. 13 and 18, $450,000; dams No. 2, 3, 4 and 5, $300,000; lock at dam No. 8, $200,000; lock at dam No. 11, $200,000; dam No. 37, $400,000.

Pennsylvania.—Monongahela Riv., lock and dam No. 2, $455,961.

South Carolina.—Charleston Harbor, $60,000; Winyaw Bay, $100,000; Great Pedee Riv., upper portion, $40,000.

Tennessee.—Tennessee Riv., below Chattanooga, $350,000.

Texas.—Galveston Harbor, channel and jetties, $300,000, and channel from outer end of inner bar to 51st St., $200,000; Galveston Ship Channel and Buffalo Bayou (divisions 1 and 2), $500,000; Trinity Riv., between mouth and Sect. 1, $250,000.

Virginia.—Hampton Roads, $215,000; Norfolk (Hospital Point), $183,957; Appomattox Riv. at Petersburg, $175,000.

Washington.—Tacoma Harbor, $100,000; mouth of Columbia Riv., $1,000,000.

Miscellaneous.

California.—Fog bell and light, Southampton Shoal, San Francisco, $30,000; Barrack, Natl. Home Disabled Soldiers, Santa Monica, $30,000.

Connecticut.—Peck's Ledge fog signal sta., Norwalk, $29,000.

District of Columbia.—National Museum Bldg., Smithsonian Inst., $250,000 (total cost not to exceed $3,500,000); roads, bridges, water supply, sewerage, etc., National Zoological Park, $95,000.

Florida.—Hillsboro Inlet light sta., $25,000.

Kansas.—U. S. Penitentiary, Ft. Leavenworth, $75,000.

Maine.—Quarantine Sta., Portland, $50,000; lighthouse, Ram Isl. Ledge, Portland, $50,000.

Massachusetts.—Broad Sd. Channel light sta., Boston, $75,000 (total not over $188,000).

Michigan.—Foundation light sta., Spectacle Reef, Lake Huron, $54,100; light sta., Middle Isl., Lake Huron, $25,000.

New Jersey.—Power house, at powder depot, Dover, N. J., $30,000.

New York.—Lamp shop, Tompkinsville, S. I., $50,000; enlargement Governor's Isl., N. Y. Harbor, $150,000.

Ohio.—Barrack, Natl. Home Disabled Soldiers, Dayton, $55,000.

Pennsylvania.—3-sty. and basement storehouse, Schuylkill Arsenal, Phila., $125,000; and roof for annex to storehouse No. 3, $25,000.

So. Dakota.—Battle Mt. Sanatorium, Hot Springs, $350,000.

Tennessee.—Bldgs., Natl. Home Disabled Soldiers, Johnson City, $900,000.

Washington.—U. S. Penitentiary, McNeil's Isl., $30,000.

Wyoming.—Improvement Yellowstone Park, $250,000.

Hawaii.—Wharf at U. S. Quarantine Sta., Honolulu, $55,000.

Philippine Isl.—Bldgs., water supply, drainage, etc., Military Post near Manila, $1,000,000.

In Public Document No. 156, the following appropriations have been made to supply deficiencies in former appropriations:

District of Columbia.—Land and bldgs. for Bureau Engrvg. and Printing, $100,000. Municipal Bldg., $250,000.

Illinois.—Champaign, P. O., $30,000.

Louisiana.—Natchitoches, P. O., $30,000.

Michigan.—Ft. Brady, barracks, $128,000.

Missouri.—St. Joseph, P. O., $50,000.

New Jersey.—Elizabeth, P. O., $60,000; Atlantic City, P. O., $25,000.

North Carolina.—Durham, P. O., $30,000.

So. Dakota.—Pierre, P. O. and Ct. H., $30,000; Yankton, P. O., $30,000.

Washington.—Tacoma, P. O., Ct. H., and C. H., $30,000; Spokane, P. O., Ct. H., and C. H., $30,000.

In Public Document No. 161, Sec. 2, the erection of following bldgs. is authorized, under limit specified:

Illinois.—Sterling, P. O., $40,000; Champaign, P. O., $70,000.

Louisiana.—Natchitoches, P. O. and land office, $60,000.

Michigan.—Traverse City, P. O., $50,000.

Missouri.—Moberly, P. O., $35,000; Columbia, P. O., $35,000.

So. Dakota.—Pierre, P. O., Ct. H., and land office, $170,000; Yankton, P. O., etc., $80,000.

Washington.—Tacoma, P. O., Ct. H., and C. H., $400,000; Spokane Falls, P. O. and Ct. H., $400,000.

WATER.

Phoenix, Ariz.—J. S. Stewart, of Louisville, Ky., and H. H. Hudson, of Cincinnati, O., are reported interested in the damming of Verde River, about 15 miles north of Phoenix, for the purpose of irrigating the lands along the river.

Pocahontas, Ark.—A charter has been granted to the Pocahontas Light, Water & Mfg. Co., with a capital stock of $50,000, to operate an electric light and water system, ice plant and cold storage. W. T. Avera, Pres.; P. H. Miller, Secy.

Sacramento, Cal.—The following bids are reported opened by the Bd. of City Trus. on Mar. 2 for water mains: The City St. Improv. Co., $95,574; the Francis Smith Co., $95,633; Risdon Iron & Locomotive Wks., $91,999; W. W. Montague & Co., $98,630; Schaw-Batcher Co., $88,443.

Fresno, Cal.—A charter has been granted to the Coalinga Consolidated Water Co. Principal place of business, Fresno. Capital, $50,000. H. H. Welsh and E. E. Manheim, of Fresno, are among the directors.

Vallejo, Cal.—The following contracts have been awarded for 100 tons of 12-in., 75 tons of 10-in. and 110 tons of 6-in. cast iron pipe, also 5 tons of specials, valves, etc., bids for which were received by the city Mar. 2 (A. P. Noyes, City Engr.): For material, the Crane Co., of San Francisco, $11,797, and labor, R. C. Mattingly, of San Francisco, $7,900.

San Pedro, Cal.—The work contemplated by the Seaside Water Co. will cost about $60,000. Jenn Drake, Auditor; O. K. Parker, Engr. in Charge.

East Chicago, Ind.—H. E. Jones, City Clk., writes that the Council contemplates putting in a new intake, to cost about $30,000. Isaac Wilcockson, Engr. in Charge.

Oakland City, Ind.—The Oakland City Water Works Co. has been incorporated, with a capital of $35,000, to build water works.

Clinton, Ind.—The Council is reported to be considering the question of constructing water works. Engineer, A. F. Maltby, of Chicago, Ill.

South McAlester, Ind. Ter.—The contract for building water works and a sewerage system is stated to have been awarded to Dunigan & Sykes, of Shenandoah, Ia. The plant will cost $150,000.

Newport, Ky.—The General Council of Newport has made a contract with J. T. Earle and associates, to supply water to the towns of Latonia and Central Covington, on the other side of Licking River. The Earle Co. is to stand the expense for making all connections, which will cost about $10,000.

Pikeville, Ky.—The Crystal Water Works Co., of Pike County, has filed articles of incorporation with the Secretary of State; capital, $15,000.

Crowley, La.—See "Power Plants, Gas and Electricity."

Mt. Airy, Md.—A press report states that the citizens of Mt. Airy are about to purchase from the B. & O. R. R. Co. a piece of elevated ground known as the Sanatorium site, from which the town will receive a good supply of water. As soon as a supply of water is secured, provision will be made to further protect the town from fire.

Quincy, Mass.—The City Council is stated to have passed an order appropriating $30,000 for water service.

Melrose, Mass.—Bids will be received by W. Dabney Hunter, Engr. and Supt. of Pub. Wks., until Mar. 21 for furnishing cast iron pipe and specials, gates and hydrants. Approximately, 463,393 tons of 4 to 12-in. pipe.

Merrimac, Mass.—See "Power Plants, Gas and Electricity."

Blackduck, Minn.—Fairbanks, Morse & Co., of St. Paul, is stated to have secured the contract for water works, at $5,307.

St. Louis, Mo.—Bids are wanted Mar. 24 for furnishing and delivering at city pipe yard, about 4,525 tons cast iron coated water pipes, 450 tons cast iron coated special castings, 191 6, 10, 12, 20 and 36 in. stop valves and 500 fire plugs; also for excavating, hauling and laying about 101,050 lin. ft. 6, 12, 15, 20 and 36-in. water pipes, taking up 6,300 lin. ft. 6-in. water pipe, furnishing 8,000 lbs. wrought iron straps, bands, etc. Hiram Phillips, Prea. Bd. Pub. Improv.

Havre, Mont.—The City Council is stated to have employed Engr. J. C. Italston to make an estimate for piping water to this city from Healy Giant Spring, 3 miles east of this city. He estimates the cost at $20,000. The city will put in its own system of mains and standpipes. G. T. Sanderson is City Clk.

Malta, Mont.—It is proposed to organize a Citizens' Irrigation Company here, to dam Milk River near Dodson for irrigating the valley. Judge Davidson and R. W. Garland are reported interested.

Helena, Mont.—A press report states that the right of the city to build and operate water works has been affirmed by the U. S. Circuit Court of Appeals. The Helena Water Works Co. sought to restrain the city from such action.

Broken Bow, Neb.—The citizens are stated to have voted on Mar. 3 to issue $13,000 bonds for the purchase of the water works.

Littleton, N. H.—See "Power Plants, Gas and Electricity."

Camden, N. J.—The Monroe Water Co., of Camden, has been incorporated, with a capital of $30,000, to operate water works for the Township of Monroe, Gloucester County. Incorporators: Wm. P. Weiser and Chas. W. Scott, Camden; Eli R. Marsh, of Williamstown, and others.

Trenton, N. J.—Campbell's Ridge Water Supply Co. has been incorporated, with a capital of $1,000,000, to build water plants for the supply of pure water. Incorporators: C. E. Ritten, of Carbondale, Pa.; E. J. Gallagher, of Pittston, Pa; Edwin Cook, of Trenton, and others.

Jamestown, N. Y.—Gov. Odell has signed the bill authorizing Jamestown to acquire the plant of the Jamestown Water Supply Co., and the stock of the Falconer Water Supply Co. for $600,000.

Colton, N. Y.—A company is reported formed, with a capital of $50,000, with Wm. Edw. Lindsay and Frank R. Andrews, as directors, to construct reservoirs and lay pipe in Colton, Parishville and Piercefield.

Cohoes, N. Y.—The Water Bd. on Mar. 2 adopted a resolution authorizing the entire board to act as a committee to secure the services of an engineer to advise the Bd. on the betterment of the water supply.

Yonkers, N. Y.—Bids were opened by the Bd. of Water Comrs. Mar. 5 for the following material—*a*, 335 lengths of 24-in. pipe at 2,811 lbs. per length of 12 ft.; *b*, 20 tons of 24-in. special castings; *c*, 500 lengths of 8-in. pipe at 600 lbs. per length of 12 ft.; *d*, 500 lengths of 6-in. pipe at 400 lbs. per length of 12 ft.; *e*, 50 lengths of 4-in. pipe at 250 lbs. per length of 12 ft.; *f*, totals (price given per ton): John Fox & Co., *a*, $33.80; *b*, $59; *c*, $33.80; *d*, $34.90; *e*, $34.90; *f*, $23,227. Warren Fdry. & Machine Co., *a*, $32.40; *b*, $61; *c*, $32.40; *d*, $32.40; *e*, $32.40; *f*, $22,254. M. J. Drummond & Co., *a*, $33; *b*, $61.60; *c*, $33; *d*, $34; *e*, $35; *f*, $22,756. U. S. Cast Iron Pipe & Fdry. Co., *a*, $33.90; *b*, $66.90; *c*, $33.90; *d*, $33.90; *e*, $33.90; *f*, $23,348. Camden Iron Wks., *a*, $33.40; *b*, $58; *c*, $33.40; *d*, $33.40; *e*, $33.40; *f*, $22,843.

Elizabeth City, N. C.—Four charters have been granted to David B. Banks and M. W. Offut, of Baltimore, Md., and C. M. Ferebee, of Elizabeth City—these being the Elizabeth City Light & Power Co., capital, $100,000; the Elizabeth City Gas Co., capital, $75,000; the Elizabeth City Sewerage Co., capital, $100,000, and the Elizabeth City Water & Power Co., capital, $100,000.

Fargo, N. D.—It is stated that bids are wanted Apr. 6 for delivering a 5,000,000 gal. pumping engine. J. M. Thompson, Supt. of Water Wks.

Brookville, O.—I. V. Miller, Corporation Clk., writes that bids will be received Apr. 3 for water works, to cost about $24,000. Engineer, John P. Force, of Columbus.

Columbus, O.—An ordinance providing for the issue of $50,000 bonds for an addition to the water distributing system has been approved by the Bd. of Pub. Wks., and recommended to Council.

Cleveland, O.—Bids are wanted Apr. 1 for $200,000 water works bonds. A. Biesinger, Chmn., Finance Com., City Council.

Cleveland, O.—Bids are wanted Apr. 3 for furnishing and delivering 395 ft. of 48-in. riveted steel water pipe. Chas. P. Salen, Dir. Pub. Wks.

Wooster, O.—J. B. Minier, City Clk., writes that the matter of extending and improving present water works is being strongly agitated and experts consulted as to best means of securing better and more adequate supply. Test wells have been driven, and probably others will be soon. Matter is in charge of Water Wks. Trus. and Committees from City Council and Bd. of Trade. No definite conclusion yet arrived at.

Coyle, Okla. Ter.—The House has passed the bill authorizing the construction of water works.

Geary, Okla. Ter.—The House has passed the bill legalizing the election at Geary, Feb. 24, by which $52,000 was voted for water works.

Hobart, Okla. Ter.—D. E. Morgan, City Clk., writes that it is proposed to construct water works, at a cost of $50,000.

Portland, Ore.—Articles of incorporation have been filed with the County Clerk by the Portland Irrigation Co. to appropriate and use water, building, constructing, owning, purchasing, leasing and otherwise acquiring and maintaining water rights, reservoirs, ditches, canals, etc., for the irrigation of lands; capital, $100,000. Incorporators: Robt. Galloway, C. H. Ball, and others.

Clearfield, Pa.—Bids will be received by the Clearfield Water Co., Clearfield, until Apr. 1 for completing a collecting reservoir, which was constructed in part last season.

Sewickley, Pa.—Bids are wanted Mar. 20 for $60,000 water works bonds. C. A. Atwell, Chmn. Finance Com.

Allentown, Pa.—Local press reports state that the following bids were opened by the Water Bd. on Mar. 3 for building a pipe line from this city to Schantz's Spring: *a*, 26,000 ft., price per lin. ft.; *b*, 1st total; *c*, rock excav. per cu. yd.; *d*, earth; *e*, standpipe complete; and *f*, 2d total: Geo. H. Hardner, *a*, $7.90; *b*, $205,400; *c*, $2.50; *d*, 75 cts.; *e*, $4,160; *f*, $197,860. H. E. Crilly, *a*, $7.48; *b*, $194,480; *c*, $2.48; *d*, 38 cts.; *e*, $4,670; *f*, $199,150. Geo. W. Shoemaker & Co., *a*, $7.80; *b*, $202,800; *c*, $1.25; *d*, 30 cts.; *e*, $6,800; *f*, $209,500. D. J. McNichol, Philadelphia, Pa., *a*, $11.23; *b*, $291,980; *c*, $4.37; *d*, $4.37; *e*, $4,577; *f*, $296,517. Richards & Gaston, *a*, $8.95; *b*, $232,700; *c*, $3; *d*, $1; *e*, $5,200; *f*, $237,900. Schiffner Bros. & Co., Stroudsburg, *a*, $7.50; *b*, $195,000; *c*, $1.50; *d*, 50 cts.; *e*, $4,100; *f*, $195,000. Allentown Paving & Constr. Co., *a*, $8.45; *b*, $219,700; *c*, $2.75; *d*, $1.25; *e*, $5,500; *f*, $225,200. Jas. Nagle & Son, *a*, $7.60; *b*, $197,600; *c*, $3; *d*, 75 cts.; *e*, $5,395; *f*, $197,600. C. H. Eglee & Co., Boston, Mass., *a*, $7.42; *b* $192,920; *c*, $2.50; *d*, $1; *e*, $4,600; *f*, $199,100. Tippett & Wood presented 3 bids for standpipe, 10 ft. diameter, 100 ft. high, as follows: $3,124 without foundations; tank steel plates, $2,950, and wrought iron plates, $3,300. Geo. H. Hardner, of Allentown, is reported to have secured the contract at $197,860.

Dubois, Pa.—Mullen & Coon are stated to have secured the contract for laying pipe from Anderson Creek for about $20,000.

Alexandria, S. D.—The American Construction Co., of South Bend, Ind., has secured the contract for constructing the water works; probable cost, $10,000.

Jackson, Tenn.—S. C. Lancaster, City Engr., writes that it is proposed to install a pumping engine before next winter, of the horizontal compound condensing type, and of either 5 or 6 million gals. capacity. Plans and specifications will be prepared at an early date.

Weatherford, Tex.—J. T. Smither, of New York, N. Y., is stated to have purchased the plant of the Weatherford Water, Light & Ice Co. The new company will expend $12,000 in enlarging and improving the property. F. E. Merrill will be the Mgr.

Port Arthur, Tex.—The Port Arthur Water Co., of Port Arthur, has been incorporated, with a capital of $100,000, to supply Port Arthur with water, etc. Jas. Hopkins, of St. Louis, Mo., is one of the incorporators.

Lynchburg, Va.—An expert engineer is reported to have been engaged to take charge of the water works and to secure a supply of water by gravity, an undertaking that will involve an expenditure of $800,000.

Christiansburg, Va.—The Town Council is reported to be considering the question of constructing water works.

Seattle, Wash.—The following bids are reported to have been opened Feb. 28 for the 1st Ave. water main: J. Markey, $13,177; J. Frank, $11,754; Bell & Price, $12,713; Stirrat & Goetz, $12,667.

The Bd. of Pub. Wks. is stated to have rejected all bids on the Dexter Ave. water main on the grounds that they were all too high; probable cost, $10,000. The 22d Ave. water main contract was made for cast-iron pipe to F. McLellan, for $32,593, provided it comes within the limit; if not, bids to be rejected and readvertisement ordered.

Ellensburg, Wash.—The Cascade Lumber Co. has filed papers with the County Auditor appropriating 2,000 ft. of water from Lake Kichelas, which will be utilized for irrigating in lower Yakima Dist. The company will soon commence building a storage reservoir near this point, at an estimated cost of $25,000.

North Yakima, Wash.—A. E. Treat and J. M. Murchie are stated to have filed papers appropriating 900 cu. ft. of water out of Naches River and 70,000 cu. ft. from Bumping Lake for developing a large body of land near the mouth of Nile River. They propose making a large reservoir out of Bumping Lake for storage purposes.

Rice Lake, Wis.—See "Power Plants, Gas and Electricity."

La Crosse, Wis.—It is stated that it is proposed to construct three 50-ft. wells at the pumping station, to cost about $12,500 each.

West Salem, Wis.—The Trus. of the County Asylum have awarded to the Chicago Bridge & Iron Co. a contract for erecting a tank at the asylum, to cost $4,800. The capacity of the tank to be 80,000 gals. and extreme height 114 ft.

Evanston, Wyo.—It is reported that the Union Pacific R. R. Co. will construct a reservoir near Evanston, to cost about $20,000. J. B. Berry, Ch. Engr., Omaha, Neb.

Stratford, Ont.—The citizens are stated to have voted Mar. 4 to purchase the plant of the Stratford Water Co. for $98,000; also to issue $8,000 bonds to improve the main thoroughfare entering the city.

Sarnia, Ont.—J. D. Stewart, Town Clk., writes that the citizens will vote on the issue of $100,000 bonds for improving the water works.

Strathroy, Ont.—See "Power, Gas and Electricity."

Montreal, Que.—Local press reports state that plans for widening the aqueduct have been ordered by the Water Com. The old channel is about 5 miles long and 50 ft. wide, and it is proposed to make it 70 ft. all through so as to conform to the width of the new intake.

SEWERAGE AND SEWAGE DISPOSAL.

Waterbury, Conn.—Bids will be received Mar. 17 by the Bd. Pub. Wks. for constructing sewers in portions of Washington Ave. and Porter St. R. A. Cairns, City Engr.

Meriden, Conn.—W. S. Clark, City Engr., writes that the H. Wales Lines Co. secured the contract for furnishing the Sewer Dept. materials (bids opened Mar. 5), for $3,998.

Augusta, Ga.—The following bids were opened by City Council Mar. 2 for 21,450 ft. of pipe sewers from 8 to 24 inches in diameter (Nisbet Wingfield, City Engr.): P. M. McAuliffe & Son, $10,899; and Hallihan & Costello, Augusta, $11,863 (awarded contract). The prices for pipe of the latter company ranged from 22 cts. to 87 cts. per ft.

Galesburg, Ill.—John B. McAuley, City Engr., writes that some new sewer work is in contemplation.

Rockford, Ill.—The Bd. of Local Improv. has passed favorably on the petition for a sewer in the Kents Creek Sewer Dist.; estimated cost, $54,000. The ordinance providing for the construction of a sewer on Railroad Ave. and 11th St. has passed City Council; estimated cost, $7,000. Edwin Main, City Engr.

Rock Island, Ill.—The contract for constructing Hampton Drainage Ditch (bids opened Mar. 3) has been awarded to R. H. McWilliams, of Mattoon, Ill., 10.65 cts. per cu. yard. Wallace Treichler, Engr.

Sterling, Ill.—The question of establishing a sewerage system is reported under consideration.

Evanston, Ill.—See "Paving and Roadmaking."

Connersville, Ind.—Bids are wanted Mar. 26 for constructing a system of combined storm water and sanitary sewers in this city. Jacob S. Clouds, City Clk.

Terre Haute, Ind.—Bids will be received Mar. 16 by the Bd. Pub. Wks. for constructing a pipe sewer in portions of 19th St. S. C. Beach, Secy.

Indianapolis, Ind.—Engr. Jas. Nelson is preparing plans for a brick sewer through Jackson Park; estimated cost, $70,000.

South McAlester, Ind. Ter.—See "Water."

Muscatine, Ia.—City Engr. A. P. Lamborn has completed surveys and estimates for a sewer from Roach's Mills to the outlet at the river.

Madrid, Ia.—It is stated that bids are wanted Apr. 6 (readvertisement) for constructing 3,000 ft. of 15-in., 2,465 ft. of 12-in., 1,560 ft. of 10-in. and 478 ft. of 8-in. tile sewer. A. Patterson, Co. Aud.

Des Moines, Ia.—Bids will be received Mar. 23 by the Bd. of Pub. Wks. for 340 lin. ft. 30, 35, 48 and 60-in., 2 ring brick overflow sewer and about 130 lin. ft. of open ditch on portions of Bluff St. J. E. Stout, Chmn.

Ft. Washington, Md.—See "Government Work."

Medford, Mass.—The Comrs. of Sewers have ordered the construction of a sewer in Norton Ave. and North St. The work to be done under the direction of Wm. Gavin Taylor, City Engr.

Chicopee, Mass.—City Engr. Frank P. Cobb estimates the cost of extending the sewer in Bway. at $14,000 and in Academy St., $4,000.

Gloucester, Mass.—A joint Special Com. of City Council has been appointed to consider the question of establishing a system of sewerage for this city. Winslow L. Webber, City Engr.

Marblehead, Mass.—W. T. Litchman, Town Clk., writes that the Com. in charge of the construction of a sewerage system will report on Mar. 16.

Worcester, Mass.—Local press reports state that the Brandon Lime & Marble Co., of Leicester Junction, Vt., has secured the contract for lime to be used by the Sewer Dept. this year, at $3.73 a ton at the Vermont works, and $6.03 at the purification works in this city; total contract reported to amount to $150,000.

Port Huron, Mich.—It is stated that bids will be received by Supt. of Pub. Wks. for constructing a main sewer in 20th St.

Grand Rapids, Mich.—The following bids for sewer work were received by Bd. Pub. Wks. (John C. Brown, Clk.) Feb. 27: John Koote, 850 E. Fulton St. and Harry Vander Veen, 875 Wealthy Ave., $5,690 (awarded contract); D. W. Boyes, 275 Stocking St., $6,078; Jas. McDermott & Son, 315 Bowery St., $5,784, and Richard Pickett, care of A. B. Knowlson, 35 Pearl St., $6,864. The work includes 5,984 ft. of pipe sewers from 9 to 24 in. in diameter, 20 manholes, and 17 catch basins. The trench is expected to average 8 ft. in depth, and will be excavated in sand, with a little rock in one street. L. W. Anderson, City Engr.

St. Paul, Minn.—W. J. Preston has secured the contract for a sewer on Mendota St. for $8,116, and P. Dougherty for a sewer on Juno St., for $4,656.

St. Louis, Mo.—Local press reports state Comptroller Player has notified the Bd. of Pub. Improv. and Sewer Comr. Hermann that they could now let contract for the construction of Blackstone Ave. sewer, as funds are available. The intention is to begin work at once; estimated cost, $80,000.

Kansas City, Mo.—New bids are about to be asked for the construction of the O. K. sewer. It will be 7 ft. high, 11,000 ft. long, and is estimated to cost $120,000.

Atlantic City, N. J.—City Engr. Hackney is reported to have prepared a plan for the drainage of the city. The system is designed to supplant the present one of surface drainage of water. The underground system will cost about $500,000.

Asbury Park, N. J.—The City Council on Mar. 2 sold $150,000 beach and sewer bonds.

Plainfield, N. J.—The Com. on Sts. and Sewers, through its Chmn., Ralph I. Tolles, 47 Westervelt Ave., has reported to Council on the extension of the present sewerage system. It estimates the cost at $65,000.

Johnstown, N. Y.—The Bd. of Aldermen is stated to have adopted a resolution authorizing the Sewer Com. to engage such assistance as they deem necessary in making plans for an intercepting sewer. F. H. McKenzie, of Hartford, Conn., will probably be employed.

Albany, N. Y.—Bids will be received Mar. 16 by the Bd. of Contract and Supply for constructing a vitrified pipe sewer in portions of Central Ave. I. Wachsman, Clk.

Brooklyn, N. Y.—Bids will be received Mar. 25 by J. Edw. Swanstrom, Boro. Pres., for constructing sewers, outlet sewers and sewer basins on portions of several streets. Engineer's estimate: 2,510 lin ft. 12 and 15-in. vitrified stoneware pipe sewer, laid in concrete; 3,358 lin. ft. 30, 36 and 42-in. brick sewer; 52 manholes, 27 receiving basins, etc.

Canajoharie, N. Y.—Morrell Vrooman, of Gloversville, is stated to have completed plans for a sewerage system for this place, and contracts will probably soon be let.

Dunkirk, N. Y.—J. P. Groesch, City Clk., writes, in regard to sewers proposed for the 4th Ward, that they will cost about $50,000 and will be of tile pipe. Jas. P. Morrissey, City Engr.

Buffalo, N. Y.—Fred. Howard, Geo. S. Gatchell and Robt. S. Donaldson are stated to have been appointed as a Comn. to appraise the value of lands to be taken by the city for the establishment of a sewage pumping station to pump sewage from the Hamburg Canal sewer into the Swan St. sewer.

Bids are wanted Mar. 19 for constructing a 24-in. brick and a 10, 15, 18 and 20-in. tile sewer in portions of Dewey and Kenmore Aves. Francis G. Ward, Comr. Dept. Pub. Wks.

New York, N. Y.—The following bids were opened Mar. 10 by J. A. Cantor, Boro. Pres., for sewers in Audubon Ave.—*a*, F. Thileman, Jr.; *b*, W. J. Ford; *c*, F. V. Smith Contrg. Co.; *d*, Anthony Kelly; *e*, Jos. Moore; *f*, W. E. Welch (lowest, $42,559):

	3 ft. 6 in.x2 ft. 4 in., Class I, 1,881 ft.	3 ft. 6 in.x2 ft. 4 in., Class II, 236 ft.	15 in. pipe, 1,810 ft.	12 in. pipe, 375 ft.	Rec. basins, 16.	Rock exc., 6,825 cu. yds.	Piling, 3,000 ft.	Found. planking, 6,000 ft.
a.....	$7.50	$7.50	$5.50	$5.00	$200.	$3.00	$20.	$25.
b.....	10.00	10.00	10.00	3.00	200.	2.00	..	30.
c.....	7.50	7.50	4.00	2.00	170.	3.20	..	..
d.....	5.35	5.09	4.25	2.00	190.	4.50	50.	50.
e.....	5.50	5.50	3.00	2.00	150.	3.75	..	50.
f.....	7.00	7.00	4.00	3.00	150.	3.00	..	..

Elizabeth City, N. C.—See "Water."

Bond Hill, O.—Bids are wanted Apr. 3 for $40,000 sewer bonds. A. J. Kiphart, Village Clk.

Cincinnati, O.—Bids are wanted Mar. 19 for improving portions of Murdock Ave. and Morris Pl. by constructing sewers and drains with appurtenances; also until Apr. 2 for similar work on portions of Eastern Ave. Robt. Allison, Pres. Bd. of Pub. Service.

The Bd. of Pub. Service has ordered City Engr. Stanley to prepare plans and specifications for sewering the south fork of Lick Run; and also a portion of Pearl St.

Cleveland, O.—Bids are wanted Mar. 19 for constructing sewers in portions of 5th Ave., Fort and Joseph Sts. and Leonette Pl.; also Apr. 2 for constructing sewers in portions of Gordon Park, Gordon and Wellington Aves. and Iona St. Chas. P. Salen, Dir. Pub. Wks.

Salem, O.—Bids will be received Apr. 3 by Geo. Holmes, City Clk., for constructing a sewer in portions of East Broadway St.

Toledo, O.—Legislation is under way establishing 3 new sewer districts: No. 36, about 700 acres with disposal plant, for which 24 acres have been purchased: No. 37, about 800 acres, and No. 39, about 700 acres. Geo. W. Tonson, City Engr.

Portland, Ore.—The Council is stated to have passed ordinances providing for the construction of sewers in 6 streets.

Ingram, Pa.—The Council is reported to have decided to ask the citizens to vote on a $50,000 bond issue for the construction of a trunk line sewerage system.

Harrisburg, Pa.—Mayor McCormick has signed an ordinance providing for the construction of a sewer in Seneca St.

Corry, Pa.—Bids are wanted Mar. 30 for constructing the outlet sewer for the 1st Ward sewer system estimates as follows: 240 ft. 36-in. iron pipe sewer, 1,700 ft. 36-in. sewer, 4 manholes, etc. Nevin R. Dickson, City Engr.

Tacoma, Wash.—Bids will be wanted about Apr. 1 for sewer work in Dist. No. 127, 7,800 ft. pipe, 8 to 21 in., estimated cost $16,862, and in Dist. No. 129, 4,120 ft. 8-in. pipe, estimated cost $4,880. N. L. Taylor, City Engr.

Seattle, Wash.—The following bids are reported to have been opened by the Bd. of Pub. Wks., Feb. 28, for the Valley St. sewer system: Stirrat & Goetz, $11,296; T. Ryan, $11,055; McLellan & Co., $11,986; Markey & Co., $12,965, and Mr. Peterson, $11,347.

Racine, Wis.—Press reports state that bids will be received until Mar. 19 for $55,000 sewer bonds. H. J. Schroff, City Clk.

BRIDGES.

New Haven, Conn.—City Engr. Kelly estimates the cost of constructing a stationary bridge at Kimberly Ave., 15 ft. above high water, between $160,000 and $170,000; a bridge 23 ft. high, $100,000 more.

Weiser, Idaho.—The Governor has signed the bill appropriating $15,000 toward constructing a $30,000 bridge across Snake River, in this city.

Irving, Ill.—See "Railroads."

Peoria, Ill.—Bids are wanted Mar. 18 for improving approaches to upper free bridge; estimated cost, $8,000. Harry E. Beasley, City Engr.

Terre Haute, Ind.—The Co. Council has passed an ordinance appropriating $175,000 to build a modern bridge across Wabash River.

Des Moines, Ia.—The City Council has adopted a resolution authorizing the Engr. to prepare plans and specifications and an estimate of the cost of constructing a bridge at State St.

Bids will be received Mar. 23 by the Bd. Pub. Wks. for constructing a 4-ft., 2-ring brick overflow sewer on portions of Willow St. J. E. Stout, Chmn.

Kansas City, Kan.—A bill has passed the House authorizing the Wyandotte Co. to construct a $30,000 bridge across Kaw River.

Press reports state that an agreement has been reached between the city officials and the officials of the Metropolitan St. Ry., the Union Pacific and the Rock Island Rys., whereby a viaduct, 900 ft. long, and to cost about $100,000, is to be built at 10th St.

Skowhegan, Me.—At the town meeting held recently it was voted to build a bridge across Kennebec River, at a cost not to exceed $15,000.

Boston, Mass.—The following bids for constructing a steel retractile draw for Wellington Bridge, Middlesex Fells Parkway, Somerville and Medford, were received by the Metropolitan Park Comn. Mar. 2 (Wm. T. Pierce, Engr.): Canton Bridge Co., Albany, N. Y., $19,600; Penn Bridge Co., Beaver Falls, Pa., $18,600; Eastern Bridge & Structural Co., Boston, $18,000; The United Constr. Co., Boston, $18,000; Berlin Constr. Co., Berlin, Conn., $17,650; The King Bridge Co., New York, N. Y., $17,550; New England Structural Co., Boston, $17,500; The Boston Bridge Wks., Incorporated, Boston, $16,950 (awarded contract).

Berrien Springs, Mich.—The Bds. of Berrien and Oronoko Townships have decided to build a steel bridge across St. Joseph River at Ferry St., at a probable cost of $23,000.

St. Paul, Minn.—The following bids were opened on Mar. 3 for the superstructure of Grand Ave. bridge: American Bridge Co., $5,169; St. Paul Foundry Co., $5,113 (awarded contract according to press reports), and the Minneapolis Steel & Machinery Co., $5,240.

Atlantic City, N. J.—J. J. Albertson, of Magnolia, Co. Engr., writes that all bids received on Mar. 4 for duplicate steel drawbridges on the highway leading from Pleasantville to Atlantic City, have been rejected, and new bids will be received on Apr. 1 by the Bd. of Freeholders at Memorial Hall, Atlantic City.

Newark, N. J.—A bill has been signed by the Governor authorizing the Freeholders of Essex and Hudson Counties to repair plank road bridges.

New York, N. Y.—Bids will be received Mar. 23 by Louis F. Haffen, Pres. Boro. Bronx, for constructing a bridge and abutments across the New York and Harlem R. R., at E. 189th St.

Troy, N. Y.—Local press reports state that the Dunsbach's Ferry bridge has been damaged by the freshets to the extent of $30,000, 2 spans and 2 abutments being carried away.

Columbus, O.—Bids are wanted Apr. 14 for furnishing material and constructing substructures, superstructures of several small bridges, also several culverts. L. E. Jones, Co. Aud.

Delaware, O.—Frank Warren, Co. Aud., writes that the contract for a 3-span bridge across Big Walnut Creek at Sunbury (bids opened Mar. 9) has been awarded to Huston & Cleveland, of Columbus, O., for $4,290.

Wapakoneta, O.—It is stated that bids will be received by the Co. Comrs. until Mar. 16 for constructing a bridge, 100 ft. long, across St. Mary's River, at St. Mary's. W. H. Meyer, Co. Aud.

Sandusky, O.—It is stated that the promoters of the Toledo, Port Clinton & Lakeside Ry. have organized the Sandusky Bay Bridge Co. with a view to building a 3-mile wagon bridge across Sandusky Bay, to be used by the electric road in entering Sandusky.

Portland, Ore.—The Governor has signed the bill authorizing the construction of a bridge across Willamette River in this city.

Erie, Pa.—Mayor Hardwick has signed the bill providing for the issue and sale of $15,000 bonds to defray the cost of constructing an over-head bridge across the P. & E. tracks at Buffalo Road.

Memphis, Tenn.—It is stated that the Frisco, Nashville, Chattanooga & St. Louis, Southern and the Union R. R. Cos. and the city, are to construct a $50,000 steel and concrete bridge across Broadway at Porter St. Thos. Bernard, Engr. Maintenance of Way of the Southern Ry., Chattanooga, Tenn.

Roby, Tex.—Bids are wanted Mar. 28 (extension of date) for constructing 2 steel bridges. Jesse Wright, Co. Judge.

Front Royal, Va.—The Superv. of Warren Co. have decided to construct a steel bridge, 540 ft. long, and having approaches 150 ft. each, across Shenandoah River, at Carson's Ford. Probable cost, $15,000.

Buckley, Wash.—Bids will be received Mar. 19 by the Co. Comrs. for constructing a wood and steel bridge over White River at Buckley to join Pierce and Kings Counties. Seattle is Co. Seat of Kings Co.

Milwaukee, Wis.—Local press reports state that the following bids were received by the Bd. Pub. Wks. Msr. 6 for constructing the bascule bridge at Muskego Ave.: Milwaukee Bridge Co., $90,000, using the trunnion principle in the lift; Scherzer Rolling Lift Co., of Chicago, 5 different propositions, ranging in cost, according to plans submitted, from $80,000 to $92,000.

Amherstburg, Ont.—It is stated that Blake, Lash & Cassels, 25 King St. W., Toronto, Ont., have applied to Parliament for an act incorporating a company having power to construct a bridge, for railway and general traffic, across Detroit River at or near Amherstburg.

PAVING AND ROADMAKING.

Newport, Ark.—J. R. Mayhan, City Recorder, writes that the City Council is taking necessary steps to pave the streets, at a cost of about $20,000.

Atlanta, Ga.—The following bids for paving with asphalt on (*a*) Peachtree and (*b*) Peters Sts., approximately 21,000 sq. yds., were received by Mayor and General Council Mar. 2, price given per sq. yd.: Sun Pav. & Con. Co., Chattanooga, Tenn., *a*, $1.98; *b*, $1.73. American Standard Asp. Co., Louisville, Ky., *a*, $2.35; *b*, $2.25. G. W. Crichfield, 1 Broadway, New York, N. Y., *a*, $2.18; *b*, $1.89. R. M. Clayton, City Engr.

Peoria, Ill.—An ordinance has been adopted by the City Council to pave with brick on a portion of Hamilton St., at a cost of $8,592.

Shelbyville, Ill.—Cass & Thompson, of Peoria, are stated to have secured the contract for 9,077 sq. yds. of brick paving on Main St. For detail bids see The Engineering Record of Feb. 28.

Chicago, Ill.—The Com. on Streets & Alleys South has recommended to the City Council the paving of a portion of Archer Ave. with asphalt at an estimated cost of $69,500.

Bloomington, Ill.—It is stated that about 2 miles of asphalt pavement is to be laid this summer.

Evanston, Ill.—The Bd. of Local Improv. has recommended granite top macadam pavements on portions of Foster and Noyes Sts.; also a system of vitrified tile pipe sewers from 36 to 12 in., to be constructed to relieve present sewers in Sheridan Road, Orrington and Sherman Aves., and their laterals from storm waters. J. H. Moore, Designing Engr.

Galesburg, Ill.—John B. McAuley, City Engr., writes that it is proposed to pave Holton St. and Grand Ave. with brick on a sand foundation, at a cost of about $16,000.

Quincy, Ill.—Bids will probably be asked for 4,500 sq. yds. rock asphalt for pavement of Park Pl. Address, F. L. Hancock, City Engr.

Rock Island, Ill.—About 15,000 sq. yds. of brick will be required to psve 15th St. Wallace Treichler, City Engr.

Chicago, Ill.—Bids will be received Mar. 19 by the Bd. of Local Improv. for constructing cement sidewalks on portions of numerous streets. A. M. Lynch, Pres.

Joliet, Ill.—The only bid received for paving Collins St. was that of the R. F. Conway Co. It bid for asphalt pavement on 6-in. natural cement concrete, 13,730 sq. yds., at $1.93 per sq. yd.; limestone curb 4-in. thick, 4,900 lin. ft. at 52 cts. per lin. ft.; excav., 3,650 cu. yds., 50 cts. per cu. yd.; catch basins, ea. $45, and valve manholes, ea. $25. Total amount of bid, $31,382.

Evansville, Ind.—The City Council has under consideration the building of a roadway and levee to the water works plant, to cost $30,000.

Bids will be received on or about Apr. 18 for paving 12 streets with brick and asphalt. Aug. Pfaffiin, City Engr.

New Castle, Ind.—The Town Bd. is taking steps to pave a number of streets with brick and asphalt. Bids will be asked by the Board.

Union City, Ind.—Eliot M. Miller, of Greenville, O., writes that he has prepared plans for about 7½ blocks of paving at Union City, which will cost about $40,000. Brick will probably be used.

Indianapolis, Ind.—Local press reports state that the city officials are considering the building of an asphalt plant, at a probable cost of between $5,000 and $10,000, said plant to be used to repair the streets of the city.

The City Council has passed an ordinance authorizing the issue of $100,000 bonds for boulevard purposes.

Albia, Ia.—The following bids for (*a*) 8,768 sq. yds. brick paving and (*b*) 4,902 lin. ft. stone curbing were received by City Clk. T. J. Baird Mar. 2: McCarthy Stone Co., Davenport, *a*, $1.69¾ per sq. yd.; *b*, 54 cts. per lin. ft. Likes Improvement Co., Des Moines, *a*, $1.80; *b*, 59 cts. Magden & Sheehy, Des Moines, *a*, $1.73; *b*, 58 cts.

Red Oak, Ia.—All bids received Feb. 25 for 41,000 yds. brick paving and 21,483 ft. of curb have been rejected, and new bids will be received.

Boone, Ia.—The contract for 8,765 sq. yds. brick paving on 7th, Greene and Alden Sts. (bids opened Feb. 27) has been awarded to E. H. Samuelson, of Boone, for $16,302.

Des Moines, Ia.—Bids will be received Mar. 27 by the Bd. Pub. Wks. for constructing brick and cement sidewalks. J. E. Stout, Chmn.

Waterloo, Ia.—The Barber Asphalt Paving Co., N. Y. City, has according to reports secured the contract for 62,400 yds. of brick paving and 17,400 ft. of curbing, at $1.36 per yd. and 35 cts. per ft. respectively. Total, $91,632.

Atchison, Kan.—The Legislature has passed a bill appropriating $20,000 for grading and paving a road from Atchison to the Orphan Home, a State institution situated near Atchison. Fred. Giddings is City Engr.

Louisville, Ky.—The following contracts have been awarded for brick pavement on 13 streets, bids opened by the Bd. of Pub. Wks. Mar. 3: G. W. Goonell, of Louisville, secured the contract for 7 pieces at $27,774, bidding $1.46 to $1.54 per sq. yd. for paving and S. R. Figg secured the contract for 6 pieces at $27,942, bidding $1.41 to $1.55 per sq. yd. for the paving. J. B. F. Breed, City Engr.

Auburn, Me.—Broad St. will be paved this year. Kind of material not yet decided upon.

Baltimore, Md.—The Bd. of Pub. Improv. has approved the ordinance to pave a portion of McCulloh St., at a cost of $37,500.

Brockton, Mass.—Local press reports state that bids are being received by the Mayor for supplying the city with curbing and paving. It is stated that about 50,000 paving blocks are desired.

Fall River, Mass.—On the recommendation of the Com. on Highways the Bd. of Aldermen has adopted an order authorizing the Supt. of Streets to receive bids for furnishing 25,000 ft. of granite and artificial steel bound curbing and 225,000 granite paving blocks.

Three Rivers, Mich.—Local press reports state that a resolution has been adopted by the City Council authorizing the awarding of the contract to pave with Wassai block on a gravel concrete foundation, and with combined curb and gutter, on Flint Ave., to Jas. E. Coniey, of Dayton, O., at $17,767.

Marshall, Mich.—Bids will be received by the Common Council until Mar. 23 for the grading, curbing, draining, concrete foundation and paving of a portion of State St. R. F. Grant, City Recorder.

St. Louis, Mo.—Bids are wanted Mar. 24 for improving by grading, reconstructing and paving with vitrified brick, on a concrete base, portions of numerous alleys. Hiram Phillips, Pres. Bd. Pub. Improv.

Trenton, N. J.—A bill has been signed by the Governor authorizing first-class cities to annually expend $100,000 for paving and repaving streets, extending the Newark paving act for 5 years.

Perth Amboy, N. J.—The Bd. of Aldermen has acted favorably on the petitions to pave with brick on Washington St., and with asphalt on Water St.

Jersey City, N. J.—The contract for 4,500 sq. yds. Belgian pavement (bids opened Mar. 10) has been awarded to Henry Byam, Mercer St., Jersey City, at $5 per cent. of standard price. C. A. Van Keuren, Ch. Engr.

New York, N. Y.—The following bids were opened Mar. 7 by L. F. Haffen, Pres. Bronx Boro., for grading, flagging and paving with granite blocks on sand foundation Tremont Ave., from 3d Ave. to Boston Road—*a*, Geo. H. Blethen; *b*, Geo. I Bailey; *c*, F. V. Smith Contrg. Co.; *d*, F. Tillemann, Jr.; *e*, Century Constrn. Co.:

	a	*b*	*c*	*d*	*e*
New curb, 5,000 ft....	$0.70	$0.68	$0.73	$0.70	$0.80
Old curb, 4,600 ft.....	.10	.14	.15	.12	.23
New bridge, 4,000 sq. ft.	.50	.60	.50	.60	.62
Old bridge, 5,800 sq. ft.	.10	.20	.10	.10	.10
Granite, 23,800 sq. yds.	2.25	2.49	2.67	2.52	2.50
Old flag, 33,000 sq. ft..	.03	.02½	.03	.03	.03
New flag, 4,000 ft.....	.23	.23	.24	.24	.23
Dry rubble, 100 cu. yds.	1.50	1.25	1.54	1.50	1.50
Recvg. basins, 13.....	100.	50.	120.	100.	100.

Bids will be received Mar. 23 by Louis F. Haffen, Pres: Boro. Bronx, for paving and repaving with asphalt block on a concrete foundation portions of Brook Ave. and E. 156th St.; also for regulating, grading, setting curbstone, flagging the sidewalks, laying crosswalks and building approaches on portions of several streets. Engineer's estimate: 23,375 sq. yds. asphalt block, 3,800 cu. yds. concrete including mortar bed; 14,625 cu. yds. earth excavation, 23,325 cu. yds. rock excavation, etc.

Watertown, N. Y.—The Bd. of Pub. Wks. has decided to pave with bituminous macadsm on a portion of State St.

Rome, N. Y.—The Common Council has instructed the City Engr. to prepare plans and specifications for asphalt, brick and bituminous macadam pavement on a portion of W. Thomas St.

Johnstown, N. Y.—The Bd. of Aldermen has adopted a resolution to pave with Warren's bituminous waterproof maeadam on a portion of William St., and to have the City Engr. prepare plans, specifications and an estimate of the cost of said improvement.

Gloversville, N. Y.—The City Council has directed Morrell Vrooman, City Engr., to prepare plans, etc., for laying about 4,000 sq. yds. of vitrified brick pavement on S. Main St.

Dunkirk, N. Y.—Bids will be received by the City Council until Apr. 1 for grading and macadamizing 3 sections of Eagle St., requiring in all about 14,823 sq. yds. of paving; also for grading and macadamizing about 11,875 aq. yds. on Deer St. J. P. Groesch, City Clk.

New York, N. Y.—Bids will be received Mar. 17 by Jacob A. Cantor, Pres. Boro. Manhattan, for regulating and repaving with asphalt portions of numerous streets. Engineer's estimate: 160,080 sq. yds. asphalt pavement, including binder course; 158,490 aq. yds. old stone pavement relaid as foundation or in approaches, etc.; 5,097 cu. yds. concrete, etc.

Wyoming, O.—Bids are wanted Apr. 11 for $3,000 street improvement bonds. W. A. Clark, Village Clk.

Toledo, O.—Final legislation is prepared for the following street work: Paving—Wakeman St., 2,940 sq. yds.; Elm St., 2,690 sq. yds.; John St., 1,547 sq. yds., and repaving—Floyd St., 3,190 sq. yds.; Superior St., 7,610 aq. yds., nnd 18th St., 4,400 sq. yds. Geo. W. Tonson, City Engr.

Greenville, O.—Bids will be received Apr. 4 by E. E. Calderwood, City Clk., for furnishing material for improving with block asphalt portions of 3 streets.

Salem, O.—Bids will be received Apr. 3 by Geo. Holmes, City Clk., for paving. About 28,000 sq. yds. of asphalt block paving and 7,000 sq. yds. of fire clay block paving will be required. B. M. French is City Engr.

Bedford, O.—Bids are wanted Mar. 26 for $5,000 street improvement bonds. Geo. S. Smith, Village Clk.

Columbus, O.—Bids will be received Mar. 23 by John A. Connor, Clk. Bd. Pub. Wks. for constructing sidewalks on 40 streets; also for constructing artificial stone walks at Livingston Park.

Cleveland, O.—Bids are wanted Mar. 17 for improving by grading, draining, curbing and paving with brick a portion of Rutland St.; also for grading, draining and improving portions of Alum and Classon Sts. Chas. P. Salen, Dir. Pub. Wks.

Toledo, O.—Garrigan Bros. is reported to have received the contract for paving a portion of Auburn Ave. at $12,312.

Bids will be received Mar. 30 by Chas. H. Nauts, City Clk., for furnishing material and improving portions of John St. by paving with blocks on a concrete, sand or broken stone foundation; also, Apr. 13, for furnishing material for improving portions of Detroit and Woodruff Aves. by paving with blocks on a 6-in. concrete, 8-in. sand, 6-in. gravel or broken stone, or a bank gravel foundation.

Philadelphia, Pa.—The Bd. of Surveyors has approved plans for the first 2 miles of the proposed Torresdale Boulevard, the total length to be about 10½ miles.

Erie, Pa.—Mayor Hardwick has signed the bill providing for the issue and sale of $14,700 bonds, to pay the cost of repaving 4th St. from State to Sassafras Sts.

Nashville, Tenn.—Bids will be received Mar. 26 by the Bd. Pub. Wks. for paving a portion of Bridge Ave. with granite block, in all about 28,000 sq. yds. Wm. M. Southgate, City Engr.

Gonzales, Tex.—The proposition to issue $7,000 bonds, for street improvements, is reported to have carried at the recent election.

Ogden, Utah.—According to bids opened Mar. 2, J. P. O'Neill was lowest bidder for two curbing contracts, aggregating $18,589, and the Barber Asph. Pavg. Co., for two paving contracts aggregating $35,656. Some of the unit prices were: Curbing contracts—1,600 cu. yds. grading, 40 cts.; 5,444 lin. ft. sandstone curb, $1; 176 lin. ft. concrete curb, 70 cts.; 3,666 sq. yds. sandstone blk. gutter, $2.80; concrete gutter, 112 lin. ft., 85 cts.; 200 lin. ft. concrete waterway, sandstone cover, $1.35; 16 ft. same with c. i. cover, $2.20. Paving contracts—2,902 sq. yds. sandstone blk. pavg., $2.75; 72 lin. ft. c. i. gutter plates, $1.50; 10 round corners, $5; 9,584 sq. yds. asphaltum on 6-in. concrete base, $2.36; 100 lin. ft. wing curbing, $1.05. A. F. Parker, City Engr.

Spokane, Wash.—City Engr. Gill has prepared plans for paving with asphalt and brick on portions of North Monroe St.

Tacoma, Wash.—Geo. Milton Savage & Co. are reported to have secured the contract to construct about 7 miles of cement sidewalks in Local Improv. Dist. No. 51, at $38,840.

Bids will be wanted about Apr. 10 for paving work in District 63, which will require about 26,000 sq. yds. of asphalt or bitulithic paving, and 3,000 yds. of cement walks; estimated cost, $80,000. N. L. Taylor, City Engr.

Waukesha, Wis.—Bids are wanted Mar. 31 for furnishing material and macadsmizing a portion of McCall St. John P. Dey, Chmn. Bd. Pub. Wks.

St. Croix Falls, Wis.—E. T. Webster, of Green Bay, is reported to have secured the contrsct to lay 19,000 sq. yds. of brick pavement in this city. Contract price reported to be $58,000.

Stratford, Ont.—See "Water."

Toronto, Ont.—Bids will be received Mar. 19 by Thos. Urquhart (Mayor), Chmn. Bd. of Control, for repairing asphalt roadways.

Windsor, Ont.—Bids will be received Apr. 10 by Stephen Lusted, City Clk., for supplying the city with broken stone for macadamizing streets.

Buckingham, Que.—Bids are wanted Mar. 30 for constructing about 3 miles of broken stone pavement from Buckingham to Masson, Que.; also 600 ft. 20-in. pipe sewer. R. W. Farley, Engr., Hull, Que. Address Town Clk., Buckingham.

POWER PLANTS, GAS AND ELECTRICITY.

Birmingham, Ala.—The Judiciary Com. of City Council has recommended that T. H. Aldrich, representing the Birmingham District Coal, Light & Power Co., be granted a franchise to construct and maintain an electric light and gas plant.

Huntsville, Ala.—A bill has been passed by State Legislature granting this city permission to issue $20,000 bonds for an electric light plant.

New Decatur, Ala.—It is reported that the Decatur Light, Power & Fuel Co. will make extensive improvements to its electric light and gas plants here in the near future.

Pocahontas, Ark.—See "Water."

Little Rock, Ark.—Mayor Duley is stated to have approved the ordinance granting a hot water heating franchise to Oscar Davis and Arthur Neill.

Pueblo, Colo.—The Gas Co. will expend $200,000 improving the gas plant; 6 miles of mains will be laid. L. E. Lyman, Pres.

Terryville, Conn.—The Dirs. of the Bristol & Plainville Tramway Co. are stated to have voted to extend their system to Terryville and supply the village with electricity. G. E. Cockings, Mgr., Bristol, Conn.

Columbus, Ga.—The stock of the Gas Light Co., of Columbus, has been sold to parties representing the Columbus R. R. Co. Many improvements will be made. The city recently renewed the contract with the R. R. Co. for street lighting for the year ending Dec. 31, 1904, at $50 per light per yr. Robt. L. Johnson is Supt. Pub. Wks.

Boise, Idaho.—The Boise Gas Light & Power Co. is stated to have accepted the franchise recently granted by this city for a gas plant and mains.

Quincy, Ill.—The Independent Light & Power Co., of Quincy has been incorporated, with a capital of $200,000, to furnish light, heat, and power. Incorporators: J. W. Cassidy, C. E. Mead, and L. P. Wheeler.

Ashton, Ill.—M. N. Glenn, Village Clk., writes that the citizens voted Mar. 10 to install a gasoline gas plant, at a cost of $7,000, and bids for its construction will be received Mar. 25.

Dixon, Ill.—The Dixon Power & Lighting Co. is arranging to put in a new gas plant, with a capacity of about 100,000 cu. ft. They will also put in about 10 miles of new gas mains.

Bloomington, Ind.—The Legislature has appropriated $20,000 for a lighting and heating plant for the State University.

Hartford City, Ind.—The City Council is stated to have granted a 20-year franchise to the Hartford City Electric Lighting Co.

Odebolt, Ia.—The Odebolt Lighting & Htg. Co. is reported incorporated, with a capital of $12,000. Jos. Mattes, Pres.; E. W. Lester, Secy.

Lewis, Ia.—Daniel Stevens is stated to have petitioned for an electric light franchise.

Guthrie Center, Ia.—The Guthrie Center Electric Light Co. has been incorporated, with a capital of $15,000, by W. F. Moore, C. G. Trent, Sr., Alex. H. Grisell, and others.

West Bend, Ia.—The City Clk. writes that there is talk of constructing a gas plant at a cost of $5,000. F. D. Boody, Mayor.

Keokuk, Ia.—J. C. Hubinger is about to petition the Council for a franchise for a steam heating plant.

Crowley, La.—M. J. Andrews, City Clk., writes that it was voted Mar. 5 to issue $100,000 bonds for an electric light plant and water works.

Boston, Mass.—See "Government Work."

Merrimac, Mass.—Bailey Sargent, Town Clk., writes that a committee was appointed at the annual meeting Mar. 2 to investigate the cost, etc., of installing water works and an electric light plant. Probably only preliminary work will be done this year.

Dexter, Mich.—John W. Barley, Village Clk., writes that it was voted Mar. 9 to issue $8,000 bonds for an electric light plant.

Schoolcroft, Mich.—J. W. Budrow, Village Clk., writes that the citizens voted on Mar. 9 to issue bonds for the construction of an electric light plant.

Plymouth, Mich.—Edw. Gayde, Village Clk., writes that it was voted Mar. 9 to issue $12,500 bonds for the construction of an electric light plant.

Detroit, Mich.—Westinghouse, Church, Kerr & Co., of Detroit, Engrs. in charge of the erection of the electric light and heating plant of the Edison Co., is stated to have received plans for the steel work of the new structure. The main building will be 227x217 ft. Four turbine wheels of 1,500-Kw. each will be placed in the plant. The engines will take 24 boilers, which will be fed by automatic stokers.

Mankato, Minn.—W. I. Gray, of Minneapolis, is stated to have been selected to prepare plans for a municipal electric light plant; probable cost, $40,000.

South Stillwater, Minn.—A press report states that the Village Council estimates the cost of constructing an electric light plant at $20,000. The question of issuing bonds will probably be submitted at the next election.

Collins, Miss.—The Collins Light & Power Co., of Collins, has been incorporated; capital, $10,000. Incorporators: W. E. Payne, H. Swinney, and others.

Bozeman, Mont.—Bids are wanted Mar. 19 for furnishing street lights and lighting the public buildings of city for a period of 2 or 5 yrs. T. M. Pierce, City Clk.

Lincoln, Neb.—C. C. Wright, of Omaha, is stated to have petitioned the State Bd. of Irrigation for the right to use the waters of the Platte and Elkhorn Rivers for power purposes. The application calls for 2,500 cu. ft. of water, and it is estimated that the plant to be constructed will cost $1,500,000.

Manchester, N. H.—The 10-year contract for electric street lighting expires May 31, and a committee, with the Mayor as Chmn., has been appointed to procure new bids; also to report on the feasibility of a municipal lighting plant. Saml. J. Lord is City Engr.

Littleton, N. H.—The House is reported to have passed a bill authorizing the town to establish or acquire an electric light plant and water works.

East Orange, N. J.—The following bids are reported to have been received on Mar. 9 for lighting the streets: The American Lighting Co. offered to install 50 c.p. incandescent gas lamps on present poles, not less than 900 lamps to be used, at $28.75 a lamp on a 1-yr. contract, $28.50 on 2 yrs. and $28.25 on 3 yrs. The Essex & Hudson Gas Co. bid for Welsbach lamps $30 for 1-yr. contract, $29.50 for 2 yrs. and $29 for 3 yrs. For open flame lamps it bid $19.50 on 1-yr. contract, $19 for 2 yrs. and $18.50 for 3 yrs.

Southampton, N. Y.—Bids will be received by the Bd. of Village Trus. on Mar. 23 for lighting the streets for 2 years from June 1, 1903. About 135 electric lights will be required.

Elmira, N. Y.—P. N. Guthrie, Supt. of the Chemung County Gas Co. is reported to be at work on plans and specifications for piping the city for natural gas. About $300,000 will be expended by the company.

Boonville, N. Y.—Horace B. Sweet, of Utica, is reported to have been selected to superintend the construction of the municipal electric light plant.

Whitehall, N. Y.—The citizens are stated to have voted on Feb. 25 to issue $4,000 bonds each year for 5 years beginning May 1, 1903, for the purpose of lighting the streets and public buildings with arc and incandescent lights.

Binghamton, N. Y.—Aldermen Fetherolf, Stephenson and Hewett have been appointed as a committee to investigate the question of municipal ownership of an electric light plant.

New York, N. Y.—Plans have been filed for the enlargement of the plant of the Mutual Gas Light Co. in 11th St., east of Ave. D. The new buildings are to cost about $45,000.

Brooklyn, N. Y.—It is stated that the Brooklyn Union Gas Co. is to build a new plant at the ft. of 12th St.

Deposit, N. Y.—The citizens are stated to have voted to expend $1,500 annually for 5 years for lighting the streets with electricity.

Buffalo, N. Y.—The Lamp Com. of the Bd. of Aldermen recommends that the Comr. of Pub. Wks. be authorized to enter into a 5-yr. contract with the Buffalo General Electric Co., which offers to furnish 4,000 lamps at $70 per lamp per yr. If the city accepts this offer, electric light will be substituted for gas light throughout the city.

Elizabeth City, N. C.—See "Water."

Fostoria, O.—W. T. Mills, of Columbus, is reported to be preparing plans for an electric light plant.

Troy, O.—The Council is stated to have granted J. W. Davis a franchise for a steam heating plant.

Portland, Ore.—The Council is reported to have passed an ordinance authorizing the Executive Bd. to secure bids for lighting the city for 5 years or less, arc lights to be used in the streets and incandescent lights in the public buildings.

Perkasie, Pa.—H. B. Scheetz, Clk. of Council, writes that it is proposed to purchase an engine and dynamo for the electric light plant.

Harrisburg, Pa.—Eight companies have been consolidated under the name of the United Electric Co., with M. A. Cumbler, of Steelton, as Pres. They are the Cumberland, the Lower Allen, the Upper Allen, the East Pennsboro, the Hampden, the Camp Hill, the Shiremanstown, and the new Cumberland Light, Heat & Power Companies.

Stroudsburg, Pa.—It is stated that the Monroe County Water Power & Supply Co., recently chartered, will begin at once the erection of a plant, to cost $75,000. Jos. H. Shull, Pres.

Easton, Pa.—Cramp, Mitchell & Serrill, bankers of Philadelphia, are stated to have purchased a controlling interest in the gas and electric properties of Easton and Phillipsburg, N. J., and intend to consolidate them. About 20 miles of new gas mains will be laid. A. J. Beadle will be Gen. Mgr.

Lancaster, Pa.—Bids will probably be received this month for lighting the streets for one year from June, 1903.

Memphis, Tenn.—It is stated that the Memphis Electric Light & Power Co. will expend about $125,000 in improvements. This will include a 2,000-H.-P. engine and a 30,000 light dynamo.

Johnson City, Tenn.—The question of constructing an electric light plant is reported under consideration.

Marinette, Wis.—Capt. Edwards, of Appleton, is stated to have completed the survey of Peshtigo River, and is making estimates of cost of utilizing the water power and transmitting same to the city and county towns.

Rice Lake, Wis.—The citizens are stated to have voted to issue $32,000 bonds to purchase the electric light plant and water works.

Berlin, Ont.—The citizens are reported to have voted to purchase the electric light plant for $80,000.

Niagara Falls, Ont.—The Queen Victoria Niagara Falls Park Comrs. are stated to have granted the Toronto & Niagara Power Co. permission to construct a cofferdam.

Strathroy, Ont.—Bids will be received Mar. 31 by the Town Council for $50,000 bonds to be used for constructing water works and electric light plants. F. J. Craig, Town Clk.

Manila, P. I.—See "Electric Railways."

Montreal, Que.—The Montreal Light, Heat & Power Co. is reported to have acquired privileges held by M. P. Davis for water power from Soulanges Canal. This will supply 40,000 H.-P.

ELECTRIC RAILWAYS.

New Decatur, Ala.—The motive power of the Decatur St. Ry. is to be changed to electricity. The company is to ask for new franchises in Decatur and New Decatur.

Whittier, Cal.—It is stated that bids will be received until Apr. 13 for a street railway franchise. W. E. Butler, City Clk.

Florence, Colo.—Thos. Whitted, Consulting Engr. of the Florence & Canon City Electric Ry., is reported to have stated that work will be begun immediately. A. C. Kelly, of Florence, will be in charge of the civil engineering, and a corps of surveyors will be put in the field at once.

Ansonia, Conn.—The Connecticut Ry. & Lighting Co. has prepared plans for the extension of its system from Ansonia north through the Naugatuck Valley to Seymour, and bids for construction will soon be invited. J. E. Sewell, Gen. Mgr., Bridgeport.

Atlanta, Ga.—The Atlanta & Marietta St. Ry. Co., which plans to build between Atlanta and Marietta, is seeking incorporation. The company has just been granted a franchise in Marietta.

Boise, Idaho.—The Intermountain Ry. Co. has secured a franchise from the Co. Comrs. of Ada County. The plan of the company is to build from Boise to Meridian.

Pontiac, Ill.—The City Council has granted the Bloomington, Pontiac & Joliet Electric Ry. Co. a 50-year franchise.

Marion, Ind.—The Indiana Northern Traction Co. has been incorporated, with a preliminary capital of $25,000, to build a line to connect Marion, La Fountain, Wabash, North Manchester and Warsaw. Directors: R. Breed, B. F. Burke, and others.

Crawfordsville, Ind.—The City Council has granted a franchise to the Indianapolis & Northern Traction Co.

Indianapolis, Ind.—The Northern Indiana Traction Co. proposes to build a line from Marion to Warsaw. The power house will probably be at Lafontaine. R. E. Breed, Pres.; G. A. Shideler, Secy., both of Marion, Ind.

Maysville, Ky.—Henry W. Huggins is interested in an electric railway to extend from Maysville, Ky., through Georgetown and Ripley to Hillsboro, O., where connection will be made with the Cincinnati & Columbus Traction Co. for Columbus.

Monticello, Ky.—The Cumberland Valley Interurban R. R. Co. has been incorporated to build an electric railway between Monticello, Somerset and Burnsides, a distance of about 20 miles. Incorporators: W. J. Loughbridge, W. C. Goodloe, Jr., and E. P. Farrell, of Lexington.

Jeffersontown, Ky.—It is stated that the Louisville Ry. Co. will soon begin work on its interurban line to Jeffersontown. The survey has been accepted, and nearly all the rights of way have been secured.

Attleboro, Mass.—The interests behind the Attleboro & Mansfield St. Ry. Co., which secured a location in Attleboro, have taken out articles of association of the Foxboro & Sharon St. Ry. Co. which is to build the link in the Boston-Providence through line, connecting the Attleboro-Mansfield Road with the Norwood, Canton & Sharon Road at Sharon.

Norton, Mass.—The Selectmen have granted a franchise to the Norton & Taunton St. Ry. Co.

Westfield, Mass.—The Woronoco St. Ry. Co., of Westfield, are about to receive bids for laying about 5 miles of track for an extension of its line to Holyoke. Material to be furnished by company.

Flint, Mich.—The Detroit United Ry. Co. will build 2 depots and a car house in Flint. The company will also build an extension from that city to the Oak Park addition. J. C. Hutchins, Gen. Mgr., Detroit.

Libby, Mont.—J. H. Greiger is reported interested in a plan to build an electric railway from Libby south into the Fisher mining district.

Great Falls, Mont.—The Marcus Daly estate has purchased the controlling interests in the Boston & Great Falls Land Co., the Great Falls Street Ry. Co., and the Boston & Great Falls Electric Co. It is reported that the new management will expend $75,000 in improvements.

Concord, N. H.—The Legislature has passed bills incorporating the Hampstead & Haverhill St. Ry., the Epping, Brentwood & Kingston St. Ry., and the Goff's Falls, Litchfield and Hudson St. Ry.

Vailsburg, N. J.—The Essex Cross Ry. Co., which plans to build an electric railway between Newark and Elizabeth, has been granted a franchise in Vailsburg. Francis M. Epply, of Orange, is interested.

Ballston, N. Y.—The plan of the Ballston Terminal R. R. Co. (J. W. Cleveland, Ch. Engr., Ballston Spa) is to issue $800,000 bonds at once, for the refunding of $385,000 outstanding bonds, and provide funds for completing the lines through Johnstown and Gloversville. Provision is also made for the construction of a line to Amsterdam.

Schenectady, N. Y.—The Schenectady Ry. Co. has completed plans for a new power house to be built in Dock St.

Lakewood, N. Y.—The Chautauqua Traction Co., capitalized at $500,000, has been incorporated to build an electric railway from Chautauqua Ave., Lakewood, to Mayorville. The road will be about 17 miles long. Among the stockholders are: Wm. Broadhead, R. N. Marvin and W. R. Reynolds.

Youngstown, O.—Bids will be received Mar. 25 by the Bd. of City Comrs. for constructing and operating a street railroad route No. 6. Wm. I. Davies, City Clk.

Shreve, O.—The Wooster & Mansfield Ry. Co. has secured a right of way connecting Wooster, Millbrook, Loudonville, Perrysville, Douglass, Robinson and Mansfield, a distance of 44 miles. W. A. Craig, of Shreve, Pres.; David Collier, of Plimpton, Secy.

Celina, O.—The People's Rapid Transit Co., which proposes to build from Toledo to Greenville, is to locate its power plant at Celina. The entire right of way is reported to have been secured, and that construction work will be begun at once.

Orangeville, O.—The Cleveland & Sharon Traction Co., which is building from Middlefield to Sharon, is planning to build a spur line from Orangeville to Greenville, Pa.

Dayton, O.—Col. D. B. Corwin, of Dayton, is reported interested in the construction of an electric railway from Dayton to Lebanon by way of Centerville, Springboro and Red Lion; also a spur line from Waynesville to Wilmington.

Toledo, O.—The Toledo & Monroe Ry. will build a line to Stoney Point, 9 miles northeast of Monroe, on the lake.

The Toledo Rys. & Light Co. is planning to build a line out Starr Ave. to the city limits. It will provide entrance to the city for the new Toledo, Port Clinton & Lakeside Ry., besides opening up new city territory.

Milford, O.—The Council has granted franchises through town to the Cincinnati, Milford & Loveland Traction Co., the Cincinnati, Milford & Eastern Traction Co. and the Cincinnati & Columbus Traction Co.

Cleveland, O.—The Cleveland, Geneva & Meadville Ry. Co. has been chartered, with $1,000 capital stock, by D. E. Warner, O. C. Pinney, and others, of Cleveland, to build from Geneva to Meadville, Pa., by way of Jefferson.

Lock Haven, Pa.—The Riverside St. Ry. Co. has been incorporated by M. B. Rich, C. H. Rich and T. M. Stevenson, to build from Lock Haven to Oak Grove, passing through Lockport, Dunnstown, Chatham's Run and other places. The power house will be located at Chatham's Run, and the machinery will be operated by water power. The line will be about 9 miles long.

Philadelphia, Pa.—The Philadelphia Rapid Transit Co. (W. S. Twining, Ch. Engr.) through the West Philadelphia Passenger R. R. Co., a subsidiary, has applied to the Council for a franchise to construct a number of lines in West Philadelphia. The northern end of the 10th and 11th Sts. line of the Philadelphia Rapid Transit Co. is to be extended from 11th and Cambria Sts. to Glenwood Ave.

The Philadelphia & Trenton Rapid Transit Co. has been incorporated at Harrisburg, for the purpose of extending the Philadelphia, Bristol & Trenton St. Ry. from its westerly terminus at Torresdale to Frankford Ave. and Dyre St., Philadelphia; capital, $42,000. Incorporators: J. W. Ellard, of Baltimore, Md.; Saml. A. Boyle, Jr., Philadelphia; W. F. Sadler, Jr., of Trenton, N. J.

Waynesboro, Pa.—Walter A. McDonald, of West Chester, Pa., is stated to have secured the contract to construct a line for the Chambersburg, Gettysburg & Waynesboro Electric Ry. Co. from Waynesboro to Pen Mar, a distance of 15 miles. Contract price reported to be $300,000. The company also proposes building a line between Waynesboro and Greencastle later in the year.

Pen Mar, Pa.—W. A. MacDonald, of Philadelphia, has secured the contract for constructing the proposed electric railway from Greencastle to the top of the Blue Ridge Mountains at Pen Mar. The line will be 14 miles in length. Contract price, $300,000.

Fayetteville, Pa.—The Chambersburg & Gettysburg Electric Ry. Co. has secured a site at this place for a power house.

Elizabeth, Pa.—It is stated that the building of the Elizabeth & Donora Electric Ry. will be commenced at once. The route is from Elizabeth to the Monongahela River at Dogg's Ferry and along the river to a point opposite Donora. The line will probably connect at this point with the system running into Pittsburg.

Newport, R. I.—It is reported that Col. Frank S. Arnold, of Providence, and John Eldred, of Boston, Mass., are interested in a plan to build an electric railway to run the length of Conanicut Island, connecting Conanicut Park at the north end with Jamestown at the south and the ferries for Newport and Saunderstown.

Dallas, Tex.—Stone & Webster, of Boston, Mass., have approved plans for the improvement of the Dallas Consolidated Electric St. Ity. Co., as recommended by their representative, J. Peyton Clark. The improvements to be made extend to all parts of the system and call for the expenditure of a large sum.

Salt Lake City, Utah.—All arrangements have been completed for financing the Salt Lake & Suburban R. R., and bids are about to be received for constructing the road.

Roanoke, Va.—It is reported that the Roanoke Ry. & Electric Co. will build extensions, including a line to Fincastle, 18 miles. John W. Hancock, Gen. Mgr., Roanoke.

Norfolk, Va.—The Chesapeake & Ohio Ry. is reported interested in the construction of an electric railway that will traverse every coast resort in this section. A. Johnston Ackiss is the local representative.

Whatcom, Wash.—The Lynden Electric Ry. & Improve. Co. has been incorporated to build an electric railway from Whatcom to Lynden; capital, $160,000.

Spokane, Wash.—The City Council has granted Jay P. Graves a franchise to construct an electric railway on Washington St.

Charleston, W. Va.—Bids will be received until Mar. 20 by Arthur Lee, Vice-Pres. of the Charleston, Clendennin & Sutton R. R., 1517 H St., N. W., Washington, D. C., for the grading and masonry work for the extension of this road from Otter to a point about 25 miles up the Elk Valley. Chas. K. McDermott, Gen. Supt., Charleston.

Manila, P. I.—The Municipal Bd. of Manila, Advisory Bd., and Philippine Comn., acting jointly, are stated to have accepted the bid of Chas. M. Swift, of Detroit, Mich., for a street railway and electric light and power franchise in the City of Manila.

RAILROADS.

Russellville, Ark.—A charter has been granted to the Russellville & Dover R. R. Co., with a capital of $125,000, to construct a line 10 miles in length through Pope County by way of Taral to Dover. W. A. Baird and W. M. Simpson are among the incorporators.

San Francisco, Col.—The Western Pacific Ry. Co. has been incorporated for the purpose of building a road from San Francisco via Oakland, Stockton, Marysville and Oroville, along the north fork of Feather River, through Sierra Valley in Plumas County, through the Beckwith Pass in the Sierra Nevada Mountains and across Nevada to Salt Lake; also to build a number of branches in California. Capital, $50,000,000.

Lincoln, Cal.—The Lincoln, San Francisco & Eastern R. R. Co. has been incorporated, to build a standard-gauge steam railroad from Lincoln to Vernon Landing, a distance of 25½ miles. Capital, $500,000. Directors: C. L. Wilson, W. H. Newell, and others.

Branford, Conn.—The House has passed a bill incorporating the Branford Steam Ry. Co.

Irving, Ill.—The C., C., C. & St. L. R. R. Co. will soon begin construction work on the proposed short line from Irving to Mitchell; a 3-span concrete bridge will be built over Indian Creek, steel over-head crossings will be put over county roads and railroads in Madison County. A switch, 1,000 ft. long, will be put in by the Illinois Terminal R. R. Co. at Wanda to connect with same. Geo. Kittridge, Ch. Engr., Cincinnati, O.

Rockford, Ill.—E. H. Keeler and C. S. Brantingham are reported interested in the construction of a railroad from Rockford to Holcomb to connect with the Great Western R. R.

Huntington, Ind.—A charter has been granted to the Cincinnati, Bluffton & Chicago R. R. Co. to build from Huntington through Bluffton, Pennville, Portland and Union City, and from Pennville to Muncie, a distance of about 90 miles; capital, $100,000.

Chanute, Kan.—Bonds for building the Arkansas, Missouri & Kansas R. R. from Chanute, Kan., to Memphis, have been placed. The new line will be 400 miles long, and will cost approximately $12,000,000.

Baton Rouge, La.—The Red River Valley R. R. Co. is about to let contracts for 47 miles of road between Baton Rouge and Angola, and will later let contracts from here to New Orleans.

Cumberland, Md.—A press report states that the construction of a 65-mile line between Cumberland and Cherry Run to connect the Western Maryland R. R. with the West Virginia Central will be begun within the next 60 days. Ch. Engr., John Q. Barlow, of Cumberland.

Cheboygan, Mich.—The Detroit & Mackinac R. R. Co. is reported to be contemplating an extension of its line to Cheboygan. C. W. Luce, Gen. Supt., East Tawas, Mich.

New Buffalo, Mich.—A charter is stated to have been granted to the Pere Marquette R. R. Co., with a capital of $500,000, to construct a railroad from a point near New Buffalo to the line between the States of Mich. and Ind., southerly through the Counties of Laporte, Porter and Lake, to a point on the line between the States of Ill. and Ind., near Hammond; length of road will be 46 miles. Fred. O. Prince, of Boston, Mass., is one of the incorporators.

Niagara Falls, N. Y.—The Buffalo & Niagara Terminal R. R. Co. has been incorporated to build and operate a steam road, 45 miles long, from Niagara Falls through Tonawanda to Buffalo, with a branch from Buffalo to Dewitt; capital, $450,000. Directors: L. I. M. Dittenhoefer, Jesse Mayer and Dudley F. Phelps, Jr., all of N. Y. City.

Elk City, Okla. Ter.—A charter has been granted to the Oklahoma & Southwestern R. R. Co., with a capital of $600,000, to build a line through the Counties of Chester, Roger Mills and Day. John Overholt, Enid, Okla. Ter., and Martin A. Lally, Little Rock, Ark., are among the incorporators.

Oklahoma City, Okla. Ter.—A charter has been granted to the Texarkana, Oklahoma & Northwestern R. R. Co., with a capital of $15,000,000, to construct a line 1,100 miles long, running northwest from Texarkana, Tex., to Denver, passing through the Seminole and Chickasaw Indian Nations, and through the Counties of Pottawatomie, Lincoln, Oklahoma, Logan, Canadian, Kingfisher, Blaine, Dewey, Woods, Woodward and Beaver in this Territory. Territorial Secy. Crimes is one of the incorporators. Principal office to be at Oklahoma City.

Pittsburg, Pa.—The Pittsburg Coal Co. is reported to be planning to build a railroad from the Pittsburg district to the south shore of Lake Erie.

New Castle, Pa.—The Pittsburg, Bessemer & Lake Erie R. R. Co. is stated to have completed arrangements for an entrance into New Castle. The present terminal of the line at Butler is to be extended.

Birchardville, Pa.—The Binghamton & Southern R. R. Co., of Binghamton, N. Y., is reported to be completing the survey for a line to run through Birchardville, St. Joseph, Choconut and other towns in Susquehanna County.

PUBLIC BUILDINGS.

See also "Sundry Civil Appropriations."

Colorado Springs, Colo.—It is stated that the Cragmore Sanatarium Co. will erect a 4-story brick building near Austin Bluff; estimated cost, $250,000.

Athens, Ga.—The plans of L. F. Goodrich, of Augusta, have been accepted for the proposed city hall, to cost $40,000. J. F. Rhodes, Mayor; J. W. Barnett, City Engr.

Joliet, Ill.—Bids will be received Mar. 16 by Sam C. Rickson, City Clk., for erecting a police station. H. A. Stevens, City Engr.

Clinton, Ill.—The contract for the erection of the Presbyterian Church is stated to have been awarded to G. B. Ballard, of Mattoon, for $28,600.

Logansport, Ind.—The Bd. of School Trus. will receive bids Mar. 25 for the erection of a Carnegie Library, to cost about $25,000. Q. A. Myers, Secy. of Bd.

Decorah, Ia.—O. H. Olson, of Stillwater, Minn., has secured the contract for erecting the court house (bids opened Mar. 3) for about $74,875. F. A. Masters, Co. Aud.

Ottumwa, Ia.—It is stated that the First Baptist Society will erect a church here, to cost $20,000.

Des Moines, Ia.—The First Church of Christ Scientist will build a church here, to cost $30,000.

Louisville, Ky.—The Fiscal Court is stated to have authorized Murphy Bros., Archts., 205 5th Ave., to secure bids, to be opened Apr. 4, for superstructure work or completion of the County Jail, which will cost about $150,000.

Taunton, Mass.—The contract for the erection of the registry building is reported not to have been awarded, as the bids were in excess of the $100,000 appropriation. Beattie & Wilcox, of Fall River, are stated to have submitted the lowest bid, $120,980.

Sault Ste. Marie, Mich.—The Congregation of the Methodist Church is reported to have decided to erect an edifice at Albert and Spring Sts., to cost $20,000.

Detroit, Mich.—Kastler & Hunter, 927 Chamber of Commerce Bldg., are stated to be preparing plans for a brick edifice, to be erected at Weson Ave. and Buchanan St. for the congregation of St. Francis's Polish Catholic Church; estimated cost, $100,000.

Duluth, Minn.—The Congregation of the United Norwegian Lutheran Church is stated to have decided to erect a hospital at 1st St. and 8th Ave., W.; estimated cost, $75,000.

Gurfport, Miss.—M. T. Lewman & Co., of Louisville, Ky., is reported to have received the contract for erecting the court house and public building for Harrison County, for $38,000.

Billings, Mont.—Bids will be received by the Bd. of Co. Comrs. until Mar. 31 for erecting a 2-story and basement brick and stone court house and an addition to jail. W. O. Parker, Chmn.; C. E. Bell, Archt., Helena, Mont.

Carthage, Mo.—Bids are wanted Mar. 23 for erecting a library. A. E. Lewis, Secy. of Library Bd.

Trenton, N. J.—The Assembly is stated to have passed a bill authorizing the erection of a city hall here; probable cost, $300,000.

The House is stated to have passed a bill authorizing an additional bond issue of $500,000 for the Essex County Court House.

Brooklyn, N. Y.—Plans are stated to have been filed for the 4-story brick hospital buildings to be erected at Henry and Amity Sts. for the Long Island College Hospital, at a cost of $600,000. Architect, D. E. Ward, 156 5th Ave., New York, N. Y.

New York, N. Y.—It is stated that McKim, Meade & White are preparing plans for a building for the Bellevue Hospital; estimated cost, $3,000,000.

Bids will be received Mar. 18 by Thos. Sturgis, Fire Comr., for furnishing material for erecting a building on Chambers St. for Engine Co. No. 7 and Hook and Ladder Co. No. 1.

Bids will be received Mar. 23 by Thos. Sturgis, Fire Comr., for furnishing material for the structural steel work of a building for a repair shop to be located at 12th Ave. and 56th St.; also for furnishing material for general repairs and alterations to quarters of Hook and Ladder Co. No. 18; also for furnishing material for constructing and delivering a steel fire boat.

Columbus, O.—Bids will be received Apr. 3 by the Bd. of Trus. of the Ohio Hospital for Epileptics for furnishing material and erecting cottages "A" to "F" inclusive, and farmhouse at the Ohio Hospital for Epileptics. Frank L. Packard, Archt.; A. P. Ohlmacher, M. D., Secy.

Columbus, O.—An ordinance is stated to have been passed to issue $40,000 bonds for an addition to the public library.

Gallipolis, O.—Bids will be received Mar. 20 by the Bldg. Com. for improv. the Presbyterian Church, including brick work, roofing, etc. Address G. J. Wetherholt.

Pittsburg, Pa.—The Hamilton Ave. United Presbyterian Congregation is reported to have decided to erect an edifice, to cost about $40,000.

Bids are wanted Mar. 17 for erecting shelter houses in West End and Grandview Parks. J. Guy McCandless, Dir. Dept. Pub. Wks.

The Congregation of Mt. Washington Methodist Episcopal Church is stated to have selected E. J. Carlisle, 700 Lewis Blk., to prepare plans for an edifice to replace the one destroyed by fire; probable cost, $25,000.

Philadelphia, Pa.—Bids are wanted Mar. 17 for erecting a fire house in 27th Ward and bath house in 40th Ward. P. H. Johnson, Fidelity Bldg.; A. L. English, Dir. Dept. of Pub. Safety, Bureau of City Property.

Easton, Pa.—Bids will be received Mar. 25 by the Bldg. Com. of the South Presbyterian Church for erecting a brick building as an addition to the present church building at Lehigh and Wilkesbarre Sts. John Young, Chmn.

Corsicona, Tex.—It is stated that bids are wanted Apr. 15 for erecting a 3-story brick and granite court house in this city, to cost about $130,000. J. E. Flanders, Archt., Dallas.

Whatcom, Wash.—The Congregation of the Catholic Church is reported to be considering the erection of a $50,000 edifice.

Seattle, Wash.—Saunders & Lawton, 733 N. Y. Blk., are stated to be preparing plans for an addition to the court house; estimated cost, $25,000.

Winnipeg, Man.—The Congregation of St. Augustine's Church is stated to be having plans prepared for an edifice, to cost about $50,000.

Libraries.—Andrew Carnegie is stated to have made the following cities offers for libraries: Camden, N. J., $100,000, and Laramie, Wyo., $20,000.

BUSINESS BUILDINGS AND DWELLINGS.

Denver, Colo.—R. Phillips, 47 Jacobson Bldg., is stated to have prepared plans for remodeling the Kaubt Blk. at 17th and Champa Sts., at a cost of $30,000.

Valdosta, Ga.—It is stated that J. N. Bray will erect a brick residence, to cost $25,000.

La Salle, Ill.—R. M. Neustadt is preparing to build a store and office building; estimated cost, $30,000. Kesson White, Ottawa, Ill., is the architect.

Elgin, Ill.—It is stated that the Fox River Butter Co. (C. S. Kilbourne, Pres.) will erect a $30,000 warehouse here.

Chicago, Ill.—H. R. Wilson, 218 La Salle St., is stated to have prepared plans for a 165x150-ft. apartment building, to be erected at 46th St. and Grand Boulevard, for W. B. White.

Streator, Ill.—It is stated that a Masonic Temple will be erected here, at a cost of $20,000.

South Bend, Ind.—The South Bend Maccabee lodges are considering the erection of a $75,000 temple.

Waterloo, Ia.—Murphy & Ralston, of this city, are stated to be preparing plans for a 3-story 40x120 ft. brick hotel, to be erected at W. 4th and Bluff Sts., for O. O. Hummell.

Sioux City, Ia.—Armour & Co. will rebuild their plant, at a cost of $900,000.

Davenport, Ia.—M. D. Peterson is reported interested in the erection of a hotel at Main and 4th Sts.; probable cost, $200,000.

Des Moines, Ia.—The Agar Packing Co. will double the capacity of its plant, by expending $100,000 in improvements.

The Blue Line Transfer Co. will erect a 4-story building, 132x132 ft., to be used for machinery and transfer purposes; cost, $60,000.

The Clifton Land Co. has plans for the expenditure of $40,000 in the erection of a number of new houses in its south side addition.

The Wallace Publishing Co. will erect a business building, to cost $25,000.

E. M. Ellingson & Co. will erect a cold storage building, to cost $20,000.

Pittsfield, Mass.—The American House is to add 2 more stories to its hotel, making it 6 stories. C. Quackenbush, Owner; J. McA. Vance, Archt.

Flint, Mich.—See "Electric Railways."

Kansas City, Mo.—A. Van Brunt & Bro., 716 Delaware St., have prepared plans for a brick store to be erected at 8th St. and Bway., to cost $40,000.

Gates & Knotts will erect a $35,000 brick store at 10 Grand Ave.

Louis Curtiss, 1106 Baltimore Ave., has prepared plans for a brick apartment house to be erected at 8 E. 9th St., to cost $40,000.

Port Chester, N. Y.—Edgar L. Marston is reported interested in the erection of a 80x130 ft. casino; estimated cost, $45,000.

Syracuse, N. Y.—The Onondaga Historical Assoc. is reported to be considering the erection of a building, to cost $40,000.

Canajoharie, N. Y.—The building of the Beech Nut Packing Co., recently burned, is to be rebuilt. It will be of brick, fireproof, 3 stories high, 70x100 ft. Walter H. Lipe, Secy.

Cincinnati, O.—It is stated that the Baltimore & Ohio Southwestern Co. (W. H. Brimson, Div. Supt., Chillicothe) will erect a freight house 580x60 ft. and a 6-story warehouse at 2d and Mill Sts.; probable cost, $400,000.

Akron, O.—Plans are stated to have been accepted for the Y. M. C. A. building to be erected at Main and State Sts.; estimated cost, $80,000.

Dayton, O.—It is stated that bids are wanted Apr. 1 for constructing a $300,000 10-story annex to Hotel Algonquin. C. I. William, Archt., Callahan Bldg.

Homestead, Pa.—It is stated that the contract will soon be let for erecting a 4-story brick building at 8th and McClure Aves., for S. W. B. Hays; estimated cost, $125,000.

Swissvale, Pa.—C. W. Milligan is stated to be preparing plans for a 3-story brick building to be erected at Edgewood and Braddock Aves., for R. E. Dickson & Bros., at a cost of $35,000.

Wilkinsburg, Pa.—It is stated that W. M. Devoe will erect a 3-story brick building on Franklin Ave., at a cost of $20,000. C. W. Hodgdon; Archt., 139 9th St., Pittsburg.

Erie, Pa.—Dr. C. M. Dunigan is reported to be considering the erection of a 3-story brick building at 1110 State St.; probable cost, $50,000.

Oak Grove, Pa.—David C. Myers, of Williamsport, is reported to have prepared plans for a hotel to be erected here, at a cost of $20,000.

Webster, Pa.—H. S. Estep, of Pittsburg, is stated to be preparing plans for a 3-story brick hotel to be erected here, at a cost of $25,000.

New Castle, Pa.—It is reported that the Pennsylvania Co. is preparing plans for a $500,000 depot to be erected at New Castle, Pa. Thos. Rodd, Ch. Eng., Pittsburg.

Grove City, Pa.—It is stated that a 40x60-ft. building will be erected at the Odd Fellows' Home, to cost $40,000.

Knoxville, Tenn.—It is stated that the Louisville & Nashville R. R. Co. (F. E. Brooks, Div. Supt., Nashville) will erect a depot here, at a cost of $125,000.

Charlottesville, Va.—The Chesapeake & Ohio Ry. Co. (J. W. Knapp, Div. Supt., Richmond) is stated to have decided to erect a depot here, to cost $25,000.

Richmond, Va.—The Mutual Assurance Society of Virginia is stated to be having plans prepared for a 9-story building to be erected at 9th and Main Sts.

Seattle, Wash.—It is stated that the contract will soon be let for the 3-story addition to the business building occupied by Stone, Fisher & Lane, at 2d Ave. and University St.; probable cost, $60,000.

Everett, Wash.—It is stated that the officials of the American Bank will erect a 4-story brick building at Hewitt and Colby Ave.; estimated cost, from $90,000 to $100,000.

Winnipeg, Man.—It is stated that Thos. Sharpe will erect an apartment house at Ellice Ave. and Carlton St., at a cost of $30,000.

SCHOOLS.

Cullinan, Ala.—The Benedictine Sisters are stated to be preparing to erect a $100,000 convent here. Bishop Allen, of Mobile, is reported interested.

San Francisco, Cal.—Plans are stated to have been prepared for the Laguna Honda School; probable cost, $40,000.

Louis Stone, Archt. Bd. of Educ., is stated to be preparing plans for the Washington Grammar School; approximate cost, $100,000; and the Bergerot School, probable cost, $35,000.

Upper Alton, Ill.—The Western Military Academy will erect a $40,000 building. A. M. Jackson, Pres., Upper Alton.

Chicago, Ill.—Henry I. Cobb, 110 Washington St., is stated to have completed plans for the 4-story addition to the 2-story Engineering Building, of the Lewis Inst.; estimated cost, $100,000.

Bids are wanted Mar. 20 for erecting an addition to Cooper School, including ventilating, steam heating, heat regulation, plumbing, gas fitting, sewerage, fire proofing, concrete and asphalt floors, etc. W. B. Mundie, Archt., Bd. of Educ.

Alton, Ill.—F. C. Bonsack, of St. Louis, Mo., is stated to be preparing plans for the buildings for the Western Military Academy; estimated cost, $150,000.

Peoria, Ill.—Albert Kiefer, 217 S. Adams St., is stated to be preparing plans for a school to be erected at 1st and Webster Sts., to cost $30,000.

Indianapolis, Ind.—Press reports state that bids will be received Mar. 31 by the School Authorities for $300,000 school bonds.

Burlington, Ia.—It is stated that a school will be erected here, to cost $75,000.

Des Moines, Ia.—The Des Moines College will build a gymnasium building, to cost $20,000.

Baltimore, Md.—Edw. Brady, Clk. Bd. of Awards, writes that the contract for erecting a school at Mount and Saratoga Sts. (bids opened Mar. 4) has been awarded to Chas. L. Stockhausen, 208 Patterson St., for $47,387, with addition for metal ceilings of $715.

Fall River, Mass.—St. Joseph Parish proposes erecting an 8-room school; probable cost $30,000. Louis G. Destremps is the Architect.

The city has been granted permission to issue $150,000 bonds for 3 new schools.

Greenfield, Mass.—It is stated that bids are wanted by the Bldg. Com. until Mar. 24 for erecting the high school. J. W. Stevens, Chmn.

Cambridge, Mass.—Bids are wanted Mar. 24 for constructing and installing a heating apparatus at the truant school, North Chelmsford. Levi S. Gould, Chmn. Co. Comrs.

Minneapolis, Minn.—Local press reports state that bids will be received Mar. 17 by the Bd. of Educ. for heating and plumbing in Franklin School.

Plymouth, N. H.—The citizens are stated to have voted to issue $40,000 bonds for a high school.

New York, N. Y.—The following bids were opened on Mar. 9 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary work at School 188, Boro. of Manhattan: Jas. Fay, $26,887; Jas. Harley, 288 Flatbush Ave., Brooklyn, $26,238 (awarded contract); Edwd. J. Renehan, $26,800.

Mayville, N. D.—Bids will be received Apr. 4 by Joseph Carhart, Secy. Bd. of Management of State Normal School for erecting a 3-story brick and stone addition to the Normal School. W. C. Albrant, Archt., Fargo.

Cleveland, O.—Bids are wanted Apr. 6 for furnishing material and erecting a school on Mill St., including ventilating, heating, plumbing, sewers, gas fitting, fireproofing, cement floors, electric wiring, iron and steel work, etc. Starr Cadwallader, School Dir., Bd. of Educ.

Bids are wanted Mar. 30 for furnishing material for erecting schools on Brandon St. and Harvard St., including ventilating, heating, plumbing, gas fitting, iron and steel work, fireproofing, sewers, electric wiring, etc. Starr Cadwallader, School Dir., Bd. Educ.

Monessen, Pa.—The Bd. of Educ. is stated to have adopted plans for a high school to be erected on Reed Ave.; estimated cost, $51,000.

Philadelphia, Pa.—Bids will be received Mar. 17 by the Com. on Property for erecting a manual training school at 8th and Lehigh Ave. A. F. Hammond, Secy.

Newport, R. I.—It is stated that a school will be erected here; probable cost, $100,000.

Racine, Wis.—Press reports state that bids will be received until Mar. 19 for $80,000 school bonds. H. J. Schroff, City Clk.

Appleton, Wis.—Plans will soon be completed for a $20,000 addition to the 4th Ward School, to be used for manual training. G. L. Hart, Clk.

STREET CLEANING AND GARBAGE DISPOSAL.

Saginaw, Mich.—Mayor Baum's recommendation that $20,000 be placed in the estimates for a municipal garbage plant has been reported on favorably by City Council.

Atlantic City, N. J.—The Sanitary Com. of City Council has arranged to procure plans and specifications for extensions and repairs to the garbage incinerating plant; estimated cost, $4,000.

Cohoes, N. Y.—John Quinlan has secured the contract for collecting the city garbage at $260 per month, and also the contract for cleaning and repairing the streets at $1,005 a month if cleaned once a week, and $1,300 if cleaned twice a week.

Watertown, N. Y.—Local press reports state that bids will probably be received by the Bd. of Health Mar. 20 for the collection of garbage.

Allentown, Pa.—The contract for the removing and depositing the city garbage for a period of 2 years (bids opened Mar. 10) has been awarded to Barney E. Gallagher, of Allentown, Pa., at $4,000 for 2 yrs. Lloyd W. Mitchell, City Clerk.

GOVERNMENT WORK.

See also "Sundry Civil Appropriations."

Wilmington, Del.—Bids are wanted Apr. 2 for constructing jetty at mouth of Mispillion River, Del. Col. Jared A. Smith, Corps Engrs.

Wilmington, Del.—John L. Grim, of Philadelphia, Pa., bid 23 cts., 19 cts. and 19 cts., and the River & Harbor Improv. Co. bid 17 cts., 13 cts. and 15 cts., for dredging in Mantua, Raccoon and Alloway Creeks, N. J., respectively, bids opened by Col. Jared A. Smith, Corps Engrs., U. S. A., on Mar. 9.

Ft. Riley, Kan.—Bids will be received by Capt. G. O. Cress, Q. M., on Apr. 6 for vitrified brick walks and pavements, as advertised in The Engineering Record.

Richmond, Ky.—Bids will be received Apr. 8 (extension of date) for completing the U. S. Post Office at Richmond. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Ft. Washington, Md.—Bids are wanted Mar. 16 for constructing a 6-in. terra-cotta branch sewer at this post. Geo. H. McManus, Constructing Q. M.

Boston, Mass.—The Bd. of Naval Officers appointed at the request of the Ch. of Bureau of Yards & Docks has made its report on the power plant at the Charlestown Navy Yard and the means which should be adopted to improve its condition, enlarge its capacity and make it fully equal to the present needs of the service and such as are likely to arise within a short period. The Bd. estimates the cost of the proposed plant at $230,000, and recommends that the money be made available immediately.

Minneapolis, Minn.—Bids are wanted Apr. 6 (extension of date) for enlarging (including heating apparatus, plumbing, electric conduits and wiring) of the U. S. Post Office in this city. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Biloxi, Miss.—Bids will be received by Capt. Cosby Spencer, Corps Engrs., U. S. A., Mobile, Ala., until Apr. 9 for dredging in harbor, at Biloxi.

Ft. Bayard, N. Mex.—It is stated that bids will be received by Capt. H. M. Powell, Q. M., until Mar. 28 for building a masonry dam.

Buffalo, N. Y.—The following bids were opened Mch. 5 by Maj. T. W. Symons, Corps Engrs.—*a*, for extending pier at Little Sodus Bay; *b*, for breakwater at Cape Vincent: Buff. Dredg. Co., Buffalo, *a*, $21,016; *b*, $43,065. John Henrick, Oswego, N. Y., *b*, $48,464. Jas. B. Donnelly, Buffalo, *a*, $22,296; *b*, $43,864. Barnett Contg. Co., Oswego, *a*, $21,051. Daly & Hannan Dredg. Co., Ogdensburg, *a*, $45,416; *b*, $45,416. The lowest bid includes the following unit prices: Foundation stone, *a*, 50 cu. yds., $1.60; timber cribs, *a*, 300 lin. ft., $36; *b*, 300 cu. yds., $70.60; stone fill in superstructure, *a*, 545 cu. yds., $1.50; *b*, 681 cu. yds., $1.40; concrete blocks, *a* and *b*, 691 cu. yds., $11.50; concrete in place, *a* and *b*, 1,116 cu. yds., $9.

Philadelphia, Pa.—The Secy. of Navy is reported to have awarded the contract for the dry dock at League Island Navy Yard to the G. M. Scofield Co., Arrott Bldg., Pittsburg, for $1,148,500.

Memphis, Tenn.—On the basis of bids for levee work, opened Feb. 12 by Capt. Chas. L. Potter, Corps Engrs., the following tenders have been recommended for award: M. J. Roach & Co., Memphis, 800,000 cu. yds. of the Lower Yazoo Dist., at 13.89 cts. per cu. yd.; Lowrance Bros., Friars Pt., Miss., 160,000 cu. yds. of the Lower Yazoo Dist., at 18 cts., and 65,000 cu. yds., at 17.9 cts.; Walker Stansell, Greenville, Miss., 845,000 cu. yds., at 15.74 cts. per cu. yd.; Geo. Royster Lacy, Ark. City, Ark., 129,500 cu. yds. of the Upper Tensas Dist., at 15.7 cts. per cu. yd.; Donovan & Daley, Magna Vista, Miss., 128,300 cu. yds., at 16 cts., and 111,000 cu. yds., at 17.25 cts.; Dulaney, Session & Leonard, Greenville, 111,000 cu. yds., at 19.74 cts.

Milwaukee, Wis.—According to bids opened Mar. 2 by Maj. J. G. Warren, Corps Engrs., the following are the lowest bidders for dredging, breakwater, pier and other work: Improving Waukegan, Ill., harbor: For pier extension and breakwater, Hausler & Lutz Towing & Dock Co., Chicago, from $248,301 to $278,468, according to plan and kind of timber, or, the govt. furnishing timber, $144,287, the bid including $9 each for 987 found. and protection piles, $12 each for 312 white oak piles, and 96 cts. per ton for 85,000 tons of stone. For pile revetment, etc., Lydon & Drewa Co., Chicago, $53,859, the work including 8,100 ft. piles, 120,000 ft. sheet piling, 337,000 cu. yds. sand and mud dredging at 9 cts., and 25,000 cu. yds. hard-pan and boulder dredging at 25 cts. For improving Sheboygan, Wis., harbor, Nelson J. Gaylord, Ludington, Mich., for $64,263 to $68,982, or, the govt. furnishing timber, $35,421, the bid including 760 piles at $9.50, 20,000 tons of stone at 85 cts., and 830 or 1,267 M. ft. lumber. For improving Manitowoc, Wis., harbor, Adolph Green, Green Bay, Wis., $34,912 to $41,178, or, govt. furnishing timber, $21,262, the bill including 396 piles at $12, and 10,000 tons of stone at 95 cts. For furnishing Oregon fir timber and plank, H. B. Waite Lumber Co., Minneapolis, 6,339.8 M. ft. timber at $8.70, 418.2 M. ft. at $8.20, surfacing timber at $1, surfacing plank at 90 cts. per M. ft. For dredging Sturgeon Bay and Lake Michigan Ship Canal, Wis., Duluth Dredge & Dock Co., Duluth, Minn., $157,500 for dredging 1,500,000 cu. yds. or $148,500, working 16 hrs. per day, and $16,500 for removing 3,000 cu. yds. rock.

Ft. Mackenzie, Wyo.—Bids are wanted Mar. 4 for installing heating, plumbing, gas-piping and electric wiring in several buildings at this post. Address Capt. Thos. Swobe, Q. M., U. S. A., Sheridan, Wyo.

NEW INDUSTRIAL PLANTS.

The Ohio Cold Storage Co., 515 Reibold Bldg., Dayton, O., will erect a 7-story, 452x80-ft. cold-storage warehouse, and will also probably install a large power plant for generating electricity.

The American Mfg. & Novelty Co., 14th and Cascade Sts., Erie, Pa., whose plant was recently burned, intends to erect at once a 2-story building having 15,000 sq. ft. floor space, and install a 60-H.-P. power plant.

D. Graham, Sons & Co., Inglewood, Ont., whose knitting mill was recently burned, will erect a 36x70-ft. mill and a 36x50-ft. picker, dye and drying room. The power plant was not badly damaged, but the company is in the market for cards, mules and knitting machinery.

The Smith Premier Typewriter Co., Syracuse, N. Y., will erect a new factory, including a 6-story and basement, 364x59-ft. main building and a 2-story, 160x48-ft. power house. Boilers of 600 to 700-H.-P. capacity, a cross-compound engine with a direct-connected generator of about 250-H.-P., and a simple lighting engine of about 90-H.-P. will probably be installed.

Thos. Jackson & Co., Ltd., Saginaw, W. S., Mich., whose lumber plant was recently burned, think they will rebuild, although it has not been definitely decided. A power plant of about 250-H.-P. will be required.

The National Tube Co., Frick Bldg., Pittsburg, Pa., will establish a pipe mill, etc., at Lorain, O.

The Passaic Steel Co., Paterson, N. J., has plans for a new steel plant in connection with its present plant, consisting of twelve 50-ton open hearth furnaces, a blooming mill, a finishing structural mill with the necessary gas producers, coal storage, boiler house and power plant, with a capacity of 300,000 tons of finished structural steel shapes per annum. The company has let contracts for two furnaces to be ready by July 1. The company also contemplates the removal of its present bridge shops to a new location and the construction of a modern bridge plant with a capacity of 3,000 tons per month.

MISCELLANEOUS.

Gridley, Cal.—The Butte County Canal Co. has been incorporated, with John P. Clark, of Fresno; A. K. Whitaker, of San Jose, and D. C. McCallum, of Oroville, as directors, to construct a ditch from Feather River, running through Biggs and Gridley, and the area brought under the waters of the canal will approximate 180,000 acres.

Washington, D. C.—Congress has appropriated $10,500 for 2 steel water-tube boilers (225-H.-P.) for the Senate wing of the Capitol.

Atlanta, Ga.—Plans for a subway to connect North and South Boule. under the tracks of the Southern and the Georgia Rys. have been completed by Second Asst. City Engr. W. T. Wilson, under direction of City Engr. R. M. Clayton; it will be about 354 ft. in length, and cost about $5,000.

Augusta, Ga.—Nisbet Wingfield, City Engr., has prepared plans for a $10,000 addition to the city wharf at 5th and Bay Sts.

Laporte, Ind.—The entire issue of $79,500 drainage bonds issued by Laporte and Stark Counties has been sold, the proceeds to be used in constructing a new channel to change the course of Kankakee River.

Topeka, Kan.—A bill has been passed by Senate authorizing the Commercial Club, of Topeka, to contruct a dam across Kansas River, within the Counties of Shawnee and Wabaunsee, Kan.

Alexandria, La.—The Red River, Atchafalaya and Bayou Boeuf Levee Bd. on Mar. 3 sold $250,000 levee bonds.

Trenton, Mich.—Bids will be received Mar. 16 by Robt. H. Stringham, Village Clk., for furnishing material and installing smoke consumers in the 2 tubular boilers of 48-in. diameter, each boiler having 40 flues of 3-in. diameter.

New York, N. Y.—Bids will be received Mar. 19 by the Park Bd. for furnishing and delivering gravel, equal to the quality known as Roa Hook gravel, where required in Central Park, Riverside Park and on

drives; also broken trap rock kill sand and trap rock screenings, where required in parks, in the Boro. Manhattan.

Bids will be received Mar. 17 by McDougall Hawkes, Comr. of Docks, for furnishing material for building a pier with appurtenances at W. 41st St., to be known as pier No. 81; also Mar. 20 for dredging on the East and Harlem Rivers.

Gov. Odell has signed the bill appropriating $70,000 for rebuilding the disinfectant plant, sea wall, and docks and repairing damaged buildings at the quarantine station on Hoffman's Island, N. Y. City.

New York, N. Y.—See "Public Buildings."

Philadelphia, Pa.—Bids are wanted Mar. 17 for improving Clark Park and dredging. P. H. Johnson, Archt., Fidelity Bldg.; A. L. English, Dir. Dept. Pub. Safety, Bureau of City Property.

Richmond, Va.—The James River Improv. Com. is stated to have awarded the contract for dredging James River to J. C. Cheatwood, at 32 cts. per cu. yd.

BUSINESS NOTES.

The New York Continental Jewell Filtration Co., New York, reports receiving the following orders: Khedive of Egypt, Jewell gravity system for the royal palaces at Mantaya near Alexandria; Royal Hungarian R. R., Klausenberg, Hungary. John J. Campbell, 3d and Cumberland Sts.; Barrett Mfg. Co., 36th and Gray Ferry Road, and Garrick Hotel & Restaurant Co. Annex, 108 S. 13th St., Philadelphia; Mutual Life Ins. Co., Cape Town, So. Africa; Cornell University, and Columbus, Ga., Water Works Co., a Jewell gravity syatem of 2,000,000 gals. daily capacity.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Union Trust Co. Bldg., Baltimore, the engine for an 80-H.-P. direct-connected unit; Fayhall Mine of the Minnesota Iron Co., Eveleth, Minn., engine for a 100-H.-P. electric lighting plant.

Owing to the fact that C. A. White, manager of the New York office of the Phoenix Iron Works Co., Meadville, Pa., has decided to connect himself with the Washington Co., 39-41 Cortlandt St., New York, the company has closed its office at 15 Cortlandt St., and made the Washington Co. its general eastern sales agents.

Kilburn, Clark & Co., of Seattle, Wash., have been made the Pacific Coast sales and distributing agents of the Nernst Lamp Co., of Pittsburg, and have established branch offices in San Francisco and Los Angeles, Cal. The increasing volume of business from that section of the country has made necessary special attention to its demands. The Nernst Co., having secured patent and selling rights in Canada, is now making arrangements for establishing a factory in the dominion.

The American Blower Co., of Detroit, is building mechanical draft apparatus for several of the collieries of the Pennsylvania Coal Co. and the Delaware & Hudson Co., and is also building the blowers, which will be equipped with direct-connected motors, for the U. S. Steamship "Yankee," under construction at the League Island Navy Yard.

The Consolidated Canal Co., Mesa, Ariz., is arranging to furnish water for irrigating a large area, and is installing in its power plant the following apparatus recently purchased from the Westinghouse Electric & Mfg. Co.: A 300-Kw., 3-phase, revolving-field alternator, running at 400 r. p. m. and 11,000 volts, which is direct-coupled to a water wheel; also three 50-H.-P. motors of 200 volts, 7,200 alternations, and 850 r. p. m. for operating pumps.

The infringement suit of the National Meter Co. against the Neptune Meter Co. has just been decided by Judge Archbald in favor of the former. By the terms of the decision all Trident meters with any style of frost bottom infringe the patent owned and controlled by the National Meter Co.

The Bishop & Babcock Co., Cleveland, is equipping its machine shop for electric driving; 7 or 8 Westinghouse induction motors, 10 to 40-H.-P., are now in operation, current being temporarily supplied from the plant of the Cleveland Twist Drill Co. The Bishop & Babcock Co. is installing a power plant of its own, and has recently purchased a 175-Kw., 2-phase engine-type alternator, with switchboard complete. Geo. S. Rider & Co. are the engineers for the plant.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Mar. 16.	Lake Park, Minn., Adv. Feb. 28	Feb. 28
Mar. 16.	Pumping Engine, Winnipeg, Man. Adv. Jan. 17 to Feb. 14.	Jan. 17
Mar. 17.	Cincinnati, O., Adv. Feb. 21,	Mar. 7. Feb. 21
Mar. 18.	Tower, Marshall, Tex., Adv. Feb. 28.	Feb. 28
Mar. 21.	Melrose, Mass.	Mar. 14
Mar. 23.	Perth Amboy, N. J., Adv. Mar. 14.	Mar. 14
Mar. 23.	Mt. Pleasant, Tex.	Mar. 7
Mar. 24.	St. Louis, Mo.	Mar. 14
Mar. 24.	Engine, Allentown, Pa. Adv. Mar. 14.	Mar. 14
Mar. 24.	Atlantic City, N. J., Adv. Mar. 14.	Mar. 14
Mar. 24.	Pipe, etc., Williamsburg, Mass. Adv. Mar. 7.	Mar. 7
Mar. 24.	Dams, etc., Williamsburg, Mass. Adv. Mar. 7.	Mar. 7
Mar. 25.	Lancaster, O.	Mar. 7
Mar. —	Alcester, S. D.	Feb. 21
Apr. 1.	Clearfield, Pa.	Mar. 14
Apr. 1.	Toronto, Ont., Adv.	Feb. 28 to Mar. 14. Feb. 28
Apr. 3.	Cleveland, O.	Mar. 14
Apr. 3.	Brookville, O.	Mar. 14
Apr. 6.	Fargo, N. D.	Mar. 14
May 1.	Chinook, Mont.	Feb. 7
———	Metera, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Mar. 16.	Albany, N. Y.	Mar. 14
Mar. 16.	Terre Haute, Ind.	Mar. 14
Mar. 17.	Waterbury, Conn.	Mar. 14
Mar. 17.	Dayton, O.	Feb. 21
Mar. 18.	Brooklyn, N. Y., Adv. Mar. 7 to 14.	Mar. 7
Mar. 19.	Cincinnati, O.	Mar. 14
Mar. 19.	Cleveland, O.	Mar. 14
Mar. 19.	Buffalo, N. Y.	Mar. 14
Mar. 19.	Cleveland, O.	Feb. 28
Mar. 23.	Des Moines, Ia.	Mar. 14
Mar. 23.	Des Moines, Ia.	Mar. 7
Mar. 24.	New Britain, Conn., Adv. Mar. 7 to 14.	Mar. 7
Mar. 25.	Brooklyn, N. Y., Adv. Mar. 14.	Mar. 14
Mar. 26.	Connersville, Ind.	Mar. 14
Mar. 26.	Cincinnati, O.	Mar. 7
Mar. 28.	Lakewood, O.	Mar. 7
Mar. 30.	Corry, Pa.	Mar. 14
Mar. 30.	South Bethlehem, Pa. Adv. Feb. 28 to Mar. 14.	Feb. 28
Mar. 30.	Marshfield, Wis.	Feb. 21
Apr. 1.	Tacoma, Wash.	Mar. 14
Apr. 2.	Cleveland, O.	Mar. 14
Apr. 2.	Cincinnati, O.	Mar. 14
Apr. 3.	Salem, O.	Mar. 14
Apr. 6.	Madrid, Ia.	Mar. 14
Apr. 6.	Canton, O.	Feb. 28
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. —	Crookston, Minn.	Feb. 21
———	Port Huron, Mich.	Mar. 14
	BRIDGES.	
Mar. 16.	Wapakoneta, O.	Mar. 14
Mar. 17.	Kearney, Neb.	Feb. 14
Mar. 18.	Peoria, Ill.	Mar. 14
Mar. 18.	Chicago, Ill.	Mar. 7
Mar. 19.	Buckley, Wash.	Mar. 14
Mar. 21.	Benwood, W. Va.	Mar. 7
Mar. 23.	New York, N. Y.	Mar. 14
Mar. 25.	Plymouth, Wis.	Feb. 14
Mar. 26.	Chatham, Ont.	Feb. 21
Mar. 27.	Washington, D. C., Adv. Feb. 7 to 28.	Feb. 7
Mar. 28.	Roby, Tex.	Mar. 14
Mar. 30.	Washington, D. C., Adv. Mar. 7, 14.	Mar. 7
Apr. 1.	Atlantic City, N. J.	Mar. 14
Apr. 14.	Columbus, O.	Mar. 14
	PAVING AND ROADMAKING.	
Mar. 16.	Menominee, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 17.	Cleveland, O.	Mar. 14
Mar. 17.	New York, N. Y.	Mar. 14
Mar. 17.	Cleveland, O.	Feb. 28
Mar. 19.	Chicago, Ill.	Mar. 14
Mar. 19.	Toronto, Ont.	Mar. 14
Mar. 19.	Cincinnati, O.	Feb. 28
Mar. 19.	Wapakoneta, O.	Feb. 28
Mar. 23.	Columbus, O.	Mar. 14
Mar. 23.	Marshall, Mich.	Mar. 14
Mar. 23.	New York, N. Y.	Mar. 14
Mar. 23.	Muncie, Ind.	Mar. 7
Mar. 23.	Newburgh, N. Y., Adv. Feb. 7 to Mar. 14.	Jan. 31
Mar. 24.	St. Louis, Mo.	Mar. 14
Mar. 25.	Cohoes, N. Y. Adv. Mar. 14.	Mar. 14
Mar. 26.	Nashville, Tenn.	Mar. 14
Mar. 27.	Des Moines, Ia.	Mar. 14
Mar. 28.	Lakewood, O.	Mar. 7
Mar. 30.	Toledo, O.	Mar. 14
Mar. 30.	Buckingham, Que.	Mar. 14
Mar. 30.	Toledo, O.	Mar. 7
Mar. 31.	Waukesha, Wis.	Mar. 14
Mar. 31.	Toms River, N. J.	Mar. 7
Mar. —	San Diego, Cal.	Jan. 31
Apr. 1.	Dunkirk, N. Y.	Mar. 14
Apr. 3.	Salem, O.	Mar. 14
Apr. 4.	Greenville, O.	Mar. 14
Apr. 6.	New Bedford, Mass., Adv. Mar. 7, 14.	Mar. 7
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. 10.	Windsor, Ont.	Mar. 14
Apr. 10.	Tacoma, Wash.	Mar. 14
Apr. 18.	Evansville, Ind.	Mar. 14
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Mar. 19.	Bozeman, Mont.	Mar. 14
Mar. 21.	Union, S. C.	Mar. 7
Mar. 23.	Southampton, N. Y.	Mar. 14
Mar. 25.	Ashton, Ill.	Mar. 14
Mar. 31.	Binghamton, N. Y.	Feb. 28
Apr. 7.	Copenbagen, Denmark	Feb. 28
Apr. 7.	Oneida, N. Y.	Feb. 7
———	Hyattaville, Md.	Jan. 31
———	Franchlae, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Mar. 16.	Ft. Washington, Md.	Mar. 14
Mar. 16.	Wiring, P. O., Wilkesbarre, Pa. Adv. Feb. 14, 21.	Feb. 14
Mar. 17.	Cincinnati, O., Adv. Feb. 14 to Mar. 7.	Feb. 14
Mar. 18.	Buffalo, N. Y., Adv. Feb. 21, 28.	Feb. 21
Mar. 19.	Wilmington, Del. Adv. Feb. 21 to Mar. 14.	Feb. 21
Mar. 20.	Ft. Howard, Md.	Feb. 21
Mar. 21.	Ft. McRee, Fla.	Mar. 7
Mar. 21.	Newport, R. I.	Feb. 28
Mar. 23.	Wheeling, W. Va. Adv. Feb. 21, 28, Mar. 14.	Feb. 21
Mar. 23.	Ft. Lincoln, N. D.	Feb. 28
Mar. 24.	Ft. Mackenzie, Wyo.	Mar. 14
Mar. 24.	San Francisco, Cal.	Mar. 7
Mar. 24.	Kalamazoo, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 25.	New York, N. Y. Adv. Feb. 28 to Mar. 14.	Feb. 28
Mar. 25.	Galveston, Tex.	Feb. 28
Mar. 26.	Boston, Mass.	Mar. 7
Mar. 26.	Ft. Monroe, Va.	Mar. 7
Mar. 27.	Wheeling, W. Va. Adv. Feb. 28 to Mar. 14.	Feb. 28
Mar. 27.	Sioux City, Ia., Adv. Feb. 28.	Feb. 28
Mar. 28.	Ft. Bayard, N. Mex.	Mar. 14
Mar. 28.	New York, N. Y.	Mar. 7
Mar. 28.	Boston, Mass.	Feb. 28
Apr. 1.	Ft. Greble, R. I., Adv. Mar. 14.	Mar. 14
Apr. 1.	Grand Rapids, Mich., Adv. Mar. 7, 14.	Mar. 7
Apr. 2.	Wilmington, Del.	Mar. 14
Apr. 2.	Philadelphia, Pa., Adv. Mar. 7, 14.	Mar. 7
Apr. 4.	Montgomery, Ala., Adv. Mar. 7, 14.	Mar. 7
Apr. 4.	Charleston, S. C.	Feb. 28
Apr. 6.	Ft. Riley, Kan., Adv. Mar. 14.	Mar. 14
Apr. 6.	Ft. Caswell, N. C., Adv. Mar. 14.	Mar. 14
Apr. 6.	Minneapolis, Minn.	Mar. 14
Apr. 8.	Richmond, Ky.	Mar. 14
Apr. 9.	Mobile, Ala.	Mar. 14
Apr. 11.	Petoskey, Mich., Adv. Mar. 14.	Mar. 14
Apr. 11.	Chattanooga, Tenn., Adv. Mar. 7, 14.	Mar. 7
Apr. 14.	Washington, D. C., Adv. Mar. 14.	Mar. 14
Apr. 17.	St. Augustine, Fla. Adv. Feb. 21, Mar. 7.	Feb. 21
Jun. 15.	Manila, P. I., Adv. Mar. 14.	Mar. 14
	BUILDINGS.	
Mar. 16.	Police station, Joliet, Ill.	Mar. 14
Mar. 17.	Shelter houses, Pittsburg, Pa.	Mar. 14
Mar. 17.	Pub. Bldgs., Philadelphia, Pa.	Mar. 14
Mar. 17.	School, Minneapolis, Minn.	Mar. 14
Mar. 17.	School, Philadelphia, Pa.	Mar. 14
Mar. 18.	Hospital, Kings Park, L. I., N. Y.	Mar. 14
Mar. 18.	Pub. Bldg., New York, N. Y.	Mar. 14
Mar. 18.	Pub. Bldg., Mansfield, O.	Feb. 21
Mar. 19.	Hospital, Athens, O.	Feb. 28
Mar. 19.	Church, Columbus, O.	Feb. 28
Mar. 20.	School, Chicago, Ill.	Mar. 14
Mar. 20.	Church, Gallipolis, O.	Mar. 14
Mar. 20.	Masonic Temple, Chillicothe, O.	Mar. 7
Mar. 20.	Bus. Bldg., Athena, Ore.	Jan. 31
Mar. 21.	Court house, Condon, Ore.	Mar. 7
Mar. 23.	Library, Carthage, Mo.	Mar. 14
Mar. 23.	Pub. Bldgs., New York, N. Y.	Mar. 14
Mar. 24.	School, Cambridge, Mass.	Mar. 14
Mar. 24.	School, Greenfield, Mass.	Mar. 14
Mar. 24.	Hospital, Cherokee, Ia.	Mar. 7
Mar. 25.	Library, Logansport, Ind.	Mar. 14
Mar. 25.	Church, Easton, Pa.	Mar. 14
Mar. 26.	School, Ames, Ia.	Mar. 7
Mar. 30.	School, Cleveland, O.	Mar. 7
Mar. 31.	Pub. Budg., Alexandria, La.	Mar. 7
Mar. 31.	Court House, Billings, Mont.	Mar. 14
Apr. 1.	Hotel, Dayton, O.	Mar. 14
Apr. 1.	School, Grand Forks, N. D.	Mar. 7
Apr. 1.	Hospital, Muskegon, Mich.	Feb. 28
Apr. 1.	Elevators in bus. bldgs., Tacoma, Wash.	Feb. 21
Apr. 2.	Hotel, Bemidji, Minn.	Feb. 21
Apr. 3.	Hospital, Columbus, O.	Mar. 14
Apr. 4.	Jail, Louisville, Ky.	Mar. 14
Apr. 4.	School, Mayville, N. D.	Mar. 14
Apr. 6.	School, Cleveland, O.	Mar. 14
Apr. 7.	Jail, Morristown, Tenn.	Feb. 28
Apr. 9.	Pub. Bldg., Xenia, O.	Mar. 7
Apr. 15.	Court house, Corsicana, Tex.	Mar. 14
	MISCELLANEOUS.	
Mar. 16.	Smoke Consumers, Trenton, Mich.	Mar. 14
Mar. 17.	Pier, New York, N. Y.	Mar. 14
Mar. 17.	Dredging, etc., Philadelphia, Pa.	Mar. 14
Mar. 19.	Supplies, New York, N. Y.	Mar. 14
Mar. 20.	Dredging, New York, N. Y.	Mar. 14
Mar. 20.	Garb. Disp., Watertown, N. Y.	Mar. 14
Mar. 20.	R. R. Work, Charleston, W. Va.	Mar. 14
Mar. 20.	Cement, Brandon, Ont.	Mar. 7
Mar. 23.	St. Ry. franchise, Somerset, Ky.	Feb. 28
Mar. 24.	Ditch, Rockwell City, Ia.	Mar. 7
Mar. 25.	El. Ry., Youngstown, O.	Mar. 14
Mar. 30.	Ry. franchise, Oakland, Cal.	Mar. 7
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
Apr. 13.	El. Ry. franchise, Whittier, Cal.	Mar. 14
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21
———	Cement, Ill.	Feb. 21
———	R. R. work, Cincinnati, O.	Dec. 20

PROPOSALS.

Notice to Material Men.

aled proposals will be received at the Clerk's office up to noon April 15, 1903, furnishing to the City of Traverse City, ., 8,800 square yards of Paving Brick about 1,200 cubic yards of crushed Stone. ecifications on file in the Office of the Clerk, Traverse City, Mich., and at the neer's Office at Bay City, Mich.

BLOOMSHIELD & McCLOY, Engineers.

IAS. M. BEERS, City Clerk.

nders Wanted for Steel Work.

Vers will be received by the undersigned April 1st for furnishing materials for erecting three steel water tanks, for icipal Water Works purposes:

) Trestle and tank at Bridgeburg, Ont., site Buffalo, N. Y., on the Niagara River.

) Trestle and tank at Edmonton, Alberta, t 200 miles north of Calgary, N. W. T., da.

(3) Trestle and tank at Strathroy, Ont. (near London, Ont.).

Plans and specifications will be sent to re sponsible manufacturers upon application.

Separate offers are to be given for each.

No tenders necessarily accepted.

WILLIS CHIPMAN, Civil Engineer.

Address 103 Bay Street, Toronto, Ont., Can.

Pumping Engine.

Sealed proposals will be received by the Board of Water Commissioners of the City of Allentown, Pa., until 6 o'clock P. M., March 24th, 1903, at their office in City Building, Allentown, Pa., for One ten million (10,000,000) gallon Pumping Engine, including foundation and all fittings for pump. Bidders will be expected to examine location, submit drawings and specifications showing engine in position, also giving boiler capacity required and specific information as to foundation. Each bid must be accompanied by a certified check for $1,000, as a guarantee that bidders will enter into contract. The Board of Water Commissioners reserves the right to reject any or all bids.

By order of Water Commissioners.

JACOB S. RENNIGE, Secy.

OFFICE OF THE ENGINEER IN CHARGE. Improvement of the Port—Manila, P. I., February 15, 1903.—Sealed proposals for constructing an additional breakwater at Manila, P. I., will be received at this office until 11 o'clock A. M., June 15th, 1903, and then publicly opened. Work to be done includes about 450,000 tons of 2,240 lbs. each, of rock filling, in water of approximately 30 feet depth. Bids must be accompanied by a bond of $50,000 U. S. Currency. One contract will be made for the whole work. Contractor's bond will be for 10% of the amount bid. The right is reserved to reject any or all bids. For specifications and blank forms apply to this office, the U. S. Engineer Office, Room "H," Army Building, New York City, N. Y., the U. S. Engineer Office, 1637 Indiana Avenue, Chicago, Ill., or the U. S. Engineer Office, Room 41, Flood Building, San Francisco, Cal. CLINTON B. SEARS, Major, Corps of Engineers, U. S. Army, in charge.

U. S. ENGINEER OFFICE, WHEELING, W. Va., February 26, 1903.—Sealed proposals for building a power house, except foundation, at Dam No. 6, Ohio River, near Merrill, Pa., will be received here until 11 A. M. (Eastern time), March 27, 1903, and then publicly opened. Information furnished on application. W. E. CRAIGHILL, Capt., Engrs.

U. S. ENGINEER OFFICE, GRAND RAPIDS, Mich., March 2, 1903.—Sealed proposals for Repair of South Pier at Portage Lake, Mich., and Extension and Repair of Piers at Frankfort, Mich., will be received here until 3 P. M., April 1, 1903, and then publicly opened. Information furnished on application. CHARLES KELLER, Capt., Engrs.

U. S. ENGINEER OFFICE, DULUTH, Minn., Mar. 12, 1903.—Sealed proposals for furnishing 6,000 barrels Portland cement for concrete superstructure to breakwater at Marquette, Mich., will be received here until noon, Apr. 11, 1903, and then publicly opened. Information on application. D. D. GAILLARD, Capt., Engrs.

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Subway Ventilation.

In the calculations for the adequate ventilation of subways there is a point of special adaptation that was not referred to in the editorial on this subject two weeks ago. Where a subway is subject to a periodic crowding and it is desired to install ventilating apparatus capable of meeting the maximum demand, it is possible to proportion it in the same manner that the ventilating plant is for a building occupied only at intervals of short duration. Such a calculation usually presupposes that between the periods of occupancy the number of persons breathing the air in the ventilated space is so small or the rate of change of air in the interim is so great that the air, when the condition of maximum usage arrives, is practically as pure as that out of doors. The time required for an individual to pollute the air in a given space will, of course, depend, among other things, on the volume of that space, and for the given period it is only necessary to furnish him with a sufficient quantity of air that at the end of the period the air shall not fall below a desired standard of purity, measured by the carbonic acid gas present.

In the article referred to an example was based on the assumption that in stations and in cars in one mile length of a subway there would be 4,000 persons at any one time. For the purposes of the present calculations this number may be considered as the amount of travel during the so-called rush hours, and it may be further assumed for convenience that this rush period lasts for two hours at a time. It can be shown that the quantity of air that should be supplied to a person who is to occupy a given space for a stated period of time, so that a maximum allowable degree of vitiation is not exceeded (say in cubic feet per hour), is equal to the quantity that would be required for continuous occupation without vitiation, less the quotient of the volume of the space occupied by the length of time occupied (cubic feet divided by number of hours). For the 3,500,000 cubic feet of space in the subway in the mile section in question, there are 900 cubic feet of space per person, assuming the air may enter the cars freely. Adopting the per capita supply that is the standard in many localities for school ventilation work, namely, 1,800 cubic feet per hour (which, as a matter of fact, means, for continuous occupation, a proportion of 7⅓ parts of carbonic acid gas in 10,000), the amount of air that need be delivered to the subway per hour is equal to $1,800—(900 \div 2) = 1,350$ cubic feet. If 8 parts in 10,000 of carbonic acid gas are allowed, 1,050 cubic feet per hour per person would suffice.

Municipal Lighting.

A report by the Commissioner of Water Supply, Gas and Electricity, to the Mayor of New York, on bids received for public lighting for the current year, appears to have placed before the municipal authorities of New York certain questions of wide interest to all large municipalities, if not to small cities as well. The streets and public places of New York City are lighted partially by electricity and partially by gas, and as the city includes districts not only widely separated, like the Boroughs of Queens, Richmond and the Bronx, but of greatly varying density of population, it would be natural that there should be at least a considerable number of electric and gas light companies in those boroughs, in the absence of municipal plants. It is equally natural to suppose under such conditions that there might be keen competition for public lighting, but the Commissioner shows that there is no competition at all, a single corporation either owning or controlling all those separate in name, or acting under an apportionment agreement, at least in effect, with those small companies not owned by it.

There are various ways of extracting large sums of money from the people of a municipality, especially if that municipality be large. Methods of levying upon contractors as well as others, not too well known in general, but rather widely practiced in connection with contracts awarded in more or less open competition, have been found quite effective in most, if not all, of the greater cities of the country. There are still other ways of satisfying the aspirations of certain municipal statesmen, fairly well known to those whose duties have brought them into more or less close contact with the construction of public works in cities, but which it is not necessary to describe.

The most refined and elegant means for tapping the public treasury and securing exorbitant rates for municipal utilities is undoubtedly the great corporation formed in accordance with statutory requirements, but so administered as to secure a multiplied profit under the guise of a dividend paid at a reasonable or even small rate on greatly inflated capital. The statement of the Commissioner will indicate with great clearness why the question of municipal ownership of public utilities is being agitated in such an active manner at the present time. Indeed, whatever may be the opinion as to the wisdom of public ownership, and there is room for great difference of opinion, it would seem that such ownership of public utilities may be forced upon many municipalities in simple self-defense.

The illuminating power of the gas furnished to New York City may be increased nearly 200 per cent. by means of the Welsbach mantle. Each street lamp in Chicago fitted with that mantle costs the additional sum of $2.40, but the bids recently received in New York show that the latter city must pay $11.50 for the same improvement in the Borough of Manhattan and $15 a year in the Borough of Brooklyn. It is a matter of small wonder that the Commissioner states: "On the Chicago basis of prices we could save enough on the 5,500 high-priced Welsbach lamps in use in Manhattan and the Bronx to change 20,000 ineffective open flame burners to incandescent mantle lights, improving the illumination of our poorly lit streets in those boroughs by 100 per cent. and saving $40,000 of the present appropriation."

That is not by any means the whole story of the gas question, but electric lighting is of dominating importance, not only because public lighting will probably soon be done by electric power very much more generally, but because already nearly two-thirds of the appropriation for public lighting in the City of New York is expended for electric lights. The significance of the part of the Commissioner's report relating to electric lamps on the streets and other public places of New York can be realized when it is observed that the price bid for a 2,000-candle-power lamp for the Borough of Manhattan is $146 per year and for a 1,200-candle-power lamp in Brooklyn $124.50. On the other hand, the data secured shows that the average price paid for 2,000-candle-power lamps in 68 other cities is $88.60 only, and $81.08 each for 1,200-candle-power lamps in 23 other cities. Roughly speaking, therefore, the City of New York is asked to pay nearly 1.7 times the average of 68 other cities for her 2,000-candle-power lamps and 1.5 times as much for the 1,200-candle-power lamps. The Commissioner further shows that the actual cost of the electric energy required is about three cents per kilowatt-hour, while the city is charged at the rate of 10.15 cents, i. e., about 3.5 times the cost.

These figures do not tell the whole story as set forth by the Commissioner; they show a few of the main features only, and the reason for them is not far to seek, when the capital account of the corporation charging these prices is examined. The New York Edison Company, the corporation controlling practically all the gas and electric lighting companies of New York, was formed by a consolidation of some nine or ten or more companies having a total capital, originally much inflated, of $30,214,100. The consolidation of these various companies resulted, through the well known processes of such capitalizing operations, in a total capital for the New York Edison Company of $45,200,000 in stock and $40,138,000 in bonds, making a total capital of $85,338,000. Interest must be paid upon these bonds and dividends upon the stock of this total inflation resulting in a capitalization of nearly three times that of the combined capitals of the constituent companies. The people of the city, therefore, are subjected to extortion for public lighting to pay dividends and bond interest, on an amount multiplied many times over the original cost of plant, good will and all other material assets. This is the latest and most refined, and, one might almost say, statutory method of tapping the public treasury and forcing out of the people exorbitant returns for public utilities which ought to be at the service of the community for little if any more than reasonable cost and maintenance. The broad question is one of the keenest interest not only to New York, but to all municipalities; and the investigation and report may be of service, indirectly, to many.

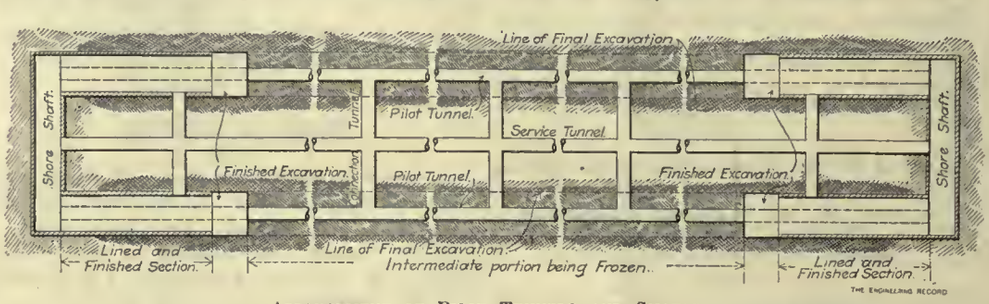
Improved Methods for Difficult Subaqueous Tunneling.—II.

New or improved methods and apparatus for constructing submerged tunnels in difficult ground, and a general review of the previous state of the art, present conditions and reasonable future prospects were given in a descriptive article and editorial last week. In continuation, descriptions of other methods and apparatus which have been designed for such work and are considered applicable to the transit problems similar to those in Greater New York are here presented. Brief reference is made to some important tunnels of recent construction, the descriptions of which it is desired to supplement with others of similar interest and importance. A discussion of such engineering designs and operations is valuable, and fair-minded criticisms are helpful to their projectors. The columns of The Engineering Record are open to communications and suggestions concerning them or to descriptions of difficulties and devices developed in similar work.

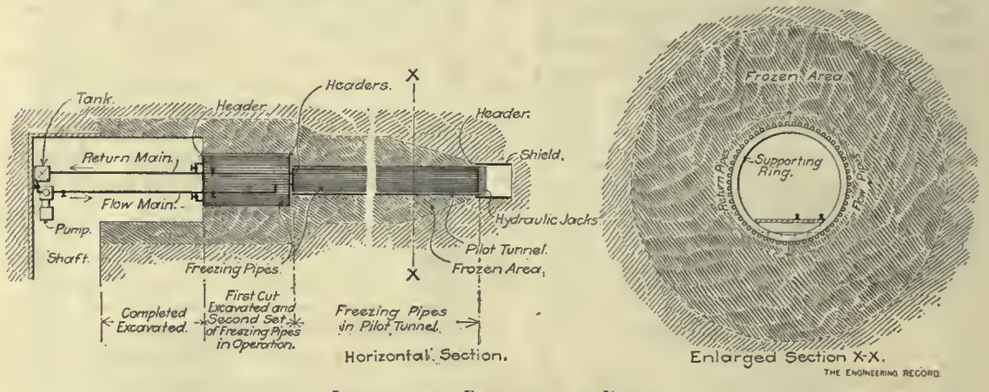
The method proposed by Mr. Charles Sooysmith, C. E., provides for a foundation of piles driven through deep water to support two or more separate or joined parallel tunnels, excavated in very soft, wet material from headings driven from the bottoms of shafts, wholly under the river bed and always retaining a roof of the natural earth above them. Novel features are involved in the driving of the piles to a great depth under water, and in the combination of the freezing method and pilot tunnels for the difficult excavation. The preliminary drawings show a special pile driver carried by two barges held by frames at a fixed distance apart. The multiple leads or guides in the space between the two barges are adjustable in both directions, so that when the barges are anchored in position several rows of piles can be driven without changing their location. Braced guides extend below the barges and through them spuds may be put down to hold the barges in position, and yet leave them free to rise and fall with the tide. Anchors and lines may be employed as usual, in addition, and the pile leads or guides are so constructed that they may be supported directly on spuds and lifted free from the barges, which would then have no connection with them and would serve only as a means of moving the leads to any position as required. Enough leads will be provided to drive several bents of piles without relocation.

Before driving each pile, a steel tube somewhat larger than the pile will be driven by hammer or water jet until its bottom is at the level of the bottom of the proposed tunnel; the pile will then be driven through this tube, the length of the pile selected being such as to make it drive to the desired resistance at the bottom of the tube. The pile within the tube will be driven by a Nasmyth steam hammer pile driver, preferably run by compressed air. This will rest upon the pile and be enclosed in an air-tight shell attached to it, open at the bottom and extending a little below the top of the pile. Air will be kept in this shell to exclude water from it so that the hammer will work as in a diving bell. The use of the guide tube, subsequently withdrawn, will avoid much of the difficulty and friction of driving piles to great depths under water and is intended to promote the rapidity, economy and accuracy of the work.

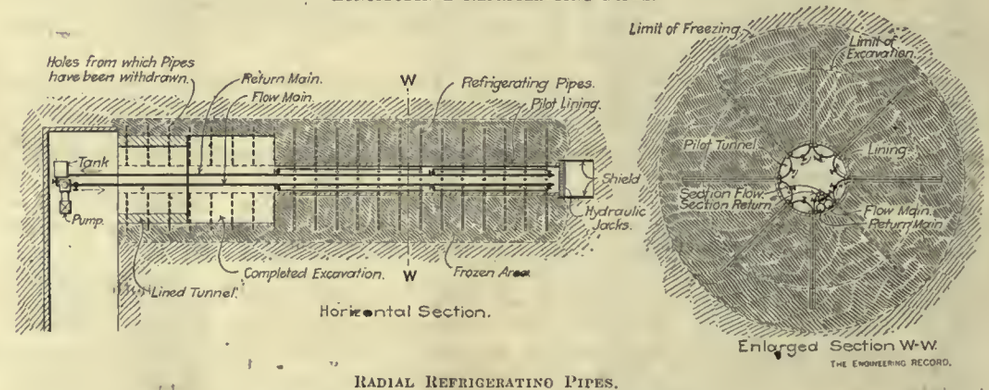
After a foundation has thus been constructed to carry the tunnel and its loads, without danger of settlement or distortion in the soft and treacherous silt, it is proposed to drive a small heading about 7 feet in diameter on the axis of each of the required tunnels. These small headings can be driven without difficulty in the usual way by compressed air, at an estimated speed of 10 feet a day or more and will serve first as refrigeration chambers and afterwards as pilot headings which will be enlarged to the full sized excavation required for the permanent tunnel. As fast as built, the temperature within the pilot tunnels will be reduced to about 10 degrees below zero, by means of pipes laid directly against the soil. Through these pipes there will be a circulation of chloride of calcium brine, cooled by an ice machine outside, precisely as is done in cold storage warehouses. The freezing will continue until the earth is frozen to such thickness that the full sized tunnel can be excavated within the protection of the temporarily hardened walls, or where the time available will not permit the freezing to



Arrangement of Pilot Tunnels and Shafts.



Longitudinal Refrigerating Pipes.



Radial Refrigerating Pipes.

Method with Pilot Tunnels and Refrigeration.

be done at one operation from the original heading, which would require several months, an enlargement of the pilot tunnel will be made in the frozen material and pipes laid against the new surface so made and the freezing continued. By reason of the increased freezing surface so obtained this will result in an economy in time from freezing the necessary distance outward. Or radial pipes can be pushed outward from the pilot tunnel before freezing and a circulation of cold brine maintained in them. In any event, the working face of the main tunnel would be bulkheaded off from the finished section by a rolling partition, which would prevent circulation of warm air to the pilot tunnel.

Experience has shown that soil so frozen is impervious to water and has great strength. It resembles a dense sandstone and can be worked in much the same manner by blasting or chipping. Tests of frozen silt from the bottom of the Hudson River show it to have a compressive strength of from 400 to 600 pounds per square inch. It is estimated that the walls should be frozen 5 feet outside the line of excavation and that for a 10,000-foot tunnel a refrigerating machine, with a capacity of 525 tons a day, would be required to accomplish the necessary freezing in one year. One of the principal advantages of the freezing method as applied to tunnels is that when the pilot tunnels are constructed and the freezing done the work of constructing the main tunnels can progress rapidly without compressed air, and in a manner permitting the most elaborate supervision and inspection. This is difficult to obtain by any other method. Another advantage claimed is that after it is once established the freezing will be progressive for some time should the refrigerating medium be withdrawn, and that an accident disabling the entire plant for several days would not necessarily cause a disaster to the work.

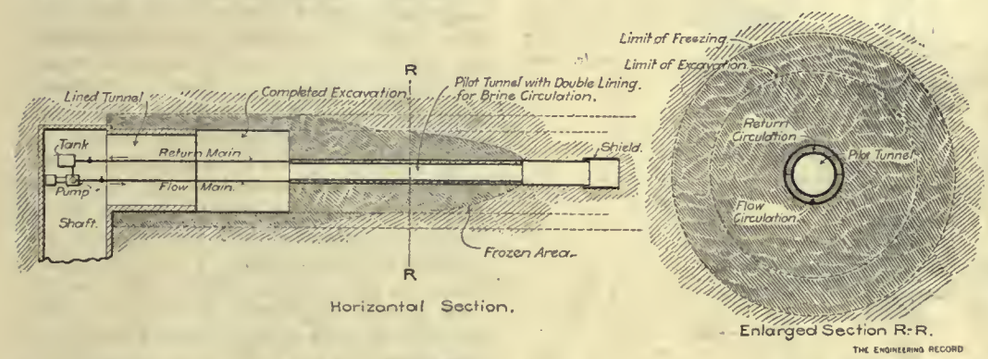
Mr. Sooysmith bases some of his calculations on data afforded by his use of the Poetsch system for sinking difficult shafts by the freezing method at Iron Mountain, as described in The Engineering Record of June 14, 1890. These data and other knowledge and experience gained by sinking vertical shafts and excavations by the freezing process enable preliminary estimates to be made which are claimed to be more accurate and less contingent as to time and cost than for other methods, and it is in-

teresting to note that while there is no record of the application of the combination of this system with pilot tunnels, the freezing process has been successfully applied to difficult tunneling as described in The Engineering Record of May 6, 1886, where the foot way tunnel in Stockholm was driven with the aid of cold air supplied to the heading.

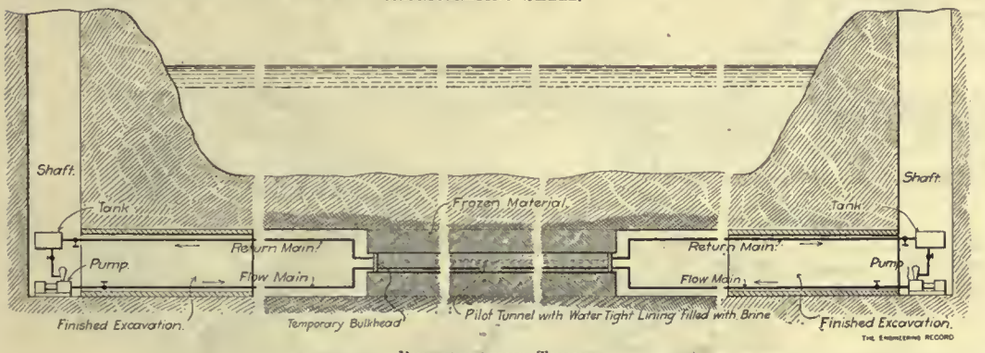
The general plan of operations includes the initial construction of three parallel 7-foot pilot tunnels in a plane through the axes of the required tunnels. The two outer pilot tunnels will be used for refrigerating galleries and subsequently enlarged to the required cross-section for the permanent tunnels. They will be connected by transverse tunnels about 500 feet apart, so that the center pilot tunnel may be used as a service gallery to expedite the construction of the main tunnels, after which it may be abandoned or retained for conduits. The pilot tunnel will be driven from shafts at each end, which will be long enough to serve both of the main tunnels, and from these shafts the excavation of the full width will be commenced on both sides of the river while freezing is in progress in the pilot tunnels, as indicated in the general diagram. It is proposed to provide the pilot tunnels with a system of longitudinal pipes laid together around the circumference of the tunnel and supported at suitable intervals on circular ribs. These pipes will be connected at both ends by circular headers in such a manner that half of them will be used for flow and the other half for return pipes, and a constant flow of brine will be maintained through them by means of circulation mains from the shore header to the pump and refrigerating machine. The pipes will be so close together that they will serve as skeleton lagging which, with the air pressure, is expected to exclude the mud; but may be reinforced, if necessary, by inserting short strips of wood between them until the mud is frozen stiff enough to be stable independent of the air pressure.

At the ends of the tunnel close to the shaft, it may be desirable to remove these pipes and make a circular excavation about 16 feet in diameter before the ground is frozen to the final limits. In this excavation another set of longitudinal pipes and headers will be placed to freeze the ground to a distance of about 5 feet beyond the limits of the final excavation, about 25 feet in diameter, which can thus be made much more quickly, but less economically, than if the freezing there was entirely accomplished from the original pilot tunnel. This method of successive cuts will only be employed at the beginning of the tunnel to expedite the construction.

As there will be four working headings, the conditions in them may vary, and another system of piping has been devised for use near the shafts where it is necessary to accelerate the freezing as much as possible, so as to be able to commence the construction of the finished tunnel without waiting a long time for freezing to be completed throughout. It is proposed in this case to line the pilot tunnels and to lay in them large longitudinal flow and return mains controlled by gate valves dividing them into sections of perhaps 1,000 feet. From each of these sections several smaller secondary parallel mains, about 100 feet long, will be valved, and from each of them connections will be made with series of radial pipes 11 or 12 feet long driven in sets about 6 feet apart.



REFRIGERATING SHELL.



REFRIGERATING TUNNEL.

Method with Pilot Tunnels and Refrigeration.

These pipes will be closed at both ends and will contain a small inner pipe connected with the brine supply and open at the outer end, the return flowing back through the large pipe. These pipes will be connected to each other and to the secondary mains in series by valved lead branches, so that the brine will flow successively through all of them from the supply to the return main, as indicated in the cross-sectional diagram. By this method freezing will be very rapid and can be controlled absolutely or varied at every point, but a very large and costly pipe installation is required. After the materials are satisfactorily frozen, the pipes can be easily withdrawn by first injecting steam, and the holes which remain, and which are shown in the diagram by dotted lines, will be useful for blasting the frozen material.

The most economical method of freezing the main part of the tunnels under the center of the river is believed to be by means of converting the pilot tunnel itself into a single large refrigerating tube, which will effect great economy of pipes and pumping, but will be slower than the process above described and will preclude any extension of the pilot tunnel which is being refrigerated. It is, therefore, proposed to treat only the central part of the tunnel in this manner, while the shore ends are being excavated and lined by methods already described. For this process the pilot tunnel will have a water-tight lining closed at both ends with bulkheads through each of which there will be made connections to flow and return mains, the former being extended nearly to the center of the tunnel. The refrigeration plants will be installed at both ends of the tunnel and will, therefore, be enabled to work together on the center section after the headings of the pilot tunnels have met. When the time available is sufficient, as when the pilots have been completed a long distance ahead of the main tunnel construction, the pilot tunnel may be lined with a double shell divided into two parts by radial diaphragms so that the flow and return mains connected at the shore ends would insure a circulation of brine to the inner end and back as indicated in the diagram.

In order to prevent any danger of leakage out of the pipes, the brine will be circulated by pumps located at the foot of the shaft, thus avoiding the head that would be incurred if the mains rose to the surface of the river. The pipes would be subjected externally to the full hydrostatic head of the ground water, so that if there were any leaks in them the flow would tend inwards instead of outwards and no damage would be occasioned. These methods have all been studied and analyzed with great care in reference to the practical results which have been obtained in successful application of the freezing process to very difficult work in this country and abroad, and it is believed by Mr. Sooysmith that the systems here described may, any or all of them, be employed under the conditions obtaining for the tunnels that they were designed for, and that they will afford the most safe and desirable method of construction for them. The accompanying illustrations of this process are conventional diagrams intended only to indicate general principles and arrangement, and are in no way definite plans for actual construction. They help explain the methods of application of the freezing process for excavation only; they omit the important pile foundation and all details of design and construction.

The plan proposed by Mr. Theodore Cooper, C. E., is based on the use of a special pneumatic shield designed to be efficient in any combination of rock, earth, silt and water. The shield can be used under very different conditions ranging from the construction of a tunnel in water without any solid excavation, to that of its construction in silt, clay, or rock or the construction with the upper and lower parts in different materials. This shield is a pilot of a full cross section of the tunnel, having the usual apron plates which project backwards over the finished tunnel lining and make a close joint with it. The front of the shield is provided with the ordinary slightly inclined cutting edge, and the upper part of it can be entirely closed by removable doors in a vertical transverse bulkhead. The lower part of the cutting edge is inclined backwards and is open, a conical bulkhead being carried from its circumference to a level with the axis of the tunnel and affording a sort of inclined scoop through which access can be had from above to the lower part of the working face, and in which water may rise above the lower edge of the vertical transverse bulkhead in the front of the shield, but will be retained at that level by an adequate pneumatic pressure inside the shield. This arrangement, which is clearly shown in the vertical and horizontal cross sections, provides, if necessary, absolute tightness to retain the air in the upper

part of the shield and leaves the bottom of the tunnel exposed and accessible through the open lower end of the shield, so that excavation may be carried on there in the dry under ordinary conditions or at the very worst, if it is impossible to wholly exclude the water, it can only rise to a limited height and excavation may be carried on below its surface. If the material is firm, the doors in the forward bulkhead may be opened and excavation made through the whole face of the shield. If it is very soft, these doors may be closed and the shield may be forced ahead into the unexcavated mass, causing the latter to flow inward and upward at the bottom through the conical apron around the lower part of the cutting edge, and even deliver itself through its apex into the material cars on the tunnel floor. If excavation is required in the bottom of the tunnel only, inclined poling boards may be driven under the lower edge of the main diaphragm as indicated in the cross section, and rock and other material removed under their shelter, so as to permit the shield to advance. In other cases these temporary poling boards may be driven, leaving the bottom accessible under the inclined cutting edge, so that if necessary sectional piles can be forced down to make a foundation under the tunnel. With the diaphragm doors all closed and the water seal maintained above the lower edge of the main diaphragm, the shield can be pushed forward on the bottom of the river and the tunnel lining built behind it in the usual manner without any excavation or the protection of any natural roof above it.

The design provides for high level and low level tracks connected by a vertical switch. The high level track will be used for bringing segments of the cast iron lining to the crown of the tunnel where they would be delivered to a car operating on a circular track to assemble them in position. The lower track would be used to remove the soil and muck. The connection of the circular track to the moving shield saves a great deal of labor and time in handling the lining segments and enables them to be put in place without interfering in any way with the operations of excavation, thus greatly expediting construction and materially reducing the total expense.

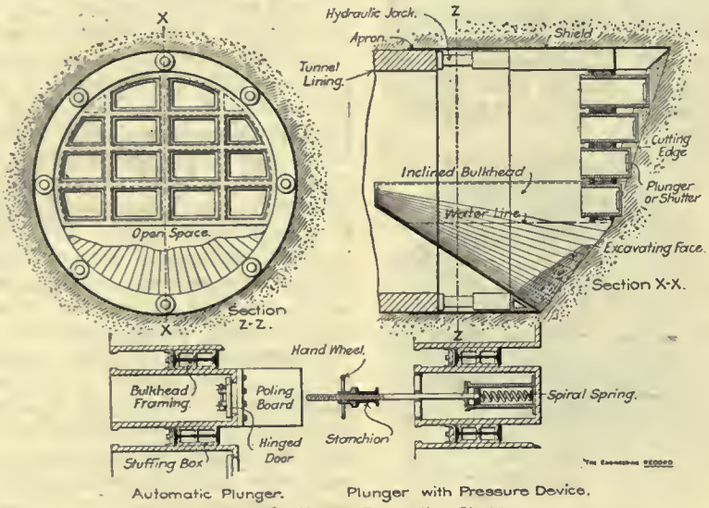
For tunneling through very wet or soft material Mr. Cooper has designed an improvement especially adapted to the shield already described, which is intended to reduce the excavation absolutely to the amount of displacement of the finished tunnel and thus prevent disturbance of the material pierced or subsidence of the surface and consequent danger to structures above; to facilitate the alignment and diminish the force necessary for driving the shield, to prevent material from caving in and to decrease the danger to workmen. This improvement avoids the necessity of having workmen stationed in advance of the forward bulkhead, or of using a long and unwieldy projecting hood. It consists essentially of forming the forward bulkhead of independent horizontal hollow plungers. Their outer ends receive most of the horizontal thrust against the end of the shield, and can be set so as to resist the pressure of the earth and water and confine its slope to a required angle.

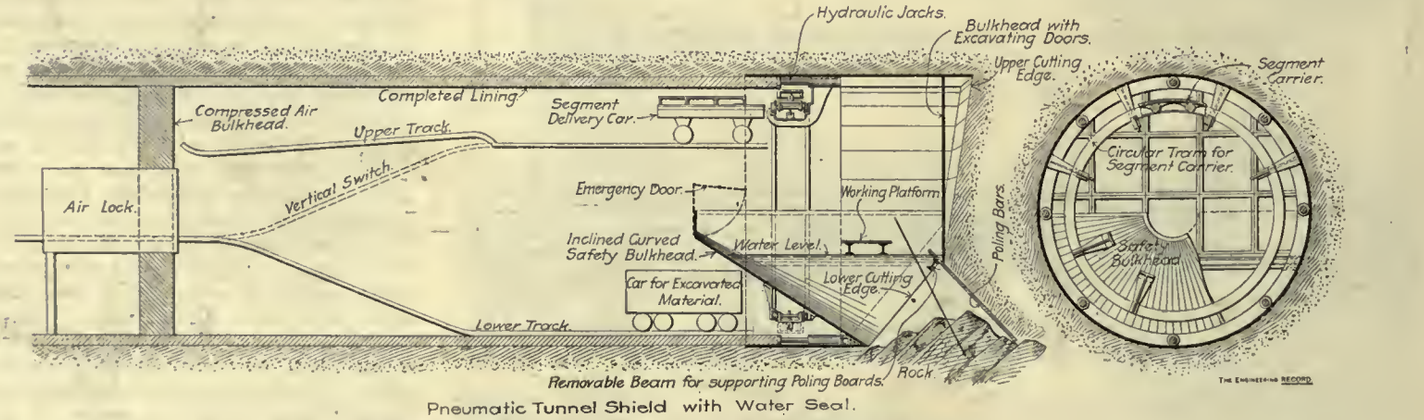
These plungers are units with dimensions suitable for their convenient operation, and enable the pressures against the outer surface to be advantageously differentiated in accordance with the conditions which vary with their positions. They virtually constitute a series of springs covering the solid face of the end of the shield, which is exposed to unequal pressures, and maintain equilibrium over that portion of the heading which is above the point of excavation. They provide for a constant and regular flow of material into the lower part of the shield where it can be handled and controlled, and permit the intermittent or continuous advance of the shield with a constant regulated pressure on the upper part. As the air pressure in the pneumatic shield is constant, while the external pressure decreases upwards, they can only be balanced at one point and the former is in excess by an amount of 60 pounds per square foot for each foot in height above the level of the water seal. This unbalanced pressure will enable the plungers to be automatically operated in the upper part of the shield, and the lower ones may be provided with special devices for overcoming the friction and increased outside pressure.

The patent drawings show the forward bulkhead extending in a vertical transverse plane to below the seal of the water line in the inclined bulkhead, and composed of a framework of vertical and horizontal I-beams with the spaces between them entirely filled by rectangular plungers working in stuffing boxes. Each of these serves as a movable shutter which is pushed out against the soft earth, and maintained there wholly or in part by the pneumatic pressure in the shield. They may be used with or without pneumatic pressure and with or without the water seal and the conical interior bulkhead. In a dry tunnel they may be used to reduce the amount of excavation, and it is believed that in either wet or dry earth they will advantageously replace ordinary poling boards.

The plungers may be open at the inner ends and closed at the outer ends by hinged and latched doors through which material can be removed if necessary, and they may be provided with projecting flaps or fixed iron poling boards to diminish the inward flow when the doors are opened in very soft material. They may also be made, as shown in the detail, with open inner ends and closed outer ends provided with spiral springs enclosed in cylinders which receive a piston head that compresses the spring by a rod commanded by a nut and hand wheel arranged inside the shield, so as to enable the plunger to be set in any required position and adjust itself to the variable pressure.

The plungers may be advanced with the shield or independently of it, or may be allowed to recede or remain stationary when the shield is advanced by the usual method, thus materially facilitating the manipulation of the shield and permitting its cutting edge to penetrate the soil with decreased expenditure of force. They afford an elastic resistance to the soil and enable any portion of it to be separately treated and all portions of it to be put under special or automatic uniform or varied pressure, while the excavation may be absolutely confined to the lower part of the shield under the water seal and governed to correspond with the definite slope of the material for the actual displacement of the shield.





Shield Method with Inside Conical Bulkhead and Sliding Shutters.

Structural Steel Work in the Ansonia Apartment Hotel, New York. IV.

STEEL CORNER TOWERS.

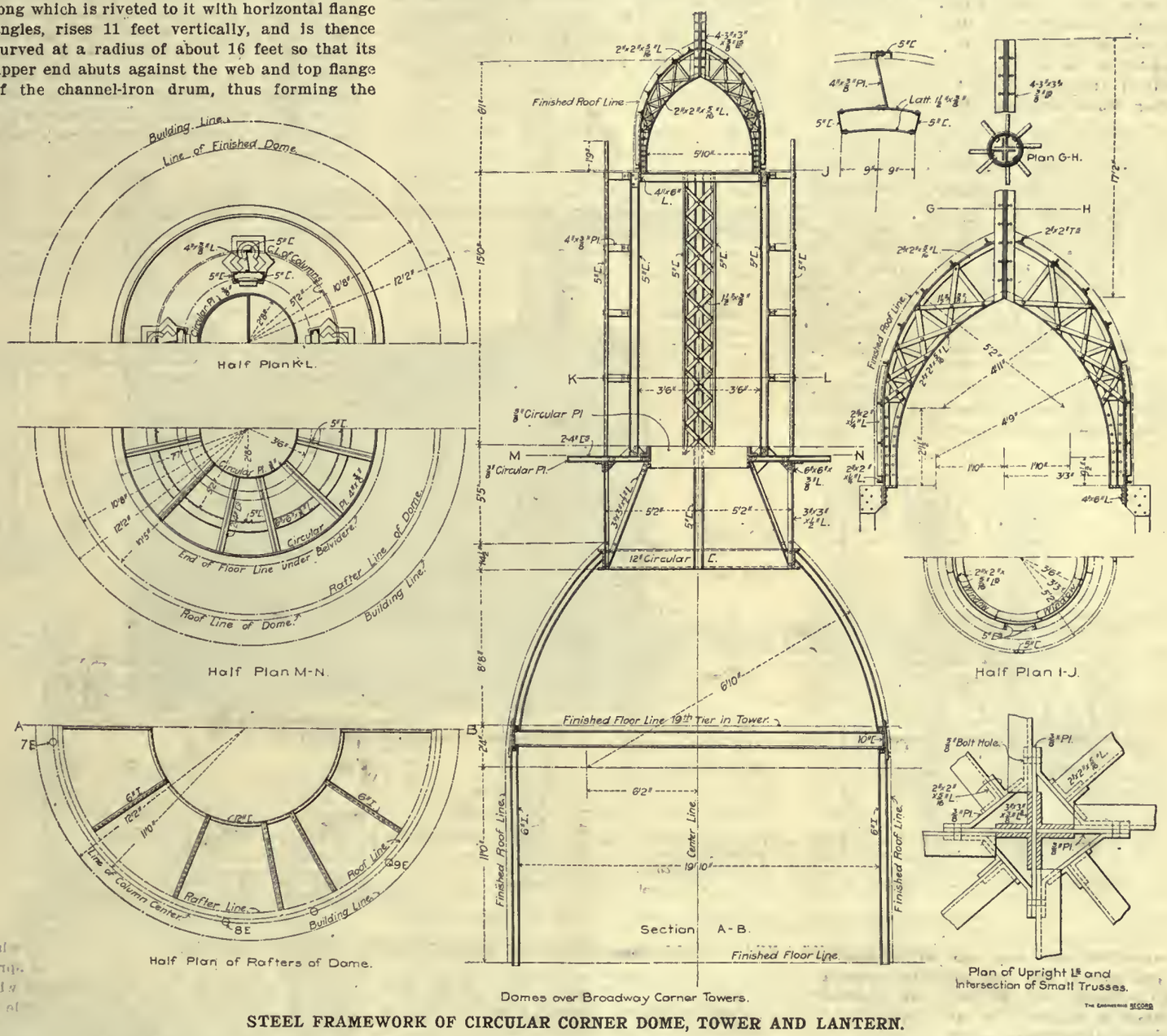
The rounded corners on the Broadway front of the Ansonia building have masonry walls carried on ordinary wall girders up to the 17th floor, where the circular cross-section is almost detached from the receding mansard roof. At this level there is a horizontal drum made of a 12 inch I-beam curved to a radius of 10 feet 8 inches and supported on the centers of six unequally spaced main columns. This drum receives the feet of 12 dome ribs, each of which is composed of a 6-inch I-beam about 23 feet long which is riveted to it with horizontal flange angles, rises 11 feet vertically, and is thence curved at a radius of about 16 feet so that its upper end abuts against the web and top flange of the channel-iron drum, thus forming the framework of a tall dome which carries the 18th floor just above its springing line.

The dome ribs are connected by horizontal circular T-bars 21 inches apart, which carry the inner metal lath and plaster and the outer tile surface. The upper drum supports a cylindrical framework 5½ feet high made of angles and carrying at the top a 6x6-inch angle-iron ring 11 feet in diameter, which serves as a fulcrum for the twelve horizontal cantilever arms, which overhang it about 2½ feet and support the projecting circular cornice. The cantilever beams are pairs of 4-inch channels about 4½ feet long with their inner and outer ends web-connected to vertical curved plates, the 4x⅝-inch outer one acting as a light fascia girder, and the 14x⅜-inch inner one acting as a girder from which the center vertical strut is supported, and as bracing for the anchorages to the dome rib. Just outside the inner circle the cantilever beams support four vertical columns each having a triangular cross-section composed of three 5-inch channels latticed together on all sides. These are enclosed with sheet copper to make the ornamental columns of the open lantern which surmounts the dome. The outer channel in each column projects beyond the rest to carry a slender finial.

The tops of the columns are riveted to an angle-iron ring 6 feet in diameter, which carries eight radial trusses forming the framework of a dome 7 feet in diameter at the base and about 7 feet high. The trusses are riveted at their apexes to bent plates connecting them to vertical intersecting diaphragms, through the base of the flagstaff, which is composed of four 3x3-inch angles 17 feet long riveted together back to back to form a cruciform cross-section. The radial trusses are connected by circular horizontal T-bars which support the roof tiles. The top of the flagstaff is about 60 feet above the 17th floor, where the dome construction begins, 175 feet above the street. The dome is calculated to stand a wind pressure of 20 pounds per square foot of exposed surface, and the stresses are assumed to be resisted by the stiffness of the members and the rigidity of the connections without the necessity of any diagonal bracing.

Mr. Paul E. Duboy was the architect; Philip E. Raqué the consulting engineer and Mr. Edward Raqué the engineer in charge for Mr. W. E. D. Stokes, the owner and builder. The structural steel work was built and erected by Messrs. J. B. & J. M. Cornell, with Mr. C. J. Wolfe, engineer in charge of the draughting department. The copper and skylight work was done by A. J. Ellis & Company.

The Panama Canal Treaty was ratified by the United States Senate, on March 17, by a vote of 73 to 5.



STEEL FRAMEWORK OF CIRCULAR CORNER DOME, TOWER AND LANTERN.

A competitive examination will be held April 4, in various places in New York State, for the position of architectural draughtsman, as advertised elsewhere in this issue. For information address State Civil Service Commission, Albany. Open competitive examinations will also be held in New York City, as advertised in another column, for the following positions: Architectural draughtsman and designer, structural steel draughtsman, electrician, inspector of conduits and reservoirs, assistant engineer, Rapid Transit Commission, and topographical draughtsman; applicants for these positions must be residents of the State of New York. Information can be obtained from Mr. S. William Briscoe, secretary, 61 Elm Street.

Direct and Indirect Supports for Underpinning a High Wall.

The excavation for the cellar of the new building at No. 56 Cedar Street, New York, was carried down about 20 feet below the sidewalk level, and several feet below the footings of the adjacent six-story brick wall of the building at No. 58. The old and new walls are in contact for a length of about 75 feet, and the old one was seated on ordinary offset footings which had to be removed and carried down several feet to the sandy bottom of the new excavation. Most of the wall was carried on nine wooden needle beams about 6 feet apart on centers, which were set about 8 feet above the bottom of the footing.

Each of the regular needles consisted of a pair of 14x14-inch timbers, one on top of the other, which projected about 10 feet into the new excavation, and were supported there on a vertical 14x14-inch post at the end with a transverse sill and longitudinal grillage timbers under its foot. The inner ends were supported on a double line of timber sills on the cellar floor, parallel to the wall. The wall was cut away several inches above the needles, and wooden packing pieces were driven in tight above them with bearing on cement mortar which was plastered on the under side of the brickwork. The needles were adjusted with jack screws under the outer ends, which were screwed up until they lifted the wall very slightly; the vertical posts were then set adjacent to the jacks, and wedged up until they released the jacks and the latter were removed after the bearings under the feet of the posts had been forced down to permanent and solid seats on the sand.

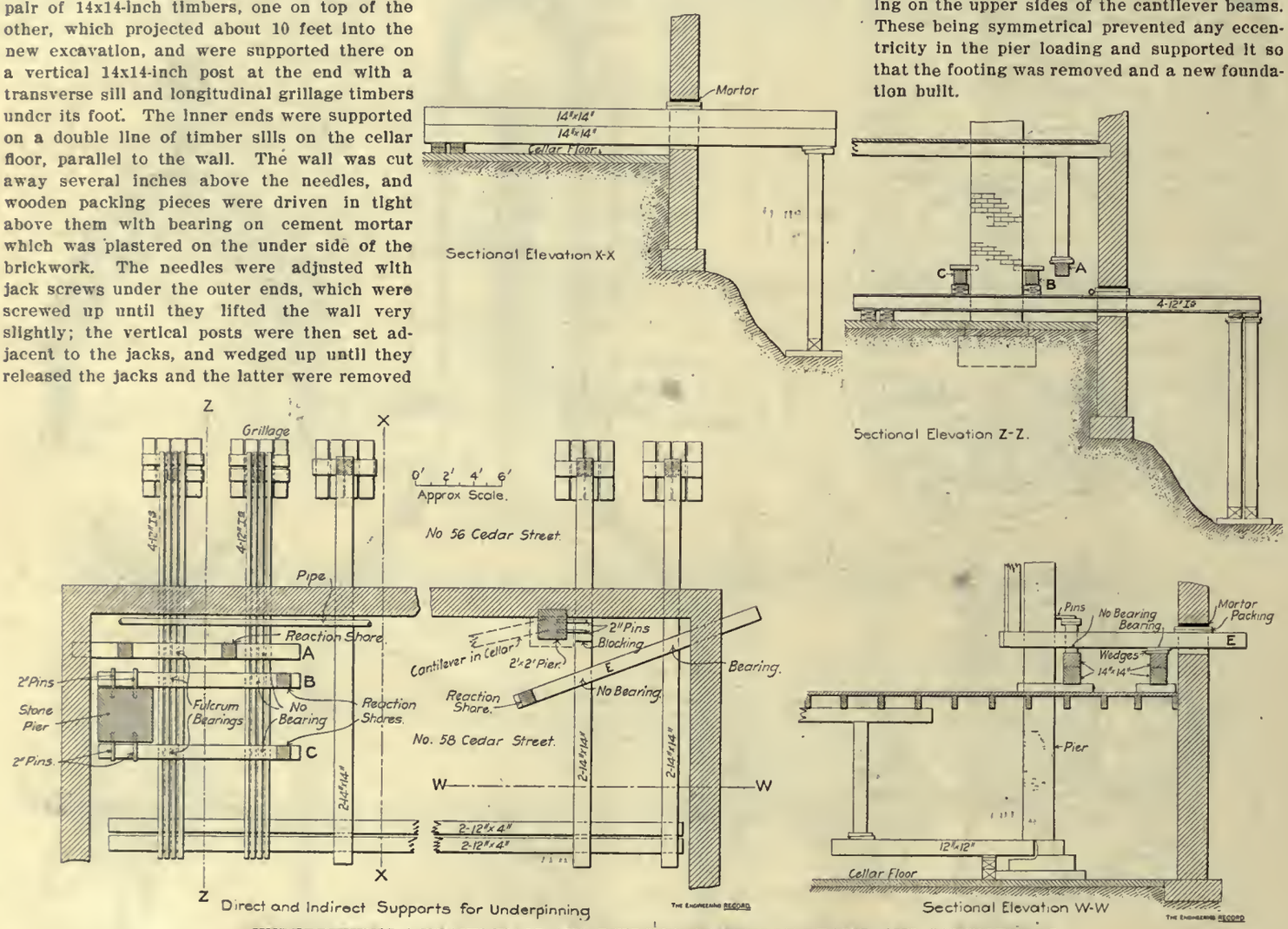
At one end of the building there was a horizontal pipe close to the wall at such a level that there was not room under it for the pairs of wooden needle beams, and so groups of steel I-beams side by side were used instead, thereby gaining about 16 inches more clearance. After the needles were loaded the old wall under them was removed, the excavation completed there and a new footing built, all in several successive sections of convenient lengths. Brick piers, 2 or 3 feet long, were built up on the new concrete footings to within 5 or 6 feet of the tops of the needles and between them. The top of each pier was entirely covered by a cut stone cap and a duplicate stone was set on it, loose, with several pairs of thin steel wedges between the two stones.

The brick pier was continued above the upper stone to the under side of the old brickwork and carefully joined to it. The wedges were driven until the loads were taken from the adjacent needles. When these were released and the new footing was permanently settled the needles were removed and the spaces which they had occupied were filled with new brickwork, closing up the openings between the wedged piers and completing the new foundations. The spaces between the wedging stones were thoroughly grouted and the weight of the whole wall was thus theoretically carried through the wedges, but the cement enclosing them was so solid, and the final sections of wall were so tightly closed up at the top that a very slight settlement or compression of the piers would practically distribute the load over the whole of the new footing before any damage could be done or appreciable movement take place.

The front wall at the Cedar Street corner was supported wholly from the inside by a horizontal cantilever timber which had one end inserted and wedged in a recess cut in the face of the brickwork. The set of steel needles nearest the front wall furnished the fulcrum of the cantilever, and the reaction was taken by a vertical post wedged up against a distributing beam across the under side of several joists in the basement floor. A vertical post on the short arm of the cantilever supported the middle of a heavily loaded stone lintel 6 feet long which it was feared might be broken if there was even a small relative displacement of its ends.

A heavily loaded stone pier 4 feet square was so near the walls in this corner of the building that there was not clearance around it for ordinary cribbing and needling to support it while its foundations were removed and rebuilt at the level of the new ones in the adjacent wall. It was ingeniously carried on the short arms of two cantilevers which were set close to each side of it with their fulcrums on a group of steel needle beams which supported part of the ontside wall. The long arms cleared the tops of the adjacent group of needle beams and reacted against vertical wooden posts bearing on distributing beams across the under sides of the floor joists. As it was difficult to secure bearing against the pier and inadmissible to cut its faces, holes 6 inches deep were drilled in it and two horizontal steel rods, 2 inches in diameter, were set in each side, projecting 16 inches beyond the face and bearing on the upper sides of the cantilever beams. These being symmetrical prevented any eccentricity in the pier loading and supported it so that the footing was removed and a new foundation built.

In the opposite end of the building the corner of the rear wall was similarly supported on the short arm of a 12x14-inch cantilever needle beam about 18 feet long which had its fulcrum on a wooden needle beam supporting the front wall and reacted, like the other cantilevers, against the floor joists above. An adjacent stone pier 2 feet square, made of thick courses of single cut stones, like a sectional column, supports one end of a heavy floor girder, is partly built into the side wall and had to be underpinned with it. It was difficult to secure bearing for its temporary supports, and unsafe to cut away so large a proportion of its cross section as would have been necessary to insert a needle beam through it. A pair of horizontal steel dowels were drilled into one side, above the basement floor, and took bearing on blocking built up from one of the regular needle beams supporting the side wall. On the op-



UNDERPINNING A HEAVY WALL AND PIERS WITH NEEDLE BEAMS AND CANTILEVERS.

posite side of the pier, several feet lower down and below the basement floor, a notch was cut in the foundation, half way under the foot of the pier to receive the short arm of a cantilever with its fulcrum on blocking laid on the floor, and its long arm reacting against the basement floorbeams.

Messrs. Clinton & Russell are the architects, and Mr. Andrew Robinson is the general contractor for the new building; and the underpinning was executed by the Gallagan Contracting Company, all of New York.

A 185-Foot Water-Power Plant near St. John's, Newfoundland.

A 3,700 horse-power hydraulic plant, operating under a head of 185 feet, has been in operation for some months at the head of Petty Harbor, eight miles south of St. John's, Newfoundland. It is of the class employing a timber flume for conducting the water from the point of diversion to the point of utilization, and includes a timber dam for directing the water to the flume and a steel penstock for carrying the water under pressure from the foot of the flume to the power house. An interesting feature of the plant is the method adopted for controlling one of the turbines.

The project to utilize the small stream at this point was determined on in 1898 to supply power for the St. John's Street Railway and at first but one turbine was installed, developing 1,860 horse-power. In 1902 an additional demand for power being created, a second turbine was installed, giving the plant a total capacity of 2,400 kilowatts, with apparatus for high-voltage transmission to St. John's.



POWER HOUSE, FLUME AND PENSTOCK.

The dam is a timber crib one 15 feet high, and at one end are located the racks and head gates to the flume. The flume is about a mile long and is built of 12x12-inch timbers, with a 3-inch plank lining and a timber top; it is 13½ feet wide and 13 feet deep. Near its end for a distance of about 250 feet the rocky hillside became so precipitous that the waterway had to be carried through a tunnel. The forebay at the end of the flume is enclosed by the gate house which protects the racks and the gates at the mouth of the penstock.

The penstock is 6½ feet in diameter and about 360 feet long and is carried down the hill at an angle of about 45 degrees to the powerhouse 185 feet below the forebay. Its metal is ¼ inch thick at the top and ½ inch at the powerhouse. There it divides into two 4-inch pipes connecting with the turbines. These are both of the horizontal type, with a generator connected to each end of the shaft. They are of the inward-flow class, the first installed being a Francis reaction wheel and the latter a Girard wheel. They are designed to run at 327 revolutions per minute and develop under the given head 1,860 horse-power. The generators are 600-kilowatt 500-volt alternators, and having 22 poles, give current at 60 cycles per second. Besides the wheels and the revolving elements of the alternators, each turbine unit carries on its shaft a momentum wheel weighing 15,500 pounds, and 7 feet in diameter, which gives it a peripheral speed of 7,200 feet per minute.

The power house is a stone building 24x130 feet in inside dimensions. It is divided by a glass partition into a generator room 100 feet long and a transformer room, occupying the remaining 30 feet. In this there are six 500-kilowatt oil-bath transformers for stepping up the current to 15,000 volts for transmission nine miles to St. John's. The transmission line is a double-pole one. The exciter set comprises a 21-inch wheel and a direct-connected dynamo which stands on the same cast-iron bed with the waterwheel. The exciter turbine receives its water from the large penstock through a 9-inch pipe, and running at 600 revolutions per minute has a capacity of 45 horse-power.

The method of control referred to comprehends the use of a gate valve interposed between the penstock and the wheel case, and no gates of any kind near the wheel guides. The valve is placed horizontally and it is opened and closed by a piston in a hydraulic cylinder under the control of a Lombard speed governor, the operation of the elements of this regulator being similar to that of the standard Lombard governor. When the load is increased, the gate is partially closed and the system works on the principle that this partial closure subjects the wheel to a reduced head without throttling the water passages through the wheel itself. This arrangement was evolved largely on account of the pitting and wear that the blades and runners of water wheels have suffered from high velocity of the water, through contracted wheel passages.

Assuming the turbines to have an efficiency of 75 per cent., it will be found that with a head of 185 feet and at rated load, 100 to 110 cubic feet will be passed per second through the two wheels. This means a velocity in the 6.5-foot penstock of about 7 feet per second and in the flume, running, say, 10 feet deep, about 1¾ feet per second.

The plant and the railway which it operates is owned by the Reid Newfoundland Company, Mr. R. G. Reid, Montreal, Que., president. The surveys for the water-power development were made by Mr. G. H. Massy, consulting engineer for the company, while the plans for the power station were made by Mr. Alva C. Rice, M. Am. Soc. M. E., consulting engineer of Worcester, Mass. The hydraulic equipment was furnished by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, O., and the electrical machinery was built by the Westinghouse Electric & Manufacturing Company.

The Comparative Cost of Street Lighting in Various Cities.

The following information relating to the cost of street lighting has been condensed from the report of Mr. Charles F. Lacombe, engineer of surface construction in New York City, whose data on the subject formed the basis for the conclusions of Commissioner Robert G. Monroe of the department of water supply, gas and electricity, whose recommendation of a municipal plant is referred to editorially in this issue. Preliminary plans and estimates for such a plant are now being prepared.

In order to compare the price that New York City pays for electric and gas lighting with the prices in other cities returns were procured from 175 cities of from 25,000 to 1,600,000 inhabitants, the figures being checked by getting the returns from both the companies and the city officials. The result of the returns from the first hundred cities answering were arranged in tabular form, and are somewhat condensed in the accompanying tables. It was found that neither the cost of coal, number of lights, nor length of contract had any comparative effect on the prices paid. New York, using 4,748 arc lamps, pays $125 to $146 each, while Evansville, Ind., with 300, pays $60. Wholesale use, while it cheapens the price to the private consumer, is of little benefit to cities. The table for gas lights is smaller than that for electric lights because out of the 100 cities only 34 use gas for city lights in a way that permits intelligent comparison with New York.

Cost of Arc Lamps in Municipal Plants.

	No. of lamps.	Price per year.
1,200 candle-power:		
Jamestown, N. Y.	338	$48.00
Jacksonville, Fla.	220	54.00
Grand Rapids, Mich.	529	68.54
2,000 candle-power:		
Columbus, O.	320	47.00
Chicago, Ill.	4,640	53.51
Detroit, Mich.	2,133	63.82
St. Joseph, Mo.	70	70.12
Allegheny, Pa.	1,414	74.29
Jacksonville, Fla.	151	90.00

Charges for 1,200 C.P. Arc Lamps Furnished by Private Plants.

(The figures following the names give the number of lamps furnished.)

$55.00 to $75.00—Duluth, Wis., 364; Norfolk, Va., 350; Covington, Ky., 290; Portland, Me., 305; Rochester, N. Y., 450; Savannah, Ga., 513; Concord, N. H., 130; Hartford, Conn., 799; Springfield, Mass., 900; Des Moines, Ia., 178.

$82.00 to $87.00—Gloucester, Mass., 66; New Haven, Conn., 550; Bridgeport, Conn., 525; Chester, Pa., 184; Lawrence, Mass., 185; Kingston, N. Y., 131; Brockton, Mass., 268.

$92.50 to $100.00—Elizabeth, N. J., 150; Dallas, Tex., 350; New Bedford, Mass., 211; Cambridge, Mass., 553; Chelsea, Mass., 224.

Yonkers, N. Y., 324 lamps at $109.50.

New York, N. Y., 872 lamps at $125.00.

In recommending municipal ownership for New York, Mr. Lacombe gives details of the municipal plants in operation in Chicago, Detroit, Allegheny, and Jacksonville. In Chicago it costs $53.51 to produce a 2,000-candle-power arc light, running all night and every night, this charge including cost of new materials and repairs. In the last 16 years of operation it has expended $3,400,663 for lighting the city and for building its own plant, whereas if it had purchased from private companies during that period at prevailing prices it would have cost $3,535,875, and it would not have had a plant. It has issued no bonds and it owes nothing on its plant, which has cost to date $1,694,000. If the price at which Chicago furnishes light were doubled, it would still be nearly $40 per lamp below the price now paid in New York.

When the municipal plant at Detroit was

built $650,000 in bonds was issued, and since then $932,000 has been spent, which includes some renewals and considerable subway construction. Detroit does not make quite as favorable a showing as Chicago, but in ten years before the building of the municipal plant, from 1885 to 1894 inclusive, Detroit paid an average price per lamp of $177.27, with an average number of lamps of 803. It paid for the year ending June 30, 1902, according to its own statements, $63.82. Although this latter figure has been criticised as not providing for a proper depreciation charge, in any case the price is much lower than what New York pays. Allegheny, Pa., has a municipal plant which furnishes 1,414 2,000-candle-power lamps at the rate of $74.29 per lamp, and public buildings at 2.74 cents per kilowatt-hour. It issued $260,000 in bonds to build its plant, but has since paid into the sinking fund to retire these bonds over $82,000.

The city of Jacksonville, Fla., supplies lights for the city and for private consumers at a price exceeding the cost, and at the end of the year, after taking out the reserve fund, interest and other proper charges, it pays the balance of its profits back into the city treasury to apply on taxes. Last year it paid the city about $22,000. It charged $90 a year for a 2,000 candle-power arc lamp and for public buildings 7 cents per kilowatt-hour. The cost of this plant was $228,700. The plant at Jamestown,

Charges for 2,000 C.P. Arc Lamps Furnished by Private Plants.

(The figures following the names give the number of lamps furnished.)

$60.00 to $70.00—Evansville, Ind., 300; Erie, Pa., 449; Portland, Ore., 712; Wilmington, Del., 298; Peoria, Ill., 641; Saginaw, Mich., 291; Seattle, Wash., 157; Dayton, O., 435; Altoona, Pa., 222.

$71.00 to $80.00—Oswego, N. Y., 243; Salt Lake City, Utah, 425; Washington, D. C., 939; Cincinnati, O., 3,750; St. Louis, Mo., 2,650; Superior, Wis., 163; Davenport, Ia., 58; Mobile, Ala., 275; Johnstown, Pa., 265; Rochester, N. Y., 2,350; Lexington, Ky., 306; Elmira, N. Y., 328; Knoxville, Tenn., 300; Birmingham, Ala., 245; Burlington, Vt., 203; Harrisburg, Pa., 418.

$81.00 to $90.00—Los Angeles, Cal., 1,050; Harrisburg, Pa., 418; Atlanta, Ga., 819; Kansas City, Mo., 459; Cleveland, O., 1,076; Milwaukee, Wis., 1,812; Toledo, O., 1,012; Binghamton, N. Y., 355; Louisville, Ky., 1,758; Lancaster, Pa., 312; Chattanooga, Tenn., 225; Indianapolis, Ind., 1,500; Memphis, Tenn., 350; Nashville, Tenn., 382; Syracuse, N. Y., 1,282; Poughkeepsie, N. Y., 306; Denver, Colo., 968; Lawrence, Mass., 169.

$92.87 to $100.00—Trenton, N. J., 388; Omaha, Neb., 446; Des Moines, Ia., 70; Pittsburg, Pa., 2,530; Jersey City, N. J., 1,377; Charleston, S. C., 163; Newark, N. J., 1,859; Baltimore, Md., 1,584; Hoboken, N. J., 246; Fitchburg, Mass., 304; New Orleans, La., 1,664.

$102 to $109.79—Paterson, N. J., 741; Atlantic City, N. J., 376; Minneapolis, Minn., 203; Worcester, Mass., 744; Fall River, Mass., 789; Utica, N. Y., 693; Lynn, Mass., 286.

$110.12 to $125—Philadelphia, Pa., 9,426; Manchester, N. H., 494; Providence, R. I., 1,870; San Francisco, Cal., 930; Camden, N. J., 509; Albany, N. Y., 671; Boston, Mass., 3,670 ($124.10); Haverhill, Mass., 47.

New York, N. Y., 3,876 lamps at $146.00.

Charges for Gas Lighting in Various Cities.

	No. of burners.	Price paid.
Welsbach Burners:		
Chicago, Ill.	11,025	$18.55
Baltimore, Md.	6,174	21.40
Dayton, O.	700	22.50
Portland, Me.	329	23.00
Charleston, S. C.	400	23.50
Seattle, Wash.	5	24.00
Cleveland, O.	5,452	24.56
Wilmington, Del.	518	25.75
Milwaukee, Wis.	2,500	28.00
San Francisco, Cal.	5,079	28.60
New Bedford, Mass.	713	28.75
Rochester, N. Y.	143	29.00
Cambridge, Mass.	284	29.88
Boston, Mass.	9,119	30.00
New Haven, Conn.	1,009	30.00
Yonkers, N. Y.	1,624	30.00
Lancaster, Pa.	270	30.00
Jersey City, N. J.	460	30.00
Providence, R. I.	793	30.00
Omaha, Neb.	1,050	30.00
Worcester, Mass.	500	30.00
Binghamton, N. Y.	176	31.00
New York (Manhattan)	4,138	29.00
New York (other boroughs)	3,956	30.00
Open Flame Burners:		
Wilmington, Del.	31	13.80
Chicago, Ill.	13,852	16.15
Cincinnati, O.	2,500	16.75
Hoboken, N. J.	71	17.50
Paterson, N. J.	450	18.00
Washington, D. C.	6,989	20.00
Nashville, Tenn.	525	20.00
Camden, N. J.	289	21.00
New Haven, Conn.	37	22.00
New York (Manhattan)	2,981	12.00
" "	1,585	13.04
" "	8,854	17.50
" (Bronx)	2,020	22.00
" "	3,586	24.00
" (Brooklyn)	6,383	16.00
" "	4,266	28.00
" (Queens)	2,742	25.00

N. Y., furnishing 338 lights, cost $95,000; that at Grand Rapids, Mich., with 529 lights, $194,700; and that at St. Joseph, Mo., with 421 lights, $103,000.

The failure of the municipal gas plant at Philadelphia is referred to in Mr. Lacombe's report with the remark that considering that no reasons have been offered for the failure of this plant, it teaches no lesson. In Boston a contract has been made with the company furnishing the light, which gives the city so much control of a portion of the plant that it is practically equivalent to and comparable with, municipal ownership.

Preliminary Report of Manhattan Bridge Commission.

The Manhattan Bridge, New York, was briefly described and illustrated in The Engineering Record of Feb. 21. The following report was presented to Mayor Low, by the special commission of engineers, on March 9:

Having been appointed by your letter of Feb. 10, 1903, a Commission to pass upon the plans which the Commissioner of Bridges is about to submit to the Art Commission, for the Manhattan Bridge across the East River, we have the honor to submit a preliminary report covering the principal features of the design, leaving our final report till the experiments which are to be made on special steel eye-bars have been completed. This report covers everything except matters dependent on the quality of the steel, and includes all features which can be of importance to the Art Commission.

The Manhattan Bridge will be a suspension bridge having a central span 1,475 feet long between centers of towers, and two side spans of equal length, each 725 feet long, measured from center of tower to anchorage connection. Both central and side spans are somewhat shorter than the corresponding spans of the old East River Bridge.

The general design consists of four cables, supported by steel towers or bents, each cable being a steel eye-bar chain, hanging in a vertical plane. The two center cables are 40 feet between centers and the side cables 28 feet between centers, making the total width 96 feet between centers of outside cables. Each tower or bent consists of four vertical posts, one under each cable, these posts having pin bearings at the bottom, the pins being carried on metal shoes of sufficient size to distribute the weight properly over the masonry.

Although the design is a true suspension bridge, the methods adopted for stiffening against irregular loads is by the use of trusses of which the cable forms the upper member, instead of stiffening trusses at the floor level, as commonly used.

Suspended from each pair of cables is a double-track, double-deck steel structure, carrying two elevated railroad tracks on the upper deck and two trolley tracks on the lower deck. The central space between the two lower decks is connected by a solid floor, which forms the highway floor. Two footways are carried in brackets, extending out from each lower deck. This arrangement gives a lower floor 126 feet wide over all, at the center of which is a clear roadway, entirely open, 35 feet 6 inches wide between wheel guards, and at each side a footway, also entirely open, with a clear width of about 11 feet. The arrangement seems likely to prove satisfactory. We have no suggestions to make for its improvement.

The maximum congested load which could possibly be brought upon this bridge would consist of a continuous train of rapid transit cars on each of the four elevated tracks, of a continuous line of trolley cars on each of the four trolley tracks, of a crowd of heavy teams on the roadway and of a crowd of people on each footway.

The heaviest rapid transit train which may run over this bridge is that adopted by the Interborough Company for the rapid transit subway; such a train, in which two-thirds of the cars are motor cars (corresponding to the practice of the Manhattan Railway), with 120 passengers on each car, is estimated to have a possible weight of 1,700 pounds per linear foot and an extreme actual load of 26,000 pounds. The estimated maximum weight of a continuous line of trolley cars is 1,000 pounds per linear foot. The estimated possible congested weight per linear foot on this bridge would then be as follows:

	Pounds.
Four rapid transit trains, at 1,700 pounds	6,800
Four lines of trolley cars, at 1,000 lbs.	4,000
35.5 feet of roadway, at 100 pounds per sq. ft.	3,550
22 feet of footway, at 75 pounds per sq. ft.	1,650
	16,000

This is a possible load which could never occur unless special pains were taken to produce it. The conditions which would block the tracks with continuous lines of cars in one direction would probably prevent cars entering the bridge from the other direction. The weight on the sidewalks would correspond to about twelve people per linear foot, or something like 35,000 people on the bridge. The congestion of the roadway would be such that teams could not move. Under these conditions we consider that one-half of this amount may be taken as a maximum working load; this would make the working load 8,000 pounds per linear foot, which is three times that provided in the plans of the Brooklyn Bridge, and 40 per cent. greater than that taken for the Williamsburg Bridge.

The provision of 2,000 pounds per linear foot for wind pressure proposed by the Commissioner is ample.

In calculating the effect of temperature provision has been made for an extreme variation of 110 degrees, which we consider sufficient.

We consider that the bridge should be so proportioned that with the congested load of 16,000 pounds per linear foot, covering the whole bridge, combined with dead load and wind pressure, no stresses would be produced anywhere reaching the elastic limit of the material or impairing the stability of the anchorage. In other words, it should not be possible for such extraordinary congested load to do any permanent injury to the bridge.

We consider that the working load of 8,000 pounds per linear foot should be used in designing the main members of the structure. The congested load should be used in proportioning the hangers. The floor systems of the railroad and trolley tracks should be computed for concentrated loads of 26,000 pounds on an axle. The floor system of the roadway should be proportioned for 100 pounds per square foot, with provision for axle concentration. The floor systems of the footways should be proportioned for 100 pounds per square foot. We think it best to defer our opinion as to the unit stresses which these different loads should be allowed to produce on different parts of the structure until our final report, when we shall have before us the results of the experiments already referred to. We can only say now that the loads specified and the stresses which we are likely to recommend will make no great change in the weight of the structure.

The design contains three features which, though not properly novel, are departures from the common practices with suspension bridges; they are the cables, the stiffening trusses and the metal towers, each of which may be considered by itself.

Cables.—The use of eye-bar chains is older than the use of wire in suspension bridges. It is proposed to make these eye-bars of special steel having an elastic limit of 50,000 pounds per square inch, and to subject them to unit stresses about one-half those put on the wire cables of the Williamsburg Bridge. As the cables must carry their own weight, as well as that of other parts of the bridge and the moving load, their section must be somewhat more than double the section of wire cables. The quality of the steel is the only novel feature about these cables, and while the indications are that a steel will be obtained which will fully meet the requirements of the case, we ask to defer any final opinion on this subject for the present. If it should be found impracticable to get this high grade of steel, similar chains can be made of steel which is in daily use, involving an increase in size of chains, but not modifying the general features of the design. The chains have decided advantages in the accessibility of all parts for inspection and protection, as well as in economy and rapidity of erection; they are to be preferred to wire cables whenever the cost of the chains is not materially greater. The cost of eye-bar chains and wire cables in this bridge would be about the same.

Stiffening Truss.—Each chain is stiffened by three trusses, one for each span, the upper members being the curved chains, the lower members being in line with the floor for about half the length of each span and inclined upward from such horizontal lines to the top of each tower. The web consisting of vertical posts, which serve also as suspenders for the floor, with diagonal tension members, the length of panels corresponding with the length of the bars in the chains. Each truss is an articulated structure the strains in which can be definitely calculated, although its peculiar outline makes these calculations more than ordinarily complicated. The great depth of the truss at the middle of each side span and at the quarters of the central span, where the tendency to disturbance is greatest, will produce a very rigid structure, the deformation being so little that the strains can be determined with all necessary accuracy without considering changes of shape. This form of stiffening truss is desirable for the greater stiffness it produces and the more positive determination of strains under all variations of loads; the eye-bar chain cables render its use possible.

Towers.—The tower adopted is perhaps the most novel feature in the design, but the novelty consists in its application to a structure of this magnitude. Each tower is really a bent and consists of four vertical posts, which are built steel members, each supported on a pin at the bottom, the chains being rigidly fastened to the top with pins. The four posts are connected by cross struts and bracing into a rigid frame more than 300 feet high and 96 feet wide between centers, which is held vertically by the chains, but is free to rock on the pin bearings below to accommodate such changes in length as may take place in these chains under strain and temperature. The design is correct in principle and secures more uniform pressures and results more closely coinciding with the calculations than may be obtained from any form of rigid tower. Wherever metal towers are used we consider that the best practice is to fasten the cables rigidly to the top of the towers, providing for changes of position by the spring of the tower rather than by movable saddles, the increased strain in the metal caused by such deflections of the towers being easily kept within safe limits. The device of a frame supported on pin bearings below eliminates even these strains.

Anchorages.—The general plan of the anchorages, as shown by the preliminary studies, seems to us satisfactory, although the permissible pressures on the foundations cannot be finally determined until the material in the bottom is exposed.

In reply to the four specific questions contained in your letter of appointment we beg to advise you that:

The plans are in accordance with advanced knowledge of suspension bridge designing. They are likely to be as economical in construction as other forms of suspension bridges. They provide fully for temperature stresses. They provide for a structure of unusual rigidity under concentrated loads. Ample provision is made for wind pressure. They are consistent with the best protection from corrosion. Our report on the quality of the steel must be deferred to await the results of tests not yet made.

The strength, stability and carrying capacity of the bridge will be adequate for any congestion of traffic which may occur on the railroad tracks, roadways and promenades if the provisions for loads laid down heretofore are followed.

The structure as designed will be incombustible.

The design favors speedy erection of the superstructure after the masonry is ready.

The report bears the signatures of Messrs. Geo. S. Morison, C. C. Schneider, Henry W. Hodge, Mansfield Merriman and Theodore Cooper, who constituted the commission, and all of whom are members of the American Society of Civil Engineers.

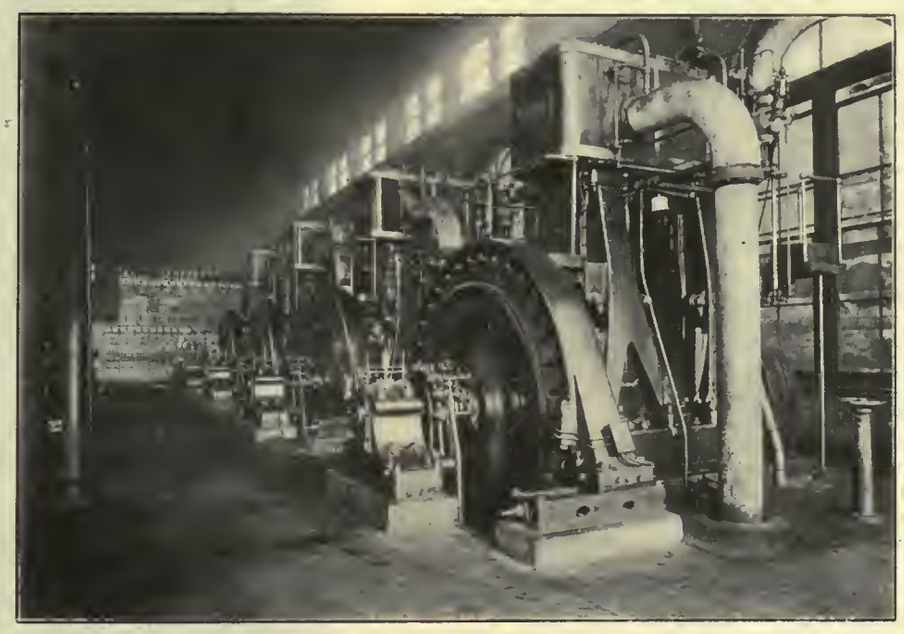
Power Equipment of the Pennsylvania Union Station, Pittsburg.

In The Engineering Record of August 30, last year, a description was printed without illustrations of the power equipment of the Pennsylvania Railroad passenger station at Pittsburg, based on a paper presented by Mr. D. B. Kinch, before the Engineers' Society of Western Pennsylvania. It is now intended to show by aid of the accompanying drawings some leading, interesting features of the design that will indicate its up-to-date character. In addition to close utilization of space, attention may be called to the arrangement of both steam and feed piping in duplicate, to insure the plant against the annoynace and expense incident with a breakdown of any kind, and to the extensive provision that has been made to collect the water of condensation in the piping.

The power house is a long, narrow building, 55x420 feet in size, the site available being a strip of land lying between the Pennsylvania freight tracks and the almost perpendicular Boulevard bluff, which had to be partly removed to accommodate the building. On the basis of its boiler capacity, 2,400 horse-power, and its total area of 23,000 square feet, there are 9.5 square feet of area per boiler horse-power. In addition to the electric generating units, which furnish light and power, there are in the engine room, which occupies but 27 per cent. of the total area of the plant, a large pumping engine, together with two smaller pumps, all for the elevator service of the station building, two large air compressors, chiefly for signals and switches, and a number of smaller apparatus, including an engine-driven and a motor-driven exciter. In the effort to economize floor space, all the machinery except the auxiliary apparatus is of the vertical type, and the units are arranged on either side of a central aisle. A basement, about 10 feet in clear height, is located under both the engine and the boiler rooms. Both live and exhaust steam piping is run in the engine room basement, and the exhaust main extends through the basement of the boiler room to a central point in that part of the power house, where its distribution for heating purposes is controlled. The boiler room basement is also utilized for the bottom run of a Hunt bucket coal and ash conveyor and for the smoke passages, the products of combustion from each boiler being conducted downward through a brick flue and discharged into the smoke duct which is an arched tunnel of brick walls 13 inches thick.

On account of the limited width of the building the boilers had to be placed in a single line, and the chimney was erected in the center, four boilers, set in two batteries, on each side of it. The smoke tunnels from the two groups of boilers discharge at opposite sides of the chimney, which is of the Alphons Custodis type of radial brick, 240 feet high and 9 feet in inside diameter. An interesting feature of the boiler equipment is the disposition of the feed pumps and feed-water heaters. The feed-water heaters are located on an elevated platform opposite the smoke stack, underneath the heaters on the boiler-room floor are the feed pumps, in duplicate, and in the basement below are the exhaust steam and other connections. In line with the feed pumps and against the outside boiler-house wall are two fire pumps and two service pumps, and against the partition wall between engine and boiler rooms is the refrigerating plant, this distributed on three stories, on account of the lack of much floor space. This installation, it may be said in passing, was made by the Carbondale Machine Company, and considerable data with reference to the duty and performance of the plant were given in the former article.

The boilers are 300-horse-power water-tube boilers of forged steel construction built by the Babcock & Wilcox Company. Each is fitted with a Roney stoker fed from steel bunkers, one bunker of 50,000 pounds capacity to each battery. The coal is fed into the stoker hoppers through steel chutes with funnel distributing ends; the flow being controlled or cut off by screw and yoke valves in the upper part of each chute. The ashes fall into a hopper below the furnace and the ash hoppers are discharged in turn into the bucket conveyor, which is also used, as stated, to carry coal to the bunkers. Each boiler has two 6-inch steam connections corresponding to the two steam mains, with two valves in each connection, one an angle valve at the boiler and the other, an angle valve of the automatic stop type, at the steam main. The branch boiler pipes are carried into the side of the steam mains, as indicated in an accompanying cross-section of the boiler house.



VIEW OF THE GENERATING UNITS.

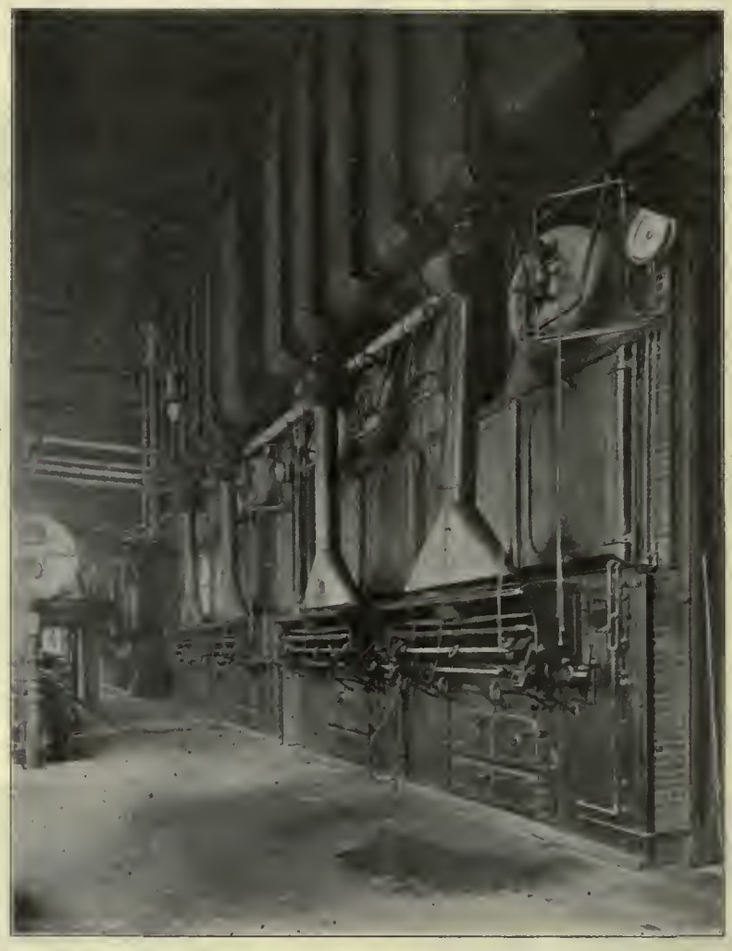


INTERIOR OF THE ENGINE ROOM.

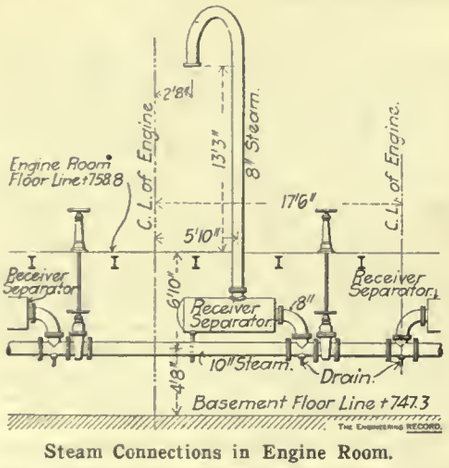
The mains are 10 inches in diameter, and each tee for connecting the boiler branch into the main is made with a pocket in the bottom for collecting water and affording an outlet for it through a 1-inch drain pipe. The construction of this tee is shown. The steam mains are carried one over the other, suspended by hangers from 9-inch I beams which are fastened to the roof trusses, as indicated in the drawings. The mains are connected together at the end distant from the engine room and valves are inserted in the mains so that a section in either one of them, corresponding to each group of four boilers can be entirely isolated or cut out of the rest of the piping either for repairs to that section or for cleaning or repairing the corresponding boilers. A light steel walk has been provided throughout the length of the steam mains, so that ready access of the valves may be had. In the center of the boiler house, the mains encircle the chimney and at that point a 6-inch line is taken from each main into the basement for the supply of the feed, fire and other pumps in the boiler house

For the supply of the engines the two steam mains drop through the boiler-room floor at the partition wall and the two lines extend along opposite walls to the extreme end of the engine-room basement, where they are connected together, as shown in the plan of the engine room. The mains thus form a continuous loop or ring from the outside end of the boiler room to the outside end of the engine room. This loop is tapped for the supply of five generating sets, the fifth yet to be installed, for the engine-driven exciter unit, for the three air compressors, of which two are already in place, for the large pumping engine and for the auxiliary pumps and air compressors. In each case, as indicated in the drawings, the branch steam pipe bends from the top of the main into a horizontal Best separator which acts as a combined receiver and separator. The main then continues from the top of the separator rising into the engine room, dropping to the engine cylinder in a 180-degree bend. The mains and receivers are suspended from a double line of 4-inch I beams attached to the engine-room floor beams and spaced about 9 inches each side of the center line of the steam main. The receiver-separator has about seven or eight times the volume of the engine cylinder. Valves operated from floor stands in the engine room are inserted in the steam main, so that the portion of it opposite each machine can be cut out. Other than this valve, each engine has but the throttle valve. Tees with the pocket for collecting condensation are also used in this piping system, and these, together with the receiver-separators, which receive the drips from the high-pressure cylinder connections, and the tees in the boiler room piping are all drained to a Holly receiver; the water is then returned to the boilers by means of the Holly system. The live-steam piping throughout is special full-weight wrought iron, with valves and fittings designed for a working pressure of 200 pounds per square inch.

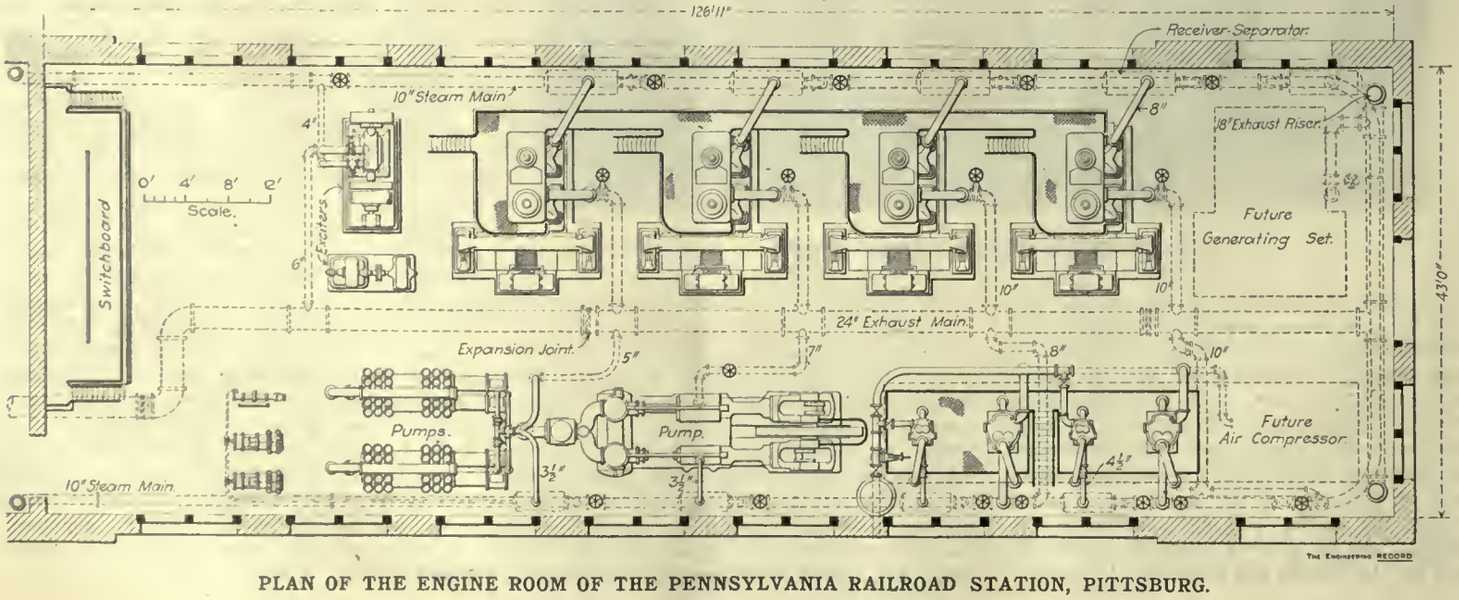
The nature of the equipment in the engine room was described in the former article. The features of design incorporated by the Allis-Chalmers Company in the Riedler air compressors and pumping engine to economize floor space were indicated, and the reasons for the choice of the auxiliary Worthington pumps for the elevator system were given. The generating units consist, as there stated, of vertical, cross-compound, Westinghouse engines, with cylinders 17 and 27 inches in diameter and 24 inches' stroke, driving by direct connection at 200 revolutions per minute 350-kilowatt, 220-volt, 60-cycle, two-phase, Westinghouse alternators. The output of electric current approximates 1,000 kilowatts, but is at times reduced to less than one-tenth of this figure. In view of this fact and the necessity of operating the plant 24 hours per day it was evident that one or two units would not be best suited to the conditions. The main features of the engine comprise a single bed-plate, carrying the horizontal built-up shaft, and the two pairs of vertical engine housings or A frames, each housing being surmounted by one of the two cylinders. The engines are rated at 475 horse-power. They are designed for a continuous overload of 35 per cent. and have a maximum capacity of 700 horse-power or 50 per cent. overload, for short periods. The high-pressure



BOILER ROOM, SHOWING BUNKERS, HEATERS AND STOKERS.



Steam Connections in Engine Room.

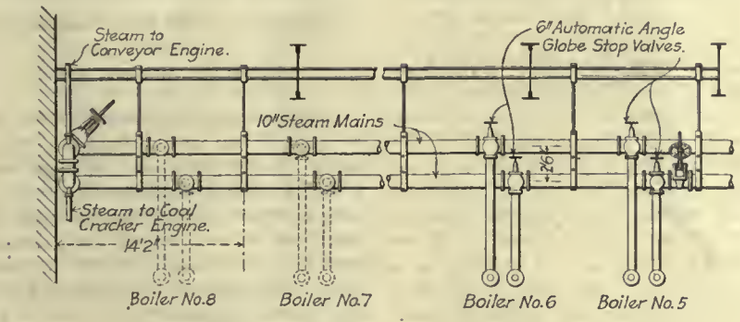


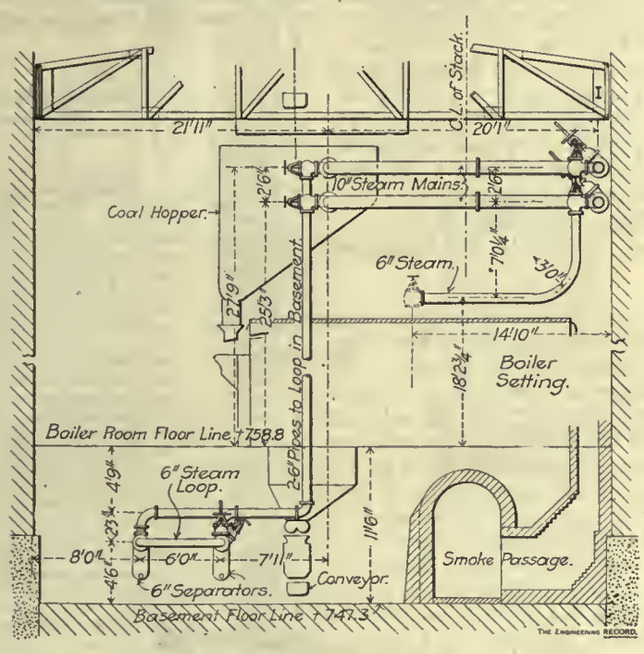
PLAN OF THE ENGINE ROOM OF THE PENNSYLVANIA RAILROAD STATION, PITTSBURG.

cylinder of the engine is fitted with a piston valve. The exhaust outlets at the ends of the valve discharge the exhaust steam into a small cast-iron receiver, concealed within the sheet steel cylinder casing.

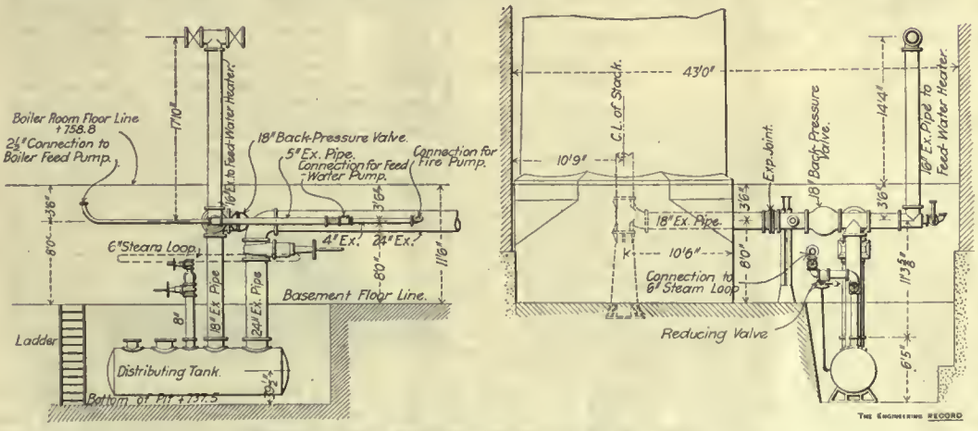
The exhaust steam from the machinery in the engine room is all carried into the basement where the branch exhaust pipes enter the side of a 24-inch exhaust main running the length of the basement between the two rows of the machine foundations. In general the heads in the two corners, the riser in each case, indicated in the engine room plan, being fitted with a back-pressure valve immediately below the roof trusses.

The exhaust main in its run through the engine-room basement has three expansion joints, spaced about 50 feet apart. It is continued through the boiler-room basement, with similar provision for expansion, to the center of the boiler house, where it discharges into a distributing tank located in a pit. This tank is





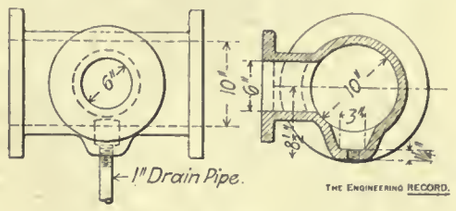
Live Steam Connections in Boiler Room.



Exhaust Steam Distribution in the Boiler Room.

valves in these connections are located in the basement, controlled by pedestal valves in the engine room. The main is full size its entire length, means for discharging the exhaust steam into the atmosphere being provided partly at the end wall of the station, while the heating system is controlled in the boiler room basement at the mouth of the tunnel connecting the power house and the station proper. The atmospheric connection at the end wall consists of two 18-inch Sturtevant exhaust 4½ feet in diameter and 16 feet long, and from it the heating mains are taken through the tunnel. A connection is also made for supplying live steam at reduced pressure, when necessary, and an outlet leads to the feedwater heaters and to an outboard exhaust pipe, this pipe being carried vertically through the center of the chimney to a point 6 feet above the chimney top. The horizontal branch to the exhaust riser contains the back-pressure valve, and the various connections are indicated.

The live steam for the heating system and for operating the feed, fire and other pumps in the boiler room is supplied in an interesting system of piping. As already mentioned, a 6-inch pipe is taken from each steam main into the basement for this purpose. There they connect in opposite sides of a horizontal loop of 6-inch piping, the ring 6 feet wide and 17 feet long, and enter it in each case through a verti-



Tees Used in Steam Main.

cal separator inserted in the loop. From the loop are taken the steam supplies to the pumps, a line to the station for heating cars and for cooking purposes and a connection to a reducing valve for the auxiliary supply to the heating system. There are four valves in the ring, an arrangement which indicates the effort that has been made throughout to secure maximum flexibility and security from interruption. The pumps being located above the loop, the separators form the low points and collect the water of condensation. The feed-water heaters are of the Cochrane open type of 1,500 horse-power capacity. The feed pumps ordinarily draw from them and are arranged to discharge into either of two systems of feed piping to the boilers.

The station was designed by the mechanical department of the Pennsylvania Railroad, under the direction of the general superintendent of motive power. Messrs. Westinghouse, Church, Kerr & Company were contractors for the stoker and electric generating equipment.

Engine Foundations.

Foundations for steam engines were referred to at some length in a paper on the design and construction of power stations, presented by Mr. John Young, town surveyor of Ayr, Scotland, before the Scottish Association of Municipal Engineers and Surveyors. Experience, he said, indicated that there is more resilience or yield in brick foundations than in those of concrete—that they are not so "hard" on the working parts of the engines. He looked for the solution of this fact in a consideration of the molecular structure and the forces set up in the materials themselves. Whatever the material of the foundation is, however its weight per cubic foot is about 130 pounds. He considered that the foundation weight should be about two and one-half to four times that of the engine, depending on the type, as to whether it is of the horizontal or vertical class, and on the outside forces exerted, such as belt driving and direct connected pump rods. In the construction of stone or brick-work beds, the supporting surfaces, he stated, should first be concreted over from 2 to 3 feet thick, and the foundations built thereon. In a foundation composed entirely of Portland cement concrete, he emphasized that precautions should be taken to prevent it getting convex-shaped on the bottom side when being laid, on account of the tendency of the mass of soft concrete to sink in the center of a broad and deep foundation. Forming coffers or dome-shaped mounds, covered with a coating of asphalt on the surface, before the concreting is commenced, and by bonding the concrete in 2-foot layers, will, he said, obviate this tendency.

A Remarkable Steam Engine Performance.

In a recent issue of "The Engineer" of London, there was printed the results of a series of tests of a 300-horse-power compound steam engine which developed 239 indicated horse-power on 9 pounds of steam per indicated horse-power hour. The engine was supplied with superheated steam and is fitted with a reheater between the high and low-pressure cylinders. It is one of a pair built by Easton & Company, Ltd., of Erith, Eng., and installed at the Brantham works of the British Xylonite Company, near Manningtree. They are employed to drive three-phase generators for power distribution about the works. The engine is a horizontal tandem-compound engine, both cylinders double acting, and is equipped with the Schmidt system of superheating, the reheater between cylinders acting to transfer a portion of the superheat of the highly superheated live steam to the steam which has done duty in the high-pressure cylinder. The tests were made by Prof. J. A. Ewing.

Steam is supplied from a Lancashire boiler at a pressure of 140 pounds per square inch and is superheated in an independently fired Schmidt superheater to nearly 800 degrees Fahrenheit. It reaches the engine at a temperature of, say, 750 degrees, but before admission to the cylinder it gives up about 170 degrees of superheat to the steam in the receiver, and consequently enters the high-pressure valve-chest at a temperature of about 580 degrees. The engine has four lift valves on the high pressure cylinder, two for admission and two for exhaust. The admission valves are worked from an eccentric controlled by a shaft governor and each of the four valves is closed, as well as opened, positively by means of a rocking lever. The low-pressure cylinder has four Corliss valves. There is a jet condenser with a vertical air pump driven by means of a bell-crank lever from the tail rod of the low-pressure piston. The cylinder diameters are 15 and 24 inches, and the stroke, 28 inches; the speed is 140 revolutions per minute.

Indicator cards were taken every quarter hour. The steam consumption was found by measuring the feed water by passing it through a pair of tanks. In reckoning the steam consumption no account was taken of steam used in feeding the boiler. The figures include all losses of steam in the boiler and pipes. Some steam was blowing continuously from a joint in the steam pipe in all the trials and at times there was a little blow-off at the safety valve. If these losses had been avoided, the results as to steam consumption would be even more favorable than they are.

The tests were made on December 16 and 17, of last year, as follows: Full load for seven hours; half-load for three hours; three-quarters for five hours; no load, for a short time. In each case the engine was run for some hours previous to beginning the trials. The results are given in the accompanying table. It will be seen that the best economy of steam occurred when the load was something less than full, but throughout the range from half to full load, the efficiency was uniformly high. In the no-load trial a few lamps were used in lighting the engine and boiler houses, and a further test was made without excitation of the dynamo and the indicated horse-power dropped from 47 to 28. Allowing for the small lamp load in the no-load trial, the indicated horse-power without load but with excitation was calculated to be 42. The power consumption due to excitation at no load thus corresponds to 14 indicated horse-power.

Results of the Engine Trials.

Indicated H.-P.	312	239	175	47
Kilowatts	190	143	97	3.5
Ratio elec. to ind. H.-P.	0.82	0.80	0.74	..
Steam per I.H.P. per hr., lbs.	9.4	9.0	9.5	..
Steam per kw. hr., lbs.	15.4	15.	17.2	..
Boiler pressure, lbs.	141	141	142	140
Saturation temp., deg. F.	361	361 ½	360	
Temp. at superhtr., deg.	800	790	810	790
Press. at engine, lbs.	134	135	139	138
Temp. at engine before superhtr., deg.	737	734	761	..
Temp after superhtr., deg.	554	590	603	..
Vacuum, Ins.	27 ¼	28	28	29
Revs. per min.	140	140	140 ½	140

The weight of coal supplied to the boiler furnaces was determined during the first day for nine hours and that supplied to the superheater on each of the two days. Both boiler and superheater were designed to supply the two engines together, so that they were working at about half only of their intended output. The furnaces were handfired and there was no economizer. A coal of a calorific value of 13,300 British thermal units per pound was supplied to the boilers and a smaller kind, of a calorific value of 11,900 thermal units, was fed into the superheater. For each pound of coal put in the boiler 8.7 pounds of steam were evaporated at a pressure of 140 pounds, and from feed water at 75 degrees Fahr. For each pound of small coal in the superheater 24 pounds of steam were superheated to 800 degrees. The total quantity of coal used in giving heat to 1 pound of steam for the engine was thus equal to $1 \div 8.7 + 1 \div 24 = 0.157$ pound. Nine pounds of steam on this basis required $9 \times 0.157 = 1.41$ pounds, that is, 1.41 pounds of coal were required by the plant per indicated horse-power per hour.

Rapid Transit Extension in Brooklyn, N. Y.

Some very radical changes in the transit facilities of Brooklyn are proposed in the report of Chief Engineer Wm. Barclay Parsons to the Rapid Transit Board of New York City, dated March 12. This report is a continuation of that of February 19, published in The Engineering Record of February 28. As it is unlikely that many of the recommendations will be acted upon at once, only a summary is given. It may be stated that the total number of miles of new road proposed in this report is 37, and the total amount of new tracks proposed, whether in new road or as additions to existing roads, is 120 miles. An approximate cost of these improvements, exclusive of abuttal damages, is $52,000,000, of which $31,000,000 represents the approximate cost of extending the subway and of constructing the second East River tunnel with its Manhattan connections.

After referring to the many plans proposed for relieving the traffic conditions at the Brooklyn Bridge, Mr. Parsons recommends the final removal of all elevated trains from that structure, the use of the present elevated tracks for trolley cars and the restoration of the roadways to vehicular traffic exclusively. To provide for the elevated trains it is proposed to have a second East River tunnel from Orange street, Brooklyn, to Maiden Lane, New York, to connect by subway with the Brooklyn, Manhattan and Williamsburg bridges in Manhattan. Until this tunnel and subway can be built a temporary connection in Manhattan by the elevated line between the Williamsburg and Brooklyn bridges is recommended, in order to give a continuous loop for Brooklyn trains.

A four-track subway is recommended, from Flatbush and Atlantic avenues to a loop at the Prospect Park Plaza, and a three-track subway along Eastern Parkway to East New York avenue. A two-track subway is also recommended along Flatbush avenue from the Plaza to East Broadway. A subway along Fourth avenue from Flatbush and Atlantic avenues to Fort Hamilton, having an outlet to Manhattan by tunnel from Atlantic avenue to Whitehall street, is also part of Mr. Parsons' plan. Third tracks are recommended for all the main elevated roads.

A new elevated line is proposed, along Franklin avenue from Fulton street through several other streets to connect with the Williamsburg and Blackwell's Island bridges, and finally passing up Debevoise avenue to Flushing Bay. Elevated extensions are recommended for the Third and Fifth avenue lines in Bay Ridge.

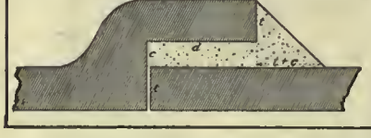
Quantity of Mortar Required for Pipe Sewer Joints.

By Horace Andrews, Albany, N. Y.

The accompanying table showing the amount of cement and sand required for filling the joints of vitrified sewer pipes is based on the width of cement space, depth of hubs and thickness of pipes as given in the trade lists and is computed with the supposition that the cement outside of the annular space is formed with a bevel of 45 degrees. This table will enable the engineer or contractor to arrive at a close idea

D	t	d	c	Cubic Yards of Mortar per 500 Joints (1000 in 2 ins)	Proportions based on Prof. I. O. Baker's Table VII: 7.14	6.45	4.16	3.74	0.88	2.86	2.57	0.60
					Mortar composed of Neat Cement		1 Cement to 1 Sand.			1 Cement to 2 Sand.		
Standard					Bbls. of 376 lbs. Portland	Bbls. of 300 lbs. Rosendale	Bbls. Port.	Bbls. Ros.	Cu. Yds. Sand	Bbls. Port.	Bbls. Ros.	Cu. Yds. Sand
3	3/16	1 1/16	3/16	0.142	1.01	0.91	0.59	0.53	0.08	0.4	0.36	0.11
4	1/4	1 1/4	-	0.174	1.24	1.1	0.7	0.7	0.1	0.5	0.5	0.1
5	5/16	1 5/16	-	0.252	1.8	1.6	1.1	0.9	0.2	0.7	0.7	0.2
6	5/16	1 5/16	-	0.290	2.1	1.9	1.2	1.1	0.2	0.8	0.7	0.2
8	3/4	1 3/4	-	0.437	3.1	2.8	1.8	1.6	0.3	1.3	1.1	0.4
9	3/4	1 3/4	-	0.514	3.7	3.3	2.1	1.8	0.3	1.5	1.3	0.4
10	3/4	1 3/4	-	0.618	4.4	4.0	2.6	2.3	0.4	1.8	1.6	0.3
12	1	2	1/2	1.056	7.5	6.8	4.4	4.0	0.5	3.0	2.7	0.9
15	1 1/8	2 1/8	-	1.487	10.6	9.6	6.2	5.6	0.8	4.2	3.8	1.2
18	1 1/2	2 1/2	-	1.912	13.7	12.3	8.0	7.2	1.1	5.5	4.9	1.5
20	1 5/8	2 3/4	-	2.359	17.1	15.4	10.0	9.0	1.4	6.8	6.2	1.5
24	1 7/8	2 3/4	-	3.347	23.9	21.5	13.8	12.5	1.9	8.5	8.6	2.7
30	2	3	-	5.493	39.2	35.5	22.9	20.6	3.2	15.7	14.1	4.4
Deep and Wide Sockets												
6	5/8	2 1/4	3/8	0.385	4.2	3.8	2.4	2.2	0.3	1.7	1.5	0.5
8	7/8	2 1/4	-	0.507	6.6	5.8	3.8	3.4	0.6	2.6	2.3	0.7
10	7/8	2 1/4	-	1.134	8.1	7.3	4.7	4.2	0.7	3.2	2.9	0.5
12	1	3	-	1.594	11.4	10.3	6.6	6.0	0.9	4.6	4.1	1.3
15	1 1/8	3 1/4	-	2.172	13.8	14.0	9.0	8.1	1.8	6.2	5.6	1.7
18	1 1/2	3 1/2	-	2.843	20.3	18.3	11.8	10.6	1.7	8.1	7.3	2.3
20	1 5/8	3 1/2	-	3.466	24.8	22.3	14.4	13.0	2.0	9.9	8.9	2.8
24	1 7/8	4	-	4.757	34.3	30.8	20.0	17.9	2.8	13.7	12.3	3.8
Double Strength												
13	1 1/2	2 1/2	1/4	1.796	12.8	11.6	7.5	6.7	1.0	5.1	4.6	1.4
18	1 5/8	2 3/4	-	2.499	17.8	16.1	10.4	9.4	1.5	7.1	6.4	2.0
20	1 5/8	3	-	3.162	22.6	20.5	13.2	11.8	1.6	9.0	8.1	2.6
24	2	3 1/4	-	4.801	34.3	30.9	20.0	18.0	2.8	13.7	12.3	3.8
30	2 1/2	4	1/4	9.093	64.9	58.3	37.8	34.0	5.3	25.9	23.4	7.3
Blackmer and Post - Standard												
27	2 1/4	4	3/4	7.847	56.0	50.5	32.6	29.4	4.6	22.4	20.2	6.3
28	2 1/4	4	-	7.967	56.9	51.2	33.1	29.8	4.6	22.7	20.5	6.4
30	2 1/4	4	1/8	10.183	72.7	65.5	42.4	38.1	5.8	29.0	26.2	8.2
33	2 3/4	4 1/2	1	13.541	96.7	87.1	56.5	50.8	7.8	38.8	34.8	10.8
36	2 3/4	5	-	16.007	114.3	102.9	66.6	59.9	8.3	45.6	41.1	12.8
Blackmer and Post - Double Strength												
27	2 1/4	4	3/4	8.353	59.5	53.6	34.7	31.2	4.8	23.8	21.4	6.7
28	2 1/4	4	-	8.932	63.8	57.4	37.2	33.4	5.2	25.5	23.0	7.1
30	2 1/4	4	1/8	11.871	84.2	73.1	47.5	42.5	6.6	32.4	29.2	9.1
33	2 3/4	4 1/2	1	14.943	106.7	96.1	62.2	55.9	8.7	42.6	38.4	12.0
36	2 3/4	5	1	17.571	125.8	113.0	73.1	65.7	10.2	50.1	45.2	14.1

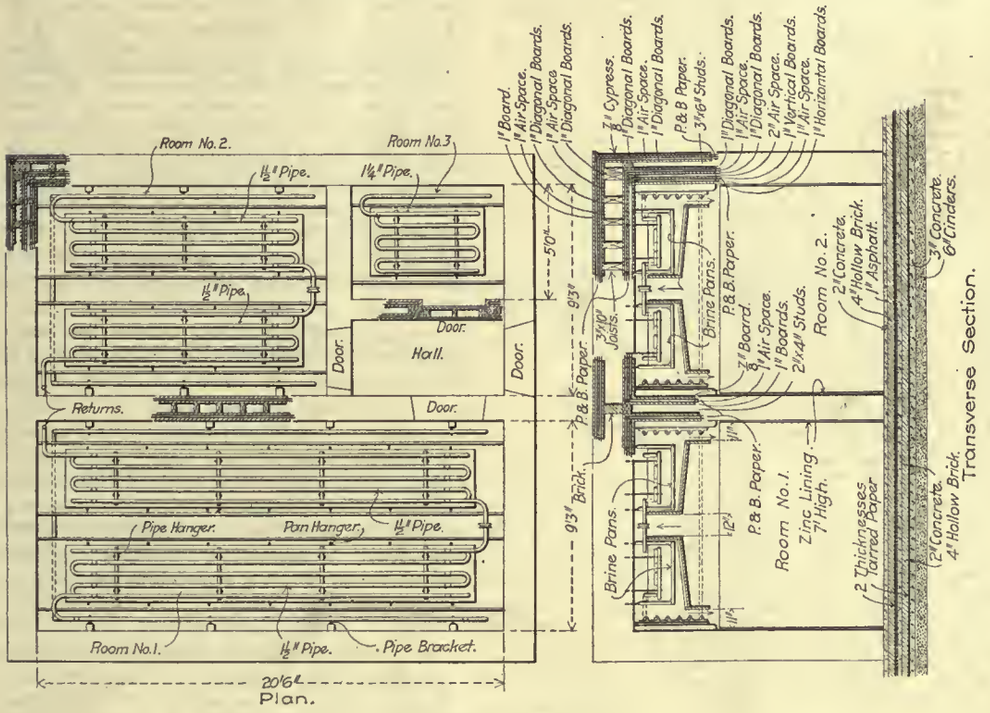
Table showing amount of Mortar for joints of Sewer Pipe.



of the amount of cement that will be required to form the joints of any kind of sewer pipe. In practice the writer has found that the smaller sizes of pipes, owing to imperfectly filled joints, will not require as much cement as the table would indicate, but that the larger sizes will require very nearly the theoretical amount. With careful jointing the smaller sizes should require the amounts shown in the table. The quantities of cement and sand deduced from the amount of mortar have been computed on the basis of the proportions given by Prof. I. O. Baker. Mortar formed of one part sand and one part cement is in the opinion of the writer preferable to neat cement or to any weaker mixture.

The Cold Storage Plant in the Cornell Medical College.

In the description of the heating and ventilating of the Cornell Medical Building, in the March 14 issue of The Engineering Record, but slight reference was made to the cold storage plant for the preservation of specimens for dissection. This article treats it in some detail as the cold storage is one of the most interesting features of the building, due to the extreme precautions which have been taken for thoroughly insulating it and for preventing its odors from being disseminated through the building. The floor of the containing room is 22 inches thick and constructed as follows from the bottom up: 6 inches of cinders, 3 inches of concrete, two thicknesses of two-ply heavy tarred paper, 4 inches of hollow brick placed on edge, 2 inches of finer concrete, 1 inch of asphalt, two more thicknesses of tarred paper, another 4-inch course of hollow brick and 2 inches of cement, the finished floor being 4 feet below the basement floor level. The outside wall of the room is faced on the inside with 4 inches of hollow brick and the windows have two sets or casements with double glass in each sash. The wall on the engine room side is double, 20 inches thick and encloses a 4-inch air space.



Detail of Cold Storage.

The cold storage proper is built within this containing room and separated from its walls by at least 2 feet of air space on all sides and the top. In exterior dimensions it is about 23 feet square by 13 feet high, the walls being 18 inches thick and the ceiling 21. The side walls are made up as follows, beginning at the outside: ⅞-inch vertical cypress boards, 1-inch diagonal boards, 1-inch air space, 1-inch boards laid diagonally in the opposite direction, 3x6-inch supporting studs, 12 inches on centers and giving a 6-inch air space, 1-inch diagonal boards, 1-inch air space, 1-inch boards laid diagonally in the opposite direction, 2-inch air space, 1-inch vertical boards, 1-inch air space, and 1-inch horizontal boards, all layers being separated with P. & B. paper and the interior lined with zinc 7 feet from the floor. The ceiling construction is similar but replaces the studding as used in the walls with 3x10-inch joists, giving a 10-inch air space in the center.

The interior of the storage is divided into three rooms and an entrance compartment by partitions consisting of two ⅞-inch and two 1-inch boards, and two 1-inch and one 4-inch air spaces. The four doors opening into the compartment from the three rooms and the containing room are Steven's insulated doors carefully fitted so as to be air-tight. The cooling is afforded by a refrigerating plant which operates on an ammonia compression system and has a capacity of six tons of refrigeration per 24 hours. The apparatus includes a 6¼x12-inch Case compressor driven through a belted countershaft by a 15-horse-power Westinghouse motor; an ammonia condenser, 4 feet in diameter and containing 300 feet of 1¼-inch extra heavy ammonia pipe in three independent coils; a suction trap or interceptor to arrest scale or dirt; a wrought iron receiver and a gauge frame supporting two combined ammonia pressure and vacuum gauges.

The ammonia pipe coils are suspended from the ceilings of the cold storage, and submerged in pans of brine. Beneath the brine pans are hung safe pans to catch condensation or leakage, which also serve as vanes to guide the circulation of the air, the warmer air rising over the center of the room, passing over the coils and brine and descending in its chilled condition down the sides of the room. The largest room, No. 1, is used for the storage of bodies, contains 2,079 cubic feet and is provided with 693 feet of pipe in cooling coils. Room No. 2 is for the storage of parts of bodies and contains 1,287 cubic feet with 430 feet of pipe in coils. The smallest room, No. 3, is for the storage of animals, is 352 cubic feet in size and contains 117 feet of pipe. The three rooms are designed to be maintained at a temperature of from 15 to 20 degrees with the apparatus running but 3 to 6 hours per day. The architect for the building was Mr. W. H. Miller, of Ithaca. The erection was supervised by his superintendent, Mr. O. H. Waltz. Driscoll Brothers & Company, of Ithaca, were contractors for the building, and the Case Refrigerating Machine Company, of Buffalo, installed the refrigerating plant.

At the Louisiana Purchase Exposition, St. Louis, automatically registering turnstiles connected electrically with dials in a central office will record the admissions.

Letters to the Editor.

Communications are always welcome, and, as far as permitted by space and interest, they may be printed in these columns. The Engineering Record, however, assumes no responsibility for the facts or opinions presented in the letters.

Subaqueous Tunnels.

In your very interesting article of March 14, 1903, entitled "Improved Methods for Difficult Subaqueous Tunneling," you mention among others, my proposed system for tunneling under water; it was so admirably described that but little remains to be said, but to call particular attention to its adaptability for tunneling through a stratum of soft silt where the conditions of stability are unusual and where the tendency of the foundation may be to yield under the weight; or where through buoyancy, the structure may be subjected to an upward movement, and, when the tunnel is in actual service and subjected to vibrations caused by passing trains, the fine material becomes softened into a semi-liquid state, rendering it unfit to support the structure, which under such unstable conditions might become seriously ruptured.

As a tunnel built in soft silt or mud must have a foundation which will be firm and unyielding, the shield or "movable pneumatic caisson" as you have well termed it will accomplish this purpose. Consequently it will be readily seen that the main advantage of the method is to provide a positive way of building foundations for a tunnel through soft materials, where the materials encountered can be seen and the foundations designed to fit known conditions. The action of gravity can be counteracted with as much certainty as with a structure built on land and the action of buoyancy can be equally well resisted.

Yours truly,

J. Breuchaud.

Croton-on-Hudson, N. Y., March 16, 1903.

Subway Construction.

Sir:—I have been working lately to secure the adoption of my double deck tunnel plans of which the enclosed is a section. In this connection I have worked out a rather important detail whereby, at the proposed express stations I bring all the tracks to the same level and use island platforms. This I accomplish by spreading the local tracks and bringing the express tracks half way up to meet them on a 3 per cent. grade. This makes it possible to locate the station on the apex of the grade, which of course will materially assist in stopping and starting the trains.

Yours truly,

J. W. Reno.

New York, March 13, 1903.

A drawing accompanying this communication shows a rectangular subway 27 feet high and 25 feet wide inside, with a center line 39⅓ feet from the building line. It very much resembles the steel construction subways of the New York Rapid Transit Railroad, except that it has two stories, the upper being apparently 13 feet high in the clear with a solid trough floor. The wall columns are 15-inch I-beams with concrete walls between their webs. The center columns are built sections, and the roof beams are box girders open on top to receive the yokes of the electric car conduits with concrete filling inside and between them. The bents are 4½ feet apart, and the side walls are extended 2 feet outside the columns for the lower story where they are shown built inside 6-inch sheet piling. On top of each lower story side wall there is a single row of wire conduits built up to the roof of the subway, and between these conduits and the wall of the sidewalk vaults is a 6½-foot space marked for pipe gallery.—Ed.

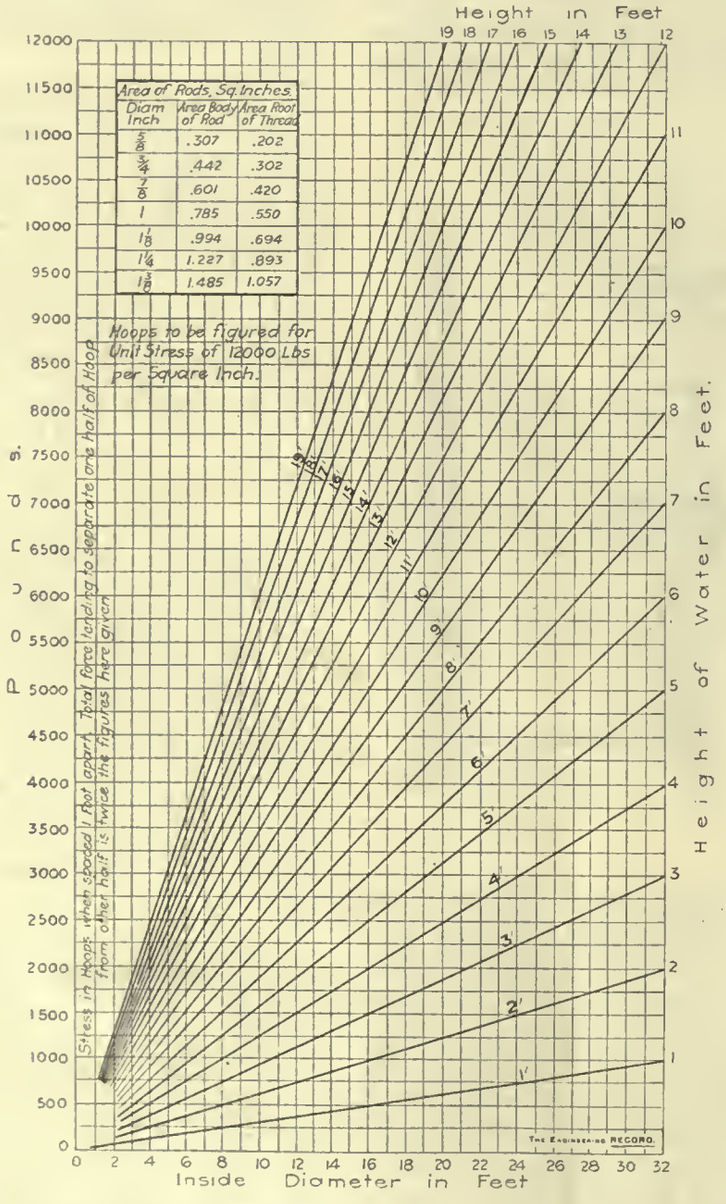
Hoops for Wooden Tanks.

Sir:—We send you herewith a diagram which we have computed for the purpose of figuring the size of hoops for cylindrical wooden tanks. Many tanks are used in buildings, especially those devoted to manufacturing purposes, and if you think this would be of service to our fellow engineers and architects, you have the liberty of publishing it. In addition to being able to determine the stress in the hoops, we have placed on the same sheet the area of rods as well as capacity of circular tanks in gallons per foot of height. We have found it very convenient in figuring tank capacities to assume that the water height is about 1 foot less than the length of the stave, and that the mean diameter is approximately 1 foot less than the outside diameter at the bottom. Tanks figured on this basis will be accurate enough for all practical purposes. The diagram is worked out on a basis of hoops spaced 1 foot apart. Of course, in practice they are put closer together than 1 foot at the bottom and farther apart than 1 foot towards the top. In determining the size of the hoops it will be necessary to determine the approximate spacing, and then from the table multiply the stress for the 1 foot spacing by the actual spacing in feet, or fraction thereof, to determine the stress in any particular case. We have found from our experience that a flat hoop should be used at the extreme bottom of the tank and round ones above. The flat hoop gives a better bearing area on the staves where they are weakest due to the groove for the bottom of the tank, the wood at this point being somewhat less in thickness. We find that the use of wrought iron is preferable to steel for hoops, and use a unit stress of 12,000 pounds per square inch in the hoops. In practice, also, we find it better not to use a hoop of less diameter than ⅝ of an inch. The particular advantage in using the round hoops over the flat ones is that they are less liable to rust out, and tank manufacturers in general are commencing to see the superiority of the round hoops.

Truly yours,

Ballinger & Perrot,
Architects and Engineers.

Philadelphia, Pa., Feb. 20, 1903.



Beautification of the National Capital.

Sir:—The building for Representatives' offices and other proposed buildings on Capitol Hill referred to in your inquiry all fit as parts of the general improvement of the national capital recommended in the report of the "Park Commission," reviewed in The Engineering Record of February 14, on which I have the honor to serve. The following statement will be found in our report, page 37:

"Distinguished alike for its historic associations and for its architectural merits, the Capitol stands in the midst of ample grounds, indeed, but is surrounded in the main by private buildings, many of them of the most squalid character, or by neglected stretches of land used as dumping grounds. From the Mall system the grounds are cut off by the Botanic Garden, walled and fenced so as to block the way.

"Facing the Capitol grounds on the east stands the Congressional Library; and it is contemplated that at no distant day the Supreme Court of the United States shall be accommodated in a building constructed for the exclusive use of that tribunal, on the square directly north of the Library; and that the Senate and the House of Representatives will have constructed for the uses of their members buildings respectively on the north and on the south of the grounds of the Capitol.

"The construction of the above-mentioned buildings as planned will make it in the highest degree appropriate that fronting the entire square occupied by the Capitol grounds only public buildings bearing a common relation to legislative work shall be erected. If the reciprocal relations of the new buildings shall be studied carefully, so as to produce harmony of design and uniformity of cornice line, the resulting architectural composition will be unequaled in magnitude and monumental character by any similar group of legislative buildings in the modern world.

"The successful development of this proposed series of buildings inclosing the Capitol square is to be assured only by strict adherence to that system of radial avenues laid down by Washington and L'Enfant, upon which the Capitol depends for its dominating character. Any invasion of these historic arteries representing the original States and centering upon the Dome must be fatal, because inconsistent with the fundamental principles upon which the city is built. The location of the Library of Congress partly in Pennsylvania Avenue is a perpetual mutilation of L'Enfant's plan, and inflicts incalculable injury to the Capitol, which the Library in part conceals. Other similar instances are the extension of the Treasury and the construction of the State, War, and Navy buildings so as to close forever carefully planned vistas of the White House. These discordant notes should warn future generations that sites for public buildings are dearly purchased at the cost of those essential elements which give to Washington its unique advantage over all other American cities."

Not only in regard to this matter, but in regard to every one concerned with the development of the Capitol, of course ultimate success will depend upon skilful design at all stages of the work; upon harmony between the many features which must be built separately and to serve various specific uses, and it will be the duty of technical journals like yours to follow the course of such improvement with a watchful eye to their larger import. The provision made by Congress for the erection of this office-building is the first essential step in the improvement of the surroundings of the Capitol, and there is every reason to hope that the next step, the selection of a suitable design, will be successfully accomplished.

Very truly yours,

Frederick Law Olmsted, Jr.

Brookline, Mass., March 16, 1903.

Water Works Engineering by City Councils.

Sir:—I enclose a clipping from "The Public Ledger," of Norfolk, of the 13th inst. It shows the situation here in regard to water waste prevention, after several years' endeavor to have the question considered from a proper standpoint. Our supply is absolutely limited to 12,000,000 gallons per diem. Our population is rapidly increasing, and we are now using 5,250,000 gallons on an average. The consumption is about 103 gallons per day per capita (not consumer), and the addition of a 30-inch main to the 24-inch main now in use, will largely increase it. Please note the description of the "patometer" by the "Mechanical expert."

Very truly yours,

W. T. Brooke,
City Engineer.

Norfolk, Va., March 14, 1903.

[The clippings mentioned reveal the usual state of affairs when a council composed of business men and politicians attempts to regulate technical matters,—time and money wasted and nothing accomplished. The proper solution is the reference of the matter to the city engineer with authority to employ a consulting engineer, if necessary, and then to act upon the recom-

mendations made. It is to be regretted that space will not permit reprinting for the entertainment of the reader the opinion of the "mechanical expert" member of the council, especially his description of the "Patometer," which raises grave question as to the accuracy of The Engineering Record's description in the issue of January 31.]

Subdivision of Contracts.

Sir:—I have just been reading the editorial in The Engineering Record of March 7, on the economy of small contracts. It is very true, as you have shown there, that in the bid prices there is an apparent economy in this method of letting work; but I venture to assert that if you will follow out these same contracts and take account of all the vexations, delays, extras and harass of the Engineer, which will occur, that the balance will be very much to the other side at the end of the transaction.

Yours truly,

Wm. B. Fuller,
Resident Engineer,
Jersey City Water Supply Co.

Paterson, N. J., March 13, 1903.

Inquiries.

Questions and answers of interest to readers may be published under this heading. Replies are solicited and should be addressed to The Engineering Record.

Chemicals for Hardening Concrete.

Sir:—Can any of the readers of The Engineering Record give me information in regard to recent undertakings in concrete where chemicals have been added to the concrete on the work to secure greater hardness and wearing resistance of the finished concrete?

Yours truly,

W. H. L., Jr.,
Chief Mechanical Engineer.

Boston, March 14, 1903.

Stack Economizers.

Sir:—Will you please ask through your columns if some of your readers will state what is their experience with regard to the resistance offered by economizers in smoke passages? Suppose after the completion of a plant, an economizer is installed, will it not be advisable to increase the height of the stack? Is it not a fact that the draft is sometimes so much reduced that a mechanical draft equipment becomes necessary, making the addition of an economizer under such a condition a questionable economy?

Yours truly,

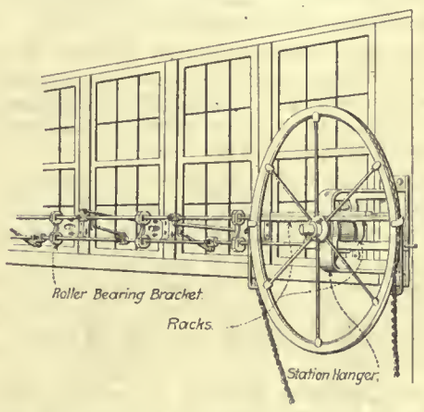
C. W. B.

Rochester, N. Y., March 16.

Window and Shutter Operating Device.

In the accompanying illustration is shown the apparatus which forms the working parts of the Lovell device for operating windows. It has already been referred to in these columns, and as there stated, is designed to afford means for opening and closing from one point a line of windows as long as 500 feet. For the purposes of description the device is shown applied to windows pivoted at the sides, but the device is intended for use with windows pivoted at top and bottom, or hinged at top or bottom, and with sliding or lifting windows. In case of fire, the desirability of being able to close the windows quickly is evident.

The method of operation is indicated in the drawing. To the mullions between adjacent windows brackets are fixed, their exact position depending on the amount of window opening desired. In line with these at the operating point is the station hanger in which is mounted a pinion engaging with two horizontal racks. To each rack is attached a continuous line of piping, which passes through the brackets and to which are fixed the ends of arms extending to the windows. The brackets are provided with anti-friction rollers, two vertical and two horizontal in each opening, so that the piping has a roller bearing on four sides. The chief point of interest, however, lies in the arrangement of the arms. Each arm is attached to the sash by a pivotal connection and to the collar on the piping by another pivotal connection. With the windows closed, as shown, the arms form an acute angle with the piping; and when the piping is moved to open the windows, the arms act as struts forcing open the windows, increasing the angle between them and the piping. The important feature, however, is that the pivotal connection of each arm to the collar is alternately above and below the piping, so as to balance the torsional stresses on the piping, which stresses would otherwise be exerted all in the same direction. These connections are indicated in the cut. There are two arms per window, one connected to the upper line of pipe and the other to the lower. When the wheel is rotated by means of the chain, which hangs within a few feet of the floor, the racks and the corresponding lines of



pipe are moved horizontally in opposite directions and the windows are opened as explained. The device has already been installed in the Buffalo plant of the American Radiator Company, in the foundry buildings of the Eaton, Cole & Burnham Company, and in the saw-tooth building of the Stanley Instrument Company, at Great Barrington, Mass. It is manufactured by The G. Drouvé Company, of Bridgeport, Conn.



Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South 4th Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Personal Notes.

Mr. Fred Harper has been elected city engineer of Butler, Pa.

Mr. Daniel E. Brinsmade has been elected borough engineer, at Shelton, Conn.

Mr. William F. Wait has been re-elected water commissioner of Auburn, N. Y.

Mr. J. G. Tenney has resigned as the superintendent of water-works of Leominster, Mass.

Mr. William J. Marvin has been appointed to his twentieth term as commissioner of bridges of Cambridge, Mass.

Mr. J. J. Van Vaikenburg, town engineer of South Framingham, Mass., has returned from a trip to Cuba and adjacent islands.

The headquarters of Mr. C. T. McLellan, division superintendent of the Atchison, Topeka & Santa Fe Railway, are to be moved to Emporia, Kan.

Mr. Samuel M. Gray, of Providence, and Mr. George W. Fuller, of New York, have been chosen to study the water supply problem of Springfield, Mass.

Mr. E. G. Cowdery, for some years general manager of the Milwaukee Gas Light Co., has been made general manager of the Laclede Gaslight Co., of St. Louis.

Mr. Guy W. Buxton, who has been for some time connected with the New York office of the H. W. Johns-Manville Co., has been appointed auditor of the company.

Dr. Coleman Sellers, consulting engineer, Stephen Girard Building, Philadelphia, has admitted Mr. S. Howard Rippey to an interest in his general office practice.

Mr. F. N. Hibbits, mechanical engineer of the Union Pacific Railroad, has been appointed assistant superintendent of motive power, with headquarters at Omaha, Neb.

Mr. James H. Fuertes, M. Am. Soc. C. E., has been engaged by the city council of Lynchburg, Va., to survey the route for a proposed gravity water supply for that city.

Capt. Mason M. Patrick, Corps of Engineers, U. S. A., has been detailed as a member of the board on geographical names at Washington, succeeding Major James L. Lusk, Corps of Engineers.

Mr. Chester J. Wallace, since July, 1895, with the Metropolitan Water and Sewerage Board of Boston, has accepted a position as principal assistant engineer to the town engineer of Brookline, Mass.

Mr. Henry Angle has resigned as superintendent of bridges and buildings on the middle division of the Chicago & Alton Railway, on account of poor health, and will be succeeded by Mr. John Horton, of Louisiana, Mo.

Prof. L. G. Carpenter, whose recent appointment as State engineer of Colorado was announced, will retain his connection with the State Agricultural College, as director of the experimental station at Fort Collins, Colo.

Mr. Norman S. Sprague has resigned his position with the Metropolitan Water and Sewerage Board of Boston, which he joined in August, 1895, to accept a position with the Commission for an Additional Water Supply of New York City.

Mr. William E. Swift, assistant engineer of the New York Rapid Transit Railroad Commission, has obtained a year's leave of absence to accept a position in the construction of irrigation works in Nevada, with headquarters at Carson City.

Mr. Horace E. Horton, president of the Chi-

cago Bridge & Iron Co., delivered a lecture on March 12, before the engineering students of the Iowa State College at Ames, on the construction of bridges and elevated steel tanks and water-towers.

It is announced that Mr. W. H. Marshall, general superintendent of the Lake Shore & Michigan Southern Railway, at Cleveland, O., will be made general manager on April 1, and that he will be succeeded by Mr. H. S. Storrs, assistant general superintendent.

Messrs. Edward P. Walters, Luther R. Sawin and Arthur W. Walker have recently accepted positions with Mr. George C. Whipple as bacteriologists in connection with the investigation of a water supply for New York, with headquarters at the Mount Prospect Laboratory, Brooklyn, N. Y.

Mr. E. S. Farwell, expert steam engineer with the International Paper Co. since its organization, has opened an office at 309 Broadway, New York, for the practice of engineering, particularly in steam power plants, electric plants and the heating and ventilation of mills and large buildings.

Mr. Thomas F. Foley has withdrawn from the partnership of Messrs. A. F. McCarty & Co., contractors and engineers, at 1215 Filbert Street, Philadelphia, and his share of the business has been purchased by the remaining members of the partnership, Messrs. Arthur F. McCarty, Eugene Y. Meyer and Alexander Senner.

Prof. Henry A. Pressey, Assoc. M. Am. Soc. C. E., hydrographer of the U. S. Geological Survey, and professor of civil engineering at the Columbian University, Washington, D. C., has become associated with Messrs. Hugh MacRae & Co., dealers in Southern investment securities, Wilmington, Del., who have opened an office in the Kellogg Building, Washington, D. C.

Mr. Arthur W. Trenholm has been appointed general manager of the Chicago, St. Paul, Minneapolis & Omaha Railway, with headquarters at St. Paul, succeeding the late Walter A. Scott, whose death was announced last week. Mr. Trenholm is succeeded as general superintendent, St. Paul, by Mr. Wallace C. Winter, and the latter, as superintendent of the Wisconsin division at St. Paul, by Mr. William Bennett.

Obituary Notes.

Edward A. Darling, superintendent of the Edison Portland Cement Co., died at his home in Stewartsville, N. J., March 15, from the injuries he received in the explosion of coal dust in the works March 2. He was about 37 years of age. For a number of years he was superintendent of building at Columbia University, and the buildings now occupied by that institution were constructed during his term of office. He was a member of the American Society of Mechanical Engineers, before which he presented in 1899 an elaborate paper describing the power plant of the University.

Trade Publications.

The following have been received from the Publication Bureau of the General Electric Co., Schenectady, N. Y.: Bulletin No. 4,307 on alternating current generator panels for circuits of 1,150 and 2,500 volts; No. 4,309 on small plant switchboards; and No. 4,310 on incandescent lamps for street car headlights. Flier No. 2,108 on attaching plugs; No. 2,109 on a combined socket and attaching plug; and No. 2,110 on a porcelain junction box with fuses. Price list No. 5,104 on type H oil transformers, low frequency type; No. 5,105 on the same for high frequency; and No. 5,106 on enclosed oil break switches, hand operated and electrically tripped. These were accompanied by three attractive pamphlets. One, entitled "The Test by Fire," contains cuts showing the slight damage suffered by several transformers in the recent fire at Atlantic City. A second concerns series enclosed arc lamp street lighting systems with many valuable suggestions as to installation, care and maintenance. The third deals with the transformers at the Pan-American and other Expositions.

Carbonizing coating is the name given by the makers, the Goheen Mfg. Co., Canton, O., to a paint for the protection of iron and steel from rust and corrosion. The firm is now distributing a pamphlet which explains the nature of the paint and gives cuts of a number of well known structures to which it has been applied.

"Graphite," the publication of the Joseph Dixon Crucible Co., Jersey City, N. J., has considerable matter this month on the uses of graphite in connection with automobiles.

An illustrated price list containing directions for applying block or air-cell asbestos and magnesia coverings to boilers, heaters and flues was recently issued by the H. W. Johns-Manville Co., 100 William St., New York.

A circular from the Pratt & Whitney Co., Hartford, Conn., shows the new building for the accommodation of its small tool department and calls attention to its increased facilities for the manufacture of small tools.

Steel rolling doors, shutters and partitions for warehouses, freight and car sheds, factories, store and office buildings, or wherever fire protection and economy of space are desirable, are shown with the various methods of erecting them, in a catalogue now being circulated by the makers, the Columbus Steel Rolling Shutter Co., Columbus, O.

A new catalogue from the J. L. Mott Iron Works, 84 Beekman St., New York, illustrates the different patterns of their "Roman" radiators and "Sunray" steam boilers and hot water heaters, with adjoining tables of sizes and prices. A few items of useful information on the subject of heating are appended.

The St. Louis Expanded Metal Fireproofing Co., Century Bldg., St. Louis, Mo., has recently issued an illustrated catalogue of 64 pages, on the use of expanded metal and corrugated bars in concrete construction, especially for bridges, dams and culverts. A smaller pamphlet relates to the corrugated bars, which are made in sizes of from ¼ to 1¼-inches square and are provided with annular ribs or projections to give them holding power in the concrete. A discussion of the strength of such construction and the derivation of suitable formulas, given in both catalogues, should prove of much value.

Catalogue No. 410 of the Sprague Electric Co., 527 West 34th St., New York City, covers comprehensively the field of interior conduit work including several forms of armored and unarmored conduits, tools, fittings, etc. It contains over 100 pages, is fully illustrated and for ready reference is provided with a convenient index.

The January issue of "Power and Transmission," the quarterly publication of the Dodge Mfg. Co., Mishawaka, Ind., contains the following leading articles: Power plant at the Eagle and Phenix Mill; Comparative cost and efficiency of power transmission outfits as applied to modern cotton and woolen mills; the plant of the U. S. Rubber Reclaiming Co.; and friction clutches.

Folder No. 4,012, received from the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., is devoted to fan motors of the swivel and trunnion type for use on alternating current circuits.

The New York Continental Jewell Filtration Co., 15 Broad St., New York, is distributing a folder pertaining to several types of pressure and gravity filters, showing to what use each is best adapted and what provisions are made for cleaning them.

A little booklet of convenient pocket size that will be appreciated in certain lines of civil engineering, is being supplied by Wm. Ainsworth & Sons, Denver, Col. It contains a solar ephemeris for 1903, a description of the Shattuck double reflecting solar attachment and how it is used, and several items of useful information.

An advance circular on the Ostergren fuel oil engine has been issued by the Fuel Oil Power Co., 60 Wall St., New York City. The engine is designed to burn heavy oils, such as fuel oil, crude oil, or kerosene, gasolene, or wood alcohol, and will be made in standard sizes of from 1 to 1,000-horse-power.

Pamphlet No. 031 from the C. W. Hunt Co., West New Brighton, Staten Island, N. Y., illustrates a number of applications of industrial railways in boiler rooms.

Ambursen & Sayles, 88 Smith Bldg., Watertown, N. Y., and Walter I. Brock, 75 Dearborn St., Chicago, are distributing bulletin No. 20 on reenforced concrete construction. It illustrates a paper mill at Marseilles, Ill., constructed entirely of concrete and steel.

Crawford boilers for steam and hot water as made by the Walker & Pratt Mfg. Co., 31 Union St., Boston, Mass., are described with illustrations of details in a neat catalogue recently received.

The Watson fireproof window, its construction and working, a number of buildings in which it is installed and an account, with photographs, of a fire test made at Philadelphia, are contained in a booklet from W. H. Mullens, Salem, O., who has purchased limited rights to manufacture and sell it in this country and the sole rights to export.

A handbook that will prove of particular value to water-works superintendents, engineers and contractors has been published by the Massillon Iron & Steel Co., Massillon, O. It is a leather covered book of 165 pages, composed almost entirely of tables, including capacity data for pipes 4 to 36 inches in diameter. The information is arranged for ready access and is provided with an index.

Under the title "New Knowledge on Belt Management," the Cling-Surface Mfg. Co., Buffalo, is distributing a cloth bound book to set forth the advantages accruing from the use of Cling Surface on belts. Numerous cuts show the operation of belts running with a remarkable amount of slack.

The Hoshor-Platt Co., 120 Liberty St., New York, has prepared a comprehensive 50-page catalogue on the subject of industrial railways, covering all the parts of a complete system, tracks, switches, curves and accessories, locomotives and cars. The flanges of the outer wheels in rounding curves are arranged to bear on the tracks to avoid friction and to take sharp curves.

A circular illustrating a turbine water wheel, of which 168 were installed at Sault Ste. Marie, Mich., and giving figures from a test made at Holyoke, Mass., is being distributed by the Webster, Camp & Lane Co., Akron, O.

The March issue of "Sparks from the Anvil" published by the Crucible Steel Co. of America, Pittsburg, contains an article on methods of hardening.

Meeting of the New England Water Works Association.

At the meeting in Boston on March 11, with President Chas. K. Walker in the chair, about 80 members and guests were present, and five new members were elected. Mr. George Bowers, city engineer of Lowell, Mass., read a paper on "Underground Water: Suggestions on How to Obtain and Care for It," of which a brief abstract is given. When a new supply was wanted surface waters were usually investigated before ground waters, because their yield is more easily estimated. In 1891 Lowell had to obtain a new supply of 10,000,000 gallons per day, because of the pollution of the Merrimac River, and was advised to consider a ground supply. Test wells were driven by one expert who pronounced them worthless, but another expert, after examining the materials and driving other wells, found there would be a good supply. For a number of years from 8,000,000 to 10,000,000 gallons have been pumped at this location. Ground water, stored many feet below the surface and frequently protected by an impervious stratum, is safer than surface water, which requires a constant inspection to prevent pollution. An advantage of ground water is its uniformity of temperature, making it better for drinking purposes in the summer and less liable to freeze in the winter than surface water. If wells are driven in fine sand a screen of fine mesh should be used; from around which fine sand should be removed, and if in gravel, an open end pipe. Each well should have a gate valve and a cap so that it may be disconnected and thoroughly cleaned at least once a year. With proper care, wells will continue to yield as much if not more than when tested. A geological examination was recommended before selecting a location, and, to assist in this, the State should employ a first class geologist, who would advise cities and towns.

The paper by Mr. John C. Chase, chief engineer of the Water Works Company, of Derry, N. H., was entitled "A Little Talk About Water Rates." No feature is of more concern than the water rates. In the infancy of water works there were no means of accurately measuring the amount of water used, consequently the different methods of assessment in vogue. The proportion to be paid by the municipality varies in different communities and at different times in the history of the works. The annual cost of public fire protection may be assessed by the frontage tax, the assessment on real estate, hydrant rental or appropriation from general taxation; but, by any of these it is impossible to really assess in proportion to the benefit received. Interest and the sinking fund requirements on the additional cost of the works to give a reserve supply for fire protection should be considered; a capacity far in excess of the ordinary in small towns. The water department should be considered a business enterprise and water used for public purposes should be paid for. In the case of private consumers, water meters may be installed, but a consumer may prefer a schedule based on the fixtures so that he may use as much water as he wishes, without increased payment. The whole supply should be measured through meters, and the fundamental price should be the same.

Mr. Edward Atkinson, president of the Boston Manufacturers' Mutual Fire Insurance Company, in a paper on "Fuel; What We Don't Know About It," described the great waste of coal, which, in the course of a century he thought would be out of existence. Steam plants convert only about 12 per cent. of fuel into work, and locomotive engines only about 5 or 6 per cent. Of 251,000,000 tons of coal used last year, 85,000,000 were used by locomotives, of which only 5,000,000 were converted into actual work. Immense deposits of vegetable matter in Alabama, Mississippi, Louisiana, and Texas, which may form lignite, were described. Small samples of mud fuel from the Taunton River, composed largely of decayed leaves, grass and roots, dried artificially and compressed in a lever press, were shown. When burned it gives a strong fire, good flame and little smoke, with about 15 per cent. ash, the potential being higher than hard wood and about equal to two-thirds of the best bituminous coal. In Germany great progress has been made in converting peat into briquettes by the addition of pitch; in Great Britain the waste product of the mines is utilized by the Monn process, introduced into this country by R. D. Wood & Company.

The June meeting to be held at Waltham, Mass., and vicinity, will be in charge of Past-Presidents Holden and Merrill and Mr. George E. Winslow. The annual convention will be held at Montreal, Canada.

Changes at Massachusetts Institute of Technology.

To relieve the overburdened secretary, the offices of registrar, recorder and dean have been created, and to further meet the needs of the students a medical adviser has been appointed. In athletics the efforts of the students are directed to track work and class rather than intercollegiate contests as involving less loss of time. The tuition fee has been advanced from $200 to $250, beginning with students entering in September, 1903. The institute has a comparatively small endowment, hence the necessity for the increase. It is believed that, with a larger grant from scholarship funds, the difficulties for students of small means will not be increased. The registration has increased 35 per cent. in three years, and an increasing number of the men have taken collegiate degrees before entering upon their technical course.

The rapid growth of the institute has created several serious problems, and on one of these President Pritchett comments in his annual report: "I wish to call attention to the fact that the institution which is large enough to require the services of several teachers in the same technical branch and has resources sufficient to secure men of high quality has a marked advantage in the very fact that a subject is being presented to students by more than one man. For some reason there has been in American colleges a great hesitation to start two men in the same institution upon parallel lines of instruction. Yet this feature of the German university is one of its sources of strength. The fact that the German student may choose not only his subject but his teacher in that subject is a powerful stimulus to good work, and forms one of the influences whereby the competition which goes on in the German universities, instead of being as with us a competition between institutions—too often a competition along purely material lines,—becomes a competition between individuals in the noble rivalry of scholarship. There is no reason why we should not in our institutions avail ourselves of this same means for quickening the intellectual life and for keeping alive the intellectual alertness of our teachers."

The buildings now occupied by the Institute are very much overcrowded and earnest consideration is being given to the advisability of removing to a new site of larger area where a wholly new group of buildings with adequate facilities may be erected.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 21, 24, 26, 29 and 30.

WATER.

Sacramento, Cal.—Schaw, Batcher & Co., of Sacramento, have secured the contract for 12,070 lin. ft. of 24-in. and 2,788 lin. ft. of 16-in. riveted steel water pipe, all laid complete, with manholes, valves, etc., for $88,443.

Oakland, Cal.—It is stated that the reservoir site and watershed on Pinole Creek has been purchased by the Contra Costa Water Co., to develop a supply for Point Richmond.

Fowler, Colo.—The Crystal Springs Water Co. is reported incorporated, with a capital of $10,000, to furnish and supply water for domestic, manufacturing, irrigation, etc., in the vicinity of Fowler. Henry M. Fosdick, Jr., and F. M. Welland are among the incorporators.

Ft. Collins, Colo.—The citizens are reported to have voted Mar. 10 to issue $200,000 bonds for the construction of new water works. The proposed plan is to tap Poudre River above the North Fork about 12 miles northwest of the city and pipe the water to the city.

Durango, Colo.—Water bonds amounting to $150,000 are reported sold.

Mancos, Colo.—Bids will be received Apr. 1 by the Bd. of Trus. for $25,000 water bonds. A. T. Samson, Town Clk.

Colorado Springs, Colo.—Local press reports state that bids will be received by the City Clk. at 1 P. M., Mar. 23, for the construction of the high line reservoir. It will have a capacity of 18,000,000 gals. and cost about $12,000.

Bids are also wanted for $409,000 water bonds, for the extension and improvement of the water works.

Boulder, Colo.—A press report states that the Water Com. has determined upon the validity of title of the Silver Lake Ditch & Reservoir Co. to Silver and Goose Lakes, and has reported to Council in favor of jointly constructing a dam to conserve the waters of the mountains and streams tributary to those bodies of water, the reservoir company giving the city one-half of the increment. Boulder owns its water system, and it is proposed to enlarge the present supply. Other reservoirs along the Middle and North Boulder will be secured in furtherance of this purpose.

Bids will be received Apr. 1 by E. K. Stafford, City Clk., for constructing a tunnel and open cut in Spring gulch, for the purpose of water conduit to Texado Park.

Norwalk, Conn.—Leo Davis, City Clk., writes that it was voted Mar. 6 to issue $100,000 bonds for constructing a 16-in. water main from Grupe reservoir to the city.

The Bd. of Water Comrs. is stated to have on Mar. 6 awarded the contract for about $48,000 worth of 16-in. c. i. water pipe to the Warren Foundry & Machine Co., of New York, N. Y. Its bid was $28.90 per ton.

Lewes, Del.—See "Power Plants, Gas and Electricity."

Washington, D. C.—A press report states that Secy. Hitchcock has granted authority for the acquisition of property, rights of way, etc., prior to the construction of irrigation works in the following 5 localities: Wyo., Sweetwater Dam; Mont., Milk River; Colo., Gunnison Tunnel; Nev., Truckee; Ariz., Salt River reservoir. These projects are estimated to cost $7,000,000, and will provide for irrigation of about 600,000 acres of arid land. In addition the Gray Bull reservoir project is to be taken up immediately. The construction remains subject to the feasibility of obtaining the necessary rights and the adjustment of private claims. The Secy. has also authorized the expenditure in the present year of $450,000 on surveys, borings for foundations and other examinations, which will be carried on in all the States and Territories included within the provisions of the law.

The District Comrs. have directed the setting apart of $50,000 of the water fund to be used in the extension of the high service system of distribution.

The following bids for furnishing 650 tons of 30-in. cast iron water pipe were received by Comrs., D. C., Mar. 14—*a*, price per ton; *b*, totals: The Dimmick Pipe Co., Birmingham, Ala., *a*, $35; *b*, $22,750. M. J. Drummond & Co., New York, N. Y., *a*, $34.80; *b*, $22,620. W. A. McFarland, Supt. Water Dept.

Columbus, Ga.—Major W. S. Greene, Receiver of the Columbus Water Works Co., is stated to have filed a petition in the U. S. Court asking permission to issue $150,000 in receiver's certificates for the purpose of improving the system.

Coeur d'Alene, Idaho.—See "Power Plants, Gas and Electricity."

Lewiston, Idaho.—The City Council is reported to have awarded to the Pacific Coast Pipe Co. and Naylor & Norlin the contract for 44,000 ft. of water pipe, of which 5,000 ft. is 16-in. steel pipe, the remainder being wooden pipe; total cost of pipe contracted for, $30,000.

Joliet, Ill.—Bids will be received at the office of the City Clk. until Apr. 3 for a steel water tower of 200,000 gal. capacity. H. A. Stevens, City Engr.; D. W. Mead, Consulting Engr., 605 First Nat. Bank Bldg., Chicago, Ill.

Oakland City, Ind.—Louis Deutsch, Pres. Oakland City Water & Light Co., writes that bids will be received about Apr. 20 for water works, to cost about $35,000. A. H. Kennedy, of Rockport, Ind., is the Engineer.

Diagonal, Ia.—C. C. Benson, City Clk., writes that it is proposed to construct water works at a cost of $2,500, and bids will be received after Mar. 30. A. E. Talley, Mayor.

Des Moines, Ia.—Local press reports state that $150,000 will be expended in the next year by the Des Moines Water Co. in changing the underground water system into two separate and distinct ones of high and low pressure.

Ft. McKinley, Me.—Capt. A. W. Gates, Q. M., U. S. A., Portland, Me., writes that H. A. Hanscom Co., of Boston, Mass., secured the contract at $11,500 for installing a water distributing system at Ft. McKinley, Me. (bids opened Mar. 2).

Lexington, Mass.—Bids are wanted Mar. 25 for laying about 9,000 ft. of cast iron water pipe, mainly 12-in., setting hydrants, gates, etc. E. S. Locke, Chmn. Water Comrs.; L. E. Hawes, Engr.

Boston, Mass.—The following contracts have been awarded by the Water Comrs., bids opened Mar. 7: To the U. S. Cast Iron Pipe & Foundry Co., Philadelphia, Pa., at $29.70 per ton for 2,900 tons of water pipe and $55 per ton for 15 tons of specials; total, $86,955. To the Roxbury Foundry Co., at 3.35 cts. and 2.9 cts. per pound respectively for miscellaneous castings; total, $44,550; and to J. H. McCafferty, of Boston, at 20½ cts., 20 cts. and 15 cts. per pound respectively for composition castings; total, $11,925.

Uxbridge, Mass.—Edw. Parker, Town Clk., writes that it was voted Mar. 7 to appoint a committee to investigate and report May 2 on the question of constructing an additional reservoir. Gideon M. Aldrich, Chmn. Com.

Springfield, Mass.—The Water Comn. has chosen as experts to consider the question of water supply Saml. M. Gray, of Providence, R. I., and Geo. W. Fuller, of New York, N. Y.

South Framingham, Mass.—The Sewer Com. has recommended a new force main from pumping station to filter beds, a distance of 2 miles.

Allegan, Mich.—See "Power Plants, Gas and Electricity."

Standish, Mich.—See "Power Plants, Gas and Electricity."

Bangor, Mich.—See "Power Plants, Gas and Electricity."

Bird Island, Minn.—The Des Moines Bridge & Iron Wks. is stated to have secured the contract for constructing water works for $6,960.

Lake Wilson, Minn.—Martin Ferrest, Recorder, writes that it was voted Mar. 10 to issue $7,000 bonds for construction of water works.

St. Cloud, Minn.—The House is stated to have passed the bill allowing this city to issue bonds for the purchase of water works.

Trumann, Minn.—It is stated that bids are wanted Apr. 7 for furnishing material and completing water works, requiring 350 ft. of 8-in. and 1,422 ft. of 6-in. mains, 6 hydrants, a 47,000 gal. tank, on an 80-ft. tower of steel, and brick pump house, 20x30 ft. M. B. Haynes, Engr., Manksto, Minn.; N. T. True, Pres. of Council.

Montevideo, Minn.—J. M. Severens, Village Recorder, writes that it was voted Mar. 10 to issue $15,000 bonds for water works.

Goodhue, Minn.—The Village Recorder writes that it was voted Mar. 10 to issue $8,400 bonds for the construction of water works.

Cold Springs, Minn.—See "Power Plants, Gas and Electricity."

South Stillwater, Minn.—See "Power Plants, Gas and Electricity."

Biloxi, Miss.—Bids will be received by the Mayor and Bd. of Aldermen until Apr. 7 for boring 1 8-in. artesian well, approximately 1,000 ft. deep; furnishing and erecting a steel tower, and tank 140 ft. high; tank to contain 240,000 gallons. Kirkpatrick & Johnson, Engrs., Jackson, Miss.

Great Falls, Mont.—Bids opened Mar. 9 for 308 tons 6 in. and 76 tons of 8 in. pipe and specials were rejected, and new bids will be received Mar. 23d. Two bids were received for the work. Crane-Ordway Co., of St. Paul, Minn., bid $20,545, and the Great Falls Iron Wks. bid $21,208. C. W. Swearingen, City Engr.

Camden, N. J.—Bids are wanted Mar. 24 for the removal of the Blake 10,000,000 gal. pump from Pavonia pumping station to Morris pumping station and building a foundation for same. Jos. Potter, Chmn. Water Com.

Brooklyn, N. Y.—Bids will be received Apr. 2 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing and delivering single and double nozzle case hydrants.

Ithaca, N. Y.—The Continental Filtration Co., of New York, has secured the contract for constructing the chemical filtration plant for the Fall Creek water to be constructed at the Reservoir on Reservoir Ave.

The University has given its final approval to a filtration plant which is to be constructed in Six Mile Creek. It will be a mechanical filtration plant, and have a capacity of 3,000,000 gals. per day. Allen Hazen, of New York, will be Engr. in charge of this work, which is to be constructed by the Water Co.

New York, N. Y.—Bids will be received Mar. 24 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for laying water mains in Silver Lane, West Farms Road, Bear Swamp Road and in Victor St., Boros. of Manhattan and the Bronx.

Yonkers, N. Y.—Bids will be received Apr. 2 by the Bd. of Water Comrs. for enlarging the Grassy Sprain Reservoir. A. W. Kingsbury, Clk.

Yonkers, N. Y.—The Warren Foundry & Machine Co., of New York, is stated to have secured the contract for the pipe and castings (bids opened Mar. 5) for $22,254.

Quogue, L. I., N. Y.—The Richardson Co., of Owego, N. Y., is stated to have secured the contract for installing the plant of the Quantuck Water Co. for $63,000.

Buffalo, N. Y.—The following were among the lowest bids received Mar. 12 for work under supervision of Hy. L. Lyon, Dep. Water Comr.: For installing 10 boilers—E. Keeler Co., Williamsport, Pa., tubular, $27,300; C. C. Peck, Rochester, N. Y., compound, $32,866, and internally-fired, $44,800; Wickes Bros., New York, water-tube, $34,673. For stoker equipment—Westinghouse, Church, Kerr & Co., New York, $9,079; Wilkinson Mfg. Co., Phila., $11,750; American Stoker Co., New York, $12,000; Green Engineering Co., $12,421. Coal and ash handling equipment: Steel Cable Eng. Co., Boston, $32,650; Aultman Co., Canton, O., $33,350. Steam lines, John W. Danforth Co., Buffalo, $10,700; Daniel Burgmaster, Buffalo, $13,890. Induced draft equipment—Boston Blower Co., Hyde Park, Mass., $3,871; Buffalo Forge Co., Buffalo, $5,766. The Smokeless Combustion Co., 1 Bway., New York, bid for the whole work, from $93,345 to $115,845, according to type of boiler and stoker.

Newbury, O.—See "Power Plants, Gas and Electricity."

Findlay, O.—The following contracts have been awarded for water works extension under supervision of John W. S. Riegle, City Civil Engr., according to bids received Mar. 10: J. B. Clow & Sons, Chicago, 48 tons 24-in. and 126 tons of 8-in. cast iron pipe at $30.75, 8 tons c. l. specials at $55, and 12 5-in. hydrants at $25; total, $6,090.50. Fred Kleinman, Findlay, receiving basin, $2,425. Amer. Sewer Pipe Co., Pittsburg, 52,300 ft. 24-in. vitrified pipe at $1.13¾, and 15 vit. pipe specials at $5.12½; total, $59,928. Dull & Hennesy, Arcanum, O., laying 52,800 ft. vit. pipe at 70 cts. and 18 cts., 12 brick manholes at $12.50, and 3,000 cu. yds. rock excavation at $2.40; total, $54,404. Total of awards, $122,847.56. E. M. Campfield, Findlay, offered to do the whole for $133,467, bidding $30 and $60 for the c. l. pipe and specials, respectively. $1.29 and $10.75 for the vit. pipe and specials, 10 cts. and 83 cts. for laying vit. pipe and $2.25 for rock excav. J. M. Healy, Chicago, bid $1.09, $45 and $2.25 for laying vit. pipe, laying vit. pipe specials and rock excav. respectively. Kerlin Bros. Co., Toledo, O., bid $81,009, not including furnishing vit. pipe and spec. U. S. C. I. Pipe & Fdy. Co., Cincinnati, bid $31 and $55 for c. l. pipe and spec. Robinson Cl. Prod. Co., Akron, O., bid $1.36½ and $1.20 and $6.14 and $5.25 for vit. pipe and spec.

Cincinnati, O.—The following bids were opened by the Water Works Trus. on Mar. 17 for the construction of coal storage houses for *a*, eastern, and *b*, western pumping stations: Ferd. Pietsch, Milwaukee, Wis., *a*, $105,381; *b*, $117,800. Chas. L. Strobel, Chicago, Ill., *a*, $89,000; *b*, $104,600. U. S. Constr. Co., Milwaukee, Wis., *a*, $114,830; *b*, $128,860. American Bridge Co., New York, N. Y., *a*, $142,657; *b*, $162,851. The L. Schreiber & Sons Co., Cincinnati, *a*, $133,900; *b*, $152,200.

Geary, Okla. Ter.—Bids will be received Mar. 24 by the Mayor and Council for $52,000 water bonds. J. M. Waterman, City Clk.

Reports state that bids for constructing water works will be received until Mar. 25. C. L. Olds, Ft. Wayne, Ind., is the Consulting Engr.

Portland, Ore.—The total length of mains contemplated by the Water Bd. is reported to be 36.019 ft.; probable cost of work, $91,895.

Altoona, Pa.—Bids will be received Mar. 24 by the Bd. of Water Comrs. for furnishing material, work, etc., for the year ending Apr., 1904. F. C. Gerhardt, Chmn.

Reading, Pa.—The U. S. Cast Iron Pipe & Foundry Co. and the Reading Foundry Co. bid $53,818 and $53,970 respectively for pipe and specials to the amount of 1,550 tons, bids for which were opened Mar. 10 by the Water Comrs. Bids were considered excessive, and new bids will be received.

Bids will be received Mar. 24 by the Bd. of Water Comrs. for erecting regulator house at Egelman filter plant. L. S. Ramsey, Secy.

York, Pa.—The Select Council has passed an ordinance providing for the construction of municipal water works.

Harrisburg, Pa.—Bids are wanted Mar. 24 for laying a 6-in. water pipe in portions of State St. E. Mather, Pres. Bd. Comrs., Water and Lighting Dept.

Philadelphia, Pa.—Bids are wanted Mar. 24 for sand washers for Upper Roxborough filters. Wm. C. Haddock, Dir. Dept. Pub. Wks., Bureau Filtration.

Montrose, S. D.—The citizens are stated to have voted to issue $5,000 water-works bonds.

Aberdeen, S. D.—The Council is reported to have ordered 3 miles of water mains laid.

Houston, Tex.—The Houston Heights Water Co., of Houston, has been incorporated; capital, $50,000. Incorporators: O. M. Carter, J. A. Milroy and C. A. McKinney.

Ogden, Utah.—The farmers of Weber County and the Utah Light & Power Co. are reported to be preparing to organize a company for the purpose of building a reservoir in Ogden Valley for the storage of water to be used in irrigation and in the generation of mechanical energy. Nathaniel Montgomery and it. S. Campbell are reported interested.

Christiansburg, Va.—It is stated that bids are wanted Apr. 1 for a franchise to construct water works and to supply power to electric light plant. E. S. Hagan, Clk.

Lynchburg, Va.—Jas. H. Fuertes, of New York, N. Y., is reported to be here surveying the route for securing a gravity supply of water for Lynchburg from Peddlar River, 23 miles from the city. He will report on the feasibility of the scheme, its cost, etc.

Chewelah, Wash.—W. L. Bowen, of Colville, is stated to have secured a franchise for water works.

Gillett, Wis.—The Hackworthy Construction Co., of Appleton, Wis., is stated to have secured the contract for constructing the water works.

Portage La Prairie, Man.—The Bd. of Trade and citizens are reported to be discussing the question of constructing water works.

St. John, N. B.—Singleton, Dunn & Co., of Glasgow, Scotland, are stated to have secured the contract for about 180 tons of water pipe for $5,608.

Toronto, Ont.—Bids will be received by the Bd. of Control until May 12 for erecting 1 15,000,000 imp. gallon triple expansion flywheel pumping engine. Thos. Urquhart, Mayor, Chmn. Bd. of Control.

SEWERAGE AND SEWAGE DISPOSAL.

Pine Bluff, Ark.—Plans and specifications for 3 miles of sanitary sewers, to cost about $20,000, are being prepared by Capt. J. H. Hany, of Little Rock. J. B. White, City Engr.

Lewes, Del.—See "Power Plants, Gas and Electricity."

Lewiston, Idaho.—A press report states that City Engr. Briggs has the profile plans, specifications and estimates ready for the Normal Hill sewer. About 25,000 cu. yds. of excavation will be necessary. The pipes vary from 8 to 16 in., and the cost is estimated at about $50,000. It will be 8 miles in length.

Chicago, Ill.—Bids are wanted Mar. 24 for furnishing and delivering natural cement for use on section "H" intercepting sewers, during term ending Dec. 31. F. W. Blockl, Comr. of Pub. Wks.

De Kalb, Ill.—The Council is reported to be considering the matter of extending the sewerage system.

Indianapolis, Ind.—Major Miller is reported to have been authorized to contract for and superintend the building of roads and a drainage system for the new army post near this city; $30,000 will be expended for this purpose.

Ft. Wayne, Ind.—City Engr. F. M. Randall is stated to have been instructed to prepare plans and specifications for a system of clay pipe sewers in Crescent, Lake and Rivermet Aves. in Lakeside in several alleys.

Vincennes, Ind.—The Vincennes Sewer Co. has been incorporated, with a capital of $20,000, to construct and operate a sewerage system. D. W. Neston, J. W. Landrum and R. M. Landrum are the directors.

New Albany, Ind.—Henry Goetz, of New Albany, is reported interested in the construction of a sewerage system.

Keokuk, Ia.—Rice H. Bell, Clk. of Council, will receive bids Mar. 28 for the construction of about 180 ft. of egg-shaped brick storm sewer 2 ft. 9¼ in. by 4 ft. 6⅛ in. J. Ross Robertson, City Engr.

Kansas City, Kan.—The City Council, of Kansas City, has passed an ordinance providing for the building of a sanitary sewer system in Armourdale. The system includes a pumping station near 1st St. and Shawnee Ave. and sanitary pipe lines and laterals throughout the districts. Estimated cost of pumping station and system, $40,000.

Boston, Mass.—The lowest bid received by Supt. of Sts. Donovan for the erection of a granite extension to the Cow Pasture pumping station is stated to have been submitted by Chas. Logue, 17 State St., for $44,975.

The Metropolitan Water & Sewerage Bd. in its report to Legislature is stated to have recommended the adoption of a system of separate sewers for sewage and rainfall.

Sunderland, Mass.—The citizens are reported to have voted to issue $4,500 bonds for sewers on Main and Bridge Sts. and old Ferry Road.

Springfield, Mass.—Local press reports state that bids will be received until Mar. 24 for furnishing the Street and Sewer Depts. with supplies for the coming year, including cement, sewer and well brick, castings, etc. Arthur Adams, Supt. Sts.

Standish, Mich.—See "Power, Gas and Electricity."

Wyandotte, Mich.—The House and Senate have passed the bill authorizing this city to issue $125,000 bonds for the construction of sewers.

Hudson, Mich.—The House has passed a bill authorizing this city to issue $15,000 bonds to repair sewers and improve streets.

St. Paul, Minn.—Patk. Doherty, 608 W. 7th St., is stated to have secured the contract for a sewer in Fairfield Ave. for $5,568, and J. M. Thornton for a sewer on Arundel St., for $11,425.

Kansas City, Mo.—Bids will be received by D. W. Pike, City Engr., on Mar. 25 for 3,700 ft. pipe sewers in Sewer Dist. No. 235, to cost $5,500 and 10,000 ft. of pipe sewers in Sewer Dist. No. 193, to cost $25,000.

Canajoharie, N. Y.—It is stated that plans and specifications for a sewerage system have been prepared, and the Village Trus. will soon ask for bids.

Corinth, N. Y.—The State Bd. of Health has approved the plans for the sewerage system, as prepared by Saml. J. Mott, of Saratoga Springs, and contracts for construction will soon be let.

Ithaca, N. Y.—The Sewer Comn. is reported to be considering the construction of an outfall sewer, to cost about $15,000.

Brooklyn, N. Y.—The following bids were opened Mar. 18 by Wm. C. Redfield, Comr. Pub. Wks., for a sewer in 19th Ave., Bergen Lane, etc.—*a*, Jas. H. Holmes & Co.; *b*, Abbott & Gamble; *c*, John J. Crean:

Brick sewer:	*a*	*b*	*c*
144-in., 1,056 ft.	$55.	$69.00	$59.
138-in., 3,420 ft.	53.	69.00	57.
132-in., 1,082 ft.	49.	65.50	55.
72-in., 40 ft.	21.	32.00	26.
48-in., 90 ft.	15.	24.00	8.
36-in., 40 ft.	9.	18.00	7.
Manholes, Class A, 7	200.	400.00	700.
Manholes, Class B, 20	95.	150.00	70.
Receiving basins, 10	100.	100.00	130.
Foundation planking, 700,000 ft.	21.	27.50	20.
Sheeting and bracing, 2,475,000 ft.	19.	18.00	20.
Concrete, 5 cu. yds.	9.	12.00	7.
Brick masonry, 5 cu. yds.	13.	12.00	10.

Massena, N. Y.—The contract for the construction of the sewer system complete is stated to have been awarded to John McLaughlin and Wm. I. Bishop, of Massena, for $35,122. Iron work for manholes to be furnished by the village, and the contract for those has been awarded to the Hackett Hardware Co., of Ogdensburg, at $2 per 100 lbs. delivered on the trench. The other bids were: C. F. Hookway, $50,851; Brennen, Hodge & O'Brien, $49,830; Sylvester Mollette, $36,807, and A. F. Nims, $35,248.

Batavia, N. Y.—The citizens are reported to have voted to issue $5,000 bonds for improving the sewerage system.

Troy, N. Y.—Bids will be received by the Bd. of Contract & Supply until Mar. 27 for constructing sewers, requiring 6,450 ft. of 8, 12, 15 and 18-in. pipe, and 700 ft. of 6-in. laterals. Jas. M. Riley, Clk.

Canton, O.—Jesse Starrett, Asst. City Engr., is stated to have about completed the survey of the route for the new main sewer to be placed in the west end, in Sewer Dist. No. 2.

Toledo, O.—Bids are wanted Mar. 30 for furnishing material for constructing a sewerage purification plant with all connections, ditches, etc. C. H. Durlan, Secy. Bd. Police Comrs.

Philadelphia, Pa.—Local press reports state that bids will be received Mar. 23 by Dir. of Pub. Wks. Haddock for constructing main and branch sewers and for completing the Cohocksink sewer; probable cost, $1,000,000.

Alliance, Pa.—The Borough contemplates building sewers on Stein and Siegfried Sts. and Howertown Road; estimated cost, $40,000. Engineers, The Lehigh Eng. Co.

Easton, Pa.—Bids will be received on Mar. 24 for constructing 1,700 lin. ft. of 4-ft. brick sewer on Berwick St. and Seitz Ave. L. A. Francisco, City Engr.

Columbia, Pa.—Boro. Pres. Denney recommends the employment of an engineer to prepare plans for a sewerage system.

Harrisburg, Pa.—Bids are wanted Mar. 23 for constructing 12-in. internal diameter terra-cotta pipe sewers in portions of 14th and 16th Sts. Chas. B. McConkey, Highway Comr.

Galveston, Tex.—Plans are being perfected at the office of Col. C. S. Riche, U. S. Engr., for a sewerage system for Ft. Clark. The new system, if adopted, will cost $75,000.

Wheeling, W. Va.—Bids will be received Mar. 23 by the Bd. Pub. Wks. for furnishing paving brick, sewer pipe, stone and concrete curbing. Thos. McGranahan, Clk.

Oconto, Wis.—The City Engr. is reported to have been instructed to prepare plans and specifications for a complete sewerage system for the West Ward.

Baraboo, Wis.—Bids will be received Mar. 26 by the Sewer Com. for furnishing material for constructing sewers in Oak St. C. P. Riley, Chmn.

BRIDGES.

San Jose, Cal.—J. G. McMillan, Co. Surveyor, is preparing plans for a steel bridge over Coyote River on Berreyessa Road. Two span 100-ft. and 60-ft. or 80-ft. concrete abutments.

San Bernardino, Cal.—It is stated that bids are wanted until Apr. 13 for constructing a 2 span riveted steel bridge at Colton Ave. and a 4 span riveted steel bridge at Tippecanoe Ave. Chas. Post, Deputy Clk.

Hartford, Conn.—The Conn. River Bridge & Highway Comn. is said to favor the building of a stone bridge across Connecticut River, connecting Hartford and E. Hartford; estimated cost, $1,940,000.

Terre Haute, Ind.—The building of a subway or viaduct at the Vandalia crossing at No. 13th St. is reported to be under consideration by the city officials and the officials of the Terre Haute Electric Co.

Logansport, Ind.—Geo. J. McCulloch, of the Union Traction Co., is seeking a site and having plans prepared for the construction of a bridge over the Wabash River at this place, for the Indianapolis Northern Interurban line.

Connersville, Ind.—Bids will be received Mar. 28 by the Bd. of Co. Comrs. for constructing a stone arch on the Everton Road, and one in Orange Township; also for repairing bridge across Williams Creek, with steel joist and new floor. H. M. Bronddus, Co. Aud.

Burlington, Ia.—Emmet Steece, City Engr., is preparing plans for the 6th St. viaduct.

Marshalltown, Ia.—The question of constructing a viaduct 1,520 ft. long on Center St. is reported under consideration.

Benton Folls, Me.—Reports state that the iron bridge across Sebasticook River, in this town, has been washed away by the freshets. Loss estimated, according to reports, at $15,000.

Flintstone, Md.—Local press reports state that the Co. Comrs. are contemplating the building of a bridge, 70 ft. long, across Flintstone Creek, in Flintstone. It has not been decided whether a stone or a concrete steel bridge will be built.

Cumberland, Md.—Press reports state that a new structure will have to be built to replace the present Blue bridge, connecting Cumberland and W. Virginia.

Frederick, Md.—The Comrs. of Carroll and Frederick Counties are considering the building of an iron bridge, 180 ft. long, across Monocacy River at Poole's Ford, near Keysville.

Williamsport, Md.—The Bd. of Co. Comrs. has appointed a committee, of which Wm. H. Armstrong is a member, to consider the matter of constructing the proposed bridge across Potomac River, at Williamsport.

Pontiac, Mich.—City Engr. Fisher has completed plans and specifications for cement and steel bridges to be built at E. Pike and Water Sts., and it is stated that bids for constructing said bridges will soon be asked by City Clk. Thompson.

Grand Rapids, Mich.—An ordinance has been adopted by the Common Council authorizing the issue of $50,000 bridge bonds.

Lansing, Mich.—Articles of association of the Pere Marquette International Bridge Co. have been filed with the Secy. of State. Capital, $500,000. It is stated to be the purpose of the corporation to construct a bridge over Detroit River near Grosse Isle.

Pontiac, Mich.—Bids will be received Mar. 23 by the Common Council for constructing 2 concrete steel bridges over Clinton River. Wm. J. Fisher, City Engr.

Duluth, Minn.—A bill has passed the Senate authorizing the issue of $100,000 bonds, for the purpose of constructing a bridge across the ship canal.

Meridian, Miss.—Plans and specifications have been prepared for a bridge, 300 ft. long, 8 ft. wide and 35 ft. high, to be built from across the tracks at 40th Ave.

Kingston, Mo.—David Stucke, of Braymer, Mo., Surveyor of Caldwell County, will let a contract on Mar. 27 for 22 county bridges at Kingston.

Newark, N. J.—The Bd. of Pub. Wks. has directed that plans be prepared showing how the Frelinghuysen and Clinton Ave. grade crossings may be eliminated. It also decided to employ an engineer to prepare plans for a bridge to cross the Lackawanna R. R. tracks at Clifton Ave. crossing, and to submit an estimate of the cost

Hoboken, N. J.—The building of a viaduct to do away with the grade crossing at 17th St. and Willow Ave., is being considered.

New York, N. Y.—Bids will be received Mar. 26 by the Park Bd. for furnishing material and constructing a concrete-steel and stone bridge over the Bronx River, in the N. Y. Botanical Garden, Bronx Park. Wm. R. Willcox, Chmn.

Bids will be received Apr. 7 by the Aqueduct Comrs. for furnishing material and constructing highways, and their appurtenances, including bridge piers and abutments, culverts, etc.; also stone wall boundary fencing in several towns in Westchester Co. Wm. H. Ten Eyck, Pres.

Press reports state that the Erie R. R. Co. is seeking permission to construct a foot bridge across West St. at Chambers St.

Yonkers, N. Y.—Plans have been prepared for a steel bridge to be built at Caryl Ave., which with approaches will cost about $14,500.

Grand Forks, N. D.—Bids are wanted Apr. 6 for furnishing bridge iron required for bridges to be built during year 1903. Wm. Ackerman, Co. And.

Akron, O.—The Railroad & Bridge Com. of the City Council has been authorized to secure funds with which to build a $5,000 bridge at Cuyahoga St. The Co. Comrs. are to appropriate $1,500 toward the project.

Cleveland, O.—City Engr. Carter recommends the construction of a low level bridge to connect East Clark Ave. with Cisrk Ave. He also recommends that the center pier at the draw of the Superior St. viaduct be removed and a bascule lift bridge substituted.

Crestline, O.—The Osborn Engineering Co., of Cleveland, is preparing plans for a bridge over Wiley St. for the Ohio Central Traction Co.

Toledo, O.—Press reports state that the Wheeling & Lake Erie R. R. Co. has had plans prepared for a double-track bridge to be built across Maumee River, in this city. T. P. Bodell, Supt. Bridges, Bldgs. & Water Service, Canton, O.

Pittsburg, Pa.—The Pittsburg, Carnegie & Western R. R. Co. is reported to have submitted to Capt. Selbert, Corps Engrs., U. S. A., for approval plans for the proposed bridge to be built across Allegheny River, near 4th St. It is stated that the bridge proper will be about 880 ft. long, and is to have 2 channel spans, 1 450 ft. long, the other 380 ft. long, and will cost about $750,000.

Linden, Pa.—The Pennsylvania R. R. Co., it is stated, will this spring build a double iron bridge at Linden across the Susquehanna River, to replace the old wooden structure.

Wilkesbarre, Pa.—The city contemplates constructing a $50,000 bridge in the east end.

Philadelphia, Pa.—See "Paving."

Pottsville, Pa.—Press reports state that the freshets have washed away the eastern abutment of the bridge across Schuylkill River between Pottsville and Palo Alto.

Knoxville, Tenn.—Local press reports state that the city officials have agreed to contribute $35,000 toward the cost of constructing the viaduct at Clinch Ave. over the Knoxville, LaFollette & Jellico R. R. tracks, but will not pay property damages, as the Railroad Co. desired.

Houston, Tex.—See "Paving and Roadmaking."

Richmond, Va.—Local press reports state that the Atlantic Coast Line R. R. Co. has decided to replace about 500 ft. of the north end of its single track bridge across James River with a double track, solid floor steel bridge, which will cost about $70,000. E. B. Pleasants, Ch. Engr., Wilmington, N. C.

Petrolea, Ont.—It is stated that bids are wanted Apr. 6 for constructing 2 concrete abutments and for putting a concrete floor with expanded metal. John McHattie, Town Clk.

PAVING AND ROADMAKING.

San Diego, Cal.—Local press reports state that the lowest regular bid received by the Bd. of Pub. Wks. for furnishing a road roller was submitted by N. B. Livermore & Co., of San Francisco, at $3,900.

Denver, Colo.—A correspondent writes that during this year 98 miles of sidewalks and 15 miles of paving will be laid.

Tampa, Fla.—The Co. Comrs. have adopted a resolution to receive bids for completing the Bayshore Boulevard.

Atlanta, Ga.—Local press reports state that the Pub. Wks. Com. of the Co. Comrs. has decided to purchase a road roller at a probable cost of $3,000.

Rockford, Ill.—The Bd. of Local Improv. is considering the macadamizing of a portion of 14th Ave.

Bloomington, Ill.—An asphalt pavement will be laid on Graham St. E. Folsom, City Engr.

Decatur, Ill.—The City Council is stated to have adopted an ordinance to resurface North Water St. with asphalt.

Chicago, Ill.—Bids will be received Mar. 25 by the Bd. of Local Improv. for improving by grading, curbing and paving with vitrified brick, asphalt, granite blocks, crushed limestone and crushed granite on 6-in. artificial hydraulic cement concrete and on 6-in. Portland cement concrete foundations portions of numerous streets. Andrew M. Lynch, Pres.

Melrose Park, Ill.—Bids will be received Mar. 27 by the Bd. of Local Improv. for improving 16, 17 and 18th Aves. by grading and paving. Address E. W. Benson.

Delphi, Ind.—Gravel road bonds amounting to $58,000, for the Townships of Burlington and Democrat, have been sold by the Co. Comrs.

Williamsport, Ind.—It is stated that bids are wanted until Apr. 0 by W. H. Gemmer, Co. Comr., for building about 10 miles of gravel road; estimated cost, $27,600.

Terre Haute, Ind.—The Bd. of Pub. Wks. has ordered S. 4th St. and Lafayette Ave. paved with brick. Ralph H. Sparks, City Engr.

Indianapolis, Ind.—See "Sewerage and Sewerage Disposal."

New Castle, Ind.—The City Council has decided to pave with brick on Broadway and Main Sts., a total distance of about 1 mile.

Indianapolis, Ind.—The Mayor has signed the $100,000 boulevard bond ordinance.

Frankfort, Ind.—Engr. Cheney has been instructed to prepare plans and specifications for improving the roadways and gutters of So. Jackson, Main St. and Main Ave.; probably brick will be used in paving.

Red Oak, Ia.—Bids are wanted Mar. 24 (readvertisement) for approximately 41,000 sq. yds. of brick paving. C. M. Kelly, City Clk.

Cedar Rapids, Ia.—It is proposed to pave a portion of 6th St. with macadam. T. L. McCauley is City Engr.

Louisville, Ky.—Local press reports state that the lowest bid received Mar. 10 for resurfacing with asphalt, in all about 20,000 sq. yds., was from the American Standard Asphalt Co., ranging from 87 cts. to $1.01 per sq. yd. The city is to lay the foundation and to put down the concrete.

Paducah, Ky.—L. A. Washington, City Engr., writes that it is proposed to pave 7 blocks with brick.

Portland, Me.—Comr. Geo. N. Fernald, of the Dept. of Pub. Wks., is reported to have stated that granite block pavement will be laid on portions of several streets at an estimated cost of $17,483, and that several streets will be macadamized at an estimated cost of $12,252.

Baltimore, Md.—Ordinances have been submitted to Bd. of Estimate with favorable report by the Council Com. on Highways for paving portion of the following streets: Ensor St., vitrified brick, 1,100 sq. yds.; Heath St., wooden blocks, 2,400 sq. yds.; Payson St., asphalt block, 9,330 sq. yds., and 7th, 8th, 9th, 10th, 12th Sts. and Clifton and Walbrook Aves. with macadam, 30,250 sq. yds.

The Bd. of Pub. Improv. has passed an ordinance appropriating $45,000 to pave Columbia Ave. from Bush to Gwynns Falls, with Belgian block.

Falmouth, Mass.—Press reports state that $50,000 has been appropriated to macadamize certain roads in this town.

Ann Arbor, Mich.—The following bids for paving with asphalt block on Liberty St. were received by Bd. of Pub. Wks. Mar. 14: Geo. H. Knial, Lansing, $25,074; Harry Jennison, Toledo, O., $25,681; Jack Carland, Toledo, O., $25,505; E. L. Schneider, Ann Arbor, $26,258. E. W. Groves, City Engr. The bid in detail of the lowest bidder, Geo. H. Knial, is as follows: 9,500 sq. yds. paving, $2.19 per sq. yd.; 3,550 lft. Berea curb, 48 cts. per ft.; 3,000 cu. yds. excav., 47½ cts. per cu. yd.; 1,200 ft. 5-in. Medina curb, 75 cts. per ft., and 500 ft. of 4x12 Medina headers, 48 cts. per ft.

Grand Rapids, Mich.—The following bids for paving about 23,010 sq. yds. with asphalt block on Wealthy Ave. were received by Bd. of Pub. Wks., Mar. 13: Luton Eng. & Constr. Co., $56,225; Kloote & Vander Veen, $54,940; Jas. McDermott & Son, $57,700; Fred Gilner, $57,000. All of Grand Rapids. L. W. Anderson, City Engr.

L. W. Anderson, City Engr., writes that the approval of the contract for the paving Wealthy Ave. with asphalt block has been delayed and the Bd. of Pub. Wks. directed to advertise the same improvement to be paved with vitrified brick. The contract includes about 23,000 sq. yds. of pavement.

Owosso, Mich.—The Barber Asphalt Paving Co., of Detroit, is reported to have secured the contract for paving with bituminous macadam in this city at a cost of $30,000.

Hudson, Mich.—See "Sewerage and Sewage Disposal."

St. Paul, Minn.—City Engr. Rundlett estimates the cost of paving on portions of Dale St. and Fairmount Ave. as follows: With brick, $9,311; asphalt, $8,547, and sandstone, $12,083.

Kansas City, Mo.—Bids will be received until Mar. 25 by the Bd. of Pub. Wks. for paving with brick on portions of 3 alleys and on a portion of 10th St. Dan. W. Pike, City Engr.

Concord, N. H.—A bill has been signed by the Governor appropriating $20,000 for the completion of the shore boulevard.

Newark, N. J.—Bids will be received until Mar. 26 by the Bd. of St. & Water Comrs. for paving with brick or asphalt, on portions of several streets, requiring in all about 36,750 sq. yds. J. Crowell Mundy, Gen. Supt. of Wks.

Belvidere, N. J.—Press reports state that the Warren Co. Bd. of Freeholders has decided to construct about 12 miles of macadam roads this year at a cost of from $35,000 to $40,000, and expects to macadamize from 12 to 15 miles of road each year until every road in the county is permanently improved.

Newark, N. J.—Ordinances have been adopted by the City Council providing for the paving with granite, asphalt or brick, and telford macadam portions of several streets.

Paterson, N. J.—The Bd. of Aldermen is considering the question of paving several streets. Material to be used will be sheet or block asphalt. Cost about $150,000. H. J. Harden, City Engr.

Trenton, N. J.—The Co. Bd. of Freeholders is contemplating the macadamizing of about 14 miles of roads in Mercer Co., at a probable cost of $85,320, the State to pay ⅓ of the cost.

Brooklyn, N. Y.—Bids will be received Apr. 1 by J. Edw. Swanstrom, Boro. Pres., for regulating, repaving, grading, flagging and constructing cement concrete sidewalks on portions of numerous streets. Engineer's estimate, 187,030 sq. yds. granite block pavement with tar and gravel joints, for furnishing and delivering 1,250,000 lbs. paving pitch, 35,880 sq. yds. Medina sandstone pavement, with cement joints, 10,470 sq. yds. asphalt block pavement, 15,980 sq. yds. wood block pavement 3 and 4-in. in depth, 19,510 cu. yds. concrete, 86,715 sq. ft. cement concrete sidewalks, 51,696 sq. ft. bluestone flagging furnished and laid, 38,543 cu. yds. earth filling, to be furnished, etc.

Brooklyn, N. Y.—The following bids for asphalt pavt. on concrete foundation were opened Mar. 14, by J. Edw. Swanstrom, Boro. Pres.—*a*, Cranford Co.; *b*, Uvalde Asph. Pavg. Co.; *c*, Brooklyn Alcatraz Asph. Pavg. Co.; *d*, Eastern Bermudez Asph. Pavg. Co.; *e*, Interstate Pavg. Co.:

Pacific St.—Grand to Bedford Avs.

	Asph., sq. yds.	Ad. pv., sq. yds.	Concr., cu. yds.	New crb. ft.	Old curb, ft.	Manhole covers.
	12,060	*90*	*2,030*	*5,060*	*1,260*	*24*
a	$1.16	$ .30	$5.00	$ .80	$ .35	$14.00
b	1.35	.30	5.00	.80	.40	15.00
c	1.40	.35	5.00	.85	.35	22.50

Gates Av.—Bedford to Lewis Av.

	10,530	*50*	*2,010*	*9,000*	*820*	*2*
a	$1.58	$ .30	$5.75	$ .80	$ .35	$14.00
b	1.75	.30	5.50	.80	.40	15.00
c	1.50	.35	6.00	.85	.35	22.50

Greene Av.—Bushwick Av. to County Line.

	15,850	*140*	*2,710*	*4,880*	*4,130*	*30*
a	$1.27	$ .30	$5.35	$ .85	$ .35	$14.00
b	1.60	.30	5.25	.85	.30	15.00
d	1.23	.30	5.25	.85	.35	18.00
c	1.40	.30	5.25	.90	.30	15.00

Driggs Av.—S. 4 th to N. 12th Sts., etc.

	12,390	*320*	*2,280*	*8,300*	*1,460*	*2*
a	$1.67	$ .35	$5.75	$ .85	$ .35	$14.00
b	1.85	.30	6.00	.90	.40	15.00
c	1.40	.35	5.00	.85	.35	22.50
d	1.49	.30	5.75	.85	.35	18.00

Frost St.—Union to Kingsland Avs., etc.

	12,180	*140*	*2,090*	*6,150*	*890*	*23*
a	$1.28	$ .35	$5.32	$ .85	$ .35	$14.00
b	1.40	.30	5.50	.90	.30	15.00
c	1.40	.35	5.00	.85	.35	22.50
d	1.23	.30	5.25	.85	.35	18.00
e	1.40	.30	5.25	.90	.40	15.00

Scholes St.—Union Av. to Waterbury St., etc.

	15,460	*150*	*2,650*	*7,850*	*970*	*44*
a	$1.26	$ .35	$5.28	$ .80	$ .35	$14.00
b	1.40	.30	5.50	.90	.30	15.00
c	1.40	.35	5.00	.85	.35	22.50
d	1.23	.30	5.25	.85	.35	18.00
e	1.40	.30	5.25	.90	.40	15.00

Harrison St.—Clinton to Court Sts., etc.

	11,950	*50*	*2,060*	*6,640*	*600*	*35*
a	$1.17	$ .35	$5.14	$ .80	$ .35	$14.00
b	1.30	.30	5.25	.85	.35	15.00
c	1.30	.35	5.00	.85	.35	22.50

De Kalb Av.—Clinton Av. to Broadway.

	23,010	*300*	*4,320*	*18,570*	*1,370*	*2*
a	$1.43	$ .35	$5.60	$ .89	$ .35	$14.00
b	1.75	.30	5.50	.85	.40	15.00
c	1.50	.35	6.00	.85	.35	22.50

Flatbush Av.—Malbone St. to Paerdegat Av.

	15,500		*100*	*100*	*200*	
a	$1.19	...	$5.75	$ .80	$ .35	...
b	1.60	...	6.00	.90	.35	...
c	1.50	...	6.00	.85	.35	...
e	1.37	...	6.00	1.00	.50	...

8th Av.—Carroll to 4th Sts., etc.

	14,800	*190*	*2,370*	*2,510*	*2,940*	*36*
a	$1.16	$ .35	$5.00	$ .75	$ .30	$14.00
b	1.25	.30	5.00	.85	.30	15.00
c	1.30	.35	5.00	.85	.35	22.50
e	1.42	.30	5.40	.90	.30	15.00

Herkimer St.—Albany Av. to Jardine Pl., etc.

	36,130	*370*	*6,040*	*16,050*	*1,950*	*92*
a	$1.14	$ .30	$5.00	$ .80	$ .35	$14.00
b	1.40	.30	5.20	.82	.40	15.00
c	1.40	.35	5.50	.85	.35	22.50
c	1.40	.28	5.25	.86	.40	15.00

Brooklyn, N. Y.—The following bids were opened Mar. 14 by J. Edw. Swanstrom, Boro. Pres., for asph. pavt. on 4th Av., from Atlantic Av. to 40th St.—*a*, Cranford; *b*, Uvalde; *c*, Brooklyn Alcatraz (recommended for award at $229,663); *d*, Eastern Bermudez; *e*, Interstate:

	a	*b*	*c*	*e*
Asph., 85,850 sq. yds.	$1.16	$1.25	$1.14	$1.42
Adj. pavt., 750 sq. yds.	.35	.25	.30	.30
Concr., 13,390 cu. yds.	5.00	5.25	4.92	5.25
New curb, 22,800 ft.	.80	.85	.85	.83
Old curb, 2,630 ft.	.35	.40	.40	.52
Manhole covers, 30	14.00	15.00	22.00	13.50
Earth exc., 14,910 cu. yds.	.40	.50	.50	.45
Top soil, 19,130 cu. yds.	1.10	1.05	1.00	1.25
Concr. curb, 23,660 ft.	.55	.55	.55	.60
Sewer basins reset, 125	30.00	65.00	40.00	15.00

Warwick St.—Jamaica to Belmont Avs.

	a	*b*	*d*	*e*
Asph., 10,513 sq. yds.	$1.39	$1.70	$1.18	$1.42
Concr., 1,472 cu. yds.	5.75	5.50	5.22	5.10
Sewer covers, 36	14.00	15.00	18.00	15.00
Earth exc., 5,742 cu. yds.	.40	.40	.45	.25
Concr. curb, 7,016 ft.	.55	.60	.60	.60
Old flags, 2,698 sq. ft.	.05	.03	.05	.04
New flags, 24,812 sq. ft.	.35	.30	.35	.28

Awards have been recommended for the bids received at this time as follows: Cranford Co., $465,577; Brooklyn Alcatraz, $266,132; Eastern Bermudez, $122,834; Uvalde, $10,276.

New York, N. Y.—Bids will be received Mar. 25 by Louis F. Haffen, Pres. Boro. Bronx, for re-regulating, regrading, setting and resetting curbstones, flagging and reflagging the sidewalks, laying and relaying crosswalks, building and rebuilding retaining walls, rebuilding receiving basins and paving with granite blocks on a sand foundation portions of Tremont Ave. Engineer's estimate, 23,800 sq. yds. granite block pavement on a sand foundation, laid with sand joints, 33,000 sq. ft. old flagging relaid, 4,000 sq. ft. new flagging, 5,000 lin. ft. new curbstone, 4,600 lin. ft. old curbstone, etc.

Toledo, O.—Bids are wanted Apr. 13 for furnishing material and improving portions of Detroit and Woodruff Aves. by grading and paving with blocks on a 6-in. concrete, 8-in. sand, 6-in. gravel or broken stone or bank gravel foundation, requiring in all about 11,570 sq. yds. Chas. H. Nauts, City Clk.

Cleveland, O.—Engr. Williams, of the Park Dept., is preparing plans, for the Road Drivers' Association, of the proposed speedway to be established on the lower boulevard between St. Clair and Superior Sts.

Colina, O.—It is stated that bids are wanted Apr. 7 for paving with block or bricks about 10,270 sq. yds. on East Livingston St. F. H. Kreusch, Village Clk.

Findlay, O.—It is stated that bids are wanted Apr. 18 for paving with block, grading and sewering Defiance Ave. F. C. Ray, City Clk.

Williamsport, Pa.—Petitions are to be presented to Council for paving two 20-ft. alleys and for part of 1 street, about 4,000 sq. yds., either brick or asphalt. Jas. F. Fisher, City Engr.

Philadelphia, Pa.—Bids are wanted Mar. 25 for grading streets, repaving tramway streets, relaying granite block pavement on portions of Master street, sprinkling macadam roads and reconstructing fenders at Penrose ferry bridge. Wm. C. Haddock, Dir. Dept. Pub. Wks., Bureau of Highways.

Meadville, Pa.—Bids will be received until Mar. 25 by the Select and Common Councils for grading, curbing and paving portions of Water and Chestnut Sts., requiring in all 5,835 sq. yds. of paving, 2,510 lin. ft. of 6x22-in. curbing, etc. A. C. Pardee, City Clk.

Houston, Tex.—John W. Maxcy, Supt. Roads & Bridges, writes that about $600,000 will be expended on roads and bridges. The material to be used for paving will be a gravel base of 8 in. with wearing surface of 4-in. clam shell.

Texarkana, Tex.—The proposition to issue $30,000 bonds for street improvements carried at the recent election.

Ogden, Utah.—A. F. Parker, City Engr., writes that J. P. O'Neill, of Ogden, secured the contract for curbing and sandstone block and asphaltum paving (bids opened Mar. 2) for about $55,000.

Beloit, Wis.—Bids will be opened in City Clerk's Office Mar. 31 for 1,800 yds. brick paving on portion of Bridge and School Sts. Robt. Caldwell, City Engr.

Madison, Wis.—A bill has passed the Assembly authorizing cities of first and second class to exact from contractors who lay asphalt a 10-year guarantee and to compel the contractors to keep the pavement in repair for that time.

Winnipeg, Man.—The Civic Wks. Com. has authorized the paving with asphalt on a portion of Spencer St., at an estimated cost of $10,700.

Montreal, Que.—Local press reports state as soon as the weather will permit numerous streets will be repaired at an estimated cost of $370,135, and sidewalks will be repaired at an estimated cost of $35,000.

POWER PLANTS, GAS AND ELECTRICITY.

Birmingham, Ala.—It is stated that the Birmingham Ry. Light & Power Co. will expend about $2,500,000 in improvements. David A. Belden, Gen. Mgr.

Berkeley, Cal.—It is stated that bids are wanted Apr. 6 for a franchise to construct and maintain pole lines for transmitting electricity as applied for by the Bay Counties Power Co. C. D. Maloney, Town Clk.

Ft. Rosecrans, Cal.—Bids are wanted Apr. 8 for constructing a power house. Capt. Edgar Jadwin, Corps Engrs., U. S. A., Los Angeles, Cal.

Lewes, Del.—The House has reported favorably on the bill authorizing the town to issue bonds for an electric light plant, water works and a sewerage system.

Gainesville, Fla.—The Gainesville Gas Co. is stated to have secured the contract for lighting the city for 5 years. Geo. I. Drig, Supt., writes that it is proposed to construct an electric light plant, to cost $30,000. Address Engineer E. E. Proctor, Wakfield, Mass.

Ft. Pickens, Fla.—Bids are wanted Apr. 4 for constructing electric lighting system at this post. Address W. E. Cole, Q. M., Ft. Barrancas, Fla.

Atlanta, Ga.—Bids will be received Mar. 23 by the Mayor and Gen. Council for electric lighting with arc and series incandescent lights for terms of 1, 3 and 5 yrs. There are at present in use 792 arc lights and 453 series incandescent lights. Evan P. Howell, Mayor.

Payette, Idaho.—J. W. Prestel & Sons is stated to have secured a franchise for an electric light plant.

Coeur d'Alene, Idaho.—B. O. Graham, Secy. Cable Milling Co., writes that his company will construct an electric light plant and water works, at a cost of $40,000. Will probably be ready for bids in 30 days.

Quincy, Ill.—It is stated that bids are wanted about Apr. 1 for a steam plant for the Independent Light & Power Co. C. E. Mead, Gen. Mgr.

Kewanee, Ill.—It is stated that the Kewanee Light & Power Co. will install a plant, at a cost of about $40,000.

Martinsville, Ind.—The Martinsville Light, Heat & Power Co. has been incorporated, with a capital of $100,000, by Robt. P. King, Merrill Moores, and others.

Tohlequah, Ind. Ter.—The City Council has granted an electric light franchise to C. W. Turner, of Muskogee. The plant at Muskogee will be removed to this place, and a new one constructed at Muskogee.

Indianapolis, Ind.—The City Engr. will soon complete specifications for an electric light contract under the new law. It will probably be let for 10 years.

Boone, Ia.—It is reported that the Boone Gas Co. will lay about 3 miles of mains and make other improvements.

Muscatine, Ia.—A. K. Raff, City Recorder, writes that no bids were received on Mar. 10 for lighting the streets with electricity for 10 years.

Chanute, Kan.—E. H. Ricksecker, City Engr., writes that W. T. Osborn & Co., of Kansas City, Mo., secured the contract for constructing an electric light plant (bids opened Mar. 12) for $31,976.

Lexington, Ky.—J. M. Roche, Mgr. Kentucky Htg. & Illuminating Co., writes that the company is applying for a franchise for a central heating station.

New Orleans, La.—The City Council has passed an ordinance granting the Consumers' Electric Co. a franchise to construct and operate an electric light plant.

New Orleans, La.—The New Orleans & Carrollton Ry. Light & Power Co. is stated to have secured the contract on Mar. 7 for lighting the city for 1 yr. at the following figures: $90 for overhead system, $100 for underground system and 12 cts. net for Kw. hour for public office. Total cost for lighting for the year under this contract will be $168,260.

Kennebunk, Me.—The Senate has passed the bill to authorize this city to own and maintain an electric light and power plant.

Boston, Mass.—Bids are wanted Apr. 2 for installing a complete system of electric light wiring and fixtures at the U. S. Marine Hospital at this post. R. H. Woodward, Custodian.

Delray, Mich.—It is stated that the Detroit Gas Co. will double its plant at Delray.

Mayville, Mich.—The citizens are reported to have voted to issue $5,000 electric light bonds.

Bangor, Mich.—The citizens are reported to have voted to issue $25,000 electric light and water bonds.

Standish, Mich.—The Governor has approved the bill authorizing the village to issue bonds to provide water, light and sewerage.

Holland, Mich.—Bascom Parker, of Niles, is stated to have secured a franchise for a gas plant.

Allegan, Mich.—C. F. Davison, Village Clk., writes that it was voted Mar. 9 to issue $30,000 bonds for purchasing the electric lighting equipment now rented and for improving the water works and water power.

Lansing, Mich.—It is stated that the Lansing Gas Light Co. will erect a new plant in the northern part of the city the coming summer capable of supplying a city of 75,000 inhabitants.

Grand Rapids, Mich.—Gen. Supt. Meyer has reported to the Bd. of Pub. Wks. that the estimated cost of installing a dynamo at the city lighting station and stringing the necessary wires for lighting the city building would be $16,000.

Mankato, Minn.—Local press reports state that bids will be received Mar. 30 for an electric light plant, to cost about $40,000. Bids will be received separately on boilers. J. R. Thompson, City Engr.

South Stillwater, Minn.—The citizens are stated to have voted Mar. 10 to issue $23,000 bonds for electric light and water works.

Cold Springs, Minn.—The citizens are reported to have voted to issue bonds for water works and an electric light plant.

Webster Groves, Mo.—Bids are wanted Apr. 6 for lighting the streets and public places of said city with approximately 200 20-c.-p. incandescent lamps, for a period of 10 years, commencing Sept. 1, 1903. C. O. Twining, Chmn. Com. on City Lighting.

Lewiston, Mont.—J. L. Bright is reported interested in the construction of an electric light plant, to cost $25,000.

Dillon, Mont.—A. F. Graeler is reported interested in the construction of an electric light plant.

New York, N. Y.—The Bd. of Estimate and Apportionment on Mar. 13 indorsed the recommendation of Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, that the city build and operate its own electric light plant. Mr. Monroe was authorized to engage an expert to make plans and estimates of cost of such a plant.

Long Island City, L. I., N. Y.—The following bids were opened on Mar. 9 by C. B. J. Snyder, Supt. of School Bldg., N. Y. City, for installing electric light wiring, fixtures and electric bell system in High School, Boro. of Queens: T. Fred. Jackson, 595 Columbus Ave., N. Y. City, $9,720 (awarded contract); Commercial Constr. Co., $11,051; Fred. Pearce, $10,495; E. E. Hewitt Co., $12,141.

Henderson, N. C.—It is reported that bids are wanted by T. Powell, Town Clk., for lighting the town for 10 years, beginning Dec. 1st. The present contract expires in Nov.

Bynums, N. C.—John W. Hayes, of Petersburg, Va., is stated to have been employed to prepare plans for the improvement of the water power on Haw River of the Odell Co. The present dam will probably be rebuilt, and new machinery installed.

Newbury, O.—The citizens are reported to be considering the feasibility of constructing an electric light syatem and water works.

Prairie City, Ore.—The City Council is stated to have granted Reveille Bros. a 20-yr. franchise for an electric plant.

Philadelphia, Pa.—Bids are wanted Mar. 24 for electric lighting system for Upper and Lower Roxborough. Wm. C. Haddock, Dir. Pub. Wks., Bureau Filtration.

Kulztown, Pa.—It is stated that the Keystone Electric Light, Heat & Power Co. will expend about $25,000 in improvements, including an addition to the power house, an 800-H.-P. engine and an extra set of boilers.

Johnstown, Pa.—Reagan & Mulock, of Philadelphia, are stated to have secured the contract for constructing a subway for the Citizens' Light, Heat & Power Co.; it will cost about $42,000.

Lancaster, Pa.—Bids are wanted Mar. 24 for furnishing material, lighting, extinguishing, caring for, keeping in repair the lights in the streets and public places of said city. E. S. Smeltz, City Clk.

Oakmont, Pa.—The entire plant of the Oakmont & Verona Light, Heat & Power Co. is reported to have been destroyed by fire Mar. 13. Jas. Marchland, Secy.

Confluence, Pa.—The citizens are reported to have voted to issue bonds for the construction of a municipal lighting plant.

Columbia, Tenn.—John H. Carpenter is reported interested in the formation of a new electric light company for Columbia.

Dalhart, Tex.—W. H. Wolff, of Gallup, N. M., is stated to have secured the franchise for an electric light plant for Dalhart.

Knoxville, Tenn.—The Knoxville Power Co. is stated to have petitioned for an increase of its capital from $10,000 to $100,000. Its plan is to dam Little Tennessee River and supply Knoxville with electricity.

Louisa, Va.—The Mayor writes that the town is ready to receive bids for the construction of an electric light plant, to cost about $3,000.

Seattle, Wash.—An ordinance has been introduced in Council providing for the issue of $590,000 bonds for a municipal electric light plant.

Palouse, Wash.—J. K. McCormack and associates are reported to have petitioned for a franchise for an electric light plant.

Wilbur, Wash.—The City Council is stated to have granted the Wilbur Electric Co. a franchise to establish and operate an electric system.

Colville, Wash.—Geo. Nixon, of Spokane, is reported to be making estimates for an electric plant to be installed at Mayers Falls, to furnish electricity to light Colville and other towns.

Olympia, Wash.—It is reported that D. B. Garrison, Secy. State Capitol Comn., would like information regarding the installation of an electric light plant of 1,500 16-c.-p. lights.

Niagara Falls, Ont.—M. A. Piggett, of Hamilton, is stated to have secured the contract for constructing a cofferdam for the Toronto & Niagara Power Co.

ELECTRIC RAILWAYS.

Oakland, Cal.—The City Council has accepted the bid of J. H. MacDonald for a street railway franchise extending from the Pleasant Valley Region, down Webster St., through the business portion of the city to 1st St.

Eureka, Cal.—The City Council has granted Geo. Henderson, of Oakland, a franchise for the construction of an electric railway in Eureka. He is said to have acquired water rights on Klamath River, where he will erect a power plant.

Los Angeles, Cal.—It is stated that bids will be received until Apr. 13 for the purchase of a street railway franchise in this city. H. J. Lelande, City Clk.

Cripple Creek, Colo.—The Pike's Peak & Cripple Creek District Electric Ry. Co. has been incorporated; the terminus of the line for the present will be at Gillett, but it is the design of the projectors of the road to eventually extend it up to the Peak.

Galesburg, Ill.—The Galesburg & Aledo Interurban Ry. Co. is about to be incorporated to build an electric railway from Galesburg and Aledo. Lake W. Sanborn and C. L. Gerould are reported interested.

Chicago, Ill.—The Englewood Elevated R. R. Co. has been incorporated, with a capital of $50,000, to build an elevated railroad in Chicago. Leslie Carter, Noble B. Judah and Henry G. Miller are among the incorporators.

Joliet, Ill.—The Joliet & Northwestern Electric Ry. Co. has been organized, with a capital of $500,000, to build an electric railway from Sandwich to Aurora through Plano and Bristol, with a branch to Morris through Yorkville.

Greenup, Ill.—The Council has granted a franchise to the St. Louis, Vandalia & Eastern R. R. Co., to construct an electric railway through Greenup connecting St. Louis and Terre Haute.

Mattoon, Ill.—Surveys are being made by the Central Traction Co. for its proposed line between Mattoon and Charleston.

East St. Louis, Ill.—It is the intention of the East St. Louis & Suburban R. R. Co. to extend its lines during the coming year so as to make a complete circuit of all towns on the East Side within a radius of 25 miles of St. Louis. J. M. Bramlette, Gen. Supt., East St. Louis.

Danville, Ill.—The Supervs. have granted street railway franchises to the Danville, Urbana & Champaign Ry. Co. (W. B. McKinley, Mgr., Champaign) and to the Paxton, Danville & Wellington Ry. Co.

New Albany, Ind.—The New Albany, Paoli & French Lick Valley Traction Co. will soon begin the survey for the proposed electric railway between New Albany and French Lick Springs.

Richmond, Ind.—Surveys are now being made for the proposed electric railway between Richmond and Anderson, in which Gus M. Hodges is interested.

Terre Haute, Ind.—The improvements to be made in the system of the Terre Haute Electric Co., including the construction of the interurban lines to West Terre Haute and Clinton, will involve the expenditure of $500,000. Considerable track within the city limits is to be relaid with heavier rails, and the power house on 9th St. is to be enlarged and additional equipment installed.

Davenport, Ia.—The City Council has granted a franchise to the Illinois & Iowa Interurban Ry. Co. The plan of the company is to build from Davenport to Clinton.

Norton, Mass.—The Selectmen have granted a franchise to the Norton & Taunton St. Ry. Co. to construct a line from Norton Center to Easton, and from Chartley to the Attleboro town line.

Southboro, Mass.—The Selectmen are stated to have granted a franchise to the Boston & Worcester St. Ry. Co. E. H. Rogers, Ch. Engr., Boston.

South Framingham, Mass.—The Framingham & Cochituate St. Ry. Co. is reported formed, to build an electric railway between Cochituate and South Framingham, a distance of about 4 miles; capital, $50,000. Directors: Chester B. Williams, of Wayland; Chas. A. Coombs, of Natick; Abner Jones, of South Framingham, and others.

North Attleboro, Mass.—The Selectmen have granted the Mansfield & Attleboro St. Ry. Co. a location in the town.

Worcester, Mass.—The Hartford & Worcester St. Ry. Co. has been granted a charter, with a capital of $300,000. The charter permits the company to build a line from Worcester to the Conn. State line in the town of Wales, a distance of 30 miles.

Lincoln, Neb.—The Omaha, Lincoln & Beatrice Ry. Co. has been incorporated, with a capital of $2,000,000, to build an electric railway between Lincoln and Omaha. Elbert C. Hurd and Henry H. Wilson are among the incorporators.

Atlantic City, N. J.—The Delaware Valley Traction Co. intends building a trolley line from Atlantic City to Pleasantville, Camden and Jersey City. Wm. B. Dixey, 107 Metropolitan Ave., has charge of the construction and purchasing of all machinery, etc. He will soon purchase machinery for power house.

Trenton, N. J.—The Trenton, Lakewood & Atlantic Traction Co. has been incorporated, with a capital of $1,000,000 to construct a line from Trenton to Lakewood, to connect at Lakewood with the Point Pleasant line. Incorporators: Albert D. Cook, of Princeton; Thos. P. Allen, of Trenton; Wm. B. Wills, of Mt. Holly, and others.

Somers Point, N. J.—The Atlantic City & Suburban Traction Co. has secured a franchise in Somers Point.

Metuchen, N. J.—The lines of the Middlesex & Somerset Traction are to be extended from Metuchen to Plainfield. Thos. Walsh, Gen. Mgr., New Brunswick.

New York, N. Y.—The Bd. of Aldermen has granted a franchise to the New York City & Interborough Ry. Co., to build and operate 36 miles of surface lines in upper Manhattan and the Bronx. The new road will cross Macomb's Dam Bridge and connect with the "Huckleberry" line.

Oneida, N. Y.—It is said that the Oneida Ry. Co. has definitely decided to extend its lines from Oneida to Rome.

Ithaca, N. Y.—The Auburn-Ithaca R. R. Co. is about to be formed for building a line between Ithaca and Auburn. Isaac P. Hazard, Pres.; Sherman Collins, Secy.

Bradford, O.—D. E. Hess, Village Clk., writes that the Covington, Bradford & Versailles Traction Co. has secured the franchise for constructing and operating St. Ry. Route No. 2.

Belle Vernon, Pa.—The Council has granted a franchise to the Webster, Monessen & Belle Vernon St. Ry. Co. John McBride, Mgr., Monessen.

Glenlyon, Pa.—It is stated that the People's Electric Ry. Co. will build a line from Glenlyon to the site of the new coal shafts near Warrien Run. R. H. Conover, Secy., Nanticoke.

Johnstown, Pa.—The Johnstown & Scalp Level St. Ry. Co. has been incorporated, with a capital of $42,000, to build a 7-mile line over the Johnstown & Scalp Level Turnpike. Directors: Jos. Ruth, Gernard Nees, and others.

Mt. Pleasant, Pa.—Work on the construction of the newly chartered Mt. Pleasant, Pleasant Unity & Bagley Electric Ry. will shortly begin. The line will be 16 miles long, and extend from Mt. Pleasant to Bagley. Directors: Wm. E. Crow, D. W. Henderson, and others.

Erie, Pa.—The Council has passed an ordinance vacating a portion of East Ave. and has approved the contracts of the Philadelphia & Erie R. R. and the Erie Electric Motor Co., in which they promise to contribute $20,000 and $15,000 respectively to the construction of the overhead crossing at this point.

Millersville, Pa.—The Tennis Construction Co., of Philadelphia, has secured the contract from the Lancaster, Millersville & York Furnace R. R. Co. for the building of a line 12⅛ miles long, from Millersville to York Furnace.

Phoenixville, Pa.—Plans are being discussed for the construction of an electric railway to connect Phoenixville and West Chester. John S. Dismant, of Phoenixville, and Marshall H. Matlack, of West Chester, are reported interested.

Granbury, Tex.—The Granbury & Glenrose Traction Co. has been organized to build an electric railway between Granbury and Glenrose. G. W. Landers, of Granbury, and G. F. Gaither, of Glenrose, are reported interested.

Richmond, Va.—It is said that $80,000 will be expended in improving the suburban lines of the Richmond Passenger & Power Co. S. W. Heff, Gen. Mgr., Richmond.

Hoquiam, Wash.—The Council has granted a street railway franchise to the Gray's Harbor Power & Light Co.

Spokane, Wash.—A franchise for the construction of two railway lines through the southeastern part of the city for the suburban line to Moran prairie has been granted the Moran Prairie Transportation Co. by the City Council.

Williamstown, W. Va.—Preliminary surveys are being made by the Osborn Engineering Co., of Cleveland, for an electric railway connecting Williamstown, St. Marys and Slatersville.

Parkersburg, W. Va.—The Parkersburg & Ohio Valley Electric R. R. Co. is reported to be completing surveys. Present work will connect with Parkersburg, Marietta & Interurban Ry., and extend north for 71 miles, connecting at Moundsville with the Wheeling roads.

Ripon, Wis.—It is stated that practically all the right of way has been secured for the extension of the lines of the Oshkosh Traction Co. to Ripon.

Madison, Wis.—The Beloit, Delavan Lake & Janesville Ry. Co. has in contemplation the construction of an extension to Madison, Wis.

Hamilton, Ont.—The Hamilton & Caledonia Ry. Co. will construct an electric line between Hamilton and Dunville, and through the townships of Oneida, Canborough and Moulton.

London, Ont.—It is said that the London, Aylmer & North Shore Electric Ry. Co. will erect a power house, machine shops and car barns, at a cost of $200,000. C. E. A. Carr, Mgr., London.

RAILROADS.

Onconta, Ala.—It is reported that the Birmingham Mineral R. R. Co. is to extend its line from Oneonta to Hobbs Island.

Union Springs, Ala.—The Stockholders of the Union Springs & Northern Ry. Co. is stated to have authorized the issue of bonds to the amount of $1,000,000, the proceeds to be used for extending the road from Ft. Davis to Tallassee. W. M. Blount, Pres.

San Francisco, Cal.—The Continental R. R. Co. has been incorporated, with a capital of $1,500,000. The company proposes to absorb the two recently organized companies, the San Francisco Ry. Terminal & Ferry Co. and the Stockton & Beckwith Pass Ry. Co. It also proposes building a road from San Francisco via Oakland, Stockton, Marysville, Oroville, along the North Fork of Feather River, through Sierra Valley in Plumas County, through the Beckwith Pass in the Sierra Nevada mountains and across Nevada to Salt Lake City; also several other branches; total length of proposed line, about 1,250. Incorporators: Walter J. Barnett, of San Francisco; F. M. West, of Stockton; Geo. Batchelder, of San Mateo, and others.

San Luis Obispo, Cal.—The Midland Pacific Ry. Co. has filed articles of incorporation in St. Luis Obispo. The road will commence at a point on San Luis Bay and extend through San Luis Obispo, Santa Barbara and Kern Counties. Provision is made for 200 miles of road, including branch lines to Midway and McKittrick, with a main line extending through Sunset to Bakersfield. Principal place of business, San Francisco. Directors: A. L. Weil, M. A. Lippett, J. W. Pauson, and others, all of San Francisco. Capital, $5,000,000.

Washington, D. C.—Local press reports state that the Wabash R. R. Co. is about to extend its line to Washington and from Washington to Newport News, Va. Jos. Ramsey, Jr., Pres., St. Louis, Mo.

Pensacola, Fla.—A charter has been granted to the Pensacola, Meridian & Northwestern R. R. Co. to construct a line from Pensacola to Water Valley, Winona or Grenada, in the State of Miss., or to Memphis, Tenn. Incorporators: John A. Lewis, Meridian, Miss.; Harry M. Coudry and Murray F. Smith, of Vicksburg, Miss.

Greenville, Ga.—The South Georgia & West Coast Ry. Co. is stated to have issued a mortgage to secure a bond issue of $250,000, to be used to extend the line from Greenville to Perry, Fla., a distance of 30 miles.

Chicago, Ill.—The Chicago Junction R. R. track elevation ordinance, which includes the branch lines of the south side elevated railroad to Englewood and to the stock yards, and an express service on the "alley L," is reported to have been passed by City Council. The measure embraces projects which will cost $4,950,000.

Connersville, Ind.—The Richmond St. & Interurban Ry. Co. has secured a franchise in Connersville. E. B. Gunn, Mgr., Richmond.

Goshen, Ind.—The Ft. Wayne & Goshen Ry. Co. is said to have completed plans for the building of its road. The total mileage, including sidings, is 65 miles. The road is practically a continuation or extension of the Indiana Ry. Co., of South Bend. Arthur S. Partridge, of Goshen, and Chas. S. Bash, of Ft. Wayne, are among the directors.

Sioux City, Ia.—It is stated that the Burlington R. R. will construct an extension from Sioux City to Ashland, Neb., a distance of about 100 miles. W. L. Breckinridge, Ch. Engr., Chicago, Ill.

Des Moines, Ia.—Local press reports state that 44 miles of the new Des Moines & Southern R. R. are to be built this spring, and bids for its construction, extending from Winterset to Greenfield, are about to be received at the office of F. W. Cherry, promoter of the enterprise. It is expected the total expense of the work to be done this year will be between $500,000 and $800,000.

Middlesboro, Ky.—It is stated that the Middlesboro Mineral Springs Ry. Co. will build a line from Middlesboro to Harlan court house, a distance of 40 miles.

Goffstown, N. H.—The Uncanooac Inclined R. R. Co. has secured a charter to construct an inclined road up the Uncanooac Mt. (1,500 ft. high) in this town; capital, $200,000. U. A. George, of Manchester, N. H., is the promoter.

Binghamton, N. Y.—The Broome County R. R. of Binghamton has been incorporated, with a capital of $450,000, to operate a steam railroad, 15 miles long, from Vestal to Binghamton. Directors: Albert B. Walters, Wilkesbarre, Pa.; Edw. J. Bond, of Baltimore, Md., and D. E. Baxter, of N. Y. City.

Cincinnati, O.—It is reported that J. G. Schmidlapp has organized a syndicate to construct an elevated railroad system, starting from 4th and Walnut Sts., touching Walnut Hills and Avondale, and extending as a surface road to Norwood.

Esplen, Pa.—A press report states that the Ohio Connecting R. R. Co. is making preparations to expend $2,000,000 in improvements. The line now extends from Esplen via the bridge to Verner station on the Ft. Fayne R. R. The Co. is reported to have acquired land at Scully station, and here additional yards will be built. The Duff branch will be improved by making extensions and additions to the line.

Pittsburg, Pa.—Contracts for improvements to the Pittsburg division of the Pennsylvania R. R. to the amount of $1,000,000 have been awarded to H. S. Kerbaugh, Harrison Bldg., Philadelphia, and McMenamin & Sims, of Philadelphia. The work embraces the 4 tracking of the Packsaddle and reducing grades and eliminating curves between Bolivar Junction and Blairsville Intersection, a distance of about 7 miles. This distance will also be 4 tracked.

Salisbury, Pa.—The Town Council has granted a franchise to the Meyersdale & Salisbury St. Ry. Co., which will build a line connecting Meyersdale and Salisbury. A. O. Lorentz, Mgr., Meyersdale.

Jacksboro, Tex.—The Chicago, Rock Island & Texas Ry. Co. is making a survey from Jacksboro to Graham westerly in the direction of Harkell, via Throckmorton. From Graham to Haskell is about 75 miles. S. B. Hovey, Gen. Supt., and J. S. Peter, Ch. Engr., Ft. Worth.

Texarkana, Tex.—The Texarkana, Oklahoma & Northwestern Ry. Co. has been incorporated, with a capital of $15,000,000; the terminus of the southern division is Texarkana, Tex., with Denver, Colo., as the northern terminus. Incorporators: John Threadgill, Oklahoma City, Okla. Ter. Wm. Grimes, Kingfisher, Okla. Ter., and others.

Ogden, Utah.—The Wyo. Division of the Union Pacific R. R. Co. is about to call for bids for 31 miles of reconstruction work between Ogden and Morgan. The work will cost abont $1,500,000.

Beckley, W. Va.—Bids will be received by C. P. Howard, Engr. in charge of the Deepwater Ry. Co., Beckley, until Apr. 14 for the graduation (including tunnels), trestle work and masonry on 35 miles of the railway, in Wyoming and Mercer Counties, W. Va.

Mill Creek, W. Va.—A charter has been granted to the Mill Creek & Addison R. R. Co., with a capital of $10,000, to build a road from Mill Creek to Addison. Incorporators: E. W. Mealey, W. H. Cardwell, and others, all of Hagerstown, Md.

Fairmont, W. Va.—The City Council is stated to have granted a franchise to the Wabash R. R. Co. to pass through the east side of the city. W. S. Newhall, Ch. Engr., St. Louis, Mo.

PUBLIC BUILDINGS.

Alameda, Cal.—The First Presbyterian Society is reported to be preparing to erect $20,000 church. W. C. Cuthbert, Trus.

Redwood City, Cal.—Plans are stated to have been submitted to the County Supervs. for the $200,000 court house.

Denver, Colo.—E. P. Varian, 413 Tabor Blk., has prepared plans for a 3-story brick and stone Nurses' Home, to be erected on 17th and Washington Sts., to cost $35,000. He has also plans for the St. Luke's Hospital, to be erected on 18th and Pearl Sts., to cost $65,000.

Wray, Colo.—Bids will be received by the Bd. of Co. Comrs. for furnishing material and erecting a court house. W. D. McGinnis, Co. Clk.

Washington, D. C.—Arthur Cowsill, 1403 F St., N. W., is stated to have submitted the lowest bid for erecting the Foundry Methodist Episcopal Church; if Indiana limestone is used, $138,077; for Gray Canyon sandstone, $126,477.

Plans are stated to have been accepted for the building for the Episcopal Eye, Ear and Throat Hospital; probable cost, $70,000.

Abbeville, Ga.—Bids are wanted May 4 for erecting a $50,000 court house. Frank P. Milburn, Archt., Columbia, S. C.

Decatur, Ill.—The Bd. of Superva. have adopted the plans of B. S. Brooks, of Decatur, for the Macon County Jail; probable cost, $20,000.

New Albany, Ind.—The Trus. of the Methodist Episcopal Church are reported to have had plans prepared for an edifice, to cost from $25,000 to $30,000.

New Castle, Ind.—The County Comrs. are reported to be considering the erection of addition to the court house; probable cost, $25,000.

Hanover, Ind.—Patton & Miller, of Chicago, Ill., have been selected to furnish plans for the $25,000 Hendricks Memorial Library for Hanover College.

Lebanon, Ind.—The Congregation of the Centenary Methodist Church has decided to build a $30,000 edifice.

Logansport, Ind.—The Broadway Methodist Episcopal Congregation has decided to erect a $20,000 edifice.

Orange City, Ia.—Symms Powers, of Sioux Falls, S. D., is stated to have received the contract for plumbing and heating the court house for $6,100.

Council Bluffs, Ia.—The Woman's Christian Assoc. is stated to have decided to erect a 4-story brick hospital at 6th Ave. and 10th St.; estimated cost, $60,000.

Des Moines, Ia.—Bids will be received Mar. 24 by the Secy. of the Capitol Comn., for furnishing material for repairs and alterations of roof and copper work at the capitol building.

Centerville, Ia.—Bids are wanted Apr. 9 for heating and plumbing the new court house. J. F. Parks, Co. Aud.

Glenwood, Ia.—W. W. Welch, of Clarinda, is stated to have received the contract for erecting the buildings for the Feeble Minded Institute, for $59,100.

Louisville, Ky.—The Young Men's Hebrew Assoc. are stated to be considering the erection of a hospital, to cost $30,000.

Baltimore, Md.—Bids will be received Mar. 25 by the Bd. of Awards for erecting an engine house at McCulloh and Gold Sts. Thos. G. Hayes, Pres.

Boston, Mass.—Bids are wanted Mar. 28 for a heating system in the Boston Insane Hospital. Apply to Hollis French & Allen Hubbard, Albany Bldg., Beach and Albany Sts.

Brooklyn, N. Y.—The Armory Bd. is stated to have authorized the expenditure of $500,000 for a new fireproof armory for Troop C.

Jamaica, L. I., N. Y.—The plans of Nicholas W. Hausman, of Jamaica, are stated to have been accepted for the Mary Immaculate Hospital, to be erected at Shelton Ave. and Ray St., by the Sisters of St. Dominic, at a cost of $75,000.

Dayton, O.—All bids opened Mar. 12 for erecting a stone gateway and lodge at the Natl. Military Home for D. V. S. have been rejected. John W. Byron, Supt. Architects, Peters, Burns & Pretzinger, Kuhns Bldg.

Canton, O.—It is stated that the First Christian Society will erect an edifice, to cost $20,000.

Columbus, O.—Frank L. Packard, Hayden Bldg., is stated to have prepared plans for the St. Paul Episcopal Church to be erected at Broad St. and Monroe Ave. Rev. John Hewitt, Pastor.

Local press reports state that bids will be received Mar. 28 by F. A. Packard, Archt., Hayden Bldg., for erecting the Eastwood Congregational Church.

Glenville, O.—Andrew Carnegie is stated to have offered this city $28,000 for a library.

Portsmouth, O.—The Smith Lumber Co., of Portsmouth, has secured the contract for erecting the Carnegie Library (bids opened Mar. 16) for $45,217.

Johnsonburg, Pa.—Bids will be received Mar. 28 by Rev. David F. Hickey for erecting church for Holy Rosary congregation.

Webster, S. D.—Bids will be received Apr. 7 by Wm. Egeland, Co. Aud., for erecting a court house. Separate bids will be required on heating and plumbing. Kinney & Detweiler, Archts., 909 Northwestern Bldg., Minneapolis, Minn.

Houston, Tex.—Collins Bros., 210 Milham St., are stated to have received the contract for plumbing, gasfitting and heating the city hall, for $8,000.

Texarkana, Tex.—It is stated that the M. E. Society will erect a $20,000 church. Rev. Jas. Thomas, Pres.

Waco, Tex.—It is stated that the Sisters of Charity will erect an hospital here, to cost about $50,000.

Mannington, W. Va.—Bids are wanted Mar. 24 for erecting a Presbyterian Church. Glesey & Faris, Archts., Wheeling, W. Va. F. A. Prichard, Chmn. Bldg. Com.

Eau Claire, Wis.—Bids are wanted Apr. 6 for erecting a library. Patton & Miller, Archts., Chicago, Ill. F. H. L. Cotton, Chmn. Bldg. Com.

Sheridan, Wyo.—It is stated that a court house will be erected here at a cost of from $40,000 to $50,000.

Winnipeg, Man.—According to local press reports no bids were received Mar. 5 for the erection of the Carnegie Library, to cost $75,000.

Charlottetown, P. E. I.—It is stated that bids are wanted Apr. 1 for completing annex to Charlottetown Hospital. J. C. McDonald, Bishop.

BUSINESS BUILDINGS AND DWELLINGS.

Fresno, Cal.—Capt. W. A. Neville and Col. Wm. Forsythe are reported interested in the erection of the 4-story building at Tulare and J Sts.; estimated cost, $150,000. Bliss & Fayville, of San Francisco, Archts.

San Francisco, Cal.—Edward J. Vogel, Claus Spreckels Bldg., is stated to have prepared plans for the proposed hall to be erected by the Golden Gate Commandery of Knights Templars; probable cost, $100,000.

The plans of Newton J. Thorp are stated to have been selected for the 8-story hotel to be erected at Sutter and Mason Sts., for E. B. Hindes, at a cost of $175,000.

Denver, Colo.—Mareen & Norton, Equitable Bldg., has prepared plans for a 5-story fireproof office building, to be erected at 1784 Bway. for D. C. Dodge, to cost $85,000.

Tunlus & Sterner have prepared plans for a 3-story brick and stone flat to be erected on S. 15th St. and 11th Ave., to cost $32,000.

John Huddart, 42 Bank Blk., is stated to have prepared plans for an apartment house to be erected at 13th Ave. and Corona St., for Wm. Mahar, at a cost of $80,000.

Washington, D. C.—The Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia, Pa.) is reported to be having plans prepared for a union station to be erected at Massachusetts Ave. and N. Capitol St.; estimated cost, $4,000,000.

Athens, Ga.—Plans are wanted by a local syndicate for a $50,000 office building. J. Y. Carothers is Pres.

Ocilwein, Ia.—Reed & Norton are stated to have received the contract for erecting a residence on Frederick St. for John Hanson, at a cost of $25,000.

Des Moines, Ia.—C. F. Blount is reported interested in the erection of a 3-story, 280x90-ft. opera house at Grand Ave.; estimated cost, $200,000.

Marion, Ind.—It is stated that bids are wanted Mar. 26 for erecting a Y. M. C. A. bldg. B. L. French, Archt., 408 Iroquois Bldg.

Logansport, Ind.—The plans of Carl J. Horns, Masonic Temple, are stated to have been accepted for the Elka building to be erected here, at a cost of $25,000.

New Orleans, La.—It is stated that the Baldwin Tourton Theatrical Co., Ltd., with a capital of $250,000, will erect a theater here.

Baltimore, Md.—Edward H. Glidden, Atlantic Trust Bldg., is stated to have prepared plans for an 8-story apartment house to be erected at Paul and Preston Sts.; probable cost, $100,000. John H. Keene is reported interested.

Worthington & Akrens are reported to be preparing plans for an 8-story brick warehouse, 200x200 ft., for the Factory Bldg. Co., recently incorporated with a capital of $500,000. Arthur Stewart is reported interested.

Kansas City, Mo.—Rudolf Markgraf, New Nelson Bldg., is reported to be preparing plans for a 7-story building to be erected at 1117 Grand Ave. for Ernest Shukert; probable cost, $90,000.

It is stated that the Williams Real Estate Co. will erect a 6-story brick apartment house at 1067 Linwood Boule., at a cost of $50,000.

St. Joseph, Mich.—The Masons are reported to have decided to erect a temple here, to cost $50,000.

Flint, Mich.—W. A. Patterson will build 5 brick stores on Saginaw St. He is also interested in a 5-story hotel to be built on 3d and Saginaw Sts.

Duluth, Minn.—J. J. Wagenstein, 401 Providence Bldg., is stated to be preparing plans for a 5-story hotel to be erected at 1st St. and 5th Ave. W. for Albert C. and E. Ribenack; probable cost, $100,000.

Natchez, Miss.—Clark & Gardner will build an opera house; estimated cost, $60,000.

Cleveland, O.—Plans are stated to have been filed for the erection of the 6-atory apartment house at Euclid Ave. and Doan St., at a cost of $190,000. C. W. Hopkinson, Archt., 50 Euclid Ave.

It is stated that Leonard Schlather and John Schneider will erect a 4-story brick apartment house at York and Bridge Sts.; estimated cost, $50,000.

Youngstown, O.—Geo. Vaughn, of Zanesville, is stated to be preparing plans for a 6-story business building to be erected at W. Federal and Chestnut Sts. for the Mahoning Land Co.; estimated cost, $35,000.

Philadelphia, Pa.—The plans of Wm. C. Furber are stated to have been selected for the 6-story brick office building for the Central Trust & Savings Co., to be erected at 4th and Market Sts.

Harrisburg, Pa.—It is stated that John Mishler will erect a theater on N. 2d St., to cost $135,000.

Pittsburg, Pa.—The Geo. A. Fuller Co. is stated to have received the contract for the erection of the Nixon & Zimmerman theater at 6th Ave. and Cherry Alley, for $500,000.

Clarksburg, W. Va.—It is stated that a 50x180-ft. Y. M. C. A. building will be erected on Pike St.; estimated cost, $90,000. T. P. Riddle, Secy.

Milwaukee, Wis.—H. J. Esser, 82 Wisconsin St., is stated to have prepared plans for a 3-story brick apartment house to be erected at Brady St. and Warren Ave., at a cost of $25,000.

Oshkosh, Wis.—The Union Club is reported to be considering the erection of a $50,000 club house. Col. S. W. Hollister, Secy.

Appleton, Wis.—Herman Wildhagen, of Appleton, is preparing plans and specifications for a brick bottling house for Appleton Brewing & Malting Co.

Cheyenne, Wyo.—Bids will be received Apr. 1 by the Capitol Bldg. Comn. for furnishing material and erecting a Governor's residence. Henry G. Hay, Secy.

SCHOOLS.

Denver, Colo.—E. P. Varian, 413 Tabor Blk., is the architect for a $28,000 building for the State School for Dependent Children.

Brookland, D. C.—The Dist. Comrs. are stated to have awarded the contract for the erection of the 4-room addition to the school, to Pavarini & Grier, of Washington, for $23,700.

Athens, Ga.—J. A. Sage, of this city, is stated to have received the contract for the erection of the addition to the Library of the Univ. of Georgia, at a cost of $20,000.

Quincy, Ill.—Plans have been completed for a school, to cost $40,000. Archt., Harvey Chatten, Wells Bldg.

Goshen, Ind.—The School Bd. has been authorized to issue $50 000 bonds for schools.

Jonesboro, Ind.—J. H. Waldren, of Gas City, is stated to have received the contract for the erection of the 3-story brick school on the site of the one burned last fall; estimated cost, $23,800.

Cedar Falls, Ia.—Proudfoot & Bird, of Des Moines, are stated to have been selected to prepare plans for the gymnasium for the State Normal School; probable cost, $60,000.

Grinnell, Ia.—The plans of Brainerd, Leeds & Russell, of Boston, Mass., are stated to have been approved for the chapel for Iowa College; approximate cost, $35,000.

Muskogee, Ind. Ter.—S. T. McMurry, Recorder, writes that it was voted Mar. 10 to issue $50,000 bonds for the erection of new schools.

Parsons, Kan.—The citizens are stated to have voted to issue $40,000 bonds for erecting a school in the 2d Ward.

Gardner, Mass.—Barker & Nourse, of Worcester, are the architects for a $20,000 brick school for Gardner.

Ecorse, Mich.—The Governor is stated to have approved the bill authorizing the issue of $80,000 bonds for schools.

St. Paul, Minn.—Bids are wanted Apr. 2 for furnishing material for erecting schools in said city, including ventilating, heating and plumbing systems. O. E. Holman, Pres. Bd. of School Inspectors.

Virginia, Minn.—It is stated that a high school will be erected here, to cost $50,000.

Minneapolis, Minn.—R. McMillan & Co., 113 N. 4th St., and Archambo Heating Co., 219 S. 3d St., are stated to have submitted the lowest bids for the erecting, ventilating and heating the Hawthorne School, for $24,586 and $8,740 respectively.

St. Louis, Mo.—The Bd. of Educ. is stated to have awarded contracts for the following buildings: Cote Brilliante School, Gillick Bros., $138,990; ventilating and heating, Missouri Htg. & Constr. Co., $13,478;

plumbing, Fink & Schuster Plumbing Co., $8,248. Benton School, Fred Becke, $49,850; ventilating and heating, Front Rank Steel Furnace Co., $5,100; plumbing, Houser & Doerner Plumbing Co., $4,405. McKinley High School, ventilating and heating, Sodeman Htg. & Power Co., $41,977; plumbing, P. C. Ring, $29,498; electric work, Newberry & Co., $13,140. The Jas. E. Yeatman High School, ventilating and heating, Sodeman Htg. & Power Co., $41,997; plumbing, P. C. Ring, $28,990; electric work, Newberry & Co., $13,140.

Bayonne, N. J.—Bids will be received Apr. 1 at the Rectory, E. 26th St. and Ave. D, for erecting a 2-story brick Parochial School for the Roman Catholic Parish of St. Henry's.

Brooklyn, N. Y.—Bids will be received Mar. 30 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for erecting school No. 47; also for installing ventilating and heating apparatus in school No. 142.

Rochester, N. Y.—Bids will be received Mar. 27 by the Bd. of Educ. for erecting a school on Hickory and Gregory Sts. J. Foster Warner, Archt.; John B. Mullan, Secy.

New York, N. Y.—Bids will be received Mar. 30 by C. B. J. Snyder, Supt. of School Bldgs., for installing passenger elevators in Morris High School, Boro. Bronx.

Long Island City, N. Y.—Bids will be received Mar. 30 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for erecting school No. 84, Boro. Queens.

New Brighton, S. I., N. Y.—Bids will be received Mar. 30 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing, ventilating and heating apparatus, in Richmond Boro. High School No. 1.

Schenectady, N. Y.—The City Council is stated to have authorized the issue of $140,000 bonds for erecting schools in Brandywine Ave. and E. Liberty St.

Batavia, N. Y.—The Citizens are stated to have decided to erect a school at Washington and Jefferson Aves., to cost $20,000.

Wahpeton, N. D.—The Legislature is stated to have passed a bill establishing a State Scientific School. A building will be erected at once at a cost of $30,000.

Weatherford, O. T.—H. J. Vandenburg, of Guthrie, is stated to have received the contract for the erection of the Southwestern Normal School, for $34,765.

Columbus, O.—The Bd. of Trus. of the Ohio State Univ. is stated to have awarded the contract for the erection of the Engineering building to D. W. McGrath, 1079 Summit St., for $73,883.

Cincinnati, O.—Bids are wanted Apr. 6 for building retaining walls at the 22d Dist. Chase and Lincoln Schools. Jacob E. Cormany, Chmn. Bldg. Com.

Philadelphia, Pa.—The contract is stated not to have been let for the Manual Training School as the bids were in excess of the appropriation. Kendrick & Roberts are stated to have submitted the lowest bid, $303,777.

Philadelphia, Pa.—Cope & Stewardson, 320 Walnut St., are stated to have been selected to prepare plans for the Wharton School of Finance and Economy for the Univ. of Pennsylvania; probable cost, $250,000.

Pittsburg, Pa.—Bids are wanted Mar. 24 for erecting an addition to the Colfax school No. 5. Willis A. Booth, Pres., Colfax Sub-school Dist.

Oshkosh, Wis.—It is stated that a school will be erected in the 13th Ward at a cost of $25,000.

Whitewater, Wis.—The Catholic Society is reported to be planning to erect a $40,000 school. Rev. M. E. Downs, Pastor.

Plymouth, Wis.—Bids are wanted Mar. 23 for erecting a school. H. J. Rooney, Secy.

STREET CLEANING AND GARBAGE DISPOSAL.

Indianapolis, Ind.—Local press reports state that bids will be received by the Bd. of Pub. Wks. Mar. 27 (readvertisement) for street sprinkling for 3 yrs.

Springfield, Mass.—Local press reports state that bids will be received until Mar. 25 by Supt. of Streets Adams, for watering the street in Indian Orchard.

Rochester, N. Y.—Geo. Bantel, 82 Driving Park Ave., is stated to have secured the contract for sprinkling the streets for 1903, at $35,959.

Philadelphia, Pa.—See "Paving."

Lancaster, Pa.—Bids will be received Mar. 26 by the Sanitary Com. for collecting garbage from residences for a term of 1 year, commencing May 1, 1903. E. S. Smeltz, City Clk.

GOVERNMENT WORK.

Mobile, Ala.—M. T. Lewman & Co., of Louisville, Ky., are stated to have secured the contract for work to be done on Warrior and Tombigbee Rivers (bids opened Feb. 28) for about $737,491.

Ft. Smith, Ark.—The following bids were opened at Treas. Dept., Washington, D. C., on Mar. 10 for construction (except heating and elevator) of extension to U. S. Court House and Post Office at Ft. Smith, Ark.: M. Yeager's Son, Danville, Ill., $83,060; Dieter & Wetzel, Joplin, Mo., $74,664; Congress Constr. Co., Chicago, Ill., $78,793.

San Francisco, Cal.—Bids are wanted Apr. 6 for constructing 2 storehouses at the Presidio of San Francisco. C. P. Miller, Ch. Q. M.

Bids are wanted Apr. 9 for dredging in Redwood Creek, Cal. Lieut.-Col. W. H. Heuer, Corps Engrs., U. S. A.

Ft. Rosecrans, Cal.—See "Power Plants, Gas and Electricity."

Ft. Pickens, Fla.—Bids are wanted Mar. 28 for constructing 5 cisterns at this post. W. E. Cole, Q. M., Ft. Barrancas.

Indianapolis, Ind.—See "Sewerage and Sewage Disposal."

Portland, Me.—The following bids for dredging and rock excavation in Carvers Harbor, Me., were received by Maj. S. W. Roessler, Corps Engrs., U. S. A., Mar. 12—*a*, 127,000 cu. yds. dredging, meas. in scow, price per cu. yd.; *b*, boulders exceeding 5 tons, price per ton; *c*, 24½ cu. yds. ledge, lump sum: Simon J. Donovan, Boston, Mass., *a*, 20 cts.; *b*, $10; *c*, $500. Eastern Dredging Co., Portland, *a*, 14¾ cts.; *b*, $5; *c*, $563.

Ft. McKinley, Me.—The contract for plumbing in 11 public bldgs. at this post (bids opened Mar. 2) has been awarded to Burnham & Stevens, of Boston, Mass., for $8,988. Capt. A. W. Yates, Q. M., Portland.

Annapolis, Md.—Prof. O. G. Dodge, U. S. N., in charge of the improvements at the Naval Academy, is reported to have had specifications completed for dredging the harbor leading from Chesapeake Bay to the Naval Academy at an estimated cost of $200,000. Bids will soon be asked.

Boston, Mass.—See "Power Plants, Gas and Electricity."

Kalamazoo, Mich.—Bids for erecting the addition to the U. S. Post Office have been extended from Mar. 24 to Apr. 9. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Grand Rapids, Mich.—The following bids for repair of piers at (*a*) White Lake, Mich.; (*b*) repair of piers and revetment at Charlevoix, and (*c*) Pentwater, Mich., were received by Capt. Chas. Keller, Corps Engrs., U. S. A., Mar. 4: Smith, Burk & Nelson, *a*, $6,658; *b*, $9,835; *c*, $7,970. Hollenbeck & Smith, *a*, $7,197. Archibald J. Beauvais, *a*, $8,218; *b*, $8,965; *c*, $8,252. Isaac F. Geer, Saugatuck, Mich., *a*, $8186. T. J. Bennett & Co.Co., *b*, $10,896; *c*, $8,944. Robt. Millen & Co., *c*, $8,299. Bidders of Muskegon unless otherwise mentioned.

The following bids for dredging harbors on east shore of Lake Michigan were received by Capt. Chas. Keller, Corps Engrs., U. S. A., Mar. 11, price given per cu. yd.: The Lydon & Drews Co., Chicago, Ill., bid 16½ cts. and 14 cts.; Linnsen & Lutz Towing & Dock Co., Chicago, Ill., 16¾ cts.; The Fitz Simons & Conaell Co., Chicago, Ill., 17½ cts. and 12½ cts.; Samuel O. Dixon, Milwaukee, Wis., 18½ cts. and 13½ cts.; W. S. Edward, Sault Ste. Marie, Mich., 15 cts.; Wm. E. Rooney, Toledo, Ohio, 18 cts.

St. Paul, Minn.—The following bids were opened on Mar. 7 at Treas. Dept., Washington, D. C., for alterations to U. S. Custom House at St. Paul: Chas. L. Koogham, $102,300; Timothy Riordan, $105,000; P. M. Hennessey, $98,000; Geo. J. Grant, $99,700; Butler Bros., $99,500; Newman & Hoy, $101,300. Bidders all of St. Paul.

Duluth, Minn.—The following bids were opened by Capt. D. D. Gaillard, Corps Engrs., U. S. A., Mar. 9 for concrete pier work, Superior Entry, Wis., amount proposed to be expended on this work, about $250,000—*a*, for building in place concrete South Pier complete, 43,000 cu. yds., price given per cu. yd.; *b*, excav. or refill. sand from or on the bottom of pier trench, 5,000 cu. yds., price given per cu. yd.; *c*, total: Lake Superior Contr. & Dredging Co., Duluth, Minn., *a*, $7.44; *b*, 30 cts.; *c*, $321,420. Porter Bros., Duluth, Minn., *a*, $9.10; *b*, 50 cts.; *c*, $393,800. Butler Bros., St. Paul, Minn., *a*, $10.15; *b*, $1; *c*, $441,450. Hugo & Tims, Duluth, Minn., *a*, $8.65; *b*, 50 cts.; *c*, $374,450. (All bids too high.)

Biloxi, Miss.—Bids are wanted Apr. 9 for dredging in harbor at Biloxi. Capt. Spencer Cosby, Corps Engrs., Mobile, Ala.

Buffalo, N. Y.—The U. S. Treas. Dept. of Washington, D. C., is stated to have selected a site on Main St. for the erection of the Marine Hospital. Plans for the building, to cost about $100,000, will probably be prepared at once.

Tompkinsville, N. Y.—Bids are wanted Apr. 2 for erecting an ice breaker, and repairing the pier at the Coxsackie Light Station, Hudson River, N. Y. Maj. Wm. T. Rossell, U. S. A., Engr. 3d Light House Dist.

Wilkesbarre, Pa.—The lowest bid opened at Washington, D. C., on Mar. 11 for the low pressure steam heating apparatus for U. S. Post Office at Wilkesbarre, was submitted by H. Sandmeyer & Co., of Peoria, Ill., for $4,190.

Ft. Mansfield, R. I.—Bids are wanted Apr. 10 for laying water main from Watch Hill to and around Post Ft. Mansfield, R. I. Address Constructing Quartermaster, 27 Granite St., New London, Conn.

Pineridge, S. D.—Bids are wanted Apr. 15 for furnishing and delivering a quantity of building material at the Pineridge Agency. Address John R. Brennan, U. S. Indian Agent.

Janesville, Wis.—The lowest bid opened on Mar. 12 at Washington, D. C., for the steam heating apparatus for the U. S. Post Office at Janesville was submitted by E. J. McDonough & Co., of Chicago, Ill., for $2,956.

Haines, Alaska.—The lowest bid opened Mar. 5 for constructing, including heating, plumbing and gas piping, of about 20 buildings at the new army post on Portage Cove, Haines, is stated to have been submitted by Bonell, Cornell & Estes, of Tacoma, Wash., for $314,541.

Sitka, Alaska.—Bids are wanted June 1 for building an extension to the coaling plant at Japonski Islands, Sitka. R. B. Bradford, Ch. of Bureau of Equipment, Navy Dept., Washington, D. C.

Cavite, P. I.—The following bids were opeaed at the Navy Dept., Washington, D. C., Mar. 14 for the construction of a steel floating drydock for the Naval Station at Cavite: The Maryland Co. bid $1,085,000 for dock complete. The other bidders were the U. S. Shipbuilding Co., of Jersey City, N. J., $1,443,000, and the Chauncey N. Dutton Co., of New York, N. Y., $1,105,000.

NEW INDUSTRIAL PLANTS.

The Crookston, Minn., Milling Co. is being organized to build a mill to have a daily capacity of 300 bbls. The power will be electricity. S. M. Sivertson, Red Lake Falls, Minn., is interested.

The Farmers' Cotton Oil & Fertilizer Co., Toccoa, Ga., is putting in a cottonseed-oil mill and expects to put in a small ice plant.

The William Howard Land & Lumber Co., Coeur d'Alene, Idaho, is having plans prepared for a sawmill.

The Empire Electric Co., Franklinville, N. Y., expects to install a 50 or 60-Kw. direct-connected, direct-current motor and an engine of about 80 or 100-H.-P. The company also expects to buy a large amount of wire.

McCoy & Alexander, Sisteraville, W. Va., expect to build a planing mill next fall, and will be in the market for a gas engine.

The Hatheway Mfg. Co., 95-97 Middle St., Bridgeport, Conn., will erect a factory to contain about 10,000 sq. ft. floor space and install a power plant of about 50-H.-P. capacity.

The Globe Grain & Milling Co., 925-931 East Third St., Los Angeles, Cal., is preparing to erect a plant in San Francisco to include two 600-bbl. flour mills, which, with the cleaning works, feed plant, etc., will require power of about 600-H.-P. It is intended to put in separate steam plants for each mill, using tandem compound engines of 300-H.-P. each. The company will be in the market for machinery within 60 days.

The Exchange Mill Co., Grafton, W. Va., expects to erect a 3-story, 40x90-ft. brick feed mill and will install a 50-H.-P. engine, a 3,000-lb. freight elevator and grain elevating and conveying machinery. The company is considering the use of a gas engine.

The Direct Separator Co., Syracuse, N. Y., will build a 32x208-ft. shop south of the Straight Line Engine Company's works, from which current will be obtained to run its motors.

The Winston, N. C., Handle Co. will purchase additional machinery and wants to secure a second-hand 30-H.-P. Westinghouse motor.

Pawling & Harnischfeger, Milwaukee, Wis., crane and hoist builders, have bought 19⅓ acres adjoining the C., M. & St. P. and the C. & N. W. Railroads, and will at once commence work on the erection of a modern plant.

The Westinghouse Air Brake Co. will at once begin the erection of a 320x65-ft. foundry of brick with steel frame, to be located west of the present air brake works at Wilmerding, Pa. Owing to the development of the traction brake business, the company's present foundry facilities have been overtaxed for some time past, and in order to insure greater efficiency in production and prompt delivery of material, it has become necessary to provide greater capacity. This addition to the plant will materially increase the company's working force, now numbering about 3,000 men.

Bids will be received by Geo. F. Hardy, Archt. and Engr., 309 Broadway, New York, for furnishing material and labor required for the construction of a paper pulp plant at Seven Islands, Que., for the North Shore Power Ry. & Navigation Co., as advertised in The Engineering Record.

The Akron, O., Brass Co. expects to erect a complete brass works, with pattern, foundry and machine departments.

The Yost Electric Mfg. Co., Toledo, O., will erect a new plant. The first building, to contain about 15,000 sq. ft. floor space, will be ready about May 1. A 25-H.-P. gas engine will be installed.

MISCELLANEOUS.

San Francisco, Cal.—The Bd. of State Harbor Comrs. is stated to have awarded to Robt. Wakefield the contract for constructing new ferry slip A, approach to same and the hoisting frame north, for $56,500.

Delphi, Ind.—Bids are wanted Mar. 28 for constructing a ditch in Carrollton Township. Jas. C. Smock, Co. Aud.

Baltimore, Md.—Bids will be received Apr. 1 by the Pd. of Awards for cement to be used on the work of the Electrical Comn. Chas. E. Phelps, Jr., Ch. Engr. Electrical Comn.

Baltimore, Md.—The Bd. of Pub. Improv. is stated to have authorized an expenditure of $50,000 to enlarge Wymans Park.

Boston, Mass.—The contract for piers at the North Ferry (bids opened Mar. 4) has been awarded to Lawler Bros., 16 City Sq., for $4,250. Jas. Donovan, Supt. of Sts.

Supt. of Sts. Donovan has awarded to John P. Cavanagh, of Boston, a contract, at $24,700, for building a sea wall and wharf on Roxbury Canal, at the paving division yard, Albany St.

Crookston, Minn.—It is stated that bids are wanted Mar. 25 for constructing Judicial Ditch No. 1, requiring about 600,000 cu. yds. of excavation, and Polk Co. Drainage Ditch, No. 35, requiring 54,000 cu. yds. of excavation. N. A. Hofford, Co. Aud.

New York, N. Y.—Bids will be received Mar. 27 by McDougall Hawkes, Comr. of Docks, for furnishing material for building a pier, with appurtenances, at E. 49th St., to be known as pier No. 99 E. R.

The following bids were opened by McDougall Hawkes, Comr. of Docks, Mar. 13 for erecting a recreation building on Pier 30, E. R.: Snare & Triest, 39 Cortlandt St., $121,253 (awarded contract); R. H. Hood Co., $129,700.

Brooklyn, N. Y.—Bids will be received Mar. 26 by Thos. W. Hynes, Comr. of Correction, for furnishing and delivering plumbing supplies, castings, etc.

Bids will be received Apr. 1 by J. Edw. Swanstrom, Boro. Pres., for furnishing, erecting, maintaining and illuminating street sign boxes and attaching same to electric light poles for a term of 1 year; also for furnishing, delivering and erecting (without maintaining or illuminating) street sign boxes and attaching same to lamp posts, both in the Boro. of Brooklyn; also for furnishing and delivering 4,150 cu. yds. clean, sharp sand, 1 portable concrete mixer with all accessories, 6,600 bbls. Portland cement, 7,310 sq. ft. granite bridgestone, 6,740 cu. yds. broken trap rock, 2,564 cu. yds. trap rock screenings, 1,066 cu. yds. paving gravel.

Hempstead, L. I., N. Y.—The contract for grading, pipe laying, etc., for the race track at Belmont Park was awarded Mar. 17 to the N. Y. Contracting & Trucking Co., 506 E. 20th St., N. Y. City.

York, Pa.—F. Van Hoffman, of New York, N. Y., is reported to be preparing plans for improvements at Penn and Farquhar Parks.

Williamsport, Pa.—J. F. Fisher, City Engr., has been requested to prepare plans for a system and method of construction for flood dykes on Lycoming Creek. There will be some excavation or dredging in creek bed.

Philadelphia, Pa.—Local press reports state bids will be received Mar. 23 by Dir. of Pub. Wks. Haddock for deepening the channel of the Schuylkill River.

La Crosse, Wis.—The Assembly Com. has favorably reported the bill permitting the La Crosse & Black River Falls R. R. Co. to dam Black River.

Falmouth, Jamaica.—Bids will be received by the Gov. of Jamaica until Apr. 20 for improving the harbor of Falmouth, including excavation and removing rock. Address Dir. of Pub. Wks., Kingston, Jamaica, W. I.

BUSINESS NOTES.

The Southern Cotton Oil Co., Savannah, Ga., has just placed an order with the New York Continental Jewell Filtration Co., New York City, for a large gravity type filtration plant. The following is an extract from a letter received by the filtration company from the City Treasurer of Chester, S. C.: "Yesterday we completed the installation of the filter, and pumped the first water through it; after a short run the water cleared up and the result is very satisfactory. The water, before passing into the filter, is highly colored by the clay in solution, and this coloring is entirely removed after passing through the filter."

The Atlantic City & Suburban Traction Co. is constructing an electric railway from the boardwalk at Atlantic City to Pleasantville, N. J., from which place the road will branch in two directions, one leading to Absecon and the other to Somer's Point, a total distance of approximately 18 miles. This road will operate 12 cars, each being equipped with four Westinghouse, 12-A motors, and five trail cars. The following electrical apparatus is also to be installed in the power house at Plessantville: Two 400-Kw., direct-current Westinghouse railway generators, running at 550 volts and 125 R.P.M., together with a switchboard, which will be of the standard Westinghouse railway type and consist of two generator panels—one load panel and four double feeder panels.

The International Harvester Co., Chicago, Ill., has recently placed an order with the Nernst Lamp Co. for 150 lamps in addition to several hundred already installed. The Western Tube Co. Kewanee, Ill., one of the first users of Nernst lamps, is now displacing all arc and incandescent lights in favor of the new illuminant.

The Engineering & Equipment Co., Bissell Block, Pittsburg, Pa., maker of electrical and mechanical supplies, desires catalogues for reference. Address Department N.

G. M. Gest, 277 Broadway, New York, has been awarded a contract for underground conduit work, having 186 ducts in one trench, in and around the L Street central station of the Edison Electric Illuminating Co., of Boston, and additional contracts by the Brooklyn Heights R. R. Co. for extensive underground conduit work along Flatbush Ave., Brooklyn.

The Allis-Chalmers Co., Chicago, reports the following among its engine sales for February, 1903: 1890 frame Reynolds-Corliss: Bucyrus Co., Milwaukee, a 16x42-in.; Albert Schwill & Co., Chicago, two 26x48-in. direct-connected; Denison, Tex., Light & Power Co., a 16x36-in.; Hartwell Bros., Chicago, a 16x42-in. Girder frame Reynolds-Corliss: Wausau Paper Co., Brokaw, Wis., a 16x36-in.; Vulcan Iron Works, San Francisco, a 14x36-in.; S. Obermayer Co., Cincinnati, a 20x48-in.; Javril Co., Battle Creek, Mich., a 12x30-in.; James Davidson, West Bay City, Mich., a 16x42-in. Southwestern Missouri El. Ry. Co., Webb City, Mo., a 30 and 60x48-in. horizontal cross compound direct-connected Reynolds-Corliss; Union Electric Light & Power Co., St. Louis, a 12x16-in.; Geo. M. Moulton & Co., Chicago, a 21 and 48x48-in steeple compound Reynolds-Corliss; Louisville, Ky., Ry. Co., two 40 and 78x60-in. vertical, cross-compound, direct-connected Reynolds-Corliss; Albuquerque, N. M., Gas, Electric Light & Power Co., a 16 and 28x36-in. horizontal, cross-compound, direct-connected Reynolds-Corliss; Chicago File & Rasp Co., a second-hand, 14x42-in. right hand F. & C. Corliss; Denver Engineering Works, two single, differential, electric-driven Riedler pumps.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Hull House, Chicago, engine for a direct-connected unit; Duquesne Brewing Co., a 125-H.-P., direct-connected unit consisting of a Ball engine and a Westinghouse generator.

The Hammond Iron Works, Warren, Pa., makers of steam boilers, stacks, etc., are erecting an 82x196-ft. building to be equipped with electric crane and other machinery. All contracts have been let.

The large turbines of the water-power plant at Massena, N. Y., were coated with preservative paint No. 700-B of the National Paint Works, Williamsport, Pa.

The Trinidad Asphalt Mfg. Co., St. Louis, Mo., has been awarded the contract by Caldwell & Drake, general contractors, for the roofing of the Agricultural Building of the World's Fair in St. Louis. This contract will require 1,000,000 sq. ft. of roofing and the company's rubber feltine silicacont roofing will be used. The company also has contracts for many of the other large buildings at the fair grounds.

The offices of the Pittsburg, Pa., Filter Mfg. Co. have been removed to the Farmers' Bank Building.

The Milwaukee, Wis., Bridge Co. has bought 15½ acres, and will erect a structural steel plant to be ready July 1 and employ 500 men. All contracts for machinery have been let.

The King Bridge Co., Cleveland, O., has been awarded the contract for eleven plate-girder bridges for the Lake Erie & Western Ry. Co., plans for which were prepared by the Osborn Engineering Co., of Cleveland.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Mar. 23.	Pipe, etc., Great Falls, Mont.	Mar. 21
Mar. 23.	Reservoir, Colorado Springs, Colo.	Mar. 21
Mar. 23.	Perth Amboy, N. J., Adv. Mar. 14.	Mar. 14
Mar. 24.	New York, N. Y.	Mar. 21
Mar. 24.	Altoona, Pa.	Mar. 21
Mar. 24.	Reading, Pa.	Mar. 21
Mar. 24.	Camden, N. J.	Mar. 21
Mar. 24.	Harrisburg, Pa.	Mar. 21
Mar. 24.	Philadelphia, Pa.	Mar. 21
Mar. 24.	St. Louis, Mo.	Mar. 14
Mar. 24.	Engine, Allentown, Pa. Adv. Mar. 14.	Mar. 14
Mar. 24.	Atlantic City, N. J., Adv. Mar. 14.	Mar. 14
Mar. 24.	Pipe, etc., Williamsburg, Mass. Adv. Mar. 7.	Mar. 7
Mar. 24.	Dams, etc., Williamsburg, Mass. Adv. Mar. 7.	Mar. 7
Mar. 25.	Lexington, Mass.	Mar. 21
Mar. 25.	Geary, Okla. Ter.	Mar. 21
Mar. 25.	Lancaster, O.	Mar. 7
Mar. 26.	Pipe, etc., Falmouth, Mass. Adv. Mar. 21.	Mar. 21
Mar. —	Alcester, S. D.	Feb. 21
Apr. 1.	Boulder, Colo.	Mar. 21
Apr. 1.	Christianburg, Va.	Mar. 21
Apr. 1.	Clearfield, Pa.	Mar. 14
Apr. 1.	Toronto, Ont., Adv. Feb. 28 to Mar. 14.	Feb. 28
Apr. 2.	Yonkers, N. Y.	Mar. 21
Apr. 2.	Brooklyn, N. Y.	Mar. 21
Apr. 3.	Cleveland, O.	Mar. 14
Apr. 3.	Brookville, O.	Mar. 14
Apr. 6.	Fargo, N. D.	Mar. 14
Apr. 7.	Biloxi, Miss.	Mar. 21
Apr. 7.	Truman, Minn.	Mar. 21
Apr. 20.	Oakland City, Ind.	Mar. 21
May 1.	Chinook, Mont.	Feb. 7
———	Meters, Schenectady, N. Y.	Dec. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Mar. 23.	Wheeling, W. Va.	Mar. 21
Mar. 23.	Harrisburg, Pa.	Mar. 21
Mar. 23.	Philadelphia, Pa.	Mar. 21
Mar. 24.	New Britain, Conn., Adv. Mar. 7 to 21.	Mar. 7
Mar. 24.	Chicago, Ill.	Mar. 21
Mar. 24.	Springfield, Mass.	Mar. 21
Mar. 25.	Brooklyn, N. Y., Adv. Mar. 14, 21.	Mar. 14
Mar. 25.	Kansas City, Mo.	Mar. 21
Mar. 26.	Baraboo, Wis.	Mar. 21
Mar. 26.	Connersville, Ind.	Mar. 14
Mar. 26.	Cincinnati, O.	Mar. 7
Mar. 27.	Troy, N. Y.	Mar. 21
Mar. 28.	Keokuk, Ia.	Mar. 21
Mar. 28.	Lakewood, O.	Mar. 7
Mar. 30.	Toledo, O.	Mar. 21
Mar. 30.	Corry, Pa.	Mar. 14
Mar. 30.	South Bethlehem, Pa. Adv. Feb. 28 to Mar. 21.	Feb. 28
Mar. 30.	Marshfield, Wis.	Feb. 21
Apr. 1.	Tacoma, Wash.	Mar. 14
Apr. 2.	Cleveland, O.	Mar. 14
Apr. 2.	Cincinnati, O.	Mar. 14
Apr. 3.	Salem, O.	Mar. 14
Apr. 6.	Madrid, Ia.	Mar. 14
Apr. 6.	Canton, O.	Feb. 28
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. —	Crookston, Minn.	Feb. 21
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
———	Port Huron, Mich.	Mar. 14
	BRIDGES.	
Mar. 23.	Pontiac, Mich.	Mar. 21
Mar. 23.	New York, N. Y.	Mar. 14
Mar. 25.	Philadelphia, Pa.	Mar. 21
Mar. 25.	Plymouth, Wis.	Feb. 14
Mar. 26.	New York, N. Y.	Mar. 21
Mar. 26.	Chatham, Ont.	Feb. 21
Mar. 27.	Washington, D. C., Adv. Feb. 7 to 28.	Feb. 7
Mar. 28.	Connellsville, Ind.	Mar. 21
Mar. 28.	Roby, Tex.	Mar. 14
Mar. 30.	Washington, D. C., Adv. Mar. 7 to 21.	Mar. 7
Apr. 1.	Atlantic City, N. J.	Mar. 14
Apr. 2.	Erie, Pa., Adv. Mar. 21.	Mar. 21
Apr. 6.	Petrolea, Ont.	Mar. 21
Apr. 6.	Grand Forks, N. D.	Mar. 21
Apr. 7.	New York, N. Y.	Mar. 21
Apr. 13.	San Bernardino, Cal.	Mar. 21
Apr. 14.	Columbus, O.	Mar. 14
	PAVING AND ROADMAKING.	
Mar. 23.	New York, N. Y.	Mar. 14
Mar. 23.	Newburgh, N. Y., Adv. Feb. 7 to Mar. 14.	Jan. 31
Mar. 24.	St. Louis, Mo.	Mar. 14
Mar. 24.	Red Oak, Ia.	Mar. 21
Mar. 25.	New York, N. Y.	Mar. 21
Mar. 25.	Chicago, Ill.	Mar. 21
Mar. 25.	Philadelphia, Pa.	Mar. 21
Mar. 25.	Meadville, Pa.	Mar. 21
Mar. 25.	Kansas City, Mo.	Mar. 21
Mar. 25.	Cohoes, N. Y. Adv. Mar. 14.	Mar. 14
Mar. 26.	Newark, N. J.	Mar. 21
Mar. 26.	Nashville, Tenn.	Mar. 14
Mar. 27.	Melrose Park, Ill.	Mar. 21
Mar. 27.	Des Moines, Ia.	Mar. 14
Mar. 28.	Lakewood, O.	Mar. 7
Mar. 30.	Toledo, O.	Mar. 14
Mar. 30.	Buckingham, Que.	Mar. 14
Mar. 30.	Toledo, O.	Mar. 7
Mar. 31.	Beloit, Wis.	Mar. 21
Mar. 31.	Waukesha, Wis.	Mar. 14
Mar. 31.	Toms River, N. J.	Mar. 7
Mar. —	San Diego, Cal.	Jan. 31
Apr. 1.	Brooklyn, N. Y.	Mar. 21
Apr. 1.	Dunkirk, N. Y.	Mar. 14
Apr. 3.	Salem, O.	Mar. 14
Apr. 4.	Greenville, O.	Mar. 14
Apr. 6.	Williamsport, Ind.	Mar. 21
Apr. 6.	New Bedford, Mass., Adv. Mar. 7, 14.	Mar. 7
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. 7.	Celina, O.	Mar. 21
Apr. 10.	Windsor, Ont.	Mar. 14
Apr. 10.	Tacoma, Wash.	Mar. 14
Apr. 13.	Toledo, O.	Mar. 21
Apr. 15.	Traverse City, Mich., Adv. Mar. 14, 21.	Mar. 14
Apr. 18.	Findlay, O.	Mar. 21
Apr. 18.	Evansville, Ind.	Mar. 14
Apr. 21.	Shawnee, Okla. Ter., Adv. Mar. 21.	Mar. 21
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
———	Ogden, Utah	Jan. 31
	POWER, GAS AND ELECTRICITY.	
Mar. 23.	Atlanta, Ga.	Mar. 21
Mar. 23.	Southampton, N. Y.	Mar. 21
Mar. 24.	Lancaster, Pa.	Mar. 21
Mar. 24.	Philadelphia, Pa.	Mar. 21
Mar. 25.	Ashton, Ill.	Mar. 14
Mar. 28.	Washington, D. C. (2 Advs.) Adv. Mar. 21.	Mar. 21
Mar. 30.	Mankato, Minn.	Mar. 21
Mar. 31.	Binghamton, N. Y.	Feb. 28
Apr. 1.	Quincy, Ill.	Mar. 21
Apr. 2.	Boston, Mass.	Mar. 21
Apr. 4.	Ft. Pickens, Fla.	Mar. 21
Apr. 6.	Webster Groves, Mo.	Mar. 21
Apr. 6.	Berkeley, Cal.	Mar. 21
Apr. 7.	Copenhagen, Denmark	Feb. 28
Apr. 7.	Oneida, N. Y.	Feb. 7
Apr. 8.	Ft. Rosecrans, Cal.	Mar. 21
———	Hyattsville, Md.	Jan. 31
———	Franchise, Vicksburg, Miss.	Jan. 17
———	Burlingame, Kan.	Jan. 10
	GOVERNMENT WORK.	
Mar. 23.	Wheeling, W. Va. Adv. Feb. 28 to Mar. 21.	Feb. 21
Mar. 24.	Kalamazoo, Mich., Adv. Feb. 21, 28.	Feb. 21
Mar. 25.	New York, N. Y. Adv. Feb. 28 to Mar. 21.	Feb. 28
Mar. 25.	Galveston, Tex.	Feb. 28
Mar. 26.	Boston, Mass.	Mar. 7
Mar. 26.	Ft. Monroe, Va.	Mar. 7
Mar. 27.	Wheeling, W. Va. Adv. Feb. 28 to Mar. 14.	Feb. 28
Mar. 27.	Sioux City, Ia., Adv. Feb. 28.	Feb. 28
Mar. 28.	Ft. Pickens, Fla.	Mar. 21
Mar. 28.	Ft. Bayard, N. Mex.	Mar. 14
Mar. 28.	New York, N. Y.	Mar. 7
Mar. 28.	Boston, Mass.	Feb. 28
Apr. 1.	Ft. Greble, R. I., Adv. Mar. 14.	Mar. 14
Apr. 1.	Grand Rapids, Mich., Adv. Mar. 7 to 21.	Mar. 7
Apr. 2.	Tompkinsville, N. Y.	Mar. 21
Apr. 2.	Wilmington, Del.	Mar. 14
Apr. 2.	Philadelphia, Pa., Adv. Mar. 7 to 21.	Mar. 7
Apr. 4.	Montgomery, Ala., Adv. Mar. 7 to 21.	Mar. 7
Apr. 4.	Charleston, S. C.	Feb. 28
Apr. 6.	San Francisco, Cal.	Mar. 21
Apr. 6.	Ft. Ethan Allen, Vt., Adv. Mar. 21.	Mar. 21
Apr. 6.	New York, N. Y., Adv. Mar. 21.	Mar. 21
Apr. 6.	Ft. Riley, Kan., Adv. Mar. 14, 21.	Mar. 14
Apr. 6.	Ft. Caswell, N. C., Adv. Mar. 14, 21.	Mar. 14
Apr. 6.	Minneapolis, Minn.	Mar. 14
Apr. 8.	Port Townsend, Wash., Adv. Mar. 21.	Mar. 21
Apr. 8.	Richmond, Ky.	Mar. 14
Apr. 9.	San Francisco, Cal.	Mar. 21
Apr. 9.	Mobile, Ala.	Mar. 14
Apr. 9.	Biloxi, Miss.	Mar. 21
Apr. 10.	Ft. Mansfield, R. I.	Mar. 21
Apr. 10.	Port Townsend, Wash., Adv. Mar. 21.	Mar. 21
Apr. 11.	Petoskey, Mich., Adv. Mar. 14, 21.	Mar. 21
Apr. 11.	Marquette, Mich., Adv. Mar. 14, 21.	Mar. 14
Apr. 11.	Chattanooga, Tenn., Adv. Mar. 7 to 21.	Mar. 7
Apr. 14.	Portland, Me., Adv. Mar. 21.	Mar. 21
Apr. 14.	Washington, D. C., Adv. Mar. 14, 21.	Mar. 14
Apr. 15.	New York, N. Y., Adv. Mar. 21.	Mar. 21
Apr. 15.	Ft. Greble, R. I., Adv. Mar. 21.	Mar. 21
Apr. 15.	Norfolk, Va.	Mar. 21
Apr. 15.	Pineridge, S. D.	Mar. 21
Apr. 17.	St. Augustine, Fla. Adv. Feb. 21, Mar. 7, 21.	Feb. 21
Apr. 20.	New York, N. Y., Adv. Mar. 21.	Mar. 21
Apr. 22.	Nashville, Tenn., Adv. Mar. 21.	Mar. 21
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 15.	Manila, P. I., Adv. Mar. 14, 21.	Mar. 14
	BUILDINGS.	
Mar. 23.	School, Plymouth, Wis.	Mar. 21
Mar. 23.	Pub. Bldgs., New York, N. Y.	Mar. 14
Mar. 24.	Capitol Bldg., Des Moines, Ia.	Mar. 21
Mar. 24.	School, Pittsburg, Pa.	Mar. 21
Mar. 24.	Church, Manningon, W. Va.	Mar. 21
Mar. 24.	School, Cambridge, Mass.	Mar. 14
Mar. 24.	School, Greenfield, Mass.	Mar. 14
Mar. 24.	Hospital, Cherokee, Ia.	Mar. 7
Mar. 25.	Engine House, Baltimore, Md.	Mar. 21
Mar. 25.	Library, Logansport, Ind.	Mar. 14
Mar. 25.	Church, Easton, Pa.	Mar. 14
Mar. 26.	Bus. Bldgs., Marion, Ind.	Mar. 21
Mar. 26.	School, Ames, Ia.	Mar. 7
Mar. 27.	School, Rochester, N. Y.	Mar. 21
Mar. 28.	Church, Johnsonburg, Pa.	Mar. 21
Mar. 28.	Church, Columbus, O.	Mar. 21
Mar. 28.	Htg. Hospital, Boston, Mass.	Mar. 21
Mar. 30.	School, Brooklyn, N. Y.	Mar. 21
Mar. 30.	School, New York, N. Y.	Mar. 21
Mar. 30.	School, Long Island City, N. Y.	Mar. 21
Mar. 30.	School, New Brighton, S. I. N. Y.	Mar. 21
Mar. 30.	School, Cleveland, O.	Mar. 7
Mar. 31.	Pub. Budg., Alexandria, La.	Mar. 7
Mar. 31.	Court House, Billings, Mont.	Mar. 14
Apr. 1.	School, Bayonne, N. J.	Mar. 21
Apr. 1.	Hospital, Charlottetown, P. E. I.	Mar. 21
Apr. 1.	Residence, Cheyenne, Wyo.	Mar. 21
Apr. 1.	Hotel, Dayton, O.	Mar. 14
Apr. 1.	School, Grand Forks, N. D.	Mar. 7
Apr. 1.	Hospital, Muskegon, Mich.	Feb. 28
Apr. 1.	Elevators in bus. bldgs., Tacoma, Wash.	Feb. 21
Apr. 2.	Pub. Bldg., Columbus, O.	Mar. 21
Apr. 2.	School, St. Paul, Minn.	Mar. 21
Apr. 2.	Hotel, Bemidji, Minn.	Feb. 21
Apr. 3.	Hospital, Columbus, O.	Mar. 14
Apr. 4.	Jail, Louisville, Ky.	Mar. 14
Apr. 4.	School, Mayville, N. D.	Mar. 14
Apr. 6.	School, Cincinnati, O.	Mar. 21
Apr. 6.	Library, Eau Claire, Wis.	Mar. 21
Apr. 6.	School, Cleveland, O.	Mar. 14
Apr. 7.	Court house, Webster, S. D.	Mar. 21
Apr. 7.	Jail, Morristown, Tenn.	Feb. 28
Apr. 9.	Htg. System in Pub. Bldg., Xenia, O. Adv. Mar. 21.	Mar. 21
Apr. 9.	Htg. Court house, Centerville, Ia.	Mar. 21
Apr. 15.	Court house, Corsicana, Tex.	Mar. 14
May 1.	Court house, Abbeville, Ga.	Mar. 21
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21.	Mar. 21
———	Court house, Wray, Colo.	Mar. 21
	MISCELLANEOUS.	
Mar. 23.	Dredging, Philadelphia, Pa.	Mar. 21
Mar. 24.	Ditch, Rockwell City, Ia.	Mar. 7
Mar. 25.	St. Sprinkling, Philadelphia, Pa.	Mar. 21
Mar. 25.	El. Ry., Youngstown, O.	Mar. 14
Mar. 25.	St. Sprinkling, Mass.	Mar. 21
Mar. 26.	Supplies, Brooklyn, N. Y.	Mar. 21
Mar. 26.	Garb. Disp., Lancaster, Pa.	Mar. 21
Mar. 27.	St. Sprinkling, Indianapolis, Ind.	Mar. 21
Mar. 27.	Pier, New York, N. Y.	Mar. 21
Mar. 28.	Ditch, Delphi, Ind.	Mar. 21
Mar. 30.	Ry. franchise, Oakland, Cal.	Mar. 7
Mar. —	R. R. Work, Creede, Colo.	Jan. 10
Apr. 1.	Cement, Baltimore, Md.	Mar. 21
Apr. 1.	Supplies, Brooklyn, N. Y.	Mar. 21
Apr. 9.	Hospital Equip., Johnson City, Tenn. Adv. Mar. 21.	Mar. 21
Apr. 13.	St. Ry. franchise, Los Angeles, Cal.	Mar. 21
Apr. 13.	El. Ry. franchise, Whittier, Cal.	Mar. 14
Apr. 14.	R. R. Work, Beckley, W. Va.	Mar. 21
May 2, '04	R. R., Oodnadatta, So. Australia.	Feb. 21
———	Cement, Ill.	Feb. 21
———	R. R. work, Cincinnati, O.	Dec. 20

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The Dirt Road.

In the course of an examination of a cross-country electric railway in Massachusetts last summer, The Engineering Record's representative saw a large steam roller and gang of men working on a road near the electric line. As such indications of advanced civilization in the heart of an agricultural country are always interesting to anyone in sympathy with the hard lot of a farmer, advantage was taken of the earliest opportunity for investigating the work. The road was of the dirt type, excellent to ride over when in the proper condition, but bad when muddy or dry. The repairs were made by a gang of paid laborers, and not by men working out their road taxes. The ditches were being cleaned out, and the dirt from them was thrown on the roadway where it was leveled off by hand. Over this mess there was dumped a quantity of alleged gravel, and then the steam roller was put into action. The gravel was merely coarse sand, with hardly a pebble as large as a bean. It was hauled over two miles from a pit where two handlings were necessary to place it in the carts, so that its cost delivered on the road must have been over 50 cents a yard. The result of this work was wretched of course. One place about an eighth of a mile long, completed a fortnight before, had passed through the test of a heavy storm, and what parts of the sand and silt that were not washed into the ditches were lying in a loose mass, without coherence, giving out a cloud of dust whenever a carriage passed over the road.

A few weeks ago The Engineering Record saw a report on the road work in this town. It is a typical community in Central Massachusetts, with the houses widely separated on roads straggling uncertainly in every direction over a hilly country where the main products of industrious farming are only boulders and indigestion, with a little hay. In the hard struggle for existence on such a poor soil, the public spirit that makes an attempt at good road building is as praiseworthy as the methods adopted were blameworthy. The report shows a very large mileage of roads within the town limits, as the scattered condition of the houses renders necessary. The annual appropriation for road building is a liberal one when the resources of the taxpayers are considered, yet it is only a trifle over $18 per mile of road. It is useless to talk of macadam at $4,000 a mile for such a community; to lay half a mile of such highway would cut off every other part of the system of roads from needed repairs.

This case may be taken as one typical of many towns, where the people are willing to do their best, but where the resources are pitifully inadequate to the needs. It is a case where the preacher of thick macadam simply spreads useless ideas, and leads the taxpayers into wasting the scanty appropriation they can afford in the hopeless endeavor to make a decent roadway of ditch refuse and sand. The uselessness of endeavoring to consolidate such stuff with a heavy steam roller is, however, exceeded by the pity of the whole affair. It was simply another attempt to copy blindly a few of the principles long and earnestly advocated by builders of stone and gravel roads. These zealous farmers did not understand that the principles on which a successful stone road is built fail when separated and applied only in part to a road of hardpan and sand.

Many years ago The Engineering Record told its readers about the extraordinary success of the thin macadam laid at $2,000 a mile at Bridgeport, Conn., where the good results of the method of construction led to its continuance to the present time. Mr. Harriman is building many miles of such roads near Tuxedo, and similar work is going on elsewhere. But even these roads are too expensive for many localities, and The Engineering Record earnestly hopes that the attention paid to dirt roads in New York by the State Engineer and his staff is but an indication of more widespread consideration of the subject by those in authority. For years Prof. Ira O. Baker has been calling attention to this need, and for a long time his voice was that of one crying in the wilderness, for all the good that came of it. Persistency has told, however, and he may well feel satisfied at the increasing intelligence of communities which are purchasing scrapers, rollers and suitable carts, and are using them properly to improve the formerly derided dirt road. It is still with us, but the increased knowledge of the men who maintain it and the admirable plant for the purpose now obtainable at low cost, are redeeming its character.

The Ventilation of Subways received the consideration of the Board of Health of the Department of the Seine, France, last fall, and apropos of the discussion in these columns, it will be interesting to record the results of observations by M. Haller, printed in the transactions of the board, October 31. From a large number of analyses of air in the tunnels and cars of the Metropolitan railway, it was found that the carbonic acid gas present varied from 4.25 to 21.4 parts in 10,000, generally from 10 to 17 in crowded cars. The average difference between the temperature out of doors and that in the cars was about 14 degrees Fahr. M. Haller concluded that the only remedy lay in mechanical means—shafts provided with fans—and that it would be expedient to enlarge the windows and supply electric fans in the cars.

The Manhattan Valley Viaduct of the New York Rapid Transit Railroad.

The west side lines of the New York Rapid Transit Railroad emerge from the subway structure at 103d Street and are carried north over the Manhattan Valley by a steel viaduct 2,174 feet in total length, which reaches from 125th Street to 133d Street and carries three lines of track over Broadway and intersecting streets with a minimum clearance for the tower bents, of 12½ feet above the top of rail of the surface tracks and a maximum height of about 54 feet from base of rail to surface of ground. At both ends the viaduct terminates with a solid fill between masonry retaining walls, and about 450 feet beyond the northern extremity the tracks again enter the subway. The ground slopes with comparative regularity from both ends of the viaduct where the base of rail is only about 15 feet above its surface to Manhattan Avenue, where the depression is greatest and the street is crossed by a 168½-foot arch span. This span is located symmetrically with the center of the station which it supports, and is designed to be the central feature of the steel construction, to present lines consonant with an attractive effect, and to avoid unnecessary obstruction to the street or blemish to the landscape.

On each side of the main span the structure consists of steel towers crossed and connected by alternate short and long span plate girders. At the north end of the span there are ten viaduct towers and at the south end there are five. Beyond these towers the height of the structure is so much diminished that the spans are carried on single transverse bents, as shown at the south end of the general elevation which corresponds to the north end and in which two braced towers and two single bents have been omitted to save space in the figure. The viaduct is a deck structure, except the end spans, which are made through to secure head room below, and are supported on masonry piers and retaining walls which join the embankment, as shown in the elevation.

The station over the arch span is not an enclosed structure and merely consists of a passenger platform about 386 feet long and 12 feet wide on the outside of each outer track. These platforms overhang the trusses and viaduct columns 4½ feet and are sheltered by double cantilever steel canopies about 12 feet wide and 10 feet high. They are 4 feet above the base of rail and are carried on pairs of light lattice-girders 5 feet deep. The platforms are separately accessible by stairs and by escalators at the south ends, which carry passengers both up and down. This part of the viaduct is about 15 feet wider than the remainder from which it is accessible by stairs from the ends of the platforms to the narrow cantilever foot walks on each side of the main spans.

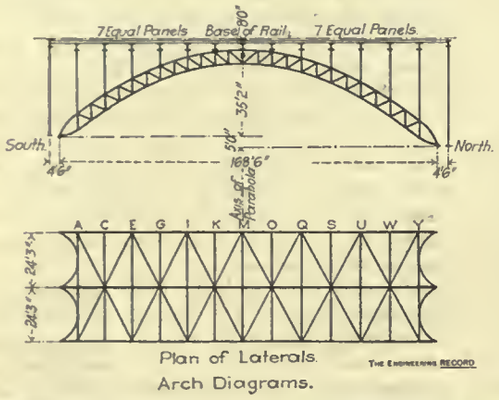
Each track is proportioned for a dead load of 330 pounds per linear foot and for a live load of 12,500 pounds per wheel on axles 5 feet apart in each pair, the pairs being alternately 27 feet and 9 feet apart, making the length from center to center of cars 46 feet, with a total load of 100,000 pounds. A traction load is assumed at 20 per cent. of the live load and in either direction, and a wind pressure of 500 pounds per linear foot is assumed over the whole structure. Longitudinal girders over 27 feet long and transverse girders have unit flange stresses of 10,000 pounds, longitudinal girders under 27 feet long and floor beams, 8,000 pounds per square inch. Shop rivets are proportioned for a bearing of 15,000 pounds and a shear of 7,500 pounds per square

inch; field rivets for 12,000 pounds and 6,000 pounds respectively.

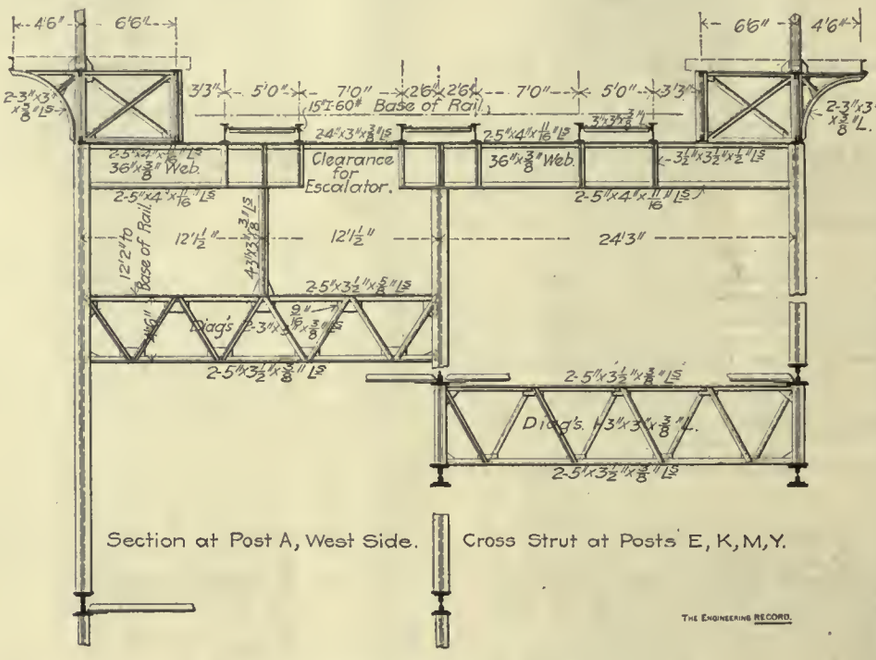
The towers at the ends of the arch span are essentially duplicates, each made with six vertical columns, three in each transverse bent X-braced with stiff diagonals and horizontal struts having riveted connections on all faces. The lower horizontal struts on all sides are latticed girders with horizontal top chords and curved bottom chords with a clearance of 12½ feet above the ground to allow for unrestricted traffic underneath. The columns have H-shaped cross sections made with a built I-beam having its flanges reinforced with channels. All connections to the braces are made with jaw plates shop-riveted across the faces of the columns and field-riveted to the ends of the struts. The tops of the columns are connected by transverse plate girders seated across their caps; to them are web-connected longitudinal plate girders and I-beam stringers to carry the track and platform as indicated in the general plan. Across the top of each tower there are six longitudinal plate girders about 3 feet deep and 5 feet apart on centers. The diagonal bracing struts are made with two pairs of 3x2½-angles latticed together back to back in I-shaped cross sections. The intermediate horizontal struts are made with 3x3-inch angles latticed together in box-shaped cross sections and are connected to them at intersections with wide flange cover-plates.

In the bent nearest the arch span on the south side, the transverse bracing is made special, and half of one panel is replaced, as shown, by a solid web plate stiffened with flange angles and pierced with large rectangular openings to give clearance for the escalator. This bracing does not occur in the other bent of the tower where both panels are like the one shown at the left in the elevation of bent No. 14, except that the lower end of one of the X-braces is omitted to give clearance for the escalator adjacent to the center column.

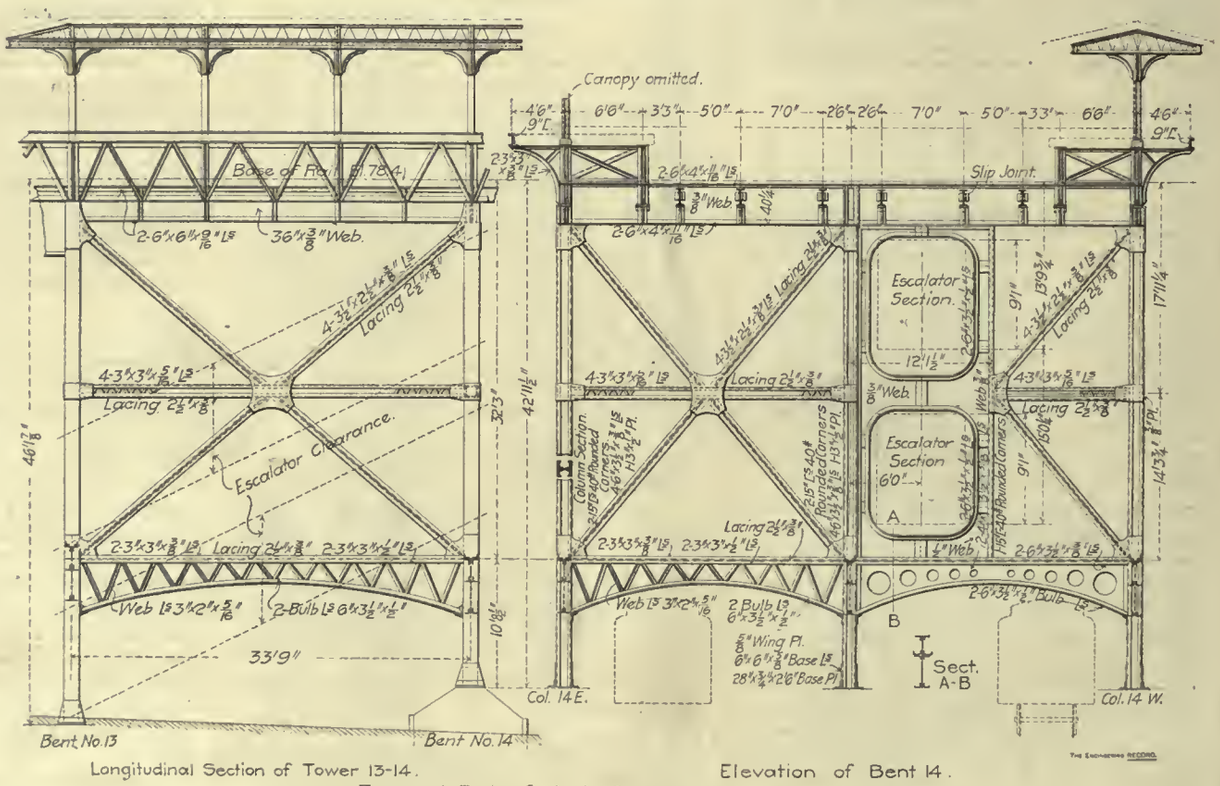
The arch span has three lattice-girder, two-hinge ribs 24¼ feet apart on centers. The



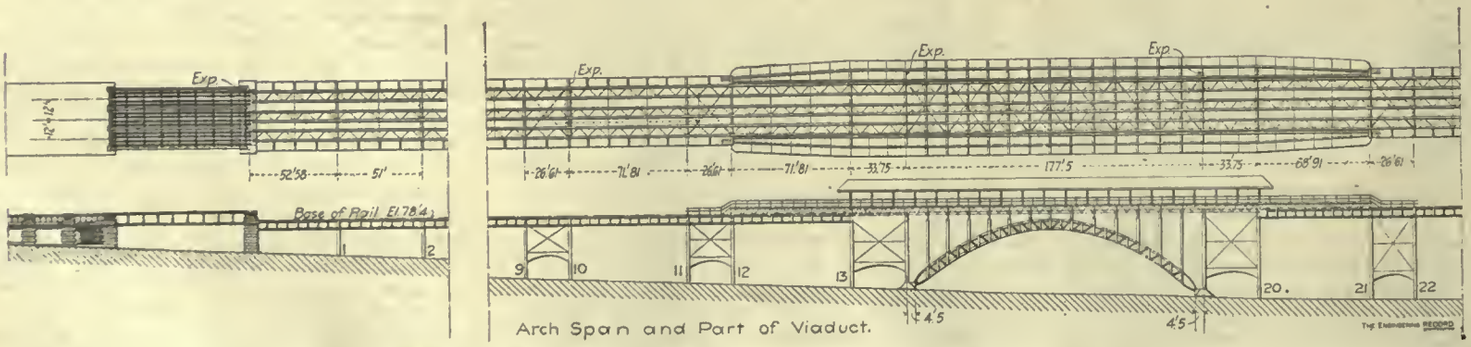
Plan of Laterals.
Arch Diagrams.



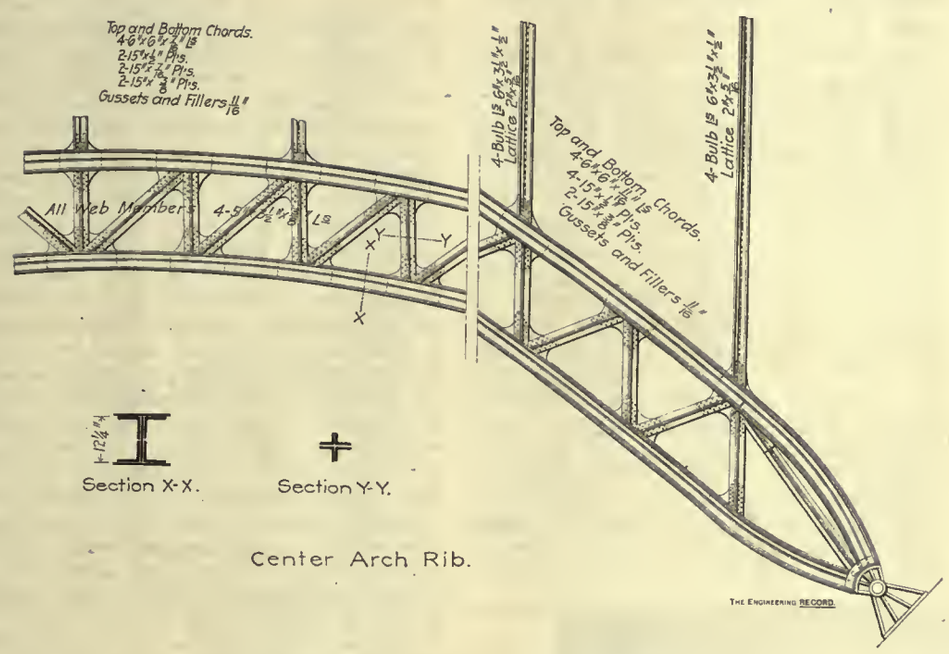
Half Sections of Arch Span.



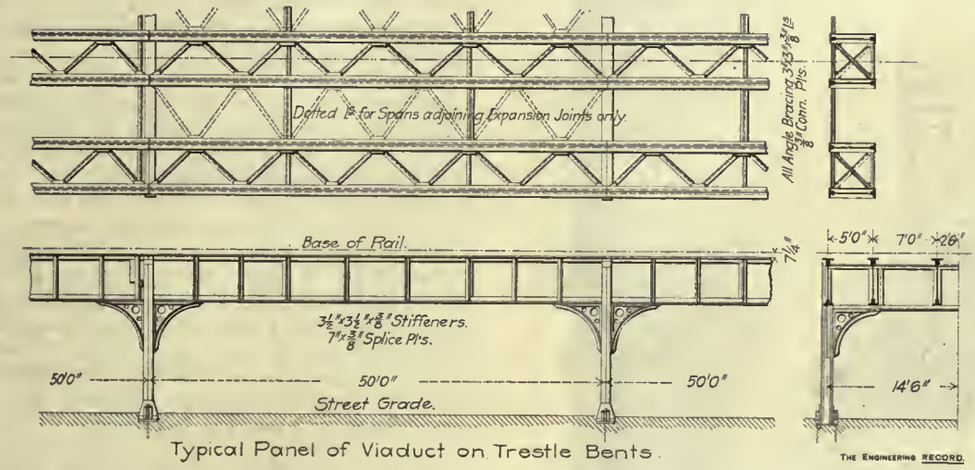
Longitudinal Section of Tower 13-14. Elevation of Bent 14.
Tower at End of Arch Span.



MANHATTAN VALLEY VIADUCT, ARCH SPAN AND TOWERS.



Center Arch Rib.

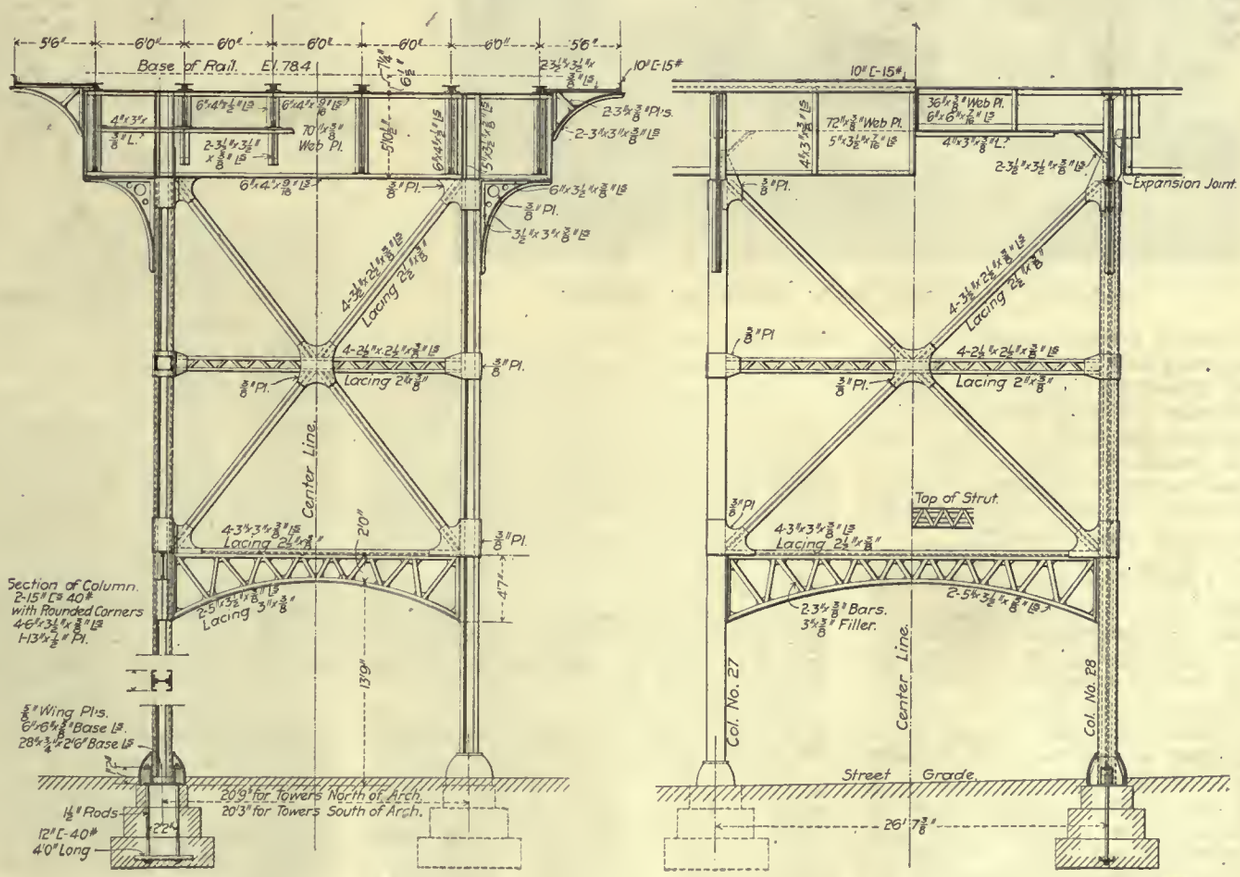


Typical Panel of Viaduct on Trestle Bents.

center line of each rib is a parabolic curve; but the two sides are not equal about the crown. This discrepancy arises because one skew-back hinge is 5 feet lower than the other, although both are on the same symmetrical curve as shown in the diagram. Each semi-arch supports six equi-distant vertical spandrel posts which carry the roadway. The spacing between them is slightly different on opposite sides of the arch center; but the difference is not noticeable in the structure. At the foot of each spandrel post, and intermediate between them, there is a vertical member in the arch rib which, together with the single system of diagonals, forms its web system.

The arch truss has parallel chords 6 feet apart on centers converging at the ends to receive the cast steel bearings from the skew-back pins. Each chord has an H-shaped cross section throughout made with four 6x6-inch angles and 15-inch flange plates. At panel points there are short sections of the web plates which extend beyond the inner flange of the chord to form gussets receiving the field-riveted connections of the web members. The reinforcement plates on both flanges of the chords are continuous; and are slotted where necessary to clear the projecting gusset plates. In both chords the section is the same and is diminished from a maximum at the springing to a minimum at the crown. The trusses will be shipped in four pieces, each field-spliced at the haunches and at the crown. The web members of the trusses are all composed of two pairs of angles riveted together back to back to make a cruciform cross-section engaging on its center line the gusset connection plates.

The details shown are for the center truss which is much heavier than the side trusses which, however, correspond throughout to the details at the skew-back and crown. In the side trusses the maximum chord sections each consist of four 6x6x7/16-inch angles, two 15x½-inch plates and two 15x⅜-inch plates, and the web members each consist of four 4x3½x⅞-inch angles. All spandrel columns have I-



Viaduct Tower.

MANHATTAN VALLEY VIADUCT, TOWERS, SPANS AND ARCH RIB.

shaped cross sections made with two pairs of 6x3½x½-inch bulb angle latticed and engaging the gusset extensions of the chord web plates. They carry transverse floor beams 3 feet deep, which support the six longitudinal lines of 15-inch 60-pound I-beam stringers under the centers of the track rails, and the four lines of lattice-girders 5 feet deep which carry the passenger platforms.

The floor beams are framed in at the tops of the spandrel posts and the stringers are seated on the top flanges of the floor beams with their ends web-spliced continuously and having expansion joints at their connections to the towers at both ends of the span. Each pair of stringers and girders is braced by zigzag horizontal 3x3-inch lateral angles, and the floor system has 4x3x½-inch X-brace angles from the ends of alternate floor beams, in the planes of the upper flanges of the floor beams. The arch ribs are connected by thirteen transverse struts in vertical planes, one at the foot of each spandrel post. Each strut is a light lattice-girder 5 feet deep with its flanges just clearing bottom flanges which extend, like knee braces, almost to the skew-back pins.

The viaduct spans on both sides of the arch vary from 71.81 feet to 46 feet in length. Between towers most of them are 60 feet long, and between single bent supports 50 feet. The lengths of all towers are 26.61 feet. In all deck spans the top laterals are single 3x3x⅜-inch angles and the bottom laterals of tower spans are 4x3x⅜-inch angles. The two sets of cross frames in each span have 3x3x⅜-inch flange angles and 3x2½x⅜-inch web angles. All columns are made with two 15-inch 40-pound channels having rounded corners, four 6x3½x⅜-inch angles and one 13x½-inch web plate. All transverse girders are 31⅓-feet long with a 70x⅜-inch web and four 6x4x9/16-inch angles. In all longitudinal girders the webs are 72x⅜-inch plates, except for the inside girders across the tops of the towers, which have 36x⅜-inch webs.

The outside tower girders have their flanges made with pairs of 5x3½x7/16-inch angles. All other longitudinal girders have their flanges made with pairs of 6x6-inch angles from 7/16 to ⅝ inches thick, according to span. The 69-foot and 72-foot girders have their flanges reinforced with single 13x9/16 and 13x⅝-inch plates 44 and 45 feet long. The through spans at the ends of the viaduct have their longitudinal girders 86 and 65 feet long respectively, made with 90x⅜-inch webs, 6x6-inch angles and 14-inch cover plates, the number and thickness of the latter varying with the span. These girders support transverse floor beams about 10 feet apart, which have 20x⅜-inch webs and pairs of 5x3½x½-inch flange angles. Twelve lines of 12-inch I-beam stringers are web-connected to the floor beams.

In the regular spans of the viaduct the transverse girders have 70x⅜-inch webs and 6x4x9/16-inch flange angles, are 31⅓ feet long, and are seated on the caps of columns 20 feet 9 inches apart at the north end of the viaduct and 20 feet 3 inches apart at the south end of the viaduct. The cantilever ends of the girders carry light angle iron brackets supporting at the level of the top flange the foot walks for the employes. The trestle bents have no transverse or longitudinal bracing but are stiffened by deep solid plate knee braces with curved stiffening angles on the lower edges and having their webs perforated with large circular holes. The upper flanges of these braces are riveted to the lower flanges of the transverse girders. The columns have H-shaped cross sections built up with a central I-beam, made of four angles and a web plate, and having a pair of channels, with their flanges turned in, riveted to the angle flanges for reinforcement. Vertical flat bars are riveted to the upper ends of the column flanges and project about 20 inches above the bottoms of the transverse girders to engage the flanges of connection angles riveted to the vertical web stiffeners. The lower ends of the columns have extended bases which are seated on offset concrete piers and anchored to reaction bars embedded in the lower part. The anchor bolts take bearing on reinforced shelf angles riveted to the faces of the columns, and are enclosed in convex cast iron guards which protect the feet of the columns.

The longitudinal girders are 72 inches deep and have 6x6-inch flange angles and 4x3-inch vertical web stiffener angles. They are shop-spliced in the middle and the outer pair has a curved bracket riveted to every alternate web stiffener angle to carry the cantilever footwalk. The outer ends of these brackets are connected by a 10-inch fascia channel with vertical web. All the fixed ends of these girders are web-riveted to the transverse girders and they are set so that their top flanges clear the tops of the transverse girders, the webs of the longitudinal girders being notched to clear the transverse girder flanges. The top flange angles of the longitudinal girders take bearing on the transverse girders and are connected by web splice plates riveted at fixed joints and having bolts in slotted holes at the expansion joints, four panels or about 200 feet apart.

The longitudinal girders are braced together in pairs by zigzag lateral angles in the planes of the top and bottom flanges. The two girders of each pair are also X-braced by sway frames at the ends and at two intermediate points of each span. The pairs of longitudinal girders are braced together by horizontal struts in the planes of the top chords at two intermediate points in the regular spans.



ERECTION OF VIADUCT WITH TRAVELING DERRICK.

those of the arch rib, and is riveted through end gusset plates to the vertical web members of the ribs. There is a system of X-bracing in the curved plane of the top chords of the ribs which just clears the transverse struts. Each diagonal is composed of a pair of 5x3x⅜-inch angles riveted together back to back and connected at the ends to gusset plates on the lower flanges of the top chords of the ribs.

At the first and fourth spandrel posts, counting from the south skew-back, the transverse struts of the west side of the arch carry at the center of the top flange, a vertical post, which is in the center of the side track, and supports the end of the floor beam section as shown in the part cross-section of the span at point *G*. At this point the floor beam is not continuous; but is made with two sections, acting as cantilevers for the support of the stringers and connected together simply by pairs of horizontal angles in the lines of their top flanges. The end transverse struts at points *A* and *Y* are plate-girder portals with curved

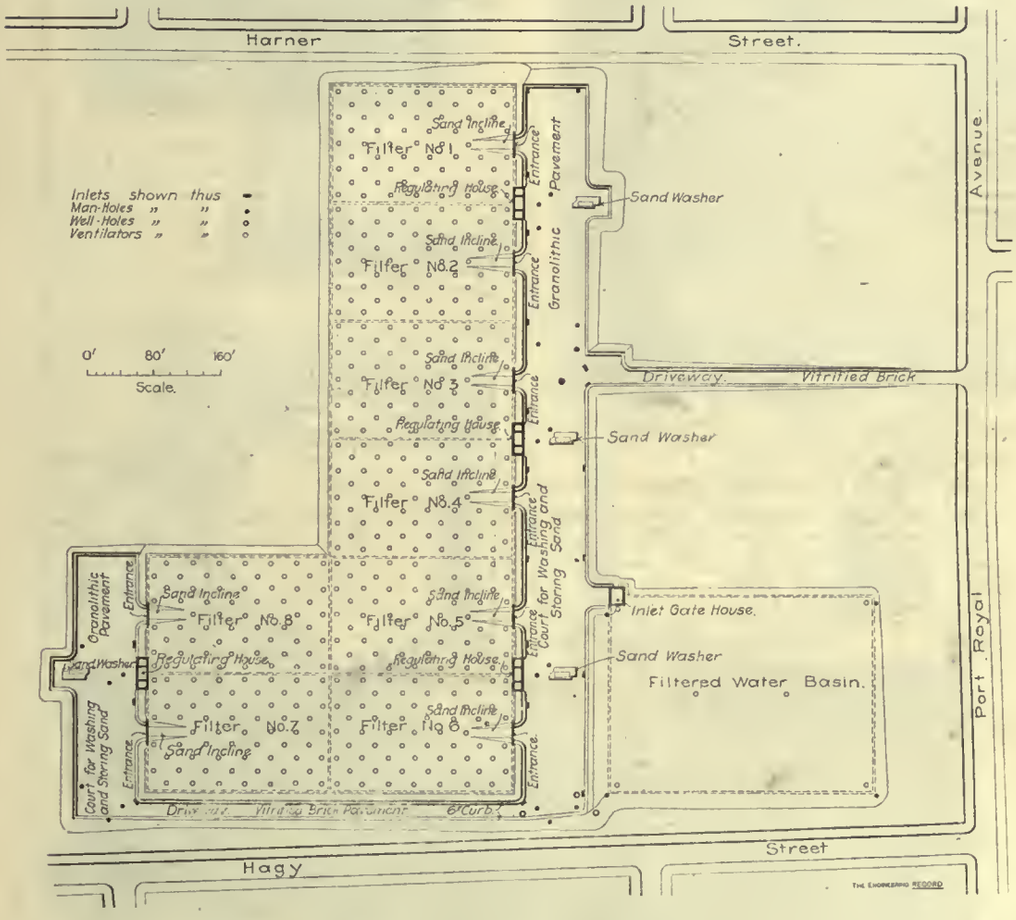
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The Cost of Filtering the Water Supply of Atlanta, Ga., during 1902, is stated in the annual report of Superintendent Park Woodward to have been $1.90 per million gallons. The total supply pumped was 2,511,700,000 gallons. The amount of alum used per gallon of water was 3/7 grain. The total cost of $5,688.04 is itemized as follows: Alum, $3,038; wages of filtermen, $1,320.75; water used in washing filters, $338.87; coal used, $26.40; maintenance, $173.80; improvements, $790.22. The cost of delivering the filtered water to the consumers was 57.77 cents per million gallons. The daily per capita consumption of water is about 68 gallons.

To Fill Engineering Vacancies has been the aim of the Engineering Agency, Monadnock Building Chicago, for ten years. During this time places have been secured for over 5,000 technical men, but at present the demands for such men are greater than can be met. The agency exercises care in its recommendations, and every man who registers is required to give a complete record of his experience. Persons found unsuitable on investigation are not permitted to register, and their registration fees are refunded. There are many vacancies on the agency's list.

The Philadelphia Filtration System.—II. Upper Roxborough Filters.

The second plant of the Philadelphia filters to be put under construction was the one situated close to the Upper Roxborough reservoir. The system includes four filtration plants, as mentioned in the general article published in The Engineering Record of January 3, in which were given some facts about the Lower Roxborough filtration plant, more fully described in an earlier issue. The Upper Roxborough filters are about a half-mile from the Lower Roxborough plant, but are about 80 feet higher, being on the top of the hill, and were so located in order to take advantage of the Upper Roxborough reservoir as a sedimentation basin and to gain the increased pressure on the gravity distribution pipe system. This plant, like the Lower Roxborough plant, will be supplied with water from the Schuylkill River by the Shawmont pumping station.



General Plan of Upper Roxborough Filters.

The Upper Roxborough reservoir, completed in 1893, consists of two basins 25 feet deep, with a total capacity of 147,000,000 gallons, thus affording ample sedimentation for the filters, the nominal capacity of which will be about 14,700,000 gallons in each twenty-four hours. Because of its relatively large capacity this reservoir will make it possible to maintain a reserve supply of water at an effective elevation for the gravity service to the district supplied by the filters. The general arrangement of this filter plant is shown in one of the accompanying drawings. It consists of eight covered sand filters, a covered filtered water basin, and courts for washing and storing filter sand. The top of the hill being flat, the filters are all on one level instead of being arranged in steps as in the Lower Roxborough plant, but the filtered water basin is at a lower level than the filters. Each filter is 140 feet 8 inches by 219 feet 10 inches on the neat lines and has a net filtering area of about .7 acre. The capacity of the plant is based on a nominal rate of filtration of 3,000,000 gallons per acre per day, allowing one filter to be out of service. The piece of land acquired here is large enough to permit the construction of additional filters. Space has been reserved for another filtered water basin, also. This plant is now sufficiently near completion for a description of its design and construction. It is anticipated that it will be ready for service by next June. No provision has been made here for preliminary, or roughing, filters such as are to be installed at the Lower Roxborough, Belmont and Torresdale plants.

The filters being about 5 feet higher than the highest water in the adjacent reservoir, settled water will be supplied by pumps, which have recently been installed in an addition built during the past year to the auxiliary pumping-station situated beside the Lower Roxborough reservoir. The equipment includes three 18-inch centrifugal pumps driven by direct-connected vertical compound condensing engines. The pumps and engines were furnished by the Henry R. Worthington Company. Water from the Upper Roxborough reservoir will be supplied to these pumps under a head not less than about 45 feet nor greater than 65 feet above the engine room floor, and will be delivered by them against a constant head of 70 feet above the engine room floor. The net hydrostatic head thus ranges from 5 to 25 feet, and the pumps are required to work smoothly under all conditions of head while discharging at rates of 7,000,000 to 10,000,000 gallons per twenty-four hours. The reasons for this arrangement and location of the pumping plant were the economy in construction and operation of the station, the use of existing boilers in the old portion of the station and the lesser difficulty in the delivery of fuel and supplies, which together overbalanced the increased outlay for mains and the slight increase in the friction head on the pumps. The water will be fed to the pumps through 2,200 linear feet of 36-inch cast-iron pipes, and the force mains consist of 2,000 feet of 36 and 30-inch cast-iron pipe and 1,180 feet of 48-inch pipe.

The filters and the filtered water basin are of the masonry groined arch and pier construction frequently adopted for filtration plants, but two or three innovations in the design are worthy of notice. The piers are wholly of Portland cement concrete instead of brick as in works previously designed. The outside walls and half arches are given a form closely resembling the half-section of an aqueduct of the type made familiar by the Wachusett and Weston aqueducts of the Boston Metropolitan Water-Works. A layer of clay puddle 12 inches thick was laid beneath the masonry and a layer 18 to 24 inches thick carried up around the outside walls to a level 1 foot above high water, for the purpose of increasing the water-tightness.

All masonry is Portland cement concrete. Floor and roof arches are 6 inches thick at the crown. The piers are 15 feet 10 inches apart on centers in both directions; are 22 inches square above the sand, and increase to 34 inches square at their bottoms. A 2-inch tile drain is built into the middle of each pier, extending from an open top, guarded by a brass strainer in the depression over the pier, to a quarter-bend which has an outlet through the side of the pier, 7 inches above the normal top of the sand. Cast-iron sleeves 8 inches in diameter are laid horizontally through the tops of the piers of one row in each filter to carry the sand ejector pipes. The outer surfaces of the roof arches and the inner surfaces of the floor arches are parabolic and the inner surfaces of the roof arches are elliptical. Cylindrical cast-iron blocks 3½ inches long and 2 inches in diameter, with a rim 5¾ inches in diameter at the upper end, are set flush in the roof of each filter and the filtered water basin, near the crowns of the arches, and are tapped to receive supports for electric light hangers.

In alternate bays and alternate rows in each filter beginning at the dividing wall, openings for light and ventilation are formed in the crown of the arch, with concrete walls carried up 6 inches above the top of the earth filling, as shown in one of the illustrations. There are similar openings in the roof of the filtered water basin but they are spaced farther apart. These openings are provided with cast-iron frames and two steel covers of the style shown. The upper covers of the filtered water basin are provided with locks.

The dividing walls are 22 inches thick above the normal sand level, and increase to 34 inches at the base. They are seated in grooves about 3 inches deep formed in the floor and the union with the floor is further reinforced by dowels of 3x3x⅜-inch steel angles spaced 5 feet apart along the center line, projecting 6 inches into the wall and 6 inches into the floor. At intervals of 20 feet, 2-inch tile drains are buried in the walls similarly to those in the piers, and a 2-inch drain is laid along the valley in the roof over the walls, with one cubic foot of gravel per linear foot around the tiles. The walls were built from base to springing line of arches in monolithic sections about 8 feet long. The shafts of the piers were formed in place as monoliths. The floors were made in square blocks so chosen that each could be formed in the easiest way with a straight screed and curved guides, alternate blocks being laid first and the intermediate ones filled in after the first had set. If cracks occurred at the joints they were grouted with cement. The vaulting was placed so that the section over each pier, included between the center lines of the adja-

cent arches, was a monolith. The entire upper surface of the vaulting was trowelled smooth.

The filtered water basin is similar in construction to the filters, but the columns are of uniform cross-section 22 inches square for the full height of 15 feet and have not the 2-inch inlet drains for the surface water underneath. Instead, all surface water is scrupulously excluded. The depressions over the piers are filled with puddle, which is carried up to give a thickness of about 4 inches over the crowns of the arches and graded so as to shed the water to roof drains. For the interiors of the filters, filtered water basin and the regulating chambers the forms were made with planed and matched boards, and all exposed surfaces of concrete are smooth, showing the mortar only. Occasional voids found on removing the forms were pointed at once with 1 to 3 mortar.

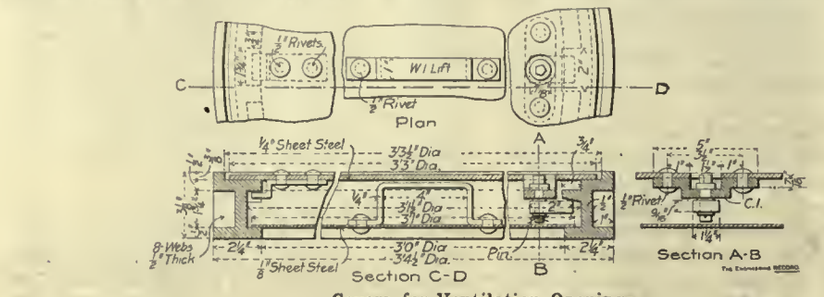
All concrete used in the structures is made of one part approved Portland cement, of the same compactness as in the original package, three parts sand and five parts broken stone, by volume. The cement was not accepted on less than 7 days' test and satisfied the following specifications: Specific gravity not less than 3.1; residue by weight on No. 50 sieve, 1 per cent.; on No. 100 sieve, 10 per cent., and on No. 200 sieve, 25 per cent; anhydrous sulphuric acid, not more than 1.75 per cent.; initial set, not less than 20 minutes; and the following tensile strengths of briquettes of 1 to 3 standard quartz mortar, seven days, 170 pounds, 28 days 240 pounds. The sand used for concrete was a bank sand, a natural mixture of fine and coarse particles, from which all pebbles larger than ¼ inch were screened out. More than 3 per cent. by weight of clay or other impurities was cause for rejection. The ballast consisted of gravel or broken stone varying from ¼-inch to 1½ inches in diameter. Some concrete was mixed wet and some contained just enough moisture to have a film of water on the surface after ramming. Tests indicate that the dryer concrete is slightly stronger and is nearly or quite as water-tight as the wet. All concrete was mixed in Carlin cubical mixers, and was deposited usually in layers of 9 inches or less. Excepting that which was mixed wet, the concrete was rammed, and for this purpose pneumatic tampers made by the Philadelphia Pneumatic Tool Company were used. These tampers proved efficient and economical and, it is said, the men did not dislike them and shirk the ramming as is so generally true with the old-fashioned rammer. It is claimed that one man with this tool accomplished as much as twelve to twenty men would with the ordinary rammer. These tampers were used also on the puddle wherever the rollers could not be used.

The piers and walls of the filters were battered near the bottom not merely for structural reasons but to insure contact with the sand and prevent the direct passage of raw water to the underdrains, this construction being preferred to the stepped offsets used in some other filtration plants to accomplish the same end. To further increase the water-tightness of the filters and the filtered water basin the interior surfaces below the high-water level were coated with a solution of silicate of soda applied with a whitewash brush. Twelve barrels were required for two coats in one filter. The solution cost about $6 a barrel of 600 pounds. Of course some cracks have occurred in the concrete, but few if any have been serious. They have been caused mostly by shrinkage during setting or by temperature changes, and whenever discovered have been pointed or grouted.

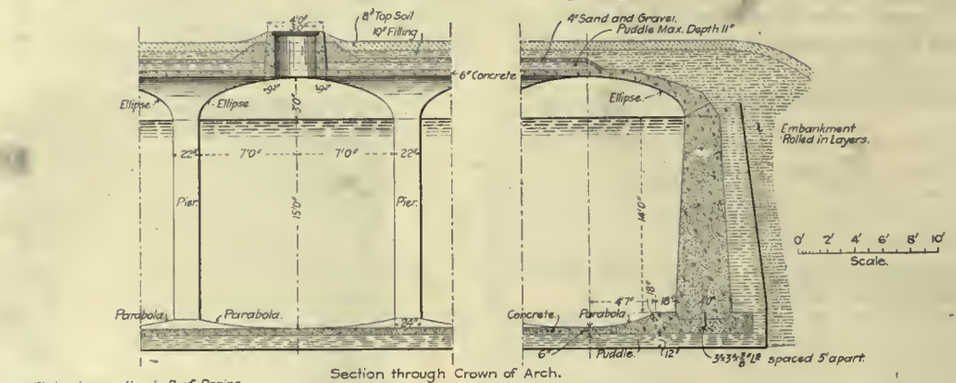
The efficacy of the various expedients for securing water-tightness is indicated by the results of tests for leakage. Leakage tests of seven of the eight Upper Roxborough filters gave the following results:

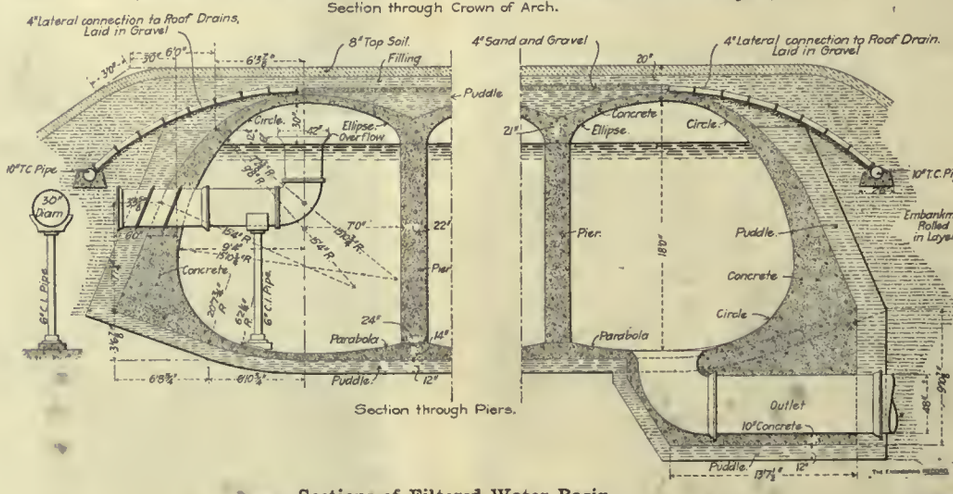
No. 1, one week's test.....No leakage
No. 2, one week's test.....No leakage
No. 3, one week's test.....690 gallons in 24 hours
No. 4, ...Not yet tested
No. 5, one week's test.....1,150 gallons in 24 hours
No. 6, one week's test.....460 gallons in 24 hours
No. 7, one week's test.....1,840 gallons in 24 hours
No. 8, one week's test.....1,150 gallons in 24 hours

This leakage should be balanced against the amount of water that will daily pass through the filters, which, with the water having ten days subsidence, is expected to be at the rate of 3,150,000 gallons per 24 hours, showing for filter No. 7, the worst of the series, at the rate of .06 of one per cent. of the capacity of the filter.

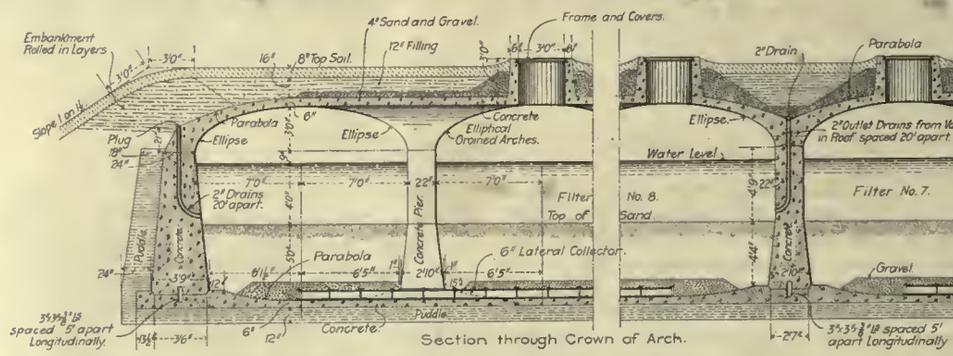


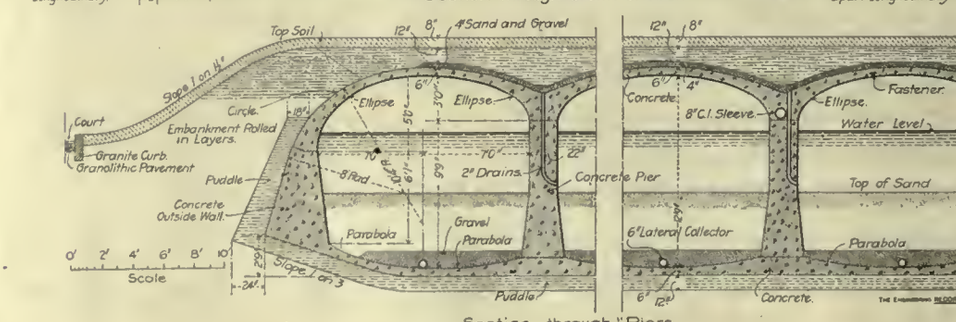
Covers for Ventilation Openings.





Sections of Filtered Water Basin.





Typical Sections of Filters.

The rule applying to the Belmont and Torresdale filters, with which the contractor must comply, is not more than 1,000 gallons loss in 24 hours for a filter of ¾ acre net sand area. The clear water basin on a two weeks test



PNEUMATIC TAMPER.

indicated no leakage whatever. The remarkable tightness of the works now being constructed at Philadelphia can be attributed solely to the extreme care exercised in the selection and placing of the materials for the puddle lining, because the sections of concrete, as will be noticed, are too thin to produce an impervious structure.

The general contract for the Upper Roxborough filters was made May 8, 1901, with Mr. D. J. McNichol, who is also the general contractor for the Lower Roxborough plant, and to whom was awarded in December, 1901, a separate contract for furnishing and placing the filter sand and gravel and the underdrains in both plants. These agreements cover practically all the work connected with the construction and equipment of the filtration plants,



INTERIOR OF FILTER, WITH GRAVEL OVER COLLECTORS.

except the machinery elsewhere mentioned, and include the requirement that "he shall be held liable for keeping in perfect repair and good order the whole of the work constructed under the contract, and for all leakage, breakage or other damage that may occur by reason of the construction under the contract for five years after the date of its completion."

The contractor began work May 15, 1901, excavations for the pipes, sewers and the filtered water basin being first undertaken. All filters are in excavation. The land was cleared of brush, trees and refuse and the loam top soil removed and kept in storage banks for dressing the finished embankments. Most of the excavations were in micaceous clay or clayey gravel. All large excavations were made by wheeled scrapers or by two Austin Manufacturing Company steam-driven excavators, which discharged the materials directly into wagons. Whenever excavations were made below the grade desired the depressions were filled with well rammed puddle or concrete or both, according to circumstances. Selected materials were reserved and used for fills and embankments. From the sites of the embankments the top soil was removed and the ground furrowed or picked to bond the materials of the embankments, which were placed in 6-inch layers and rolled with grooved rollers weighing about one ton per linear foot. During rolling the earth was kept moist but not wet enough to be sticky. Progress on the embankments around the filters and the filtered water basin was regulated by the construction of the masonry, and the embankments were not built against the side walls until the arches at the top were sprung.

The puddle was made of one part of plastic red clay from Swedeland, Pa., one part of red clay from Delaware City, Del., and two parts sandy gravel or broken stone smaller than ¾ inch in greatest diameter. The clay was ground in pug mills to reduce all lumps and thoroughly mixed with the stone or gravel, a suitable quantity of water being added to make a stiff paste. While plastic the puddle was spread in layers, 8 inches thick, in large areas, and while drying was repeatedly rolled with grooved rollers weighing about half a ton per linear foot, until all shrinkage cracks were closed and the mass thoroughly compacted so as to be water-tight. The final rolling reduced the layer of puddle to 6 inches in thickness. In case of unequal drying in spots, during the process of rolling, the dryer places were sprinkled lightly. Each layer was well consolidated and dried before another was placed upon it. The rapidity of drying varied with weather and other conditions, but it required usually about 3 days for each layer.



CENTERING FOR FILTERS.

The filling over the filters and the filtered water basin was of a different nature from the rolled embankments. Over the arches of the filters there were placed first 4 inches of gravel, above which there are 12 inches of selected light loose earth and 8 inches of loam. The filling on top of the filtered water basin was similar excepting that puddle took the place of gravel. The corners at the tops and the angles at the bottom of the embankment are rounded, the bottoms being finished to curbs at the courts and drives and graded into the natural surface elsewhere. The embankments over filters and the filtered water basin were not rolled, the filling being arranged to convey the surface water promptly to the drains. The embankments have been seeded, and sods were placed along the edges of the courts and driveway and in similar positions.

The approximate final quantities, under contract No. 12, for the Upper Roxborough filters are:

Excavation, unclassified, cubic yards	121,441
Puddle, cubic yards	17,623
Concrete, cubic yards	28,551
Embankment, cubic yards	59,464
Top soil, cubic yards	10,828
Granolithic pavement, square yards	10,100
Straight curb, linear feet	3,846
Curved curb, linear feet	508
Cast-iron pipe and specials, tons	1,250

(To be continued.)

An Industrial Plant Aerial Tramway.

An interesting double line aerial tramway 4,000 feet long, recently installed by the John A. Roebling's Sons Company for the Pittsburg Plate Glass Company, at Ford City, Pa., presents some interesting and novel features, and was designed by Mr. S. A. Cooney, C. E. It has a capacity to carry 400 cubic yards of sand 4,000 feet in ten hours, and is used to deliver sand from the storage bins across the river, for grinding purposes. The cables are in five spans of about 485, 600, 630, 690 and 1,500 feet, and are supported at the terminal stations and by four intermediate steel towers from 60 to 110 feet high.

There are two parallel sets of cables in the same horizontal plane, one for transporting the loaded buckets and the other for returning the empty ones. Each set has two main cables in the same vertical plane. The bucket is supported on the upper one, which is 2 inches in diameter, for the loaded buckets, and 1½ inches in diameter for the empty buckets. The lower cable is the traction cable, and is attached to the bottom of the bucket at two points, thus making the bucket itself serve as a link in the cable and preventing undue deflection of the suspended bucket. The bucket can be dumped at any point of the line by setting an automatic trip there which engages a trigger and causes the bucket to be reversed by the weight of its contents. As soon as these are discharged the weight of the empty bucket restores it by gravity to the original position without the necessity of an attendant. The line is equipped with fifty-five steel buckets of 10 cubic feet capacity, which are loaded through chutes at one terminal, and at present discharge their contents at two different points.

The carrying cables are entirely independent of the traction cables and extend beyond the terminals. At these points the buckets are automatically switched off and are carried on pairs of steel rails, U-shaped in plan, which connect the cables for the empty and loaded buckets and provide for a rapid and simple transfer of the buckets from one cable to the other. This device enables the buckets to be returned to the starting place from points intermediate between it and the cable terminals, which are very easily established by the interposition of the switch rails. It also provides for the convenient deflection of the traction cables and for the diversion of the buckets to a lateral branch at any horizontal angle at any convenient point. In this installation the cables are located in a straight line; but the buckets dump at two points, one being at the terminal and another 1,000 feet distant, near the second tower.

The plant is operated by a General Electric Company's 120 horse power motor which can develop about 100 per cent. more power than is actually used. The buckets have a speed of 300 feet a minute and together with the terminal service and machinery, require a force of only five men when operating at full capacity.

The sand transported is manufactured from sandstone, which is quarried in the adjacent hillside, crushed, washed and delivered by bucket elevators to storage bins at one end of the tramway. As it has to be handled while still wet, it was deemed impracticable to deliver it to the buckets through automatic chutes, as would be ordinarily done for dry sand, and a special system of loading was devised by Mr. Cooney and has been found satisfactory during the six months in which the plant has been in successful operation. The sand is stored in two 20x40 foot bins about 15 feet high and 5 feet apart, which are located over the center line of the loading cable. The space between the bins forms a narrow gallery, having in the center line of the floor three hoppers with cross sections larger at the bottom than at the top. The holes of the hoppers are directly over the line of empty buckets and are closed by segmental valves suspended from horizontal axes through their centers of curvature and operated by horizontal levers which revolve them open when depressed. The sides of the bins adjacent to the hoppers are closed with removable horizontal boards which are set to correspond with the height of the sand. One man standing between the bins can easily scrape down the sand over the tops of the flash boards and thus fill the hoppers and empty them into the buckets as fast as required. The flaring shape of the hoppers prevents any possibility of clogging, and the moist sand is easily handled where it would be difficult or impossible to make it flow automatically by gravity alone.

Collapse of a Montreal Pier Shed.

Recently while a large steamer was burning at its pier in Montreal, a crowd of spectators climbed on one of the movable pier sheds there, causing it to collapse under them and killing and injuring a number of people. A bridge engineer who witnessed the accident writes that these sheds are constructed so as to be easily taken down in the winter and were then being set up for next summer's use, but that no covering had yet been put on the purlins of this one and that it had no longitudinal diagonal braces of any kind. Describing the structure from memory, he estimates its dimensions to be 30 feet wide by 100 feet long, and says that the simple triangular wooden trusses of 30-foot span consisted of two inclined rafters braced at the middle points by diagonals from their horizontal 4x8-inch bottom chords, and having three vertical rods at the panel points. They were seated on wooden columns about 10 feet high, to which they were braced by knee braces with hook and eye connections at each end. The purlins were about 3x6-inch timbers, and were also hooked to the top chords. The roof sheathing was not in place, and the number of persons, estimated at three hundred, who were seated on the purlins and rafters was not sufficient to break the trusses which fell successively, one on top of the other from end to end of the shed, as roof trusses usually do when collapsing for lack of longitudinal bracing. Our correspondent says: "The shed did not fall because of any hidden fault of construction. The only lesson to learn from it is one not likely to be learned in Montreal, namely: that the police force ought to get to a fire before the fire department starts to go home. If the police had kept people off the wharf they could not have climbed on to the roof."

The Demand for Engineers throughout America far exceeds the number of men available. Several engineering colleges report already that more good places are offered than there are students in the graduating classes to fill them. And this in spite of large classes and improved facilities. Several prominent technical institutes are adding new buildings and increasing their equipment.

Superiority of Creosoted Wood Block Paving.

The Wood Block Paving on the Rush Street bridge, Chicago, offers a striking comparison of the wearing qualities of untreated blocks and those creosoted. In the fall of 1899, one of the two driveways of this bridge was paved with creosoted blocks and the other with Norway pine blocks. It had been the intention to pave both sides with the creosoted pavement, but this was not done on account of the delay in obtaining the materials and the demands of the public for the immediate use of the bridge. The bridge carries an extremely heavy traffic of great volume—greater, according to Mr. F. F. Quilty, assistant engineer in the Department of Public Works, than any other bridge in the city. Each of the roadways is 18 feet wide, and the following number of vehicles was observed to pass over them between 7 A. M. and 12 midnight on December 19, 1902: Heavy trucks, drays, etc., 3,598; light vehicles, 3,275; carriages, buggies, etc., 2,078; automobiles, 165; making a total of 9,116 vehicles in 17 hours. This, it is stated, may be assumed to be the normal traffic carried by the bridge. In December of last year, it became necessary to replace the paving on the side laid with the untreated Norway pine blocks on account of its bad condition, the 5-inch blocks being in some cases worn through to the sub-planking. At the same time some of the creosoted blocks were removed for inspection, and they were found to have worn on an average ⅛ inch per year, and were sound, unbroken, true to their original shape, and in general gave no evidence of deterioration other than the wear noted.

Humidity Regulation as it will be applied to the new buildings now under construction in Washington for the National Bureau of Standards, was referred to in a paper recently read before the Philosophical Society of Washington by Prof. Edward B. Rosa. By controlling the humidity it will be possible to perform at any time of the year certain experiments that ordinarily are possible only in winter, besides reducing, if not preventing, much rusting of valuable apparatus. In winter the humidity may be controlled by drying the air, and in the summer by over-cooling it. The latter may be affected economically by the use of a heat exchanger in which the air on its way to the cooling chamber imparts heat through a thin metal wall to the overcooled air coming from the chamber.

A New Superheater, the invention of Mr. Thomas Sugden, of London, is described in a recent issue of "The Engineer," of England, which shows it as applied to a 30x8½-foot Lancashire boiler constructed to carry a daily working pressure of 160 pounds. It consists of a number of 2½-inch tubes of long U-form, suspended in vertical planes, parallel to and at the rear of the flues, their open ends being fixed in headers having covers over each tube end to facilitate repairing. One principal feature of the superheater is the device for protecting it when steam is first raised, when the boiler is not doing full duty, or during stoppages, without resorting to the common and, for some reasons, objectionable practice of flooding the tubes with water. This is accomplished by placing it in a separate chamber, so arranged with balanced dampers that it may be put in operation or the gases by-passed at will. Another advantage claimed lies in the provision of doors at the rear through which the tubes of the superheater may be cleaned while it is working and therefore as frequently as desired, thus maintaining the maximum efficiency.

The Hazen-Williams Hydraulic Slide Rule.

This is a slide rule designed by Professor Gardner S. Williams, of Cornell University, and Mr. Allen Hazen, of New York, to compute the flow of water in pipes and channels. The most commonly used formula for determining the velocity of flow of water in pipes and channels is the Chezy formula, namely, $v = c\sqrt{sr}$, where v is the velocity in feet per second, s is the hydraulic slope and r the hydraulic radius in feet. c is a factor, the value of which is an approximation to a constant, but depends upon the roughness of the pipe and upon the hydraulic radius and slope. The variations of c are considerable and make difficult the general use of the formula.

Kuttér's formula was devised to compute the value of c in the Chezy formula. The value of c so computed depends upon an assumed coefficient of roughness, upon the slope and upon the hydraulic radius. With the same degree of roughness the value of c increases with the hydraulic slope and with the hydraulic radius. This is because the exponents used for them in the formula are below the true values. If the exponents were increased to correspond more nearly with the facts, the variation of c would become less. If exponents could be selected agreeing perfectly with the facts the value of c would depend upon the roughness only, and for any given degree of roughness c would then be constant. It is not possible to reach this actually, because the values of the exponents vary with different surfaces, and also their values may not be exactly the same for large diameters and for small ones, nor for steep slopes and for flat ones. Exponents can be selected, however, representing approximately average conditions, so that the value of c for a given condition of surface will vary so little as to be practically constant. Several such "exponential" formulas have been suggested. These formulas are among the most satisfactory yet devised, but their use has been limited by the difficulty of making computations by them.

The difficulty with the fractional exponent can best be overcome by the use of a slide rule constructed for that purpose. Such a slide rule has been constructed to determine the velocity by the formula $v = cs^{0.54}r^{0.63}0.001^{-0.04}$. The exponents in this formula were selected as representing as nearly as possible average conditions as deduced from the best available records of experiments upon the flow of water in such pipes and channels as most frequently occur in water-works practice. The last term, $0.001^{-0.04}$, is a constant, and is introduced simply to equalize the value of c with the value in the Chezy formula, and other exponential formulas which may be used, at a slope of 0.001 instead of at a slope of 1.

In size and general appearance the rule is like an ordinary Mannheim 10-inch slide rule. It has an improved back which will prevent warping. The upper scale on the rule, marked No. 1, and the upper scale on each side of the slide, marked No. 2 and No. 5, are like those on the Mannheim rule. One face of the slide is marked V (for velocity) at the right-hand end and contains scales No. 3a and 3b. Scale 3a, in the middle of the slide, gives hydraulic radii for channels and conduits. Scale 3b, on the lower edge, is graduated for the hydraulic radii of pipes and is marked with diameters in inches. The other side of the slide is marked Q (for quantity) at its right-hand end and contains scales No. 6a and No. 6b, marked for diameters in inches. The lower scale, No. 4, on the rule is graduated for slopes in feet per thousand. The scales are made in Germany and the graduation has been very carefully done. Before putting the rule into permanent form, experimental rules were used by the designers for about two years to satisfy themselves of its utility. On the back of the rule are several tables to aid in the convenience of computations to which the rule is applicable. The rule will soon be on sale by Mr. G. G. Ledder, 9 Province Court, Boston. The Engineering Record is indebted to the designers for a description of the rule and methods of using it.

METHOD OF USE.

To compute velocity.: Put the slide in the rule with the side up having V at the right-hand end. Move the slide so that the diameter of pipe in inches on scale No. 3b will be over the slope on scale No. 4. In case the channel is not circular in form, compute the hydraulic radius in units of one foot, not inches, and, with the aid of the marker, bring this on scale No. 3a over the slope.

Determine from the table on the back of the slide rule, or otherwise, the value of c to be used. Find this value upon scale No. 2. Opposite to it on scale No. 1 will be found the velocity in feet per second. This procedure gives the numerals in the velocity but does not give the position of the decimal point. To find the position of the decimal point, consult the table on the back of the rule, showing the velocities in feet per second for various sizes of pipe and slopes with c=100. Enough values are given in this table to enable the position of the decimal point to be determined by inspection. If the velocity is known and the value of c is to be determined, the rule is set as above described and the value of c, on scale No. 2 found under the observed velocity. By a similar procedure the slope or diameter can be computed for a given velocity on scale No. 1 with a known or assumed value of c.

To compute Quantity: To compute the quantity, reverse the slide so that the side is up which has Q on the right-hand end. Bring the diameter of the pipe, scale No. 6a or No. 6b, over the slope in scale No. 4. Determine from the table on the back of the rule, or otherwise, the value of c to be used. Find this upon scale No. 5, and opposite it in scale No. 1 will be the quantity in American gallons per 24 hours. As before, the numerals are given, but not the position of the decimal point. To find the position of the decimal point, or the number of ciphers to be added, consult the table for that purpose on the back of the rule. The position of the point can be determined by inspection.

To obtain the results in gallons per hours, gallons per minute, cubic feet per second, or any other units, multiply or divide the result obtained on scale No. 1, with the aid of scale No. 2. If a considerable number of computations are to be made, in which the results are required in the same unit other than gallons per day, a special value of c can be found which will give directly the desired result at one operation.

In case the pipe is more than 86 inches in diameter (that being the largest diameter shown on the scale) divide the actual diameter by 2.4; find the discharge corresponding to the new size, and multiply the result by 10. Or, divide the diameter by the square of 2.4, namely, 5.76, and multiply the result by 100. To find the discharge of pipes less than 2.7 inches in diameter (that being the smallest size shown on the scale), multiply the diameter by 2.4; find the discharge corresponding to the new size, and divide the result by 10. Care must be exercised in extending the process to very small pipes, as for them the values of c may vary considerably from those used for larger pipes. To find the velocity or discharge for hydraulic slopes of more than 50 in 1,000, find the velocity or discharge for a slope that is one hundredth of the actual slope and multiply the result by 12.05.

SPECIAL COMPUTATIONS.

Knowing the flow of water through a pipe or system of pipes produced by a given slope or head, to determine the corresponding flow at any other slope or head: Find the slope or head for which the results are known on scale No. 4, and with the aid of the marker bring the figure in scale No. 2 or scale No. 5, corresponding to the equivalent discharge, over it. Other discharges will then be opposite other slopes or heads. The figures on the slope scale can be used for pounds pressure, feet of head, etc., and those on scale No. 2 or scale No. 5 can be used for the discharge in any units which may be employed. In doing this, decimal points on the scale may be neglected. The position of the decimal point in the final result can be controlled if necessary by taking off a number of intermediate approximate values.

Example: If 54 pounds pressure are required to overcome friction in a certain line of pipe when discharging 320 gallons per minute, how much pressure will be used in supplying 470 gallons per minute? Put marker on 54 on lower scale (say on 0.54 foot per 1,000). Bring 320 on No. 2 scale to marker, then move marker to 470 on same scale and find amount required on lower scale (1.1 foot per 1,000) 110 pounds pressure, which is the answer.

Knowing the discharge in a given size of pipe at a given slope, what size of pipe must be used to produce the same discharge for any other slope? Have the quantity side of the slide up. Bring the known size over the known slope. Other sizes will then be found over the corresponding slopes. In case it is desired to compare sizes in scale No. 6a with sizes in scale No. 6b, it will be necessary to move the scale exactly its length, marking the first position of the end with the marker, as in multiplying on the lower scales of an ordinary slide rule when the operation runs off the scale.

To compute the discharge through a compound pipe, that is a pipe of larger diameter connecting with a pipe of smaller diameter, or a series of such pipes: Assume some quantity of water. Compute the total friction in each part of the pipe, corresponding to that quantity, by multiplying the computed slope in that pipe by the length of pipe. The sum of these frictions will be the total friction with the assumed discharge. Place the marker at this head on the slope scale, and move the scale until the quantity assumed is opposite the marker, on scale No. 2 or scale No. 5; other corresponding quantities will then be opposite other heads on the respective scales.

Example: To find the discharge through a compound pipe consisting of 16,000 feet of 30-inch pipe, 5,500 feet of 24-inch pipe, and 8,700 feet of 36-inch pipe, when the total loss of head is 30 feet. The pipe being moderately old take c=100 and compute the losses of head first for a discharge of 10,000,000 gallons daily. The computation may be tabulated as follows:

Quantity.	Diameter, inches.	Slope, per 1000.	Length, feet.	Loss of head, feet.
10,000,000	30	1.72	16,000	27.50
10,000,000	24	5.05	5,500	27.80
10,000,000	36	0.71	8,700	6.18
Total loss of head for 10,000,000 gallons....				61.48

Set marker on 61.48 on slope scale and bring 10 on No. 2 scale to it. Then move marker as desired, e.g.: taking it to a loss of head of 30 feet we find the corresponding discharge to be 6.8 million gallons daily.

To compute the friction of a given amount of water flowing through two pipes of different

diameters and different lengths, freely connected at each end: Assume a given loss of head between the two points of connection. Divide this head by the length of each line to determine the hydraulic slope of that line. Compute the discharge for that slope. The sum of the discharges for the two lines is the total discharge for that head. Bring this amount on scale No. 2 or scale No. 5 over the assumed head on the slope scale and then move the marker to the desired quantity, when it will show on the slope scale the desired head.

Allowance for loss of head at entrance and in curves. Allowance for velocity heads and for extra friction in curves can be most accurately made separately, but allowance can be made with sufficient accuracy for most practical purposes by adding to the length of pipe, before computing the slope, such an amount that the friction of water in passing through it would equal the velocity head, and the additional losses in passing curves. In general it may be assumed that it takes about two velocity heads to give the water in a pipe a given velocity, and approximately one is recovered when the water is discharged into a receptacle above the end of the pipe, leaving a net loss of one velocity head; and it may further be assumed that about one-quarter of a velocity head will be lost for each quarter bend of pipe. The allowance is therefore made by adding to the length of pipe that amount in which the friction is equal to the velocity head, and in addition, one-quarter of this amount for each quarter bend in the line of pipe. The lengths of pipe in which the friction is equal to a velocity head for a number of sizes and for two values of c are shown in a table on the back of the rule.

To get with one setting of the slide the quantity of water corresponding to any slope. Have the quantity side of the slide up. Find the value of c in scale No. 1. Bring either end or the middle of scale No. 5 to it. Move the marker to the size of pipe on scale No. 6, and move either end or the middle of scale No. 5 to it. If the marker is now put at any desired slope it will show on the scale No. 5 the corresponding quantity; or, set on the desired quantity, will show the required slope.

To get with one setting of the slide the quantities of water discharged by pipes of different sizes for a given slope and coefficient. Put the slide in with the Q side showing, but inverted. Bring the coefficient over the slope, and the quantities will appear directly over the respective pipe sizes.

Experimenter.	Diameter in inches.	No. of Obs.	Range of velocity. Feet per second.	Range of c in H. & W. Formula.	Mean value of c.	Remarks.
New Cast-Iron Pipe.						
Darcy	3.22	8	0.36 to 5.15	119.5 to 120.0	120	Uncoated
Darcy	5.39	8	0.5 " 7.48	132.1 " 125.8	129	Uncoated
Darcy	7.40	6	1.6 " 8.22	125.0 " 116.0	121	Uncoated
Williams, Hubbell, Fenkell.	12.00	30	1.0 " 5.00	139.3 " 148.5	144	Coated, very straight, no specials
Iben	12.	4	1.6 " 3.1	107.0 " 121.5	114	Coated, Bonn service main
Iben	12.	4	1.6 " 3.1	106.0 " 117.0	111	Coated, Bonn service main
Williams, Hubbell, Fenkell.	16.02	20	1.0 " 5.0	146.0 " 145.8	146	Coated, well laid
Williams, Hubbell, Fenkell.	16.02	30	1.0 " 5.0	145.0 " 145.6	145	Coated, well laid
Lampe	16.48	4	1.6 " 3.1	129.0 " 133.0	131	Coated, Danzig main
Darcy	19.68	9	1.4 " 3.7	112.0 " 117.8	115	Uncoated
Williams, Hubbell, Fenkell.	29.96	30	1.25 " 2.90	138. " 142.	140	Coated, straight, no specials
Kuichling	36.	2	4.2	129.	..	Coated, Rochester main
Stearns	48.00	3	2.6 to 6.2	142.0 to 141.0	142	Coated, Rosemary siphon
Gale	48.	1	3.5	112.3	..	Coated, Edinburgh main.
Cleaned Cast-Iron Pipe.						
Darcy	1.43	7	0.4 to 3.7	130. to 134.	132	Paris main.
Darcy	3.16	7	0.6 " 5.0	124. " 114.	119	Paris main
Brackett	6.	6	0.95 " 2.46	100. " 86.	93	Boston main
Darcy	9.63	7	0.9 " 8.44	110. " 103.	107	Paris main
Darcy	11.69	8	0.8 " 10.4	107. " 106.	107	Paris main
FitzGerald	48.00	21	2.0 " 5.0	144. " 141.	142	Rosemary siphon
Tuberculated Cast-Iron Pipe.						
Darcy	1.41	6	0.26 to 2.1	86. to 76.	81	Paris main
Darcy	3.13	6	0.4 " 3.7	82. " 85.	83	Paris main
Brackett	4.	4	0.47 " 1.23	13 " 20.	16	Boston main
Brackett	4.	3	0.51 " 1.19	15. " 22.	18	Boston main
Brackett	6.	7	0.38 " 1.70	38. " 30.	34	Boston main
Brackett	6.	8	0.38 " 1.70	44 " 42.	43	Boston main
Darcy	9.57	8	1.0 " 1.26	89. " 79.	84	Paris main
Forbes	16.	4	1.15 " 1.97	111. " 102.	106	Brookline force main
Kuichling	36.	2	4.08	81.	..	Rochester main
FitzGerald	48.00	35	1.0 to 5.0	119. to 105.	112	Rosemary siphon
Riveted Pipe.						
Darcy	1.05	7	.30 to 2.79	131. to 125.	128	Coated sheet iron
Giltner and Ketchum	3.00	222	.18 " 2.33	118. " 116.	119	Galvanized sheet iron riveted
Darcy	3.25	7	.58 " 6.14	124. " 143.	133	Coated sheet iron
Darcy	7.72	10	.59 " 10.01	141. " 144.	142	Coated sheet iron
H. Smith, Jr.	10.93	5	4.70 " 10.00	119 " 124.	121	Riveted sheet iron
Darcy	11.22	7	1.30 " 10.52	123. " 136.	129	Coated sheet iron
H. Smith, Jr.	12.67	4	4.60 " 10.10	121. " 118.	119	Riveted sheet iron
H. Smith, Jr.	14.76	6	4.40 " 12.10	132. " 123.	127	Riveted sheet iron
Herschel	36.00	8	0.56 " 5.70	122. " 98.	110	Riveted steel
Knichling	38.00	10	0.50 " 1.20	126. " 134.	130	Riveted sheet steel
Herschel	42.00	24	0.96 " 4.99	130. " 88.	109	Riveted steel
Herschel	47.4	51	2.04 " 6.06	126 " 91.	104	Riveted steel
Marx, Wing and Hoskins.	72.24	29	1.57 " 3.80	117. " 108.	111	Riveted sheet steel
Marx, Wing and Hoskins.	72.24	39	1.12 " 4.80	87. " 98.	93	Riveted sheet steel
Herschel	102.96	40	1.00 " 4.50	127 " 101.	114	Riveted sheet iron
Wooden Stave Pipe.						
Adams	14.05	5	.70 to 1.53	124. to 134.	129	Los Angeles
Noble	44.	11	3.46 " 4.80	112. " 115.	113	Seattle
Noble	54.	11	2.28 " 4.70	119. " 127.	123	Seattle
Marx, Wing and Hoskins.	72.36	48	1.20 " 5.30	124. " 117.	120	Ogden
Cement Pipe.						
Fanning	20.	11	1.49 to 4.04	127. to 118.	122	Cement-lined iron
Bazin	31.50	10	2.78 " 6.60	148 " 144.	146	Experimental conduit
Circular Brick Tunnels.						
Clarke	90.	2	3.769 to 3.798	113. to 111.	112	Boston main drainage
Benzenberg	144.00	10	3.90 " 7.00	95. " 80.	87	Milwaukee sewer
Aqueducts.						
Fteley	..	..	1.897 to 2.973	135. to 134.	134	Sudbury, Boston
Fteley	..	17	1.11 " 3.01	118. " 130.	125	New Croton, New York
New Wrought Iron.						
H. Smith, Jr.	0.628	2	1.03 to 1.58	100. to 127.	113	½ inch gas pipe
H. Smith, Jr.	1.051	8	0.96 " 3.17	114. " 134.	124	1 inch gas pipe
New Brass Pipe.						
Saph and Schoder	0.50	39	0.95 to 14.97	129 to 146.	131	Seamless drawn
Saph and Schoder	0.63	20	0.65 " 6.76	142. " 149.	145	"
Saph and Schoder	0.82	16	0.72 " 5.47	130. " 146.	138	"
Saph and Schoder	1.05	10	0.36 " 3.09	131. " 145.	138	"
Saph and Schoder	1.24	16	0.43 " 3.64	130. " 144.	137	"
Saph and Schoder	1.50	16	0.38 " 4.36	130 " 147.	138	"
Saph and Schoder	2.09	9	0.63 " 4.95	140 " 150.	145	"
New Lead Pipe.						
Reynolds	0.498	6	1.14 to 2.14	136. to 138.	137	
Darcy	0.55	2	0.81 " 1.46	133. " 135.	134	
Darcy	1.06	5	0.62 " 3.35	122. " 139.	130	
Darcy	1.61	7	0.39 " 7.56	116. " 129.	123	
Glass Pipe.						
H. Smith, Jr.	0.75	2	1.40 to 2.65	128. to 133.	130	
H. Smith, Jr.	0.92	2	1.95 " 2.94	131 " 135.	133	
Darcy	1.95	5	0.50 " 6.92	119. " 125.	122	
New Wood, Bored.						
H. Smith, Jr.	1.26	2	1.65 to 2.47	95. to 95.	95	
Fire Hose.						
Freeman	2.65	4	12.50 to 20.00	144. to 141.	143	"A," extremely smooth
Freeman	2.47	3	13.40 " 20.00	140. ..	140	"C," Rubber lined
Freeman	2.49	4	13.20 " 21.00	139. " 136.	138	"D," "
Freeman	2.68	4	7.50 " 17.00	136. " 130.	132	"E," "
Freeman	2.69	4	11.50 " 18.00	114. " 119.	116	"I," "
Freeman	2.12	3	14.00 " 21.81	134. " 135.	135	"M," "
Freeman	2.53	8	3.50 " 19.00	122. " 101.	106	"K," "mill hose"
Freeman	2.60	7	3.50 " 20.00	93. " 87.	89	"L," unlined linen hose

THE VALUE OF c.

Some approximate values of c are given upon the back of the rule. Cast-iron pipe very straight and smooth may give c=140, but for ordinary conditions c=130 is fair for new pipe. As pipes rust and become dirty, c decreases. For general computation and estimate c=100 is a fair value, but it is even less for pipe in bad condition. The values of c in a number of hydraulic experiments are given in the table.

Kew Highway Bridge.

The Kew highway bridge across the Thames, England, has moderate span elliptical masonry arches of small rise with their springing line below high water mark and the intrados tangent with the uniform faces of the brick piers, which are built on 39x107-foot concrete footings 12 feet thick, carried down about 30 feet below high water and built in open excavation inside heavily braced sheet pile cofferdams. The piles were 14 inches square, grooved on opposite faces to receive 2x4-inch elm splines. They were so carefully driven in the London clay to about 38½ feet below high water that very little leakage occurred between them, and the cofferdam was easily maintained water-tight. There were three lines of 12x12-inch rangers inside and outside of the piles, and the dam was divided into four panels 26½ feet long by two end and three intermediate sets of transverse 12x12-inch struts each made in three pieces with iron fish plate splices on the vertical sides. There was a horizontal knee brace in every corner of each panel, and the ends of adjacent knee braces were connected by straining beams spiked to the struts and rangers. There were five struts in each set, the two upper ones being queen post trussed to support their own weight and that of the lower ones which were suspended from them by vertical bolts and braces with bolted angle iron connections. Above high water level the sides of the cofferdam were extended 5 feet by means of 6x12-inch timbers laid flat and sheeted inside with 6x3-inch vertical planks. The heavy stone voussoirs were set on steel centering which consisted of elliptical plate girder ribs supported at the skew-backs, and by intermediate trestle bents; but designed so as to give the maximum clearance underneath, and to afford a wide central passageway under the bridge. A working platform was built up over the full length of the span to above the top of the crown and on it a traveling derrick moved to handle the masonry. The bridge was described in "The Engineer," London.

Topographical Maps recently issued by the United States Geological Survey cover respectively the rich dairy region of New York State surrounding the city of Norwich, the Bradshaw Mountain region lying between Prescott and Phoenix, Arizona, and the Velpen coal district of southern Indiana. These sheets may be obtained at five cents each from the Director of the Geological Survey, Washington, D. C.

Improved Methods for Difficult Subaqueous Tunneling—III.

A paper on tunnel construction under water, presented by Mr. Howard A. Carson, to the Boston Society of Civil Engineers, was published with the discussion, in the Journal of the Association of Engineering Societies, for December, 1902, and is of interest as giving further information on other methods recently successfully adopted or carefully planned by competent and experienced designers for difficult subaqueous tunneling.

Mr. Carson described the method of constructing the two-track horseshoe-shaped concrete-lined East Boston tunnel which has a total length of about 4,400 feet and a maximum depth of 90 feet from the bottom of the invert to water level. It is about 24 feet wide inside, with walls 30 inches thick, and is driven generally through clay which forms a roof 18 feet thick above the tunnel, over which there is 35 feet of water at low tide, as described in The Engineering Record of Jan. 11 and April 19, 1902. Two headings 8 feet square were first driven and timbered at the bottom of the tunnel, and in them the lower parts of the side walls were built in two sections. On the upper surface of these sections steel tracks were laid to receive the semi-circular steel roof shield, on transverse rollers, which were advanced as the material was excavated through openings in the forward bulkhead. The concrete arch was reinforced by transverse twisted steel rods, and the jacks reacted against horizontal longitudinal rods permanently embedded in the arch ring.

The tunnel was driven under a maximum air pressure of 25 pounds, and the heading was protected by an air-tight bulkhead with three independent locks, the upper one being reserved entirely for persons and constituting an emergency safeguard in case the tunnel should be flooded. This work is now in successful progress. Similar work on the Metropolitan subway, Paris, differed from this in minor details and in that the upper arch was first built and then underpinned by the side walls, and the masonry was composed of small stones of irregular sizes. The tunnel has been constructed through clay at a monthly average rate of five feet a day.

The dimensions of the Blackwall tunnel under the Thames, England, are comparable to those of the East Boston tunnel, but it has a circular cross section with a cast iron shell lined with concrete. It was driven with a shield under pneumatic pressure at an average rate of 8 feet a day through sand, and 4 feet a day through clay. When the East Boston tunnel was first proposed, a plan was seriously considered for building it with separate twin tubes, 16 feet in diameter inside, which were to be floated to position and sunk in sections in a dredged trench. The amount of dredging would have been about 120 cubic yards per linear foot, estimated at $1.00 a yard, and it was thought that the tunnel if built by this process would have cost the same as by the process adopted.

The sewer tunnel under Shirley Gut is built of iron and brick with an external diameter of about 10 feet. The tunnel was built on shore in sections 50 to 65 feet long, closed with watertight bulkheads at each end and moved on rollers to low water. At high water they were floated to position, sunk by water ballast and bolted together by divers. The Deer Island sewage outfall tunnel was built with a brick lining 6¼ feet in diameter inside, and concentric rings of concrete masonry outside. It was built above water in cradles alongside a wharf in sections 52 feet long weighing about 220,000 pounds each. The ends were closed and they were lowered into the water by screw bolts slacked off by an engine, towed to position and sunk to bearing on accurately-placed saddles. The ends of the sections in both these tunnels had rubber gaskets, and the joints were made by divers.

Mr. George S. Rice described the two-track tunnel of the New York Rapid Transit Railroad under the Harlem River, 450 feet of which, between and adjacent to the pier head lines, is to be built with a cross section having a total inside width of 27½ feet, with a lining composed of intersecting segmental flange-connected cylindrical cast-iron shells, 15 feet in diameter, with a vertical diaphragm in their common chord of intersection. These tubes will be enclosed in a rectangular mass of concrete about 33 feet wide and 22 feet high with the upper corners cut off at an angle of 45 degrees. The subgrade will be at a maximum depth of about 50 feet below low water. A channel 50 feet wide at the bottom was dredged across the river on the center line of the tunnel to a depth of 10 feet above sub-grade. Transverse timber bulkheads 12½ feet wide were built across the trench at the ends of the tunnel section and sheathed with 12x12-inch timbers. Transverse bents of four piles each, placed 8 feet apart, were driven across the axis of the tunnel between the bulkheads and sawed off at about the level of the top of the tunnel. A framework of three tiers of 12x12 to 16x16-inch horizontal waling pieces, connected by vertical posts and by transverse horizontal braces of the same dimensions, was floated into position and sunk so as to engage the transverse pile bents and rest on strips previously bolted to them. This framework was thoroughly X-braced and formed a sort of skeleton core for the cofferdam in which the tunnel is to be built. Outside the waling pieces 12-inch sheet piles have been driven to form the walls of the cofferdam which will be cut off at the required level under water. A timber platform 40 inches thick, consisting of three layers of 12x12-inch timbers and two intermediate layers of 2-inch tongued and grooved planking will be sunk so as to rest on the tops of the sheet piles and form a roof over the tunnel, and it is purposed to calk the joints and pump the water out of the interior so that excavation can be made in it under atmospheric pressure. If it is found necessary, provision will be made for back filling with clay over the tunnel roof and putting air pressure inside. The work is to be done in separate halves meeting in the center of the river. At present the side walls are in position and ready for the roof on the first half of the tunnel.

Mr. John F. O'Rourke proposed a method of tunnel construction under water without sending workmen, other than divers, below the surface until the construction was practically completed, the system depending largely upon satisfactory results obtained with an automatic bucket for depositing concrete under water. He considers this method an ideal one for ordinary depths and moderate currents in favorable soil. The first operation is to dredge a trench 200 or 300 feet long to subgrade in the bottom of the river on the axis of the tunnel. Foundation piles will then be driven in the bottom of the trench, cut off at the required level and sheet piling will be driven on each side to form vertical limits for the side walls of the tunnel. A concrete bed 5 or 6 feet thick over the pile tops covering the bottom of the trench will be deposited by automatic closed buckets, as described in The Engineering Record of Dec. 2, 1899. The top of the concrete will be surfaced by hand or machinery, and a hollow centering and core mould, built on the surface, will be lowered into position on this concrete floor and covered and surrounded by concrete deposited by the special bucket between the sheet pile walls to form the sides of the tunnel. The tunnel will be built in successive sections 200 or 300 feet long, the floor of each projecting in advance of the joints, and the forward end closed by a bulkhead, but without pumping the water out until the tunnel is completed.

An Electrically-Operated Gold Dredge.

An electrically-operated gold dredge is to be used for placer mining at Atlin, B. C., in the territory south of the Yukon District. A power plant will be erected two miles distant by the Western Engineering & Construction Company, of San Francisco, and alternating current transmitted to the dredge. The electric equipment, which has been purchased from the Westinghouse Electric & Manufacturing Company, will be shipped from the East Pittsburg works, and in its journey will take an interesting route. It will be taken directly across the continent to Vancouver, B. C., from which city it will be reshipped by steamer to Skagway; it will then be conveyed over the Chilkoot Pass to Caribou, by way of the White Horse Railway; carried by teams to Tagish Lake, where it will be reloaded on a small lake steamer and taken to a landing on the other side of the lake; then transported on a narrow gauge road about six miles to another lake; re-loaded on another steamer to be taken across this lake, and then freighted to Atlin. It is expected that the machinery will be in operation in July of this year, and enough gold recovered during the season to pay the entire cost of the installation, which, including the hydraulic machinery, amounts to over $150,000.

The Future of Steam Turbines.

Steam turbines were discussed at length, on March 18, by Dr. Robert H. Thurston, director of Sibley College, Cornell University, in a lecture before the New York Electrical Society. With regard to the future of the steam turbine his conclusions are substantially as follows: The promise would seem at the moment to be the introduction very widely of a new type of prime mover which adapts itself in a peculiarly happy manner to purposes to which the common forms of steam-engine are not likely to prove as satisfactory. The indications are that the supply of power by means of this motor will be made as low as with the best types of reciprocating engine and possibly lower; while its simplicity of plan and ease of construction would seem to insure freedom from liability to either accident or depreciation of value to any important extent for long periods of time. The theory and the practical modification of theory in the design, construction and use of the machine are so well understood and the real so closely approaches the ideal that the engineer may readily see his way toward the solution of any practical problem of design that may be presented, while he also may as readily see a remedy for any observed defect of efficiency or of mechanical action. It should therefore be expected that such approximation to the ideal perfect machine as is possible will soon be attained; particularly as, already, the study of the theory and the observation of the practice of the time with this machine is now being made the task of an immense number of learned men of science, of able practitioners and of skilful constructors. Probably never, in the history of engineering, was so simple a machine made the object of investigation of so large a number of able men, inventors, constructors, engineers and men of science, and the subject of such extensive experimental research.

Report on Improved Water Supply for Toledo, Ohio.

Late in August, 1902, Messrs. G. H. Benzenberg, Allen Hazen and W. G. Clark were appointed an engineering commission by the Trustees of the Toledo water-works to determine the best method of securing "an ample supply of clear, pure and wholesome water for domestic, manufacturing and municipal purposes, for, say, the next forty years." The present supply is drawn from the Maumee River, which flows through the city, at an intake about one mile upstream from the city limits. The river above the intake has a drainage area of 6,431 square miles, upon which there is a population by the census of 1900 of 469,000, equivalent to 73 persons per square mile. For 8 miles above and below the intake, excepting during floods, the river is at the level of Lake Erie and is subject to constant fluctuations due to the action of the wind on its surface and that of the lake. As the ordinary flow down river is insufficient to produce a perceptible current, there is frequently a flow upstream caused by the wind. The water is seriously polluted and frequently turbid, and hence is condemned as unsafe.

The population of Toledo in 1900 was nearly 132,000 and the estimated population for 1940 is 412,000. The daily per capita consumption in 1900 was 63 gallons, the average total consumption 8,250,000 gallons and the maximum 13,500,000 gallons. The average daily consumption in 1940, allowing for some increase in the per capita rate, is estimated at 41,000,000 gallons, and the maximum at 58,000,000. Ground water supplies from artesian wells, from large sand beds some 10 miles or more southwest of the city, and from wells or filter galleries on the islands in the river or the deposits beneath the river were carefully studied but were rejected as unsuitable and insufficient or too expensive. Of the sources connected with the river it is stated that the sand is too fine to allow water to pass with the necessary freedom; that the depth of the deposit, from water level to bed rock, is not sufficient for the works nor to give the necessary areas for the passage of large quantities of water; that the deposits contain large amounts of decomposing organic matter, so that water passing through them is fouled instead of being purified, and as drawn contains objectionable amounts of iron; and that no effective currents scour and clean the surface of the sand deposits.

Surface water supplies from Lake Erie, from Swan and Ten-Mile creeks southwest of the city, from the Maumee River and from the Miami and Erie Canal, which parallels the river, were all found to be feasible, but would require filtration and, with the exception of the canal, pumping plants to supply the filters. Covered filters would be necessary. The west end of Lake Erie has an average depth for 10 miles from the south shore of about 23 feet, and the bottom is clayey so that the wind frequently causes the water to be turbid. To obtain a supply from this source a submerged intake 3 miles from shore with a 6-foot brick tunnel to a pumping station and sand filter plant about 6 miles southeast of the city and a 7-foot brick conduit to a clear-water basin in the southern part of the city are suggested. The total length of the conduit from the intake to the existing pumping station would be nearly 20 miles. An alternative plan which contemplated a new pumping station and improvements in the distribution system required a conduit but 13½ miles long. The development of Swan and Ten-Mile creeks would involve the construction of a large earth dam and a reservoir of about 5,000,000,000 gallons capacity. The reservoir would have a large area of shallow flowage and the capacity of this source could not be fully relied upon for future requirements.

The principal advantage in using water from the canal would be the saving of preliminary pumping, since the canal takes its water from the river above a dam several miles upstream from the intake in the river. For the supply from the Maumee River the existing works could be utilized and mechanical filters and a clear-water basin constructed. The turbidity of the water is such as to require a coagulant. For this plant mechanical filters of masonry construction in units not exceeding 400 square feet each and a new intake some distance upstream from the present intake are recommended. The works required to obtain a supply from Lake Erie on either route are estimated to cost upwards of $2,000,000, and the Swan Creek supply would cost but little less, on the basis of construction immediately required; but the improvements of the Maumee River supply are estimated to cost only about $775,000. On the basis of operating expenses, and interest and sinking fund charges, also, the river supply was estimated to be the more economical. Hence the commission recommends that the Maumee River be continued as the source of supply, with proper filtration, and that if at any time it should become possible to secure the right to use water from the canal in sufficient quantity, a suitable connection should be made between the canal and the coagulation basin, since in this way the cost of filtered water could be reduced by about $2 per million gallons. It is further recommended that the operation of the plant should be in charge of a competent and experienced person. A map of Toledo and vicinity, estimates of cost and tables of population, rainfall, chemical analysis and turbidity accompany the report.

A Fire Prevention Congress will be held in London July 6 to 10, in connection with the International Fire Exhibition, of which Mr. Ellis Marsland, 1 Waterloo Place, Pall Mall, London, S. W., is secretary. This congress, it is thought, will bring together many architects, engineers, building officials, municipal and fire brigade officers, insurance experts, etc., not only from Great Britain but from other countries.

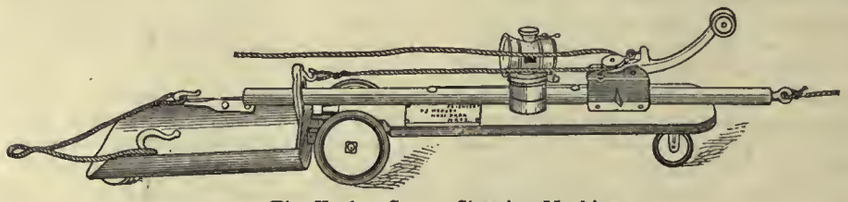
The Düsseldorf Exhibition has demonstrated that such institutions may prove a success financially as well as educationally. Up to five days before its closing it had been attended by 3,056,627 paying visitors and 36,681 season ticket holders. The gate receipts in that time were 3,184,355 marks, or nearly $758,000, and on the closing day the accounts showed a profit balance of over 1,000,000 marks, or about $240,000.

An Extensive System of Irrigation is being developed in Siam, under the supervision of the government, according to Consul-General Hamilton King, in "Consular Reports" for February. The network of canals throughout the country is also being improved by dredging old ones and opening up new ones, thus improving transportation facilities. The improvement of the mouth of the Menam River and the harbor of Bangkok is also being considered.

An Efficient Sewer Cleaning Device.

There has recently been placed on the market a sewer cleaning device which seems in every way to bear out the claim of the inventor, Mr. P. J. Healey, of Hyde Park, Mass., that it will clean any properly constructed sewer regardless of the quantity or quality of the sediment with which it may be stopped. As an illustration of the rapidity with which this machine can be worked and its general effectiveness it may be stated that at a demonstration at Union avenue, Brooklyn, N. Y., on March 14 there were removed from a 3-foot sewer 108 pails of sediment in 135 minutes, or 4 pailfuls in 5 minutes. The distance between the manholes at the ends of the section cleaned was 135 feet, and the difficulties of the case for the use of ordinary cleaning methods were greatly increased by the presence of a curve between the manholes. All previous attempts to clean this sewer had failed, and it was proposed to dig down to it in places to clear out the sediment, largely sand. This section of sewer was entirely cleaned by the Healey sewer cleaning machine while it remained nearly full of water.

The general construction of the machine is shown in the accompanying illustration. It consists of a metal shovel followed by a rolling platform. Ordinarily it is guided by a rope attached to two hooks at the front of the shovel and another rope attached to the rear end of the platform. In special cases, however, where it is necessary to overcome uneven places in the sewer invert, a third rope is attached to the back of the shovel, passes backward through a pulley at the rear of the machine and then forward again. By pulling on this rope the front of the shovel is raised, while a special device prevents the rear end of the platform from rising.



The Healey Sewer Cleaning Machine.

To use the machine it is first necessary to pass a rope through the section to be cleaned, by means of a jointed rod or otherwise. The machine is attached to this rope at the downstream manhole and drawn into the sewer, rear end first for about 10 feet. It is then pulled out and the sediment, collected and pushed ahead by the shovel, is removed. The next time the machine is sent in 10 feet farther, and so on until the entire section between manholes is cleared. In an 18-inch sewer near the Park Circle, Brooklyn, N. Y., recently cleaned by this process, the sewer was found to be so badly stopped with a fine silt that it was necessary to begin operations with a 12-inch instead of an 18-inch machine. The invention is one which on account of its simplicity and effectiveness appeals to the men who have to do the actual work of cleaning sewers. It avoids the necessity of entering the sewers where they are large enough to do so, and furnishes a means of quickly and thoroughly cleaning a sewer of any size. P. J. Healey Company, of Boston, are the makers of this machine.

Lime for Sewage Treatment at the chemical precipitation plant in Worcester, Mass., will cost $3.73 a ton at the kiln and $6.03 at the purification works, and about 2,500 tons will be required for the year. The contract was awarded to the Brandon Lime and Marble Company, of Leicester Junction, Vt.

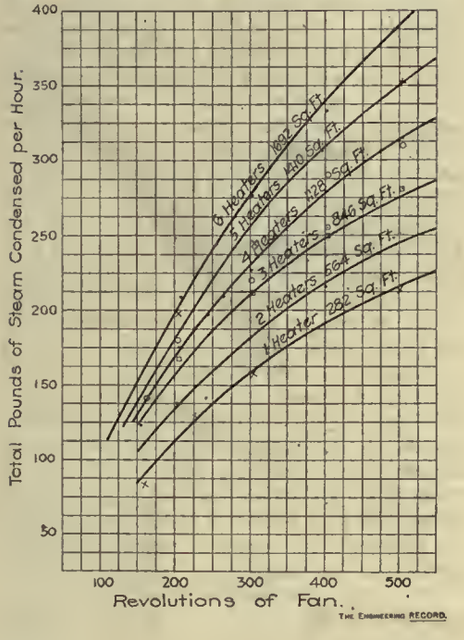
Test of a Cast-Iron Heating Surface in Connection with a Fan System of Heating.

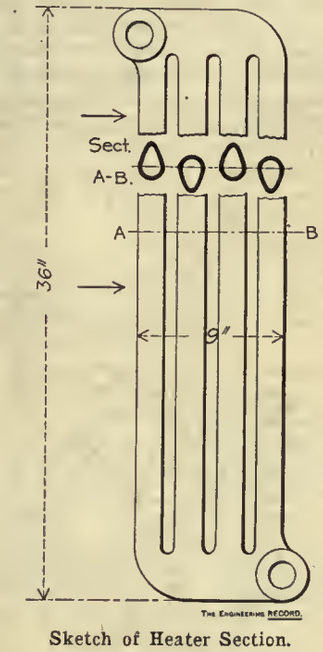
In the report of the ninth annual meeting of the American Society of Heating and Ventilating Engineers, as given in The Engineering Record of January 31, 1903, a brief mention was made of a paper read by Prof. R. C. Carpenter on a test made at Sibley College, Cornell University, of a cast iron heating surface used in connection with a blower fan for heating the air. Since that time the data and record of the test have become available, and are given in slightly condensed form in the following. The heating system was arranged specially for the experiment by the American Radiator Company and consisted of twelve radiators placed side by side in two rows of six each, one row above the other and both extending parallel to the flow of the air. Each radiator was composed of 21 sections, each of which was a single casting 9x36 inches, in the form of four nearly triangular tubes, slightly staggered, with half-inch air spaces between the tubes, all as shown in the accompanying sketch. Each section has a surface of 6.7 square feet giving a total for the whole heater of 1,692 square feet.

The fan drew the air over the heater and discharged it into a small chamber, to remove eddies, and thence through a delivery pipe and nozzle, where its velocity was measured, into the room. The fan used was made by the American Blower Company and was of the following dimensions: Height over all, 80 inches; diameter of wheel, 48 inches; width at periphery, 17.5 inches; inlet diameter, 30 inches; outlet, 27x27 inches. The fan was driven by a 6x6-inch vertical engine and arranged to run at different speeds. The individual radiators were controlled independently so that it was possible to make tests with different amounts of heating surface.

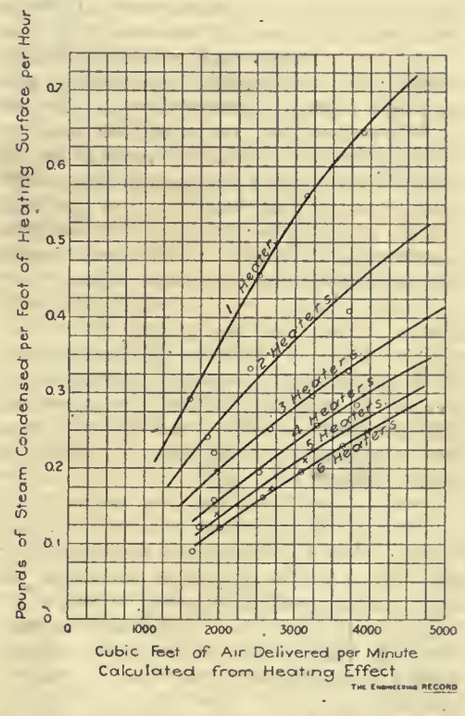
The general results of the test are shown in the accompanying table, which contains a selection of eighteen runs from the twenty-eight as given with the report. Three runs at different speeds are given for each of the six different amounts of heating surface used, each amount representing a unit consisting of two superimposed radiators. The diagrams herewith show the relation between the speed of the fan and the pounds of steam condensed per hour, for different amounts of heating surface; and the relation between the pounds of steam condensed per square foot of heating surface per hour and the cubic feet of air discharged per minute by the fan, for different amounts of heating surface. These curves show at a glance the proportionate decrease in the benefit derived as more heaters are added. In the discussion following the paper Prof. Carpenter stated that beyond 16 pipes, or in this case four heaters, the advantage gained was slight.

Three other diagrams presented with the paper but not given here, show the relation between the steam condensed for different speeds of the fan; the relation between the temperatures of the entering and discharge air; and the relation between the speed of the fan and the steam condensed per square foot of surface per hour, for different amounts of heating surface. The author was assisted in the test by Messrs. Neave and Cazenove, graduate students in the university.





Sketch of Heater Section.



Result of Tests.

a. Number of run	1	3	5	6	8	10	11
b. Number of heater units	1	1	1	2	2	2	3
c. Heating surface, sq. ft	282.	282.	282.	564.	564.	564.	846.
d. Steam press., lbs. abs	24.69	24.81	24.81	24.69	24.87	24.77	24.81
e. R. P. M. of fan	161.	303.	500.8	155.4	304.1	501.5	205.3
f. Static head, ins. water	0.207	0.797	2.294	0.203	0.774	2.21	.314
g. H.-P. consumed by fan	0.387	1.182	4.178	.0997	1.122	4.17	.3269
h. Vel. disch. head, ins. water	0.184	0.780	2.29	0.193	0.763	2.18	.291
i. Steam per sq. ft. heat. sur. per hr., lbs.	0.293	0.561	0.721	0.22	0.334	0.408	0.196
j. Temp. air received	73.6	73.4	72.3	81.0	81.	83.0	74.1
k. Temp. air delivered	125.1	124.6	118.8	143.7	150.4	146.1	158.9
l. Rise in temp. of air	51.5	51.2	46.5	62.7	79.4	63.1	84.8
m. Temp. water leaving coils	211.7	189.4	186.7	215.6	205.	209.	207.4
n. Wt. of air disch. per min, lbs	109.	214.	318.	132.	163.	253.	134.
o. B. T. U. per sq. ft. heat. sur. per hr.	285.3	556.	750.	208.5	325.	397.	190.5
p. Air disch., ft. per min., meas	1992.	3529.	5813.	2015.	2530.	5900.	2473.
q. Air enter'g coils, ft. per min., meas	234.	412.	683.	233.	401.	675.	273.5
r. Cu. ft. air per min., calc	1605.	3150.	4700.	1940.	2400.	3720.	1970.
s. Ratio of expansion of air	1.095	1.097	1.090	1.116	1.128	1.120	1.159

Result of Tests.—(Continued.)

a...	12	14	15	17	19	20	21	23	24	26	28
b...	3	3	4	4	5	5	5	6	6	6	6
c...	846.	846.	1128.	1128.	1128.	1410.	1410.	1410.	1692.	1692.	1692.
d...	24.81	24.81	24.69	24.75	24.47	24.84	24.75	24.79	24.69	24.77	24.77
e...	302.	502.	159.6	301.5	502.4	203.	304.	501.	154.1	302.08	493.
f...	.746	2.167	0.173	0.733	2.08	0.32	0.74	2.07	0.197	0.743	2.08
g...	.864	3.774	.2249	1.003	4.12	.367	.778	3.38	..	..	..
h...	.733	2.15	0.167	0.724	2.05	0.28	0.72	2.04	0.193	0.718	2.04
i...	0.251	0.33	0.123	0.195	0.284	0.140	0.174	0.25	0.09	0.163	0.232
j...	79.1	86.2	80.0	83.9	80.0	69.9	86.6	91.4	84.4	77.0	74.0
k...	159.1	160.3	159.4	169.4	164.4	172.3	177.6	177.8	174.1	182.3	179.2
l...	80.0	74.1	79.4	85.5	84.4	102.6	91.	86.4	89.7	105.3	105.2
m...	206.3	203.4	219.6	203.9	203.	199.6	204.2	216.4	216.2	215.1	212.3
n...	182.	257.	119.	175.	265.	136.	186.	275.	114.	177.	250.
o...	237.8	322.8	118.8	190.5	276.5	137.3	170.5	240.	862.	156.4	223.
p...	3560.	5890.	1992.	3500.	5960.	2518.	3570.	5980.	2022.	3560.	5960.
q...	398.	666.5	221.	389.	662.5	270.5	393.5	663.5	222.	382.	640.
r...	2680.	3710.	1730.	2520.	3830.	1960.	2690.	3980.	1650.	2560.	3610.
s...	1.150	1.134	1.148	1.157	1.156	1.198	1.164	1.158	1.168	1.196	1.198

The Appropriation for Relief for the Philippine Islands recently passed by Congress in the sundry civil expenses bill is $3,000,000. This amount is "to be expended under the direction and in the discretion of the Philippine government in such proportions as they deem wise, in the direct purchase and distribution or sale of farm implements, farm animals, supplies, and necessaries of life, and through the employment of labor in the construction of government wagon roads, and other public works."

The Lawrence, Mass., Water Board will proceed at once to build a new filter as an auxiliary to its existing plant, which is overtaxed. Chapin & Knowles, of Pittsburg, Pa., have been retained as consulting engineers to co-operate with the city engineer, Mr. A. D. Marble.

Notices for the Abatement of Nuisances are issued by the Board of Heaith of New York City upon the facts and evidence contained in the written reports of the sanitary inspectors. During the quarter ending June 30, 1902, the number of notices issued was 10,306, according to the quarterly report of the Department of Health. The notices call the attention of owners, lessees and agents to violations of the sanitary code in each case, and require the necessary alteration, cleaning or improvement of the premises within five days from the receipt of the notice. If, upon reinspection it is found that the requirements of the notice have not been complied with, a suit for penalty is commenced.

Letters to the Editor.

Communications are always welcome, and, as far as permitted by space and interest, they may be printed in these columns. The Engineering Record, however, assumes no responsibility for the facts or opinions presented in the letters.

Difficult Tunnel Construction.

Sir:—I desire to thank you for your very satisfactory description, in the issue of March 14, of our proposed submerged tunnel roof shield. There is one statement, however, not in the article but in the editorial thereon, to which I take exception, and in which exception I think you will concur after a little thought on the subject. You say our system is essentially the same as that being used under the Harlem River for the subway. I have no criticism whatever to offer on this very ingenious and interesting device, but I am convinced that in fundamental principles the two schemes are entirely different.

As I understand it, the Harlem River device is essentially a box with a flat roof resting on vertical pile walls, while we propose (1) longitudinal arch members, or voussoirs which give the structure longitudinal as well as lateral strength; (2) Lateral arch members, to give additional strength transversely; (3) Lateral tie rods to bind the whole together, and (4) chord stiffeners to counteract the pull of the tie rods and hold the structure in shape until it can be put in final position. It is thus seen that the structure has longitudinal stability in itself sufficient to bridge it over small inequalities in a submerged foundation, which therefore does not require special care in its preparation. With one end resting on the finished work and the other on the ground ahead the men can work in safety underneath to prepare the finished foundation in short sections, and with the compressed air acting as a buoy, the weight on the side foundation is greatly lessened.

In the 14 and 15-foot sewer tunnel which we are building in 64th and 62nd streets, Bay Ridge, Brooklyn, after driving the heading drift, the width of a quarter section of the roof, with the combination poling boards, which form a sectional shield, we proceed, in some of the headings, to hold up the roof with arch timbers resting on wall plates laid in side excavations.

If the ground is good, that is, if there is no running sand and water nor quicksand, we sheet down for and build a section of the invert. In running sand and water, we first put in heavy I-beams resting on the solid ground ahead, and on the finished work behind, and from these the arch timbers are braced. In quicksand (of which we have encountered a goodly supply), we use 25-foot 15-inch I-beams, and usually go for one 8-foot "bottom" at a time, in this way not disturbing the ground far ahead. In one instance we have put in heavy crown bars and are bracing them up with arch timbers, which in turn will be braced up from I-beams bridging over a short "bottom" between the finished work and the ground ahead.

Here we have the exact methods which would be utilized in the case of our system under the river. The crown bars, the lateral arch members and the wall plates are represented by the voussoirs, the arch members, and the concrete foundation, while the thrust of the arches which we now transmit to the ground outside is taken up by the tension members. The rest of the arch may be proceeded with as we now carry it on with the added advantage of the compressed air. We are also using a pilot for bracing in some of our headings, but for very bad ground the last-mentioned combination method has been most successful. From my experience in connection with the East River borings, I can say that pile clusters for the guidance of submerged structures are entirely practical, but the question of river shafts in streams where traffic is so congested, and where tides are so strong as those of the North and East Rivers would have to be cautiously approached and carefully considered.

I desire to say in conclusion that the proposed scheme, which is partially controlled by the Borough Construction Company, and which you have described on page 275, is intended primarily as an emergency method, which can be tried and I believe successfully used in those places when others may have failed, as for instance, to help a shield across some difficult place. Or it might be tried in anticipation of a difficulty after which a shield could be set up, and the work pushed to a more rapid conclusion.

Very truly yours,

J. C. Meem,

Consulting Engineer, Borough Construction Co.

New York, March 19, 1903.

Elastic Deformation.

Sir: In order to clear up any misunderstanding with respect to my remarks on elastic deformations as published in The Engineering Record of February 14, allow me to illustrate by an example the method recommended to construct deformations due to assumed exterior

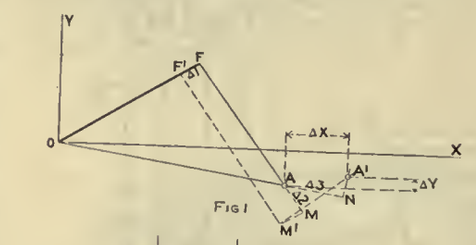


Fig 1

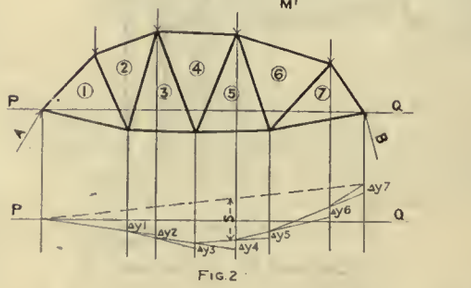


Fig. 2

forces. Let O F A (Fig. 1) represent at usual scale of about 1 to 100, a triangle of a truss-diagram, showing the truss in its true extension, when unloaded, and referring to a system of co-ordinates O X Y. On account of an assumed vertical system of loading, and two corresponding reactions such as A, the intensity of the stresses are determined, for instance compression in O-F, tension in O-A, and in F-A, to which are due reductions or additions of length of members Δ1, Δ2, Δ3, which may be represented in about full size (or double size) in diagram. Making F^1-M^1 equal and parallel to F-M, and drawing perpendiculars in M_1 and N, the intersection A^1 of the latter indicates the changed location of point A due to elasticity from direct stresses. The dislocation is in full (or double) size. The corresponding co-ordinate changes Δx and Δy may be tabulated for all triangles of the truss, keeping one side of each fixed.

Fig. 2 shows how to assemble above results in order to find the sag of a truss due to its load and reactions. If P-Q represents a horizontal line connected to the truss when not loaded and Δy1, Δy2, Δy3, etc., are the tabulated ordinate changes of the triangles, the polygon indicated shows the deformation of line P-Q in a vertical direction. The maximum sag S is to be measured in the scale of the Δy. For a two-hinged arch the sum of the Δx 1, Δx 2, etc., for all triangles must be zero, if reactions A and B due to the assumed loading have been correctly chosen. In view of the comparatively rare necessity of applying the theory of elasticity for the computation of the exterior forces of a truss, it would seem to be well worth the while in structures of some importance to use this or some other equally indisputable method as a final check. The elastic deformation under positive or negative direct stresses is, of course, not doubtful in the least.

In various analytical and graphical methods some influences more or less essential for the deformation, such for instance as that of web-members, have been omitted for simplicity. These and other similar abbreviations may be justifiable as long as the merely approximate nature of the computation is kept in mind.

Very respectfully,

C. S.

Washington, D. C., March 2, 1903.

Tunnel and Subway Ventilation.

Sir:—No doubt this subject matter of inquiry is an important one, but let us beware of exaggeration. When it is considered that even the ventilation of sewers is a disputed point, that sewer scavengers are among the healthiest in the community, that the Paris "Grand Collecteurs" and side issues are visited every month by hundreds of English, French and German ladies and gentlemen, that I have sat for three consecutive hours with five members of a health committee in a room of 8x12x8 feet with closed door, being 40 feet of air per hour to each inmate instead of the stipulated 1,800, when one considers how very little an individual takes in at a breath, and how unpoisonous to the child wrapped in, head and all, in its blankets, is the carbon from the lungs which he breathes and rebreathes over and over again as a harmless soporific, it is well to consider if the figures arrived at for subway ventilation are not somewhat overdrawn, as, if one-fifth or one-tenth the quantity of air to be extracted or forced in would be sufficient, the solution of the problem would be so much easier and less expensive.

Very truly yours,

A Subscriber.

Quebec, March 13, 1903.

Inquiries.

Questions and answers of interest to readers may be published under this heading. Replies are solicited and should be addressed to The Engineering Record.

Stack Economizers.

Sir:—In answer to the inquiry of C. W. B. in your issue of 21st inst., it may be said that the introduction of economizers into stacks or smoke flues usually increases the resistance to the flow of the gases. This is due to the passage of the gases through the economizer itself, and to the long horizontal flues with bends and dampers which are usually necessary. Proper design and arrangement will keep this loss down to reasonable figures. The greatest impairment to the draft comes of course from the reduction in temperature of the gases—usually 200 to 300 degrees Fahrenheit. These losses must always be given careful consideration. If there was originally no surplus of stack capacity the addition of economizers will reduce the working capacity of the plant, and some provision will have to be made to make good the deficiency. Occasionally it happens that the original stack capacity is so great that even after economizers are put in, there is still sufficient draft to do the work. When a new plant is being designed to include economizers, provision for the required draft can be made either by increased height of

chimney, or by mechanical apparatus. The advisability of installing economizers in any particular case depends upon the size of plant, cost of coal, the number of hours out of 24 that it is in operation, and the first cost, including mechanical draft, when required. Many situations will show a handsome profit, and many others the reverse.

Very truly yours,
William H. Bryan,
Consulting Engineer.

St. Louis, March 23, 1903.

New Books Received.

Under this heading books received from publishers will be punctually announced. Reviews may be published in subsequent issues. Publishers are requested to send retail price with each book.

The Induction Motor; Its Theory and Design Set Forth by a Practical Method of Calculation. By Henri Boy de la Tour, Chief Electrician and Designer, Electrical Department of the Compagnie Fives-Lille, Givors, France. Translated from the French by C. O. Mailloux, M.A.I.E.E., M.I.E.E., past president of the New York Electrical Society. New York: McGraw Publishing Company. 200 pages, illustrated. Price, $2.50.

Storage Battery Engineering. A Practical Treatise for Engineers. By Lamar Lyndon, B.E., M.E., Consulting Electrical Engineer, Associate Member American Institute Electrical Engineers, Member American Electro-Chemical Society. New York: McGraw Publishing Company. 382 pages, illustrated. Price, $3.

Book Notes.

Engineering for Land Drainage. A Manual for Laying Out and Constructing Drains for the Improvement of Agricultural Lands. By Charles G. Elliott, M. Am. Soc. C. E. New York; John Wiley and Sons. 232 pages, illustrated. Price, $1.50.

Mr. Elliott's book is valuable, the only one in print giving the present practice in many features of drainage. However, it does not pretend to be an exhaustive treatise such as would meet the need for an exhaustive and thoroughly modern book on land drainage, presenting adequately the engineering side.

The author does not treat the topics taken up in great detail, and seems to prefer to state his general conclusions and views without giving the arguments and experience in specific cases. The engineer of the present day must be thoroughly well informed on all sides of his work, and he hesitates to adopt the conclusions of any writer without knowing the data on which they are based. Eleven pages are devoted to a general introduction, but do not discuss the extensive history of drainage. Twenty-three pages are given to soils, a space so limited as to make necessary the omission of most of the results of the large amount of recent scientific research. No discussion whatever of rainfall, evaporation or plant nutrition are attempted and very little is given about ground water. An exceedingly elementary description of the process of leveling is given, but no description of surveying instruments or discussion of their use and adjustment. No adequate discussion of drainage laws in different States is given, and only very general statements regarding the exact financial benefit of drainage are made. The data for estimating the cost of drains are not illustrated by examples. The author discusses the laws of flow in drains, but does not give tables or diagrams of the capacities of tile or open ditches, which would be much more convenient for use than any formula could be. Poncelet's formula, which he adopts for tile drains, is of inconvenient form to use, and Chezy's formula could have been used with a value of the constant giving practically the same results.

The author seems to think that in general tile drains should be laid 3 or 4 feet deep, but he says that there are some soils in which the benefit from going deeper than 2½ feet is not proportional to the increased cost. The statement is made that distances apart may range from 33 to 200 feet, depending on the soil and the depth. The author corrects the common erroneous statement that 3 inches per 100 feet is the minimum allowable grade for tile, and gives a table of minimum grades ranging from 0.04 per cent. for a 12-inch tile to 0.10 per cent. for a 2-inch. Regarding the proper size of drains the conclusions are in much better agreement with current practice than are the statements often made that tile drains should be able to remove ½ inch to 1 inch depth of water per twenty-four hours. The author recommends ¼ inch for tile drains, and for open ditches, which must take both surface and under drainage, capacities ranging from ¾ inch per twenty-four hours for 1,000 acre tracts to ¼ inch for 8,000 to 30,000 acre tracts; and says that usually ½ inch per twenty-four hours is the proper capacity. In computing sizes of main tile drains the advice to add to the head of the main the average excess of head of the laterals above the main is not defensible. The book is one no drainage engineer can afford to be without, but plenty of room is left for a future more exhaustive work.

Statics by Algebraic and Graphic Methods. By Lewis J. Johnson, C. E., Assoc. M. Am. Soc. C. E., Assistant Professor of Civil Engineering in Harvard University, New York: John Wiley & Sons. 141 pages, illustrated. Price, $2.

This book has been written primarily for the use of students of engineering and architecture but will be found useful to designing engineers and architects. It will be especially useful to that class of men in practice who are making a study of graphical statics without the aid of a teacher for it gives only the principles and methods necessary to understand the practical applications. In the first part the usual definitions, general principles and methods of statics are given, and in the second part are illustrations of the application of the principles to specific cases. One of the features of the book is the comparison of the graphic and algebraic solutions of the same problem. This is done by placing the two solutions side by side, which enables one to compare them easily. The scheme of notation, by which the magnitude, direction and point of application of a force is fixed, is a good one. In part two there are outlined the various steps necessary in the solution of practical cases such as roof trusses, bents in mill buildings, masonry dams, etc. The determination of the stresses in trusses under movable loads, such as bridge trusses, is only mentioned, the reader being referred to the standard books for a study of these problems. The author realizes the important fact that there are many problems which are best solved by graphical methods while in the solution of others the analytical methods are the most useful. He says "the choice between one method or the other for a given problem before an engineer is a matter of convenience, but in many cases both should be used for the sake of the check upon results thus obtained." Another point is made regarding the relation between the degree of precision in the solution of a problem and the degree of accuracy used in the determination of the data. There are many cases where one sees data given which are assumed and which may be in error as great as five per cent., while the results based on this data are given oftentimes to a degree of accuracy which would correspond to an error in the data of a small fraction of one per cent.

A Text-Book of Field Astronomy for Engineers. By George C. Comstock, Professor of Astronomy in the University of Wisconsin. New York: John Wiley & Sons. 202 pages, illustrated. Price, $2.50.

This work is designed as a text-book for students in technical colleges, by an astronomer who has had a long experience in teaching practical astronomy to such students. The author states his belief that the parts of astronomical practice most pertinent to engineering instruction are: "(a) Training in the art of numerical computations: (b) Training in the accurate use of such instruments of precision as the sextant and the theodolite, with special reference to the elimination of their errors from the results of observation: (c) Determinations of time, latitude, and azimuth, with portable instruments, as furnishing subject-matter through which (a) and (b) may be conveniently realized." The book is well planned to aid the student in acquiring training in these three lines.

The first chapter is devoted to the formulæ used in spherical trigonometry, to the proper arrangement of the numerical work and to the accuracy of the computations used. The systems of coordinates and transformation from one to another of the systems, forms the subject-matter of the second chapter. One chapter is devoted to each of the subjects of time and corrections to the coordinates. The next three chapters, forming the greater part of the text, treat of the methods of observation and computation for the determination of time, latitude and azimuth. A very admirable feature of this treatment is the division of the observations into three classes: rough determinations, approximate determinations and accurate determinations. The methods described for the several determinations are all methods which are recognized as standard or ones which the author has found well adapted to the results sought. The instruments used are the engineer's theodolite, the sextant and a chronometer, usually a watch. A short chapter is devoted to the transit instrument. The text is clear and concise, so concise that it would be somewhat difficult for the unaided student to follow all of the work. As a text-book for classes in technical schools it is a model and will fill a long felt need.

An Obstructionist.

The following anecdote was sent to The Engineering Record by Mr. Philip D. Borden, city engineer of Fall River, Mass.:

Considerable annoyance and delay is caused to the contractors on grade crossing work by the action of an abutter who refuses to allow the running of a guy rope from the derrick over his premises, although the guys were strung at such a height as in no way to interfere with any and every use to which he can put the land. This abutter went so far as to procure a long ladder and cut the guys. The contractor attempted to build a retaining wall on the line of this abutter's property, but the abutter prevents him from doing so by arresting any man who in any way trespasses on his premises.

To "dog" a stone and swing it into position it would pass over said abutter's land, and to this he objected. Some nice questions are involved, and the Supreme Court of Massachusetts is wrestling with them. In the meantime it has been necessary to suspend operations and the citizens are deprived of the use of one of the most important thoroughfares in the city. This is a reminder that any person who wishes to insist on all of his *legal* rights, no matter how much inconvenience he causes his fellowman can do much mischief. In this case the abutter does not suffer any injuries except to his feelings. The contractor has offered to give good and sufficient bond to indemnify the abutter, but he will not accept any bond. This should be a warning to parties having the preparation of plans and specifications for such work, as the trouble could have been avoided had the decree of the court authorized the person directed to do the work to enter upon and occupy such of the adjoining property as was necessary in the proper execution of the work, they to pay all damages caused by so doing.

Fourth Convention of the American Railway Engineering and Maintenance of Way Association.

The meetings of the fourth annual convention of the Association were held in the Auditorium Hotel, Chicago, on March 17, 18 and 19, with President George W. Kittredge, chief engineer, C. C. C. & St. L. R. R., in the chair.

The reports of the secretary and treasurer were presented and the new board of officers, whose names are given under "Personals," was elected. The sessions were principally occupied with the reading and discussion of the reports of the standing committees on roadway, ballasting, rails, wooden bridges and trestles, ties, track, buildings, signs, fences, crossings and cattle-guards, signaling and interlocking, water service, records, reports and accounts, iron and steel structures, yards and terminals, uniform rules and organization, and masonry. These reports are intended to aid in the regulation of the practice of the members of the association with the idea of bringing about greater uniformity. Some of the reports not fully discussed in the meetings may be further discussed by letter. These reports will be printed in the proceedings.

Annual Meeting of the Boston Society of Civil Engineers.

The annual meeting of this society was held on March 18 with an attendance of 146. Six new members were admitted. The canvass of the letter ballots showed the election of the board of officers named in the "Personal" column. The annual reports of the officers and several special committees were read and accepted, and the special committees were reappointed. The present membership is 509, a net increase of 2 during the year. The library committee reported that 237 volumes had been added, the total number of accessions to date 5,000. During the year eleven meetings were held, with an average attendance of 86, and thirteen excursions were taken to various engineering works and manufacturing plants, the average attendance being 43. The New England Water Works Association has for some years shared the rooms of the Society in Tremont Temple and the New England Association of Gas Engineers now desires to make a similar arrangement. Mr. A. W. Parker presented a short illustrated paper entitled "Early and Curious Types of the Cantilever Bridge in New England and New Brunswick," describing many structures built in 1868-'69 and the early seventies from the designs of his brother, Mr. Charles H. Parker. (A description of early iron railway bridges on the New Brunswick Railway was printed in The Engineering Record of July 27, 1901.) President George A. Kimball in his address suggested the advisability of forming sections of the Society to be devoted to mechanical, marine, electrical and sanitary engineering, there being at present no local organizations in these branches of the profession.

Personal Notes.

Mr. John H. Harden has been elected surveyor of Phoenixville, Pa.

Mr. Charles Wehr has been elected water superintendent of South Bethlehem, Pa.

Mr. John D. Rullmann has been elected city engineer of San Antonio, Tex.

Mr. John M. McAdam has been elected borough engineer of Washington, Pa.

Mr. G. Warren Mudy has been elected superintendent of the Cambridge (Md.) Water Co.

Mr. Fred Hart has been appointed superintendent of the Batavia, N. Y., municipal plant.

Mr. Charles R. Allen, Jr., has been appointed city engineer of Barre, Vt., succeeding Mr. Phil S. Smith.

Mr. I. G. Rawn has resigned as general superintendent of the Baltimore & Ohio Railroad at Pittsburg.

Mr. Cornelius C. Vermeule, of East Orange, N. J., has been in Ithaca, N. Y., in connection with the water-supply question now before that city.

Mr. George Gillespie has been appointed superintendent of the Albany & Hudson Railway & Power Co., with headquarters at Albany, N. Y.

Mr. George E. Martin has resigned as superintendent of the shops of the Pedrick & Ayer Co., manufacturers of railroad machine tools at Plainfield, N. J.

Mr. Arthur M. Waitt, M. Am. Soc. M. E., has resigned as superintendent of motive power and rolling stock of the New York Central & Hudson River Railroad, taking effect April 1.

Mr. William G. Smith, for some time in the employ of the Metropolitan Water and Sewerage Board of Boston, has resigned to accept a position with the Washington Aqueduct Commission.

Mr. William Graham has been appointed assistant engineer of bridges and buildings of the Baltimore & Ohio and of the Baltimore & Ohio Southwestern Railroad, with headquarters at Baltimore.

Mr. E. G. Pratt, of Des Moines, Ia., has been appointed general manager of the Milwaukee Gas Light Co., succeeding Mr. E. G. Cowdery, who has become general manager of the Laclede Gas Light Co., of St. Louis.

Mr. J. C. Patterson has been appointed assistant engineer of the Great Northern Railway, with headquarters in St. Paul, and Mr. W. P. Whitten has been elected resident engineer at St. Paul, succeeding Mr. Patterson.

Mr. Archibald L. Parsons, Assoc. M. Am. Soc. C. E., assistant engineer in the U. S. Engineer Office for the Government Printing Office at Washington, D. C., has been nominated by the President to be civil engineer in the U. S. Navy

Messrs. George S. Webster, Joseph T. Richards and Rudolph Hering have been appointed to pass on the plans for the proposed sewer system in Lower Merion township, Ardmore, Pa. Mr. J. S. G. Dunn has been reappointed township engineer.

Mr. J. M. Stark has been appointed principal assistant engineer of the Chicago, Rock Island & Pacific Railway, and the Choctaw, Oklahoma & Gulf Railroad, with headquarters at Little Rock, Ark., succeeding Mr. F. A. Molitor, who has resigned.

Col. Peter C. Hains, Corps of Engineers, U. S. A., is to be made a brigadier general and retained on the active list until his statutory retirement in July, 1904. He is now stationed at Baltimore as engineer of the Southeast Division, in charge of the defense and harbor improvements at that city.

Mr. A. L. Dabney, M. Am. Soc. C. E., of Memphis, Tenn., has assumed the duties of assistant chief engineer of the Yazoo Mississippi Levee District, during the present high water. He resigned from that position about a year ago to practice hydraulic and municipal engineering, which he intends to continue.

Charles O. Vandevanter, M. Am. Soc. C. E., engineer in charge of the Western Maryland Railroad, with which he has been connected for fourteen years, has resigned and formed a partnership with Mr. J. M. Hood, Jr., with offices in the Equitable Building, Baltimore. Mr. Hood's experience has been largely along railroad lines.

The Boston Society of Civil Engineers has elected the following officers: President, Ira N. Hollis; vice-president for two years, Dwight Porter; secretary, S. E. Tinkham; treasurer, Edw. W. Howe; librarian, Frank P. McKibben; director for two years, J. R. Worcester. Vice-president Fred Brooks and director G. B. Francis hold over for one year.

Mr. George E. Howe, for six years prior to August, 1901, with the Metropolitan Water and Sewerage Board of Boston, and since that time with the Hudson River Water Power Co., of Glens Falls, N. Y., has accepted a position with the Commission on an Aditional Water Supply for New York City, the headquarters of which are in the Park Row Building.

First Lieut. William D. Conner, Corps of Engineers, U. S. A., and First Lieut. Harley B. Ferguson, Corps of Engineers, have been ordered to report to the Superintendent of the U. S. Military Academy, at West Point, on August 20 and Captain Henry Jervey on December 15. First Lieut. Edwin R. Stuart, Corps of Engineers, is to be relieved from his duties at the Academy in the fall.

The American Railway Engineering & Maintenance of Way Association has elected the following officers: President, Hunter McDonald, chief engineer of the Nashville, Chattanooga & St. Louis Railway, Nashville, Tenn.; first vice-president, H. G. Kelley, chief engineer, Minneapolis & St. Louis Railroad, Minneapolis; second vice-president, James Dun, chief engineer, Atchison, Topeka & Santa Fe system, Chicago; secretary, L. C. Fritch, Chicago; treasurer, W. S. Dawley, chief engineer, Chicago & Eastern Illinois Railroad, Chicago; directors, F. H. McGuigan, manager Grand Trunk Railway system, Montreal; T. F. Whittelsey, general manager, Toledo Railway & Terminal Company, Toledo, O.; A. W. Johnston, general superintendent, N. Y., Chicago & St. Louis Railroad, Cleveland; J. Kruttschnitt, fourth vice-president, Southern Pacific Co., San Francisco; A. W. Sullivan, assistant second vice-president, Illinois Central R. R., Chicago; G. W. Kittredge, chief engineer, Cleveland, Cincinnati, Chicago & St. Louis Railway, Cincinnati.

Obituary Notes.

A. W. Morley, chief engineer, U. S. N., retired, died March 24 at his home in Brooklyn, N. Y. He entered the navy at the beginning of the Civil War; in 1882 he became chief engineer and in 1896 was retired. He was a member of the Naval Advisory Board, on whose recommendations the reorganization of the navy was begun.

Thomas Monro, a distinguished civil engineer of Canada, died at Coteau Landing, Que., March 20. He was born in Ireland in 1831, and came to America in 1850. For a long time he was in the service of the Public Works Department at Quebec; and since then with the Department of Canals at Ottawa. He was identified with many important works in the construction of canals and railways in the Dominion, and his most noted work was probably the Soulanges Canal, of which he was chief engineer. He was a member of the Institution of Civil Engineers and past president of the Canadian Society of Civil Engineers.

The Office of State Architect has been created by a bill which passed the New Jersey Senate on March 18. The salary is to be $5,000 per year.

A National and International Good Roads Convention will be held in St. Louis, Mo., from April 27 to May 2. Scientific methods of common road construction, including plans for providing for their cost and maintenance, together with recommendations for practical legislation, will be discussed.

The Cost of Asphalt Pavement is thus limited in the sundry civil appropriation bill recently passed by Congress: "Under appropriations herein contained no contract shall be made for making or repairing concrete or asphalt pavements in Washington City at a higher price than $1.70 per square yard for a quality equal to the best laid in the District of Columbia prior to July 1, 1886, and with a base of not less than 6 inches in thickness."

The Worcester Polytechnic Alumni Association of New York held a well attended and enthusiastic meeting at the Hotel Albert, on Tuesday evening, March 17. The association includes seventy-five graduates, the majority of whom hold prominent positions in engineering and manufacturing concerns in that city. The next meeting will be held at the same hotel on April 28, and all Worcester "grads" in the vicinity are cordially invited to be present.

New York Canal Improvements were briefly outlined in The Engineering Record of March 7. On the 24th the State Senate passed a bill "making provision for issuing bonds to the amount of not to exceed $101,000,000 for the improvement of the Erie Canal, the Oswego Canal and the Champlain Canal, and providing for a submission of the same to the people to be voted upon at the general election to be held in the year 1903." This is known as the 1,000-ton barge canal bill.

Surveys of Buildings during Erection are required in the District of Columbia, according to the annual report of Mr. Henry B. Looker, surveyor. An official plat of each lot to be used as the site of a building is also required. The results of these regulations, which went into effect March 1, 1902, are said to have amply justified their adoption. Up to June 30 probably fifteen cases of errors of builders in location of party walls were discovered before it became difficult to correct the error.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS,
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 21, 22, 24, 26, 27 and 31.

WATER.

Oceanside, Cal.—Press reports state that bids are wanted Apr. 17 for $15,000 water bonds and $10,000 wharf bonds.

Modesto, Cal.—Bids will be received Apr. 7 by the Co. Bd. of Dirs. for $140,000 Modesto Irrigation District bonds.

Silverton, Colo.—R. H. Cooper, City Clk., writes that it is proposed to lay from 1 to 4 miles of 10-in. pipe; probable cost, $7,500.

Hartford, Conn.—Allen Hazen, of New York, N. Y., is stated to have submitted to the Water Bd. a report on the future water supply of the city. Among other things he recommends the establishment of a plant for the filtration of river water.

Meriden, Conn.—Local press reports state that the Bd. of Pub. Works has awarded the contract for furnishing pipe and other supplies for the Water Dept., amounting to $12,000, to the Reading Iron Co., of Reading, Pa.

Laurel, Del.—The Legislature has passed the bill providing for improvement of water works.

Wilmington, Del.—The Water Dept. has obtained authority to borrow on bonds of the city $200,000 for the construction of a reservoir and filtration plant. Plans will be prepared at once.

Washington, D. C.—All bids opened Feb. 20 for filter materials have been rejected, and new bids will be received Mar. 31, as advertised in The Engineering Record of Mar. 21. For detail bids see issue of Engineering Record, Feb. 28.

Jacksonville, Fla.—It is stated that bids are wanted by the Water Wks. Trus. until Apr. 6 for furnishing f. o. b. cars 1 12-in. centrifugal pump, connected to 225 H. P., 220 volt induction motor, together with transformers. R. N. Ellis, Supt.

Smithville, Ga.—The citizens are stated to have voted to issue bonds for boring an artesian well.

Harvard, Ill.—The citizens are reported to have voted to issue $5,500 water bonds.

Crete, Ill.—M. A. Earl, of Chicago, Ill., is reported to have submitted plans for water works, to cost $5,000, exclusive of mains and hydrants.

Mason City, Ia.—The City Council is reported to have decided to construct a concrete water reservoir.

Burlington, Ia.—It is reported that a resolution has passed the Council authorizing the issue of $30,000 bonds for extension of water mains.

Boone, Ia.—C. B. Shuman & Co., of Boone, has secured the contract for 2,550 lin. ft. of 6-in. c. i. main, including hydrants and valves, at $1.02½ per lin. ft.; total, $2,614. Chas. E. Russell, City Engr.

Peabody, Kan.—It is stated that the Rock Island R. R. Co. will construct a reservoir about 3 miles south of Peabody.

Lalonia, Ky.—Bids will be received Apr. 7 by W. H. Dye, Town Clk., for furnishing the town with water from Ohio River for a term of 20 years.

Dexter, Me.—J. W. Haines, Town Clk., writes that it was voted Mar. 23 to construct water works.

Augusta, Me.—The Augusta Water District is being formed to furnish the city of Augusta and town of Chelsea with water from China Lake, 14 miles. The City Council has endorsed bill which has passed State Judiciary Com. W. B. Getchell, City Engr.

Salisbury, Md.—The Dirs. of the Salisbury Water Co. are stated to have accepted plans for a pumping station and for sinking an independent system of wells. Dr. L. S. Bell, Secy.

Lonaconing, Md.—A. M. Evans, Secy. Lonaconing Water Co., writes that it is proposed to construct about 2 miles of pipe and a reservoir, and the company is now ready to receive bids on same.

Taunton, Mass.—The City Council is stated to have appropriated $10,000 for construction work in Water Dept.

Lawrence, Mass.—Preliminary surveys are being made by Chapin & Knowles, of Pittsburg, Pa., for an addition to the filter bed for the Lawrence Water Works. A. D. Marble is City Engr.

Newburyport, Mass.—It is stated that the Water Comrs. propose laying 3,000 ft. of 12-in. water main from the pumping station through the Pines.

Quincy, Mass.—Bids are wanted by the Bd. of Pub. Wks. for 170 tons of 4, 6 and 10-in. c. i. pipe. Hamilton Flood, City Engr.

Duluth, Minn.—Bids will be received Apr. 6 by the Common Council for $40,000 bonds to be used for extending water and gas plant. H. W. Cheadle, City Clk.

Wood Lake, Minn.—It is stated that $5,000 bonds have been voted for water works.

Blythe, Miss.—See "Industrial Plants."

Yazoo City, Miss.—See "Power Plants, Gas and Electricity."

St. Louis, Mo.—Water Comr. Flad is stated to have submitted to the Bd. of Pub. Improv. plans for altering the settling basins at Chain of Rocks. The cost of reconstructing the basins will be $110,000. The plans provide for the building of weirs in the walls of the basins.

Forsyth, Mont.—See "Power Plants, Gas and Electricity."

Enfield, N. H.—Bids are wanted Apr. 15 for laying about 5 miles of 4 to 12-in. pipe, and setting about 35 hydrants, gate valves, and boxes. Everett B. Huse, Chmn. Water Comrs.

Hammonton, N. J.—The citizens are reported to have voted to issue $45,000 water bonds.

Pennsgrove, N. J.—The matter of constructing water works has been indefinitely postponed.

Greene, N. Y.—See "Power Plants, Gas and Electricity."

Tonawanda, N. Y.—City Engr. A. P. Smith estimates the cost of a 24-in. water main to be constructed across Niagara River, at $12,379.

Wayland, N. Y.—The citizens are stated to have voted Mar. 17 to issue $25,000 bonds for the construction of water works.

Watertown, N. Y.—F. W. Streeter, City Clk., writes that at the election Mar. 20 to obtain the public sentiment of the citizens on the water question, the proposition was carried. According to local press reports the following was the question voted upon: The erection and maintenance of a pumping station near Sackets Harbor, by which water could be brought from Lake Ontario; the installation of a mechanical filtration plant, and the establishment of a system by which a proper water supply could be brought from some source in the region of the Adirondacks.

Little Falls, N. Y.—About 2,000 ft. of vitrified conduit pipe will be replaced by 20-in. c. i. pipe.

Dunkirk, N. Y.—The Bd. of Water Comrs. contemplate an extensive improvement in water mains, several new mains and relaying some old ones.
The Bd. of Water Comrs. are reported to have decided to employ an expert hydraulic engineer to prepare plans for the proposed water works extensions.

Alexandria Bay, N. Y.—The citizens are stated to have voted Mar. 17 to construct water works, to cost $30,000, and a sewerage system, to cost $30,000.

Fargo, N. D.—Bids will be received Apr. 6 by H. J. Gibson, City And., for furnishing and delivering 2 horizontal tubular boilers of 100-H.-P. each; also 2 internally fired "Continental" boilers with Morrison corrugated furnaces of 100-H.-P. each.

Cincinnati, O.—The Water Works Comrs. are stated to have awarded the contract for constructing the coal storage houses of steel for the eastern and western pumping stations of the new water works to C. L. Strobel, of Chicago, Ill., for $193,600.

Cleveland, O.—Bids are wanted Apr. 2 and also on Apr. 16 for furnishing and delivering water valves, as advertised in The Engineering Record.

Toledo, O.—Bids will be received Apr. 3 by the Water Wks. Trus. for furnishing f. o. b. cars 1,100 tons 4, 6, 8 and 20-in. cast iron water pipe, said pipe to weigh per length of 12 ft. 2,700 lbs. T. R. Cook, Supt.

Milford, O.—The citizens are stated to have voted Mar. 14 to issue $25,000 bonds for the construction of water works.

Bridgeport, Okla. Ter.—The House has passed a bill to legalize the vote of Bridgeport for water works.

The Dalles, Ore.—J. M. Filloon, City Recorder, writes that it is proposed to construct water works, to cost about $25,000, but the question will have to be submitted to a vote of the people first. Engineer, D. W. Cummings.

Portland, Ore.—It is stated that bids are wanted Apr. 8 for furnishing 38,200 lin. ft. of 4 to 20-in. pipe, 30 tons of special castings, tees, etc. Frank T. Dodge, Supt. Water Bd.

Philadelphia, Pa.—The following bids were opened on Mar. 24 by Wm. C. Haddock, Dir. of Pub. Wks., for sand washers at Upper Roxborough filter plant: E. M. Nichols, $3,849; Pat'k Gormley, $5,500; D. J. McNichol, $7,600; P. H. Morris, $4,898.

Pittsburg, Pa.—A press report states that the Kennicott Water Softener Co., of Chicago, Ill., has secured the contract for 10 water softening plants to be constructed for the Pittsburg & Lake Erie R. R. Co; total cost, about $200,000.

Stewartstown, Pa.—The citizens will soon be asked to vote on the question of issuing $15,000 bonds for water works.

Allegheny, Pa.—Dir. D. L. Fulton, of the Dept. of Pub. Wks., in his first annual report to Councils, will advocate the construction of a reservoir for the city and also the establishment of a water-meter system.

Gallitzin, Pa.—The Mountain Lake Water Co. has been incorporated to supply water in the township of Gallitzin; capital, $50,000. Frank U. Ferguson, Wm. C. Bracken and John P. Bracken are among the incorporators.

Allentown, Pa.—Bids will be received Apr. 7 by Fred. E. Lewis, Mayor, for $164,700 water bonds.

Aberdeen, S. D.—The Council is stated to have adopted resolutions providing for the laying of 14,000 ft. of water mains; also for 7,500 ft. of 15-in. pipe extensions.

Dyersburg, Tenn.—The citizens are stated to have voted to issue $25,000 bonds for sewers and $33,000 bonds to extend the water works, and establish a stand-pipe and filters.

Dyersburg, Tenn.—It is stated that bids are wanted Apr. 9 for a stand pipe 27 x 50 ft. W. A. Fowlkes, Jr., Mayor.

Center Point, Tex.—See "Power Plants, Gas and Electricity."

Marshall, Tex.—T. D. Seaberry, City Secy., writes that bids will be opened Apr. 14 for the construction of the steel water tower.

Salt Lake City, Utah.—City Engr. Kelsey is making a preliminary survey for a new storage reservoir in City Creek canyon. It will have a capacity of 5,000,000 gals., and cost about $40,000.

Williamsburg, Va.—The City Council will soon submit to the voters a proposition to bond the town for $50,000 for water works.

Richmond, Va.—Bids are wanted Apr. 6 for covered steel water tower 30 ft. diam. and 30 ft. high, supported on steel superstructure 120 ft. high, 16-in. cast iron supply pipe and 8-in. overflow pipe included; also on same date for furnishing 4 to 20-in. c. i. pipes, 6 to 20-in. hub end gate valves, 50,000 lbs. special castings, etc. Chas. E. Bolling, Supt. City Water Wks.

Ceredo, W. Va.—See "Power Plants, Gas and Electricity."

Saratoga, Wyo.—Bids are wanted Mar. 30 for $20,000 water works bonds. R. W. Dyer, Town Clk.

Paris, Ont.—See "Power Plants, Gas and Electricity."

SEWERAGE AND SEWAGE DISPOSAL.

Ensley, Ala.—Aiber & Byrne, of Birmingham, have been engaged to prepare plans and specifications for a sewerage system at Ensley. The city will vote on the matter Mar. 31st, and the work on the plans and specifications will be commenced about April 1st. It is proposed to expend about $35,000 for sanitary sewers, and about $40,000 for storm-water sewers.

Los Angeles, Cal.—It is stated that bids are wanted Apr. 1 for constructing a sewer system, estimated to cost $1,000,000. H. J. Lelande, City Clk.

Bridgeport, Conn.—Bids will be received Apr. 9 by Patrick Kennelly, Dir. of Pub. Wks., for furnishing material for constructing sewers in portions of Thompson St. and Wheeler Ave. Engineer's estimate: 1,520 ft. 30-in. brick sewer, 360 ft. cement pipe 14x21, 1,160 ft. cement pipe 10x15, 115 brick manholes, etc.

Hartford, Conn.—The Bd. of St. Comrs. has voted to recommend to Council an appropriation of $45,000, to complete two sections of the intercepting sewerage system.

Wilmington, Del.—The House has passed the bill providing for an appropriation of $90,000 for sewers in the 9th Ward.

Milford, Del.—A bill has been passed in Legislature authorizing Milford to borrow $20,000 for street and sewer improvement.

Tallahassee, Fla.—The City Council Com. has reported favorably on the proposition contained in Mayor Moor's message, recommending an issue of $100,000 bonds for sewerage and paving.

Peoria, Ill.—Local press reports state that bids will be received Mar. 30 by the Bd. of Local Improv. for constructing the Persimmon St. sewer system, estimated to cost $19,000.

Evanston, Ill.—The Council has passed the ordinance providing for granite top macadam pavements on portions of Foster and Noyes Sts.; also for a system of vitrified tile pipe sewers from 36 to 12 in., to be constructed to relieve present sewers in Sheridan Road, Orrington and Sherman Aves., and their laterals from storm waters. J. H. Moore, Designing Engr.

Boone, Ia.—Bids are wanted Apr. 6 for furnishing f. o. b. cars 7,500 8 to 15-in. tile for constructing drain No. 7 in Garden Township. Archie Patteson, Co. Aud.

Ottumwa, Ia.—Bids will be received on Apr. 6 by T. F. Keefe, Chmn. St. Com. for the construction of about 4,100 ft. of the So. Ottumwa trunk sewer.

Burlington, Kan.—Bids are wanted Apr. 1 for the construction of a sewerage system. Engineers, Burns & McDonnell, Postal Teigh. Bldg., Kansas City, Mo. Della Hall, City Clk.

Covington, Ky.—Bids will be received Apr. 1 by J. M. Carr, Town Clk., of Central Covington, for $30,000 sewer bonds.

Bar Harbor, Me.—W. H. Sherman, Town Clk., writes that it is proposed to expend $10,000 for new sewers.

Oakland, Md.—The City Council is stated to have granted a franchise for a sewerage system to F. T. Martin, of Fairmont, W. Va.

West Newton, Mass.—About 6,800 ft. of 12-in. and 8-in. sewers will be constructed by the city of Newton. Irving T. Farnham, City Engr.

Easthampton, Mass.—Jos. W. Wilson, Town Clk., writes that it is proposed to build a trunk line sewer to cost about $30,000, and for sewers in 3 streets, to cost about $7,000.

Lancaster, Mass.—J. C. L. Clark, Town Clk., writes that the matter of constructing a sewerage system is under consideration, and the matter may be voted on at the town meeting Apr. 6.

Jackson, Mich.—The citizens will vote at the spring election on a proposition to bond the city for $100,000 to establish a complete sewer system, including the construction of trunk sewers, an intercepting sewer along Grand River and a purification plant. A. B. Stevens, City Engr.

St. Paul, Minn.—City Engr. Rundlett is stated to have sent to the Bd. of Pub. Wks. a preliminary estimate for the So. Wabasha St. sewer extension; probable cost, $18,976.

Vicksburg, Miss.—It is stated that bids are wanted Apr. 6 for constructing sewer. J. D. Laughlin, Clk.

Blythe, Miss.—See "Industrial Plants."

Yazoo City, Miss.—See "Power Plants, Gas and Electricity."

Weehawken, N. J.—C. E. Buchholz, Engr. of the N. Y. Central R. R., is reported to have asked the Township Com. of Weehawken to submit to him plans for a sewer to be laid under the tracks of the N. J. Junction Ry., near Willow Ave.

Atlantic City, N. J.—Henri D. Dickinson, Sanitary Engineer for the State of New York, and G. Everitt Hill, Pres. and Mgr. of the City Wastes Disposal Co. of New York, the experts employed by the Sewerage Co. to examine and report upon the local system, and the disposal of its sewage, have made their report. A number of suggestions are made for the betterment of the system which include a plant for the clarification of the sewage.

Cape May, N. J.—Bids will be received Apr. 28 by the City Council, for constructing a sewer system, approximately 3 miles in length. John Halpin, Pres.

Lestershire, N. Y.—The plans for a sewerage system for the village prepared by Knight & Hopkins, of Rome, are stated to have been approved by the State Bd. of Health. It will cost about $70,000.

Canajoharie, N. Y.—Bids will be received Apr. 8 by the Bd. of Village Trus. for furnishing material and constructing sewers and sewer appurtenances.

Dunkirk, N. Y.—The Common Council contemplates putting in an extensive sewer system adequate to drain the 1st and 3d Wards, about 3 miles of sewers of various sizes.

Little Falls, N. Y.—About 1,000 ft. of extensions and about 8 or 10 overflow or relief manholes for disposal of surface water will be built. E. Ten Eyck, Lansing, City Engr.

Gloversville, N. Y.—The bill authorizing the city to issue $250,000 bonds for building a trunk sewer and a sewerage disposal plant is reported to have been advanced to third reading in Legislature.

Homer, N. Y.—A sewerage system has been recommended for this village.

Alexandria Bay, N. Y.—See "Water."

Dayton, O.—The following bids were opened Mar. 17 for constructing (*a*) brick or (*b*) concrete sewers in portions of Coate Ave. and Orchard St. The work includes 820 ft. of 5-ft., 330 ft. of 4½-ft., 720 ft. of 4-ft. and 100 ft. of 3-ft. sewers: Robt. J. Paul, *b*, $8,598. John Munger, *a*, $9,061; *b*, $8,610. Wm. Hilt, *a*, $9,796; *b*, $8,620. Jas. Reid & Co., *a*, $9,657; *b*, $8,879. Geo. R. Hively, *a*, $9,691; *b*, $9,703. C. T. McCracken, *a*, $15,486; *b*, $14,497, and for Parmley Patent Concrete Sewer, $11,849.

Sandusky, O.—Bids are wanted Mar. 30 for furnishing material and constructing sewers in portions of 3 streets, including manholes, catch-basins, etc. Alex. M. Wagner, City Clk.

Glenville, O.—Bids are wanted Apr. 15 for constructing a main storm-water sewer in portions of Eddy Road. B. F. Davies, Jr., City Clk.

Toledo, O.—Bids are wanted Apr. 13 for furnishing material for constructing 24-in. circular brick sewers, 4-in. shell and 8, 10 and 12-in. circular pipe sewers in portions of 11 streets. Chas. H. Nauts, City Clk.

Easton, Pa.—The following bids for 1,650 ft. 4-ft. brick sewer, 370 ft. 18-in. terra cotta pipe, 16 catch basins and 4 manholes, were received by L. A. Francisco, City Engr., Mar. 24: John McInerny, $11,872; Thos. McCormick, $11,711; Thos. Lesher, $13,552; Miles Fehr Con. Co., $17,979. Bidders all of Easton.

North Braddock, Pa.—H. S. Harrop, 339 5th Ave., Pittsburg, Boro. Engr., writes that bids will be received on Apr. 1 for 1,800 lin. ft. 5 ft. 3 in. egg shaped brick sewer and 1,500 lin. ft. of 30-in. terra cotta pipe sewer, to cost about $15,000.

Scranton, Pa.—Bids will be received on Mar. 30 by the Dept. of Pub. Wks. for a lateral sewer on N. Main St., about 1,580 ft., to cost about $5,435. Jos. P. Phillips, Ch. Engr.

Philadelphia, Pa.—An appropriation of $50,000 is reported to have been made for the construction of a sewer on Wakeling St. N. W. to Harrison St., in the direction of Little Tacony Creek.

The following bids were received on Mar. 23 by Wm. C. Haddock, Dir. Dept. Pub. Wks. for sewers (*a*) McKean St., $75,000 available for this work; (*b*) extension of Cohocksink, $100,000 available, and (*c*) extension of Orthodox St., $15,000 available, price given per ft.: Dani. Dooley, *a*, $29. Jos. Perna, *a*, $27.85. David Peoples, *a*, $35; *b*, $49; *c*, $16.85. Geo. A. Vare, *b*, $47.50; *c*, $21. R. P. Bemis, *c*, $10.

Doylestown, Pa.—The ordinance granting the Doylestown Sewerage Co. the right to establish its plant in the borough has been adopted, and construction work will probably soon commence.

Ardmore, Pa.—Geo. Webster, Ch. of Bur. of Surveys of Philadelphia; Jos. T. Richards, Engineer of M. and W. of Pennsylvania R. R., and Rudolph Hering, of New York, N. Y., have been appointed by the Comrs. of Lower Merion Township, to pass upon the plans for the proposed sewer system in the Township, which will cost about $250,000.

Glassport, Pa.—Bids are wanted Apr. 3 for the construction of sewers in 3 streets. R. J. Kelly, Chmn. Sewer Com.

Warren, Pa.—See "Street Cleaning and Garbage Disposal."

Dyersburg, Tenn.—See "Water."

Culpeper, Va.—Bids are wanted Apr. 7 for constructing a sewerage system. R. F. Boonton, Chmn. Sewerage Com.: A. F. Brown, Engr.

Tacoma, Wash.—Geo. Milton Savage & Co. are stated to have secured the contract for constructing the first portion of the Edison trunk sewer, for $13,728.

Sheboygan, Wis.—Bids are wanted Apr. 6 for furnishing material and constructing approximately 920 lin. ft. 48-in. brick sewer, 1,540 lin. ft. 10 and 12-in. pipe sewer and 60 lin. ft. 10-in. iron pipe sewer, including 15 manholes. C. U. Boley, Chmn. Bd. Pub. Wks.

Racine, Wis.—Jas. Cape & Sons, 468 Water St., are stated to have secured the contract for constructing the Duck Creek sewer, for $16,950.

Beloit, Wis.—The City Engr. is stated to have been ordered to prepare plans for a complete sewerage system.

Vancouver, B. C.—A press report states that it is proposed to construct 3 additional septic tanks for the disposal of sewage.

Walkerville, Ont.—It is stated that bids will be received Mar. 31 by the Bd. of Pub. Wks. for constructing brick sewers in Wyandotte St. and 15-inch crock sewer in Victoria Ave. R. Kerr, Chmn.

BRIDGES.

Montgomery, Ala.—Bids are wanted Apr. 6 for constructing a steel bridge over Conecuh River at McGowin's ferry. N. R. Leigh, Sr., Judge of Probate.

San Luis Obispo, Cal.—It is stated that bids are wanted Apr. 6 for constructing a masonry culvert between Islay and Neff Sts. Geo. W. Robbins, City Clk.

Quincy, Cal.—It is stated that bids are wanted May 4 for constructing a steel bridge over Clear Creek on the Indiana Valley road. H. P. McBeth, Co. Clk.

Hopedale, Ill.—The Co. Bd. of Superv. is reported to have under consideration the building of a bridge near Hopedale, at a probable cost of $5,000.

E. Moline, Ill.—By an agreement between officials of the Moline, East Moline & Watertown Ry. and the Rock Island system, the interurban company will build a steel viaduct at East Moline for the crossing over the C., R. I. & P. tracks on the street car line to Watertown.

Crawfordsville, Ind.—Bids will be received Apr. 8 by the Bd. of Co. Comrs. for constructing substructures and superstructures for several small steel bridges ranging from 30 to 100 ft. spans. James D. Wilson, Chmn.

Dubuque, Ia.—Plans and specifications have been prepared for a viaduct to be built across Illinois Central right of way at Rockdale. Probable cost $15,000.

Waterville, Me.—The city and the Waterville & Oakland Electric R. R. propose joining in the expense of a new bridge across Messalonskee River on Western Ave.

Benton Falls, Me.—The iron bridge, costing $10,000, recently swept out by the flood, will be replaced by the town of Benton.

Haverhill, Mass.—The building of a bridge across Merrimac River, in this city, is reported to be under consideration.

Lawrence, Mass.—It is stated that the Boston & Maine R. R. Co. may build a bridge in this city. J. P. Snow, Bridge Engr., Boston, Mass.

Salem, Mass.—The Bd. of Aldermen has passed an order authorizing the appropriating of $20,000 for the Castle Hill bridge and the grading of Jefferson Ave.

Grand Rapids, Mich.—City. Engr. Anderson is preparing 2 sets of plans for a bridge to be built at Bridge St., 1 for a concrete bridge the other for a concrete and steel structure.

Saginaw, Mich.—According to local press reports the Bd. of Pub. Wks. is about to receive plans for a plate girder, fixed span, bridge, to be 500 ft. long, have a 90-ft. channel, roadway 40 ft. wide and sidewalks on each side 8 ft. wide. The plans are to be purchased by the city at a price not to exceed $7,500.

Minneapolis, Minn.—Press reports state that bids will be received by the Com. on Ways and Means of the City Council Apr. 15 for $715,000 bridge bonds.

St. Paul, Minn.—Local press reports state that among the bridge improvements to be made this year is the building of substructure of the Grand Ave. bridge, at a cost of $7,500; extension to the 3d Ave. bridge, by replacing the present wooden structure at the east end of the bridge with a steel trestle, at a probable cost of $8,500, and replacing the Mendota arch bridge with a new structure at a cost of about $12,000.

Duluth, Minn.—Reports state that the officials of the Great Northern R. R. are to build a steel truss bridge, across Kettle River, to be 250 ft. long and 150 ft. above water. J. F. Stevens, Ch. Engr., St. Paul, Minn.

Kansas City, Mo.—Press reports state that Pres. Corrigan, of the Metropolitan St. Ry. Co., has offered to build a viaduct on Charlotte St. over the Belt line if he is allowed to divert the Holmes St. car line by way of 22d and Charlotte Sts., to get down town.

Camden, N. J.—The Camden & Suburban Ry. Co. will build a bridge over Pensauken Creek, also a 400-ft. trestle over Pennsylvania R. R. tracks. W. E. Harrington, Mgr., Camden.

The Philadelphia & Reading R. R. Co. will construct a bridge, 66x116 ft., at Broadway. Wm. Hunter, Ch. Engr., Philadelphia, Pa.

New York, N. Y.—Bids were opened Mar. 26 by Park Comrs., 64th St. and 5th Ave., for a concrete-steel bridge over Bronx River in Botanical Garden, as follows: F. V. Smith Contr. Co., $33,600; Geo. L. Walker, $32,400; John R. Sheehan & Co., Inc., $31,740; Robt. R. Fox, $28,380. Details of lowest bid are: Bridge complete, $26,600; 2,000 ft. piles, $.24; 20,000 ft. yellow pine timber, $20; 200 cu. yds. concrete, $4.50.

Little Falls, N. Y.—The West Shore Ry. (H. Fernstrom, Ch. Engr., N. Y. City), will build an iron bridge across Casen St. cut about a 90-ft. span.

The city will build an iron bridge across the head gates of the Erie feeder at Hauser Ave. E. Ten Eyck Lansing, City Engr.

New York, N. Y.—The King Bridge Co. was the lowest bidder Mar. 23 for constructing bridge and abutments, E. 189th St., over N. Y. & Harlem R. R., Bronx Boro. ($21,155), the only other bid being that of M. J. Leahy for $23,611. Details: 200 cu. yds. masonry, etc., $1.50; 350 cu. yds. new masonry, $15; 208,200 lbs. iron and steel, 6.45 cts.; 18,000 ft. y. p. lumber, $40; 120 ft. ornamental railing, $3.75; 580 sq. ft. bridgestone, $0.70; 1,200 cu. yds. earth fill, $0.50.

Columbus, O.—Local press reports state that agreements have been reached between the Co. Comrs. and the officials of the Railroad Cos., whereby the R. R. Cos. are to contribute 80 per cent. of the cost of constructing viaducts across the railroad tracks at Cleveland Ave., connecting Milo and the city.

Walter Braun, Co. Engr., has been authorized by the Co. Comrs. to revise plans for the superstructure, substructure and approaches to the Hayden Run bridge over the Scioto River. The bridge will cost approximately $100,000.

Bellaire, O.—Press reports state that the Baltimore & Ohio R. R. Co. contemplates spending $400,000 in repairing the Bellaire bridge and erecting a steel trestle in order to give direct connections with the C., L. & W. division. J. M. Graham, Ch. Engr., Baltimore, Md.

Cleveland, O.—The construction of a lift bridge over Cuyahoga River at Jefferson St. is being considered. The span will be 140 ft. in the clear, and will provide a clear waterway of 120 ft.

Zanesville, O.—It is stated that bids are wanted by the Co. Comrs. until Apr. 20 for constructing 3 single span steel bridges in Monroe Township.

Painesville, O.—Bids will be received Apr. 6 by the Co. Comrs. for constructing a bridge across Chagrin River, about 2 miles north of Willoughby, to be 175 ft. long and 16 ft. wide. J. C. Campbell, Chmn.

Akron, O.—Bids are wanted Apr. 11 for constructing a concrete steel arch over Little Cuyahoga River at Cuyahoga St. Span of arch, 40 ft., with over all 50 ft.; skew of bridge, 60 deg.; estimated cost, $5,000. J. W. Payne, City Engr.

Portland, Ore.—The City Engr. is preparing plans for a steel bridge for Marquam Gulch, to be 300 ft. long, 60 ft. wide, and to have a center pier 70 ft. high, concrete abutments, and estimated to cost about $27,000.

Pittsburg, Pa.—The Pennsylvania R. R. Co. is reported to have approved plans for a bridge to be built across Allegheny River, on the Enon cut-off. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Philadelphia, Pa.—The following bids were opened on Mar. 23 by Wm. C. Haddock, Dir. Dept. Pub. Wks., for, *a*, construction of bridge on Stockley St. on line of Philadelphia & Reading Ry., and *b*, bridge on 17th St., over Philadelphia, Germantown & Northern R. R.: Henderson & Co., Ltd., *a* $28,144, *b* $83,012; McGaw & Gray, *a* $22,400, *b* $73,000; Hoffmann Eng. & Cont. Co., *a* $31,450; McCormick & Co., *a* $32,792, *b* $91,259. Bidders all of Philadelphia.

Scottsdale, Pa.—Bids are wanted Apr. 16 for constructing the superstructure of a joint steel or iron bridge over Jacobs Creek near Scottsdale; to be built by the Comrs. of Fayette and Westmoreland Counties. Bids will also be received for masonry. Alvin J. Stentz, Chmn. Fayette Co. Comrs., Uniontown.

Benwood, W. Va.—Bids will be received Mar. 31 by the Bellaire, Benwood and Wheeling Bridge Co., for constructing a steel bridge over the Ohio River between Benwood, W. Va., and Bellaire, O.; probable cost, $325,000. Address Jas. H. McCrady, Pres., 301 6th St., Braddock, Pa. Engineer; A. Luclus, 137 Potter Bldg., New York, N. Y.

Wheeling, W. Va.—City Railway Co., of Wheeling, W. Va., will build a bridge over Wheeling Creek on Market St., alongside of the present highway structure. The bridge will carry a single track and will be about 160 ft. in length. Plans are being prepared by the Osborn Engineering Company, Cleveland, O.

Milwaukee, Wis.—The War Dept. has approved the plans for a bascule bridge to be erected at E. Water St., in place of the present swing bridge, and also plans for the Milwaukee road's new bridge to be built nearby.

Sherbrooke, Que.—Press reports state that an iron bridge at Brompton Falls has been carried away by the freshets. Loss reported to be about $12,000.

PAVING AND ROADMAKING.

Milford, Del.—See "Sewerage and Sewage Disposal."

Wilmington, Del.—The House has passed a bill appropriating $500,000 for improving the streets of Wilmington.

Tampa, Fla.—Bids are wanted Apr 7 for constructing sidewalks. W. R. Fuller, Pres. Bd. Pub. Wks.

Atlanta, Ga.—Local press reports state that the Southern Paving & Construction Co., Chattanooga, Tenn., has secured the contract to pave with asphalt on Peters and Peachtree Sts., approximately 21,000 sq. yds., at $1.73 and $1.98 per sq. yd. respectively.

Mattoon, Ill.—It is reported that the Bd. of Local Improv. will pave 16th St. between Broadway and Charleston Ave. this spring.

Chicago, Ill.—Bids are wanted Apr. 2 for furnishing material for repairing asphalt pavement in the city during the term ending Dec. 31, 1903. F. W. Blockl, Comr. Pub. Wks

Wilmette, Ill.—Bids are wanted Apr. 1 for grading, filling, curbing, guttering and paving with brick on certain streets. Vertus B. Roberts, Engr., Reaper Blk., Chicago; Henry B. Gates, Chmn. Bd. Local Improv.

Evanston, Ill.—See "Sewerage and Sewage Disposal."

New Albany, Ind.—A resolution has been adopted by the Common Council to receive bids Apr. 20 for paving with asphalt on a portion of E. 11th St. Samuel T. Mann, City Engr.

Lafayette, Ind.—Bids are wanted Apr. 27 for about 12,000 sq. yds asphalt paving. G. H. Stevenson, City Engr.

South Bend, Ind.—According to Alonzo J. Hammond, City Engr., Jas. Nelson submitted the lowest bids on Mar. 13 for brick block paving on Clinton St., 5,315 sq. yds.; Marion St., 11,054 sq. yds., and La Salle Ave., 7,060 sq. yds., at $7,388, $14,794 and $9,560 respectively; and Defrees & Beyrer, for paving Madison St. with brick block, 9,037 sq. yds., for $12,759.

Anderson, Ind.—Press reports state that the City Council has ordered brick pavement on several streets at a cost of between $100,000 and $200,000. Among the streets to be paved are S. Main, W. 7th and W. 3d Sts.

Boone, Ia.—The following bids for paving (*a*) 9th St., (*b*) Story St., (*c*) W. 3d St., in all 19,295 sq. yds., 2 course brick paving, 6,195 lin. ft. cement curbing and 1,650 lin. ft. hardwood curb, were received by Jesse L. Hull, City Clk., Mar. 13: E. S. Samuelson, Boone, *a*, $13,969; *b*, $15,735. W. A. Edgar, Cedar Rapids, *a*, $14,271; *b*, $15,777; *c*, $11,673. Likes Improv. Co., Des Moines, *a*, $13,913; *b*, $15,639; *c*, $10,757. O. P. Herrick (awarded contract), Des Moines, *a*, $13,839; *b*, $15,240; *c*, $10,680. The detail bid of O. P. Herrick is as follows: Brick paving, $1.85 per sq. yd.; cement curb, 50 cts. per lin. ft.; hardwood curb, 20 cts. per lin. ft., and grading, 35 cts. per cu. yd. Chas. E. Russell, City Engr.

Des Moines, Ia.—Bids will be received Apr. 15 by the Bd. of Pub. Wks. for paving portions of Elm St. with about 3,057 sq. yds. with vitrified paving brick, on 6-in. concrete foundation, with Portland cement top filler. B. O. Hauger, Chmn.

Davenport, Ia.—The following bids for paving with brick on Tremont Ave., about 1,104 sq. yds. of Telford and 4,506 sq. yds. brick, were received by Bd. of Pub. Wks. Mar. 17: McCarthy Stone Co., $12,451; Davenport Const. Co., $13,048; Peoples Const. Co., $13,314; Snouffer & Ford, Cedar Rapids, $13,156. The detail bid of the lowest bidder is as follows: Excav., 39 cts. per cu. yd.; Telford, 70 cts. per sq. yd.; brick paving, $1.49½ per sq. yd., and stone curbing, 59½ cts. per ft. Bidders of Davenport, unless otherwise mentioned. Thos. Murray, City Engr.

Covington, Ky.—W. E. Gunn, City Engr., writes that the following bids have been received for paving Scott St. with brick: E. Woods, Covington, $11,321; J. Trapp, Latonia, Ky., $11,091; J. Sullivan, Central Covington, $10,890; T. Evans, Cincinnati, O., $10,095 (awarded contract); J. Collopy, Newport, Ky., $10,545, and E. Evans, Cincinnati, O., $10,287. The detail bid of Thos. Evans is as follows: For grading, 1 ct. per cu. yd.; concrete, $3.50 per cu. yd.; brick paving, $1.06 per sq. yd., and cement curb and gutter, 50 cts. per ft. He also secured the contract for about $15,000 worth of work on other streets at similar prices.

Topeka, Kan.—About 44 blocks will be paved this year with brick, stone curbing to used. J. W. Squires, City Clk.

Louisville, Ky.—The American Standard Asphalt Co. is reported to have secured the contract to resurface with asphalt on portions of numerous streets, in all about 20,000 sq. yds., at from 87 cts. to $1.01 per sq. yd. according to location.

The Bd. of Pub. Wks. is contemplating the paving with asphalt on 3 squares in the south end of 7th St.

Fall River, Mass.—As soon as the City Solicitor decides the question as to whether the Mayor or the Bd. of Aldermen has the authority to order the purchase of paving blocks, the Supt. of Sts. will purchase a supply for 1903.

Ann Arbor, Mich.—The City Council has authorized the Bd. of Pub. Wks. to prepare plans and specifications for paving with asphalt on a portion of 4th Ave.

Grand Rapids, Mich.—L. W. Anderson, City Engr., writes that bids for paving Wealthy Ave. with brick or concrete will be received on Apr. 3, the bids for asphalt block having been rejected by Council.

Port Huron, Mich.—A correspondent writes that bids will probably soon be asked for paving 10th St.

Corning, Mich.—See "Water."

Menominee, Mich.—Albert Hass, City Engr., writes that the letting of the contract for paving and curbing Main St. (bids opened Mar. 16) has been postponed indefinitely.

Duluth, Minn.—W. B. Patton, City Engr., writes that the following paving work is in contemplation: For paving with sandstone blocks 3 blocks on 2nd Ave., W.; 2 blocks on Michigan St., and 2 blocks on 1st Ave., E. Petitions have been received or are in circulation for paving with dressed sandstone blocks Lake Ave.; also for paving Superior St., class of pavement to be designated later by Council.

St. Paul, Minn.—Local press reports state that bids are wanted Mar. 30 for paving Exchange St. R. L. Gorman, Clk. Bd. Pub. Wks.

St. Paul, Minn.—The Barber Asphalt Paving Co. is reported to have received the contract for paving with asphalt on a portion of Central Ave. at $8,679.

The Barber Asphalt Paving Co. is reported to have secured the contract for all repair work at $1.65 per sq. yd. This is for surfacing only, and when concrete is to be put in, $1 extra per sq. yd. is to be added.

St. Louis, Mo.—Bids are wanted Apr. 14 for improving portions of 18 streets by grading, curbing and paving with asphalt brick and granite on concrete foundation. Hiram Phillips, Pres. Bd. of Pub. Improv.

Cape May, N. J.—Bids are wanted by the City Council until Apr. 28 for constructing a beach drive, a bulkhead and boardwalk, approximately 12,500 ft. in length. John Halpin, Pres.

Trenton, N. J.—Bids will be received Apr. 14 by the Co. Bd. of Chosen Freeholders for furnishing material and macadamizing 6 county roads. Jos. H. Black, Dir.

Little Falls, N. Y.—The city will put in ¼ of a mile of brick block pavement on W. Main St. E. Ten Eyck Lansing, City Engr.

Utica, N. Y.—It is proposed to pave about 18,000 lin. ft. with asphalt, at a cost of about $135,000. Paul Schultze, City Engr.

New Brighton, S. I., N. Y.—Bids will be received Apr. 3 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing material and grading, repaving with asphalt blocks, granite blocks and macadam, on a concrete foundation, portions of several streets. Engineers estimate 15,730 sq. yds. granite block pavement, 11,350 sq. yds. asphalt block pavement, 2,410 sq. yds. macadam pavement, 4,400 cu. yds. concrete, 10,500 lin. ft. 20-in. curb, etc.; also for furnishing 1 7-ton steam road roller.

Albany, N. Y.—Bids will be received Mar. 30 by Edw. A. Bond, State Engr. and Surveyor, for improving the Delaware Turnpike, in Bethlehem, Albany Co.

Rensselaer, N. Y.—It is stated that considerable paving may be done in this city this summer, including the paving of Broadway, 3d St., Alken Ave., Columbia and 2d Sts.

New York, N. Y.—Bids will be received Apr. 7 by Jacob A. Cantor, Pres. Boro. Manhattan, for regulating and repaving with stone and asphalt on portions of 40 streets. Engineer's estimate: 187,050 sq. yds. asphalt pavement, including binder course; 161,900 sq. yds. old stone pavement, to be relaid as foundation or in approaches, etc.

Solvay, N. Y.—According to reports the proposition to issue $50,000 bonds to continue the paving of Milton Ave., a distance of about 5,600 ft., and to build cement sidewalks on said Ave., carried at the recent election.

Walden, N. Y.—On Mar. 17 it was voted to appropriate $3,000 toward the paving of Main St. with vitrified brick. Probable total cost, $9,000.

New York, N. Y.—The following were among the bids opened Mar. 17 by J. A. Cantor, Boro. Pres. Manhattan, for asphalt paving on present pavt. relaid as found.—*a*, Barber Asph. Pavg. Co.; *b*, Uvalde Asph. Pavg. Co.; *c*, Continental Asph. Pavg. Co.; *d*, Century Constr. Co.; *e*, Sicilian Asph. Pavg. Co.; *f*, Asph. Constr. Co.:

Bidders.	Asph., sq. yds.	Relay., sq. yds.	Concr., cu. yds.	New curb, ft.	Old curb, ft.	Man. covers.	Totals.
69th St.—Ave. A to Lexington Ave,	*8,000*	*8,050*	*230*	*4,380*	*250*	*31*	
a	$1.12	$0.40	$5.48	$0.89	$0.38	$20.	$18,054
b	1.24	.40	6.00	.82	.35	20.	18,819
c	1.50	.35	6.00	.85	.35	21.	20,659
d	1.27	.39	5.50	.85	.40	20.	19,008
e	1.45	.30	6.00	.90	.50	20.	20,082
38th St.—Broadway to 11th Ave.	*12,340*	*12,390*	*390*	*7,040*	*330*	*45*	
a	$1.11	$0.40	$5.48	$0.89	$0.38	$20.	$28,082
b	1.10	.40	6.00	.82	.35	20.	27,658
c	1.40	.35	6.00	.85	.35	21.	30,997
23d St.—Ave. A to Broadway.	*15,480*	*12,820*	*370*	*6,100*	*500*	*54*	
a	$2.34	$0.40	$5.48	$0.89	$0.38	$20.	$50,078
b	2.25	.45	6.00	.82	.35	20.	49,076
c	1.50	.35	6.00	.85	.35	21.	36,421
122d St.—Pleasant to Madison Aves.	*11,650*	*11,750*	*310*	*6,700*	*270*	*35*	
a	$1.06	$0.40	$5.48	$0.89	$0.38	$20.00	$25,513
d	1.23	.33	5.50	.85	.40	20.00	26,415
c	1.45	.30	6.00	.90	.50	20.00	29,143
f	1.20	.30	6.00	.85	.35	21.50	25,907
Lexington Ave.—119th to 131st Sts.	*9,100*	*9,370*	*225*	*4,500*	*1,500*	*15*	
a	$1.05	$0.42	$5.48	$0.89	$0.38	$20.00	$19,598
d	1.43	.33	5.50	.85	.40	20.00	22,008
f	1.50	.30	6.00	.85	.30	21.50	22,409

Awards have been made for the bids received at this time, as follows: Barber Co., $223,073; Uvalde Co., $68,337; Continental Co., $39,549; Asph. Constr. Co., $11,721.

The following bids were opened Mar. 23 by L. F. Haffen, Pres. Bronx Boro., for asphalt block pavt. on concrete foundation:

	Asph., sq. yds.	Concr., cu. yds.	N. curb, ft.	O. curb, ft.
Brook Ave.—From Webster to Wendover Aves.	*15,275*	*2,450*	*2,500*	*5,905*
Hastings Pavt. Co.	$1.77	$6.00	$1.00	$0.32
Continental As. Pav. Co.	1.65	6.40	.95	.25
E. 156th St.—Park to St. Ann's Ave.	*8,100*	*1,350*	*3,250*	*2,000*
Hastings Pavt. Co.	$1.66	$6.00	$1.00	$0.55
	1.73	6.40	.95	.47

The following bids were opened at same time for grading, curbing, flagging, etc.—*a*, F. V. Smith Contr. Co.; *b*, D. W. Moran; *c*, W. F. Murray; *d*, Chas. W. Collins:

E. 188th St.—Park to Beaumont Aves. (Main items).

Bidders.	Earth exc. 3,900 cu. yds.	Rock exc., 11,750 cu. yds.	Fill, 14,100 cu. yds.	N. curb, 4,450 ft.	Flags, 18,400 sq. ft.	Bridge-stone, 750 sq. ft.	Dry rub., 750 cu. yds.
a	..	$1.20	$0.40	$0.75	$0.23	$0.60	$1.50
b	..	1.75	.54	.70	.24	.50	1.00
c	$0.79	1.50	.10	.79	.25	.65	2.25
d	..	1.50	.50	.70	.22	.55	1.00

E. 189th St.—Park Ave. to Southern Boul.

	5,900 cu. yds.	8,200 cu. yds.	18,700 cu. yds.	5,875 ft.	23,350 sq. ft.	2,050 sq. ft.	575 cu. yds.
a	..	$1.20	$0.40	$0.75	$0.23	$0.60	$1.50
b	$0.60	1.75	.23	.70	.24	.60	1.00
d	..	1.50	.50	.70	.22	.55	1.00

Cincinnati, O.—Bids are wanted Apr. 13 for furnishing material and improving by curbing and paving with boulders portions of Hatch St. Robt. Allison, Pres. Bd. Pub. Service.

Bids are wanted Apr. 20 for improving by grading, curbing and paving with granite blocks and asphalt portions of Calhoun St. Robt. Allison, Pres. Bd. Pub. Service.

Bids are wanted Apr. 21 for grading, curbing and paving with asphalt and constructing the necessary drains and the approaches to Spring Grove Ave. Bridge over Millcreek. Robt. Allison, Pres. Bd. Pub. Service.

Cleveland, O.—It is stated that bids are wanted Apr. 2 for paving with brick on Brandon St. Chas. P. Salen, Dir. Pub. Wks.

Napoleon, O.—It is stated that bids are wanted Apr. 10 for road improvements, estimated to cost $52,000. P. F. Coe, Co. Aud.

Youngstown, O.—It is stated that bids are wanted Apr. 11 for paving on portions of 3 streets. C. E. Cross, City Clk.

Ironton, O.—Bids will be received Apr. 9 by Geo. H. Davies, City Clk., for improving portions of Hepler St. by grading, curbing and paving with macadam on a furnace cinder foundation and constructing necessary sewers. J. R. C. Brown, City Engr.

Massillon, O.—Bids will be received Apr. 14 by Thos. H. Seaman, City Clk., for furnishing material for curbing and paving with brick on So. Erie St.

Cleveland, O.—The City Council, at its meeting on Mar. 23, approved the contracts with the Barber Asphalt Co. for paving 118 streets with brick. The total amount approved was $55,478.

Columbus, O.—Local press reports state that contracts have been awarded for paving with asphalt on a portion of Garfield Ave. to the Cleveland Trinidad Paving Co. at $12,745, and for paving with Hocking Valley block on Sullivan Ave., to Frank J. Fisher, at $11,548.

Bids will be received Apr. 13 by John A. Connor, Clk. Bd. Pub. Wks., for improving by grading and paving with asphalt, hard burned bricks or blocks, macadam or other material, on portions of 4 streets.

Philadelphia, Pa.—The City Councils have appropriated $80,000 for changing the grades of Market and 30th Sts., to meet the plans of the proposed Market St. subway.

Philadelphia, Pa.—Bids are wanted Apr. 2 for improving Logan Square. Appropriation, $25,000. A. L. English, Dir. Dept. of Pub. Safety, Bureau of City Property.

Harrisburg, Pa.—The following bids were opened Mar. 14, according to M. B. Cowden, City Engr., for paving 2d St., involving 49,000 sq. yds. paving and 16,000 ft. curbing: Joseph C. Rock, N. Y. City, Mexican sheet asphalt, $1.94½; curbing, granite, $1.14; bluestone, $1.25; Medina, $1.24; steel, $1.20; resetting, 25 cts. The Warner-Quinlan Asphalt Co., Syracuse, N. Y., sheet, Trinidad, asphalt, $1.84½; curbing, granite, $1.11; bluestone, $1.11; Medina, $1.11; resetting, 23 cts. The Barber Asphalt Co., N. Y. City, Trinidad Lake sheet, $1.79 if surface is 1½ in. thick, and $1.89 if 2 in. thick; curbing, granite, $1.21; bluestone, 89 cts.; Medina, $1.06; resetting, 23 cts.; vitrified-brick, Clearfield or Mack, $1.99. The Warren Bros. Co., N. Y. City, for bituminous waterproof paving, $1.97; curbing, granite, $1.19; bluestone, $1.15; Medina, $1.13; resetting, 19 cts. The Flibert Paving & Const. Co., Phila., Pa., for any known or approved pave., $1.84; curbing, $1.15; bluestone, $1.25; Medina, $1.25; resetting, 25 cts. The Warner-Quinlan Asphalt Co., for bituminous macadam waterproof pave., $1.62. The Barber Asphalt Co., for bituminous macadam waterproof pave., $1.74; if bituminous coating is omitted $1.64, and if base coating and surface finishing is omitted $1.51; curbing, granite, $1.81; bluestone, $1.89; Medina, $1.06; resetting, 23 cts.

Memphis, Tenn.—The paving with asphalt, on a concrete base, on a portion of Rayburn Ave. is being considered. Probable cost, $30,000.

Houston, Tex.—The City Council has adopted a resolution authorizing the Mayor to receive bids until Apr. 13 for resurfacing 3 streets.

Local press reports state that a resolution has been adopted by the Bd. of Aldermen authorizing the Mayor to receive bids until Apr. 6 for paving on a portion of McKinney Ave.

Milwaukee, Wis.—The paving of Commerce St., at a probable cost of $36,000, is being considered. Kind of pavement has not as yet been decided.

Montreal, Que.—Local press reports state that the following bids were received by the Road Com. Mar. 19 for supplying and laying permanent pavements and sidewalks required during the year 1903: Sicily Asphalt Co., laying granite blocks on concrete, $1.89 yd.; Canada Asphalt Co., asphalt pavements, $2.25 yd.; Bellhouse, Dillon Co., asphalt blocks, $1.70 yd.; Barber Asphalt Co., bituminous macadam, $1.74 yd.; Canada Asphalt Co., laying granite blocks between car tracks, with 6-in. concrete, $1.40 yd.; Sicily Asphalt Co., asphalt sidewalks, $1.99 yd.; Bellhouse, Dillon & Co., asphalt sidewalks, $1.75 yd.; Warren Bros., sidewalks of "Kallo," a composition material, at $1.40 yd. There were several cheaper materials offered for sidewalks, the lowest of which was that of Bellhouse, Dillon & Co., at $1.25 yd. The only bid for furnishing and erecting an asphalt plant (for which bids were received at the same time) was according to reports from Warren Bros., at $13,000.

POWER PLANTS, GAS AND ELECTRICITY.

Florence, Ala.—See "Electric Railways."

Los Angeles, Cal.—The Independent Gas & Electric Co., of Los Angeles, has been incorporated, with a capital of $200,000. Incorporators: E. H. Durant and M. A. Newkirk, of Los Angeles.

Stockton, Cal.—It is reported that Engineer F. A. Worthley, of Riverside, estimates the cost of constructing a municipal lighting plant for Stockton at $140,000.

Ft. Sheridan, Ill.—See "Government Work."

Kankakee, Ill.—It is reported that the Citizens' Gas Co. will expend about $50,000 in the improvement of its plant during the summer.

Rantoul, Ill.—The Rantoul Water, Light & Power Co., of Rantoul, has been incorporated; capital $2,500. Incorporators: G. P. Heckel and T. J. Roth.

Paxton, Ill.—The Paxton Light, Htg. & Power Co. has been incorporated; capital, $150,000. Incorporators: Jas. B. Richardson, Walter H. Bond, and Geo. A. Griffin.

Anderson, Ind.—It is stated that the Union Traction Co., of Indiana, contemplates going into the electric lighting business, and will soon apply for franchises along its line. Geo. F. McCulloch, Gen. Mgr., Indianapolis.

Greensburg, Ind.—A. R. Thompson & Co., of Chicago, Ill., contemplate constructing an electric light plant here.

Council Bluffs, Ia.—The 7th St. and 11th Ave. Gas Co. will erect new condensers and scrubbers, place a new 10x10 station meter and lay between 4 and 5 miles new cast iron mains, 8, 6 and 4 in.; cost about $30,000.

Keosauqua, Ia.—The Electric Power Co. has been incorporated, with a capital of $10,000, to construct a canal for power purposes and construct and operate power plants. Capt. W. A. Duckworth, Pres.; E. L. McCord, Secy.

Hamilton, Ia.—Jas. L. Humphrey is reported interested in the construction of an electric light plant.

Des Moines, Ia.—J. B. Marsh is about to petition the Council for a franchise for the construction of a heating plant.

Harrodsburg, Ky.—The City Council is reported to be prospecting for a site on which to construct a municipal electric light plant. H. Grimes, Mayor, Chmn. Com.

Anson, Me.—The House is stated to have passed the bill granting a charter to the Carratunk Power Co. to build a dam, and to build and equip a power station on Carrabasset River, and light the towns of Madison and Anson. C. O. Sturtevant, formerly Supt. of the Waterville & Fairfield Electric Ry. Co., is reported interested.

Madison, Me.—A committee is stated to have been appointed to investigate the question of constructing an electric light plant. T. F. Manter, City Clk.

Ellsworth, Me.—The Bar Harbor & Ellsworth Light, Gas & Power Co. is stated to have secured option on Union River dam properties. This company will continue the electric lighting in Ellsworth and Bar Harbor, and will probably extend to Northeast Harbor and Seal Harbor.

Baltimore, Md.—Bids will be received Apr. 1 by the Bd. of Awards for furnishing hard burned arch brick, special duct pipe, etc., for use on the Electrical Comn. Chas. E. Phelps, Jr., Ch. Engr.

Otis, Mass.—J. E. Merritt, of Otis, and F. B. Gilligan, of New York, N. Y., are reported interested in the construction of a power plant between Otis and New Boston.

Tolland, Mass.—The G. L. Straw Co., of Boston, is reported interested in the construction of a power plant on Farmington River, between Tolland and Sandisfield.

Winona, Minn.—The Winona Ry. & Ligbt Co. will expend about $100,000 in improvements, including the purchase of motors, an engine, a condenser, new arc lights, etc.

Duluth, Minn.—See "Water."

Mankato, Minn.—T. R. Thompson, City Engr., writes that on Mar. 20 the Court issued an order restraining the city from selling $40,000 bonds for pumping station and lighting plant. Order returnable on Apr. 6. On Mar. 23 bids for buildings were opened, J. B. Wilson & Co. being lowest, at $10,200 and $12,000 on different plans.

Norris, Minn.—The Council is reported to be considering the question of establishing a lighting plant.

Yazoo City, Miss.—A press report states that the Supreme Court has reversed the decision of Chancellor Cona in the injunction suit which restrained this city from issuing $75,000 bonds for constructing water works, an electric light plant and a sewerage system. This means the construction of the system.

Biloxi, Miss.—Bids will be received by the Biloxi St. Ry. & Power Co. until Apr. 6 for furnishing material, machinery and labor necessary for the building of a complete modern railway and lighting system.

Excelsior Springs, Mo.—W. A. Bell, of Denver, Colo., is reported to have purchased the electric light plant and water works, and will expend about $70,000 in improvements.

Mexico, Mo.—The City Council is reported to have appointed a committee to correspond with manufacturers in regard to having gas and electric light plant built here, giving a franchise in exchange for street lighting.

Virginia City, Mont.—The Bismarck-Nugget Gulch Consolidated Mining Co. is stated to have secured a franchise for an electric light and power plant on Mill Creek.

Forsyth, Mont.—The Co. Comrs. are stated to have granted Barney Blum and L. L. Crocket a franchise for a lighting plant and water works.

Benedict, Neb.—W. G. Keeler is reported to have purchased the electric light plant, and will remodel same.

Greenville, N. H.—The Town Clk. writes that a committee has been appointed to investigate the question of constructing an electric light plant.

Vailsburg, N. J.—The Council is stated to have granted Jos Wehrle, John B. Scarlett, and others a franchise to operate gas works.

Ward's Island, N. Y.—The contract for electric work, rewiring and fixtures in offices, Wards No. 1 to 21 inclusive; Annex Bldg., Wards 31, 32, 33 and 34, and staff house at Ward's Island, bids for which were received by State Comn. in Lunacy, Capitol, Albany, N. Y., Mar. 4, has been awarded to Edw. Joy, of Syracuse, for $7,962.

Batavia, N. Y.—See "Water."

Far Rockaway, N. Y.—The Queens Borough Electric Light & Power Co. has filed with the Dept. of Bldgs. plans for a power house to be located on Clinton St., to cost $25,000. Architect, W. E. Baker.

Manchester, N. Y.—A. Dunham, Village Clk., writes that it was voted Mar. 17 to construct an electric light plant.

Akron, N. Y.—E. E. Stratten, Village Clk., writes that it was voted Mar. 17 to issue $10,000 bonds to establish an electric light plant.

Greene, N. Y.—The citizens are stated to have voted Mar. 17 to issue bonds to the amount of $27,000 to construct water works; $13,000 for the construction of an electric light plant and $2,500 to purchase the local electric plant, to use until new plant is completed.

New Rockford, N. D.—The Light, Water & Improvement Co. is reported to have been formed to put in a light plant.

Columbus, O.—Bids will be received Apr. 13 by John A. Connor, Clk. Ed. of Pub. Wks., for erecting a municipal electric light plant.

Defiance, O.—The Council is reported to be considering the granting of a franchise to W. P. Engle for a hot water heating plant.

Sherodsville, O.—M. R. Fickes, City Clk., writes that a franchise for an electric light plant has been granted to C. C. Bolen and A. H. Snively.

Wilmington, O.—It is stated that bids are wanted Apr. 15 for improving the plants of the United Water & Light Co. It is expected to install 250-Kw. and 125-Kw. machines, a 20x42 engine, a 16x42 engine, 3 200-H.-P. water tube boilers, and 2 1,000,000-gal. pumps, 30 miles of wire, and 10 miles of pole line; also 10 miles of water mains and a standpipe, 18x120 ft. J. C. Martin, Gen. Agt.

Weston, Ore.—The City Council is stated to have appointed a committee to investigate the feasibility of the plans, and probable cost, of obtaining power for an electric light plant from Umatilla River.

Philadelphia, Pa.—The following bids were opened by W. C. Haddock, Dir. Pub. Wks., Mar. 24 for electric lighting system for Upper and Lower Roxborough—*a*, for 2 engines and 2 generators, including steam and exhaust pipes, valves, etc.; *b*, for poles and transmission line: D. J. McNichol, *a*, $5,264; *b*, $17,700. Walker & Kepler, *a*, $5,070 to $5,156; *b*, $19,750. M. R. Muckle, Jr., & Co., *a*, $6,000; *b*, $13,250. Keller, Pike & Co., *a*, $5,070; *b*, $12,620. Jno. F. Buchannan & Co., *a*, $4,850; *b*, $12,060. David Halstead, *a*, $5,600. Penna. Equipment Co., *a*, $5,220; *b*, $9,545.

Lancaster, Pa.—E. S. Smeltz, City Clk., writes that the contract for lighting (bids opened Mar. 24) has been awarded to Edison Illuminating Co., of Lancaster, for electric light, at $93.50 per light per yr.; to Lancaster Gas Co., for gas, at $30 per yr., with Welsbach burners, and for gasoline to Pennsylvania Globe Gas Light Co., of Philadelphia, Pa., at $30 per yr. every night and all night for one yr.

Reading, Pa.—It is reported that the Metropolitan Heat & Lighting Co. is making arrangement to erect a power house at the lower end of the city.

Pottstown, Pa.—It is stated that a 300-H.-P. engine and two 100-H.-P. generators will be added to the equipment of the Pottstown Light & Power Co.

Wayne, Pa.—The Haverford Electric Light Co. and the Wayne Electric Light Co., both owned by the United Gas Improvement Co., will be merged and the villages in Lower Merion Township will all soon be lighted by electricity from the Wayne plant, which will be enlarged.

Knoxville, Tenn.—A charter has been granted to the Knoxville Gas Co., with a capital of $400,000, to construct a gas plant. Incorporators: Reuben L. Gates, Wm. Irby and W. P. Flenniken.

Jacksonville, Tex.—The Jacksonville Electric Co. has been incorporated to supply light, power and heat; capital, $20,000. Incorporators: J. D. Gibbs, A. D. Sawyer and J. C. Brasher.

Center Point, Tex.—The Center Point Electric Light, Power & Irrigation Co., of Center Point, has been incorporated to operate dams, reservoirs and laterals to furnish water for milling, mining and irrigation purposes and to furnish electric power; capital, $6,000. Incorporators: H. Noll, Jas. Sellers and Jas. Crotty.

Caldwell, Tex.—Wallin & Scott are stated to have decided to construct an electric light plant.

Petersburg, Va.—The Virginia Passenger & Power Co. is stated to have secured the contract for furnishing the city with electric lights of 2,000 c. p. for 1 yr. at $57 per light per yr.

Vancouver, Wash.—It is stated that the Electric Light Co. will soon install another 500-H.-P. Corliss engine.

Ballard, Wash.—F. J. Pazuk, of Seattle, is stated to have petitioned for an electric light franchise.

Ceredo, W. Va.—The Ceredo Water & Light Co. has been incorporated, with a capital of $20,000, to operate water works and a lighting plant. Incorporators: Louis Prichard, W. F. Burns, and others, of Ceredo.

Sun Prairie, Wis.—Dr. L. V. Lewis and Prof. Jas. Meville are reported to have been appointed to investigate the matter of a municipal electric plant.

Stevens Point, Wis.—It is reported that the Stevens Point Lighting Co. will construct a water power plant. U. Mainland, of Oshkosh, is reported interested.

Liverpool, N. S.—It is stated that bids are wanted Apr. 15 for installing an electric light and power plant in the city, including hydraulic dams, turbines, generators, pole line, etc. D. C. Mulhall, Mayor.

Paris, Ont.—Bids will be received Mar. 30 by Thos. McCosh for $17,887 electric light and water works bonds.

ELECTRIC RAILWAYS.

Florence, Ala.—The City Council has granted franchises to J. W. Worthington and associates for an electric railway to be constructed from Tuscumbia and Sheffield and for the lighting of the city.

San Mateo, Cal.—The South San Francisco R. R. & Power Co. has been incorporated to build 13½ miles of electric road in South San Francisco and San Mateo. Its principal stockholder is Wm. J. Martin, Secy. of the South San Francisco Land Co.

Visalia, Cal.—The franchise for the construction of an electric railway through Tulare County, as applied for by John Hays Hammond, of New York, and Harold Wheeler, is to be sold at public auction on April 8. Eugene L. Scott, Co. Clk.

Hanford, Cal.—Bids will be received Apr. 10 by the Clerk of Bd. of Superv. for a franchise to operate an electric car line on certain roads in Kings Co.

San Jose, Cal.—Local press reports state that the Mayor and Common Council have petitioned for a street railroad franchise on North Market St., and bids for said franchise will be received Apr. 20.

Los Angeles, Cal.—The Clear Lake Electric Ry. & Power Co. has been incorporated, with a capital of $1,000,000, by Dr. W. R. Prather, W. C. Phillips, and others, to construct an electric railway between Cloverdale and Lakeport, Cal., a distance of about 40 miles.

Denver, Colo.—The Denver & Northwestern R. R., which owns the Denver Tramway, is about to let contracts for building an electric railway to be operated in connection with the Denver Tramway, from Denver to Golden, and from Denver to Boulder, a distance of 33 miles; cost of construction estimated at $750,000. S. M. Perry, Pres. & Mgr., Denver.

Meriden, Conn.—It is reported that a third-rail electric service will be established between Meriden and Middletown by the New York, New Haven & Hartford R. R. The Meriden Division, which runs from Waterbury to Middletown, will be electrically equipped between this city and Middletown soon, and the third-rail system will probably be established between Meriden and Waterbury. Col. M. Ingersoll, Jr., Ch. Engr., New Haven.

Rockville, Conn.—The Stafford Springs Electric Ry Co. is stated to have secured a franchise to build into Rockville.

Wilmington, Del.—The Morton Traction Co., of Wilmington, capitalized at $100,000, has been incorporated by Elzy E. Van Atta, of N. Y. City, N. Y.; Frank A. Field, of York, Pa., and David H. Lincoln, of Marion, O.

Piedmont, Ga.—Application has been made to the Secy. of State for a charter for the Piedmont Electric Ry. Co., which proposes to build an electric railway to Roswell and from Roswell through Alpharetta to Cumming; capital, $500,000. Incorporators: E. S. Brazelton, of Birmingham, Ala.; Chas. S. Kingsbery and John Burnett, of Atlanta.

Girard, Ga.—The Columbus R. R. Co. has secured franchises in Girard City and Phoenix City. H. S. Reynolds, Mgr., Columbus, Ga.

Monmouth, Ill.—The Illinois Ry. Co. has been organized to build from Monmouth to Galesburg, with a line through Aledo to Rock Island, Moline and Davenport. John S. Brown, Pres.; Jas. E. Gregg, Secy.

Galesburg, Ill.—The Illinois Electric Ry. Co. has been incorporated to construct an electric railway to connect Galesburg, Monmouth, Aledo, Moline, Rock Island and Macomb; capital, $10,000. Incorporators: John S. Brown and Wm. H. Sexton, of Monmouth, Ill., and others.

Decatur, Ill.—The City Council has granted a franchise to the Danville, Urbana & Champaign Interurban Ry. The new road is to extend from Danville to Springfield.

Greencastle, Ind.—The City Council has granted J. N. Halstead and J. G. Bryson a franchise for the construction of an electric railway.

Crawfordsville, Ind.—The Indianapolis & Northwestern Traction Co., which is constructing a line between Indianapolis and Crawfordsville and to Lafayette, has secured a franchise in Crawfordsville.

Manning, Ia.—An electric railway is projected to Kimballton by the Manning & Kimballton Ry. Co.

Vincennes, Ind.—It is reported that an interurban electric railway is to be constructed from Vincennes to Jasper, and Rockport, Ind., and to Owensboro, Ky. N. H. Kennedy, of Rockport, is the principal promoter.

Vincennes, Ind.—N. H. Kennedy, of Rockport, is interested in the construction of an electric railway from Vincennes to Jasper, Rockport, Ind., and Owensboro, Ky.

Fairfield, Me.—The Fairfield & Shawmut Ry. Co., which has in contemplation the construction of an electric railway from Fairfield to Shawmut, has been organized, with Amos F. Gerald, Pres., and Harvey D. Eaton, Secy.

Rockville, Md.—It is reported that the Capital Traction Co. will extend its Chevy Chase line, to Rockville, Md. G. T. Dunlop, Pres., Washington, D. C.

Princeton, Mass.—The Worcester & Northern St. Ry. Co. has secured a franchise in Princeton.

Douglass, Mass.—The Selectmen have granted a franchise to the Uxbridge, Whittinsville & Douglass St. Ry. Co.

Biloxi, Miss.—See "Power Plants, Gas and Electricity."

Kansas City, Mo.—The Metropolitan St. Ry. Co. has taken out a permit for its new power house at 2d and Grand Aves., to cost $300,000.

Lewiston, Mont.—The Citizens' Electric Co. has under consideration a plan to build an electric railway from Lewiston to Kendall. J. L. Bright, Pres.

Buffalo, N. Y.—The Co. Clk. has received official notice that the International Ry. Co. intends to extend its lines along several streets to the city line. T. E. Mitten, Gen. Mgr., Buffalo.

Clayton, N. Y.—E. G. Connette, of Syracuse, Gen. Mgr. of the Syracuse Rapid Transit Co., acting for outside parties, is reported to have investigated the advisability of building an electric railway between Clayton and Chaumont.

Goshen, N. Y.—The Intervale Traction Co. is reported to have arranged for a survey of its line between Goshen and Newburgh. Edw. R. Emerson, Pres., of New York; W. J. McKay, Secy., of Newburgh.

Hornellsville, N. Y.—The Allegheny Electric Construction Co. has been organized, with a capital of $150,000, to build an electric railway in Hornellsville, Alfred and Almond.

Binghamton, N. Y.—The Binghamton Ry. Co. has filed with the Co. Clk. a certificate of the extension of its line over Conklin Ave., in Binghamton, and through Conklin, N. Y., to the Pennsylvania State line. J. P. E. Clark, Gen. Mgr., Binghamton.

Oswego, N. Y.—Plans are being perfected for the organization of a company to build an electric railway to connect Oswego, La Raysville and Nichols. R. Randall, of Rochester, and C. N. Tylee, of Worcester, Mass., are reported interested.

Toledo, O.—The Toledo Urban & Interurban Ry. Co. has been incorporated, with a capital of $100,000. The immediate route of the line will be from Toledo to Grand Rapids, Mich. C. F. Chapman and T. H. Tracey are among the incorporators.

Cleveland, O.—H. A. Williams and Chas. Hubbell, who propose to build a new line from Cleveland to Medina, following the Wooster pike, have received a franchise from the Cuyahoga Co. Comrs. The grant also provides for a spur line to Berea.

Port Clinton, O.—The Lake Erie, Bowling Green & Napoleon Ry. Co. has secured a franchise through Port Clinton. E. H. McKnight, Gen. Mgr., Bowling Green.

East Liverpool, O.—C. A. Smith has secured a franchise for a new city line.

Cincinnati, O.—The Cincinnati, Milford & Loveland Traction Co. has contracted with the Falk Co., of Milwaukee, Wis., for the construction of 33½ miles of road from Cincinnati to Loveland. The power house will be erected at Milford. Contracts have been placed with the Carnegie Co. for rails. E. H. Kroger, of Cincinnati, is at the head of the company.

Salem, O.—The Youngstown & Ohio River Ry. has secured a franchise through Salem. Max P. Goodwin, of Cleveland, is the chief promoter. The power house will probably be established at Teegarden.

Columbus, O.—The Columbus, Bellefontaine & Northwestern Electric Ry. Co. has been incorporated, with a capital of $10,000, by D. E. Sullivan, H. C. Grosc, Geo. Riddle, and others, to build a line from Columbus to Lima by way of Bellefontaine.

Akron, O.—It is reported that all rights of way and franchises have been secured by the Akron-Alliance Connecting Ry. Co. and actual construction work will start about May 1. R. D. Gibbey, President.

Mansfield, O.—The Council has granted a franchise to Chas. Brumfield for the city portion of a new line to extend from Mansfield to Galion.

Salem, O.—The Youngstown & Ohio River Ry. has

Ridgway, Pa.—John B. Hoefgen is reported interested in a plan to build an electric railway from Ridgway to St. Mary's and Johnsonburg. The road will be about 20 miles long.

Oklahoma City, Okla. Ter.—The Oklahoma Traction Co. has completed a survey of its line between Oklahoma City and Guthrie.

Portland, Ore.—It is stated that the Oregon Water Power & Ry. Co. intends to extend its Springwater branch over the mountains and into Eastern Oregon. It is also said that a line will be built to Salem. G. L. Brown, Ch. Engr., Portland.

Dillsburg, Pa.—The Boro. Council has granted a franchise to the Star Electric Ry. Co. Rights of way have been secured for the construction of the line from Mechanicsburg to Wellsville.

Scranton, Pa.—The survey for a railway from Scranton to Lake Winola has been completed. It is reported that the enterprise is in the hands of the Delaware, Lackawanna & Western R. R. (Edwin M. Rine, Div. Supt., Scranton), and that it will be an electric line.

Falls Creek, Pa.—The Borough Council has granted a right of way to the Du Bois Traction & Electric Light Co.

Lehighton, Pa.—It is stated that the Tamaqua & Lansford St. Ry. Co. will shortly extend its line to Lehighton. W. Drumheller, Ch. Engr., Lansford.

Knoxville, Tenn.—The Knoxville Traction Co. is proposing to extend one of its lines to Lonsdale, a distance of about 1½ miles.

Olympia, Wash.—The Capital City Traction Co. has been incorporated, with $10,000 capital, to build an electric railway at Olympia. J. B. Weddell, Pres., Mansfield, O.; E. B. Connor, Secy., Coshocton, O.; A. S. Caton, Treas., Olympia, Wash.

Pickens, W. Va.—The Pickens & Addison Ry. Co. has been incorporated to construct a railway from Pickens to Addison; capital, $5,000. Incorporators: F. O. Havener, Parkersburg; J. F. Johnson, Pickens, and others.

Elgin, Ont.—The Middlesex & Elgin International Electric Ry. Co. has secured a franchise for an electric railway through the Township of Yarmouth.

RAILROADS.

Ft. Davis, Ala.—The Union Springs & Northern R. R. Co. is stated to have decided to extend its line from Ft. Davis to Rockford, a distance of about 60 miles. P. C. Blain, Gen. Mgr., Elliott, Ark.

Birmingham, Ala.—Surveying corps in the employ of the Illinois Central R. R. Co. are reported to be in Winston County locating a route for a branch line to Birmingham. The proposed extension is to leave the main line near Jackson, Tenn., and follow a general southeasterly direction by the way of Sheffield to this city. H. U. Wallace, Ch. Engr., Chicago, Ill.

Russellville, Ark.—The Russellville & Dover R. R. Co. has been incorporated in Arkansas to build a line ten miles in length from Russellville to Dover. W. A. Baird, Pres.; J. B. West, Secy.

Paris, Ark.—The Central R. R. Co., of Arkansas, has been incorporated to construct a railroad from Paris to Hot Springs, a distance of 150 miles; capital, $3,000,000. Directors: F. A. Molitor, A. W. Lefeber, and others.

Elkhart, Ind.—The Lake Shore & Michigan Southern R. R. Co. is reported to be preparing to greatly enlarge the Elkhart yards, the present plan being to lay 30 tracks in a strip of land about 3 miles long, and to run a short line from this addition to the yard. The improvements are estimated to cost $400,000. E. A. Hnody, Ch. Engr., Cleveland, O.

Binghamton, N. Y.—Surveyors are reported to be at work on a new railroad, which has been incorporated at Albany, under the name of the Binghamton & Southern R. R., to build a line to Hoytville, Pa., connecting with the Buffalo & Susquehanna, making a through line from Binghamton to Buffalo.

Huntdale, N. C.—The J. M. Buck Lumber Co. has purchased timber lands in Yancey County, and will build a railway from Huntdale into these timber lands.

Edinburg, N. D.—It is reported that the Pembina Portland Cement Co. expects to build a railroad this year from Edinburg to the mines, a distance of 21 miles, at a cost of $150,000.

Cleveland, O.—A press report states that bids will be received by the Ft. Wayne R. R. Co. for 36 miles of double-track construction and for the construction of a large freight building at Cleveland.

Akron, O.—According to press reports Supt. H. W. Thornton, of the Cleveland, Akron & Columbus Ry. Co., has announced that $60,000 will be spent on the line between this city and Columbus during the coming summer. The money will be expended in building new yards at Orrville, and new sidings at other points along the line.

Guthrie, Okla. Ter.—A charter has been granted to the Mountain Park, Texas & Northwestern Ry. Co., with a capital of $4,000,000, to build a line 200 miles long from a point on Red River in Comanche County, to the northern boundary of Okla. in Woodward County. Incorporators: Oklahoma capitalists.

Millwood, Pa.—It is stated that about $7,000,000 will soon be expended by the Pennsylvania R. R. Co. in building a 4-track freight line from Radebaugh to Millwood on the Pittsburg division, a distance of about 18½ miles. Surveys have been made and plans are now being prepared by Ch. Engr. W. H. Brown, in Philadelphia.

Punxsutawney, Pa.—The Buffalo, Rochester & Pittsburg R. R. Co. has secured a right of way between this place and Johnstonburg, a distance of 75 miles, for a 4-track road. A. G. Yates, Pres., Rochester, N. Y.

Somerton, Pa.—The Philadelphia & Reading Co. will within a short time put its engineers at work locating a new line to connect with the New York division near Somerton. Wm. Hunter, Ch. Engr., Philadelphia.

Knoxville, Tenn.—A press report states that a large share of the $15,000,000 recently secured by the Louisville & Nashville R. R. Co. (H. Montfort, Ch. Engr., Louisville, Ky.) will be expended in the eastern portion of Tennessee. The plans contemplate the completion of the Knoxville, LaFollette & Jellico from Jellico to Knoxville, extensive improvements on the Atlanta, Knoxville & Northern from Knoxville to Marietta, Ga., and the building of terminals in Knoxville and a large union station in that city at a cost of between $150,000 and $200,000.

Dallas, Tex.—It is stated that the International & Great Northern R. R. Co. propose building a line between Dallas and Palestine, via Scurry. Leroy Trice, Gen. Mgr., Palestine.

Lynchburg, Va.—Plans are reported as being prepared for double tracking the main line of Norfolk & Western R. R., from Lynchburg, Va., to Columbus, about 600 miles, at a cost, in connection with the straightening of the road and the reduction of grades and curves, of about $10,000,000. C. S. Churchill, Ch. Engr., Roanoke, Va.

Vancouver, Wash.—Bids are wanted Apr. 1 for constructing 3 miles of road, construction consisting of clearing, grubbing, culverts and grading, comprising about 185,000 cu. yds. of earth. Address Pres. Portland, Vancouver & Yakima R. R. Co.

Cecil, W. Va.—The Sandy Creek, Kingwood & Cheat River R. R. Co. has been incorporated to build a line from Cecil to Kingwood; capital, $50,000. Incorporators: Clarence S. James, L. R. Lewis and Geo. D. Prentice, of Allegheny, Pa.

PUBLIC BUILDINGS.

Monroeville, Ala.—Bids will be received Apr. 16 by the Bd. of Co. Comrs. for erecting a court house. Andrew J. Bryan & Co., Archts., 1104 Hennen Bldg., New Orleans, La. Address Hon. N. J. Stallworth, Probate Judge.

Jacksonville, Fla.—Plans will be received Apr. 20 by the Free Pub. Library Trus. for a library. J. R. Parrott, Pres.

Athens, Ga.—Bids will be received Apr. 8 by the Mayor and Council for erecting a city hall, as advertised in The Engineering Record.

Monticello, Ill.—The plans of J. W. Royer, of Urbana, are stated to have been selected for the brick court house to be erected here, to cost about $80,000.

Olney, Ill.—Bids will be received Apr. 15 by the Bd. of Dirs. of Pub. Library for erecting a library. J. W. Gaddis, Archt., Vincennes, Ind. Chas. Brill, Vice-Pres.

Ft. Madison, Ia.—State Architect Liebbe is reported to be preparing plans for the hospital for the penitentiary; probable cost, $30,000.

Decorah, Ia.—O. H. Oleson, of Stillwater, Minn., is stated to have received the contract for erecting the Winneshiek County Court House for $74,875.

Des Moines, Ia.—Bids will be received Apr. 8 by W. N. Heaton, Chmn. Bldg. Com., for the completion of the Des Moines Free Public Library. Archts., Smith & Gage, 300 Youngerman Bldg.

Davenport, Ia.—Chas. Gruetzkow & Co., of Milwaukee, Wis., are stated to have submitted the lowest bid ($32,841) for the erection of a library.

Russellville, Ky.—Press reports state that bids will be received Apr. 1 by the Co. Comrs. for erecting a $40,000 court house.

New Orleans, La.—Bids are wanted Mar. 30 for certain sanitary improvements in yards of new court house and jail building. V. Tujaque, Compt.

Yarmouth, Me.—It is stated that a library will be erected here, to cost $20,000.

Taunton, Mass.—It is stated that bids are wanted Apr. 3 for erecting a library. L. C. Couch, Acting Mayor.

Marquette, Mich.—Patton & Miller, of Chicago, Ill., are stated to be preparing plans for the library to be erected at Front and Ridge Sts.; probable cost, $40,000.

St. Paul, Minn.—The Senate passed a bill providing for an appropriation of $50,000 for a State Sanitorium for Consumptives.

Delano, Minn.—It is stated that bids are wanted Apr. 6 for erecting St. Joseph R. C. Church. H. Kretz & Co., Arch., St. Paul.

Shakopee, Minn.—It is stated that bids are wanted May 8 for installing a steam heating plant in the court house. Address E. E. Deschene, Minneapolis.

Dover, N. H.—The plans of J. E. Randlett, of Concord, have been accepted for the $30,000 Carnegie Library.

Newark, N. J.—Benj. F. Hurd, Prudential Bldg., is stated to have been selected to prepare plans for the police station for the 4th Precinct at 17th Ave. and Livingston Sts.; probable cost, $20,000.

Wenonah, N. J.—Kendrick & Roberts, of Philadelphia, Pa., are stated to have received the contract for erecting the Presbyterian Church, at a cost of $30,000.

Utica, N. Y.—The Governor is stated to have authorized the issue of $50,000 bonds for the completion of the library.

New York, N. Y.—The following bids were opened at the office of the Fire Dept. Mar. 25 for furnishing all labor and material required for the structural steel work of a building to be located on 12th Ave. and 56th St. for a repair shop: Bigelow & Brown, $42,533; The Snare & Triest Co., $36,700; American Bridge Co., 7 W. 22d St., $34,745 (awarded contract).

Robt. R. Fox, 217 W. 124th St., has secured the contract, at $8,100, for furnishing all labor and material required for general repairs and alterations to quarters of Hook & Ladder Co. 18; bids opened Mar. 25th.

Brooklyn, N. Y.—The Congregation of the Park Congregational Church is stated to have decided to erect an edifice at 8th Ave. and 2d St., to cost about $50,000. Rev. M. B. Taylor, Pastor.

Albany, N. Y.—The city will erect a new police station, a steamer house and a public bath, with swimming tank attached.

Long Island City, L. I., N. Y.—The Bd. of Estimate and Appropriation is stated to have authorized the issue of bonds for the erection of a borough hall, at Jackson Ave. and Pearson St.; probable cost, $400,000.

Troy, N. Y.—Bids will be received Apr. 6 by the Bd. of Co. Comrs. for erecting a court house. Address W. D. Allen, Register of Deeds.

Jamestown, N. D.—M. E. Beebe, of Fargo, is reported to be preparing plans for a State hospital to be erected here, to cost about $45,000.

Casselton, N. D.—It is stated that bids are wanted Apr. 2 for erecting a brick church. R. C. Rev. J. Quillman.

Youngstown, O.—It is stated that the St. Columbus Society will erect a $40,000 church. Rev. E. Mean, Pastor.

Lisbon, O.—Bids will be received Apr. 16 by Lodge Riddle, Village Clk., for erecting a Village Hall.

Springfield, O.—R. C. Gotwald, Gotwald Bldg., is stated to have prepared plans for a city prison, workhouse and patrol house to be erected here, to cost about $22,500.

Cleveland, O.—F. S. Barnum & Co., New England Bldg., is preparing plans for a stone edifice to be erected at Euclid Ave. and Genesee St. for the Congregation of Unity Church.

Philadelphia, Pa.—Bids are wanted Apr. 2 for erecting a portion of the Administration Building of the Philadelphia Hospital for the insane. Philip H. Johnson, Archt., Fidelity Bldg.; John V. Shoemaker, Pres. Dept. of Charities and Correction.

Warren, Pa.—Bids are wanted Mar. 30 for erecting a church and parish house for the Swedish Lutheran Church. Grumminger & Phillips, Archts. Address Carl Henderson, Pastor.

Scranton, Pa.—Owen McLane, of Wilkesbarre, is stated to be preparing plans for a 3-story brick monastery to be erected at Boulevard and Sloan Ave. by the Passionist Fathers. A church will also be erected on this site, the 2 buildings to cost about $100,000.

Pittsburg, Pa.—The contract for erecting an engine house (bids opened Mar. 11) has been awarded to Wm. Kerr's Sons, Smithfield and 6th Ave., for $26,540. A. H. Leslie, Dir. Dept. Pub. Safety.

Yankton, S. D.—Bids will be received Apr. 9 by the Bd. of Charities and Corrections for erecting a hospital for the asylum at Yankton, to cost $30,000. W. E. Tipton, Secy., Armour, S. D.

Redfield, S. D.—Bids will be received Apr. 9 by the Bd. of Charities and Corrections for erecting a custodial building for the Northern Hospital at Redfield, to cost $45,000. W. E. Tipton, Secy., Armour, S. D.

Corsicana, Tex.—It is stated that bids are wanted Apr. 1 for erecting a 3-story brick and granite court house, to cost about $130,000. J. E. Flanders, Archt., Dallas.

Manitowoc, Wis.—Detweiler & Kinney are stated to be preparing plans for a 3-story brick court house to be erected here, to cost $120,000.

Sault Ste. Marie, Ont.—It is stated that bids are wanted Apr. 4 for erecting a stone edifice for the Central Methodist Church. W. H. Hearst, Secy., Bd. Trus., Ganley Blk.

BUSINESS BUILDINGS AND DWELLINGS.

San Francisco, Cal.—Albert Sutton, Safe Deposit Bldg., is stated to have prepared plans for a 3-story apartment house, to be erected at Washington St. and Van Ness Ave. for Mrs. E. Reene; probable cost, $43,000.

Los Angeles, Cal.—H. Lechler is stated to have had plans prepared by A. L. Haley for a 4-story brick apartment house to be erected at Hill and 3d Sts., to cost about $37,000.

San Pedro, Cal.—The Pacific Electric Ry. Co. (G. E. Pillsbury, Ch. Engr., Los Angeles) and the Southern Pacific are said to be interested in the erection of a hotel, bath house, observatory and pavilion here to cost about $800,000.

Oakland, Cal.—The W. W. Watson Co. is reported to be considering the erection of a 3-story building at San Pablo Ave. and 17th; probable cost, $35,000.

Pasadena, Cal.—The Home Telephone Co. will probably erect a 2 or 8-story telephone exchange at Raymond Ave. and Union St.

Denver, Colo.—The Evans Blk. at 15th and Lawrence Sts. is reported damaged by fire Mar. 11th.

Pueblo, Colo.—The Pueblo Trades & Labor Assembly is reported to have had plans prepared for a building to be erected on 4th St., at a cost of $20,000.

Wilmington, Del.—Wm. A. Fink, of Reading, has prepared plans for two 4-story brick apartment houses to be erected on Jefferson St., to cost $23,000.

Indianapolis, Ind.—The Vancamps Hardware Co. will erect a building at Maryland and Missouri Sts.; estimated cost, $200,000.

Evansville, Ind.—The contract will soon be let for the erection of the round house at Howell for the Louisville & Nashville R. R. Co. (John W. Logsdon, Div. Supt.); estimated cost, $100,000.

Des Moines, Ia.—Bids are wanted Apr. 1 for erecting a fireproof warehouse. A. B. Funk, Chmn. of Capitol Comrs.

It is stated that Lederer & Straus will erect a 7-story brick, 60x132-ft. building at Plum St. and 6th Ave.; also a 6-story brick office building on Plum St.

Chanute, Kan.—Bids are wanted Apr. 6 for erecting a 3-story, 60x135-ft. opera house. Garstang & Itea, Archts., 204 Grome Bldg., Joplin, Mo. Fred. Hetrick, Owner.

Louisville, Ky.—W. Y. Davis is stated to have decided to remodel the building at 3d and Main Sts.; probable cost, $20,000.

Alexandria, La.—F. B. & W. S. Hull, of Jackson, Miss., are stated to have received the contract for erecting the 3-story brick building for the Rapides Opera House Co.; estimated cost, $33,000.

Lewiston, Me.—Gahn & Grant, of Portland, Me., will build a show house in Lewiston this summer, to cost $50,000.

Springfield, Mass.—W. B. Reid, of Holyoke, is stated to be preparing plans for a 4-story brick apartment house to be erected at State and Orleans Sts. by T. J. Moriarty; probable cost, $60,000.

Boston, Mass.—Plans have been filed for 4-story brick paint manufactory, 139x64 ft., to be erected at 266-282 Border St., East Boston, for John Brigg & Co., 31-33 Batterymarch St., Boston. Builder, J. J. & T. F. Mack, Batterymarch St.; Architect, Arthur F. Gray; estimated cost, $40,000, and for an 11-story office building on Milk St. and Sewall Pl. Owners, Penn Mutual Insurance Co., Philadelphia, Pa. Builders, Norcross Bros., Worcester, Mass.; Architects, Roberts & Seeler, Philadelphia, Pa.; estimated cost, $350,000.

Fall River, Mass.—Wm. J. Dunn, of this city, will soon erect a 7-story fireproof, steel frame office building on So. Main and Spring Sts., 50x90 ft. Probable cost, $150,000. Architect, Louis G. Destremps, 56 No. Main St.

St. Paul, Minn.—Jas. McClure is reported interested in the erection of a 3-story brick building on E. 6th St.; estimated cost, $40,000.

It is stated that M. J. O'Neil will erect a 4-story building at 5th and Cedar Sts.; estimated cost, $60,000. Louis Lockwood, Archt., Natl. G. A. Bank Bldg. Bldg.

St. Peter, Minn.—Engesser Bros. are reported interested in the erection of an opera house to be erected here, to cost about $25,000.

Kansas City, Mo.—The Deering Harvester Co. will erect a brick warehouse on Ewing St. and State line, to cost about $200,000.

Warsaw, N. Y.—It is stated that the Warsaw Opera House Co. will erect a 70x55-ft. brick building; estimated cost, $20,000.

Chagrin Falls, O.—The Eastern Ohio Traction Co. (R. L. Andrews, Mgr., Cleveland) is receiving bids for erecting and equipping the car house, repair shop and office, to replace buildings recently destroyed by fire. The structure will be 80x150 ft.

St. Marys, O.—Bids are wanted Apr. 9 for erecting the I. O. O. F. Temple, including steam heating, plumbing and gas fitting, at E. Spring and Spruce Sts. C. W. Schmehl, Secy., The Shawnee Temple Co.

Newark, O.—The Columbus Buckeye Lake Traction Co. (J. R. Harrigan, Mgr., Newark) is stated to have awarded the contract for erecting the car barn and repair shops in West Newark to P. S. Phillips, for $60,000.

Oklahoma City, Okla. Ter.—The Oklahoma City Labor Temple Assoc. is reported incorporated, with a capital of $50,000, to erect a temple to cost about $50,000. Incorporators: Richard Ressel, J. T. Highley, and others.

Canonsburg, Pa.—The Citizens Trust Co. is stated to have awarded the contract for erecting the 5-story bank building on the site of Central Hotel, to Taylor & Crawford; estimated cost, $70,000.

Mt. Carmel, Pa.—Geo. H. Keefer, of this city, is stated to have received the contract for erecting the 50x110-ft. brick Masonic Temple, for $20,483.

Philadelphia, Pa.—Chas. B. Prettyman is reported interested in the erection of a 6-story, 100x70-ft. brick apartment house to be erected at Broad and Pine Sts.

Altoona, Pa.—A site has been selected at 1204 12th Ave., by I. C. Mishler, for the erection of a new theatre.

Johnstown, Pa.—Chris. Hornick, of this city, is stated to have received the contract for erecting the building at Franklin and Locust Sts., for the Elks of this city, for approximately $25,000.

Nashville, Tenn.—Maj. A. W. Wills is reported interested in the erection of a 6-story, 96x116-ft. brick apartment house on Vine St. Architects, Thompson, Glibel & Asman, Cole Bldg.

Port Angeles, Wash.—The St. Louis and Port Angelea Investment Co. is reported incorporated, with a capital of $150,000, to erect a 3-story, 100x100-ft. brick hotel at 3d and Francis Sts., and a 2-story apartment house. H. A. Lingenbrink, Mgr.

Ballard, Wash.—C. A. Breitung, of Seattle, is reported to be preparing plans for brick building to be erected at Ballard and 2d Aves. for Matthes Bros.; probable cost, $20,000.

Menasha, Wis.—Bids are wanted Mar. 31 for furnishing material for erecting a hotel. Wm. Waters, Archt., Oshkosh. Address Geo. H. Utz, Menasha.

SCHOOLS.

Haywards, Cal.—The citizens are stated to have voted to issue $30,000 bonds for schools.

Colorado Springs, Colo.—Douglas & Heatherington, Gazette Bldg., are stated to be preparing plans for a dormitory for women for Colorado College; estimated cost, $20,000.

Los Angeles, Cal.—It is stated that the Free Methodist Church will erect a seminary at Highland Park, to cost $25,000. Rev. C. B. Ebey, of Pasadena, is reported interested.

Sheldon, Ga.—It is stated that bids are wanted Apr. 8 for erecting a school. F. W. Bloxham, Secy. Bd. Educ.

Canton, Ill.—Chas. Johnson, of Canton, is stated to have received the contract for erecting the high school, for $36,330.

Bloomington, Ill.—The Southern Illinois Const. Co., of East St. Louis, is stated to have submitted the lowest bid, $53,900, for erecting the Edward School on W. Market St.

Dwight, Ill.—Julian Barnes, of Chicago, is reported to have completed plans for a 2-story, 66x128-ft. laboratory and office building for the Keeley Institute, to cost $100,000.

Peoria, Ill.—Bids will be received Apr. 4 by the Bd. of Educ. for erecting a school; separate bids will be received for heating and plumbing. Albert Kiefer, Archt., 410-411 Woolner Bldg. Henry G. Triebel, Chmn. Bldg. Com.

New Albany, Ind.—It is stated that a high school will be erected here, to cost about $60,000.

Indianapolis, Ind.—It is stated that a 3-story building will be erected at 23d and Alabama Sts., for the Indiana Normal Kindergarten School; estimated cost, $30,000.

Winona, Ind.—J. A. Schumacher & Co., of Indianapolis, are stated to have received the contract for erecting the Mount Memorial Bldg. for Winona Agricultural and Technical Institute at Winona Lake. The building will be a 3-story brick structure, and cost $60,000.

Brazil, Ind.—The Bd. of Educ. is considering the erection of a high school here, to cost $50,000.

Evansville, Ind.—Bids will soon be received for the erection of a manual training school, to cost $30,000.

Rushville, Ind.—The Council has authorized the School Bd. to issue $30,000 bonds for a high school for this city.

Grinnell, Ia.—The citizens are stated to have voted to issue $60,000 bonds for a school.

Augusta, Me.—A. G. Wing has been engaged to prepare plans for a 2-story brick grammar school to be erected by the Village School Dist.

Somerville, Mass.—The contract for ventilating and heating the Morrison Ave. School is stated to have been awarded to Huey Bros., of Boston, for $3,457.

Brockton, Mass.—J. W. Beal, of Boston, is stated to have submitted plans for the 3-story, 196x205 ft. high school, to be erected here; estimated cost, $212,000.

Cambridge, Mass.—The contract for installing a heating plant in the Truant School at N. Chelmsford (bids opened Mar. 24) has been awarded to Farrell & Conaton, of Lowell, Mass., for $11,700. Levi S. Gould, Chmn. Co. Comrs.

New Bedford, Mass.—Bids are wanted Apr. 15 for furnishing material for erecting a high school, boiler house and other work in connection with same on County St. Saml. C. Hunt, Archt., Odd Fellows' Bldg. Chas. S. Ashley, Mayor, Chmn. Com. on New High School.

Minneapolis, Minn.—Bids will be received Mar. 31 by the Bd. of Educ. for ventilating and heating the Monroe School. F. G. McMillan, Chmn. Com. on Bldgs. and Repairs.

The Bd. of Educ. is stated to have awarded the contract for the addition to the Franklin School to J. E. Pilgrim, 2828 Pleasant Ave., for $29,568; contract for plumbing to J. C. Fay, for $1,075.

Tenafly, N. J.—The citizens are stated to have voted to erect a school, at a cost of $40,000.

Brooklyn, N. Y.—Bids will be received Apr. 6 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for alterations, repairs, etc., to Schools Nos. 13 and 32; also installing, ventilating and heating apparatus in School No. 105 and for erecting School No. 47.

Schenectady, N. Y.—The contract for wiring the high school is stated to have been awarded to Finch & Hahn for $5,530.

Buffalo, N. Y.—All bids received Mar. 4 for erecting a school at Leroy Ave. and Girder St. have been rejected and new plans ordered.

Cleveland, O.—Bids are wanted Apr. 20 for furnishing material for erecting a school on Doan St. Starr Cadwallader, School Dir., Bd. of Educ.

Mansfield, O.—Bids will be received Apr. 14 by H. E. Cave, Clk. of Bd. of Educ., for furnishing material for erecting an addition to the high school. Vernon Redding, Archt., Bird Bldg.

Glenville, O.—F. S. Barnum & Co., Rose Bldg., are stated to have been selected to prepare plans for the school to be erected here, at a cost of $50,000.

Oxford, O.—Bids will be received Apr. 1 (readvertisement) by the Bd. of Trus. of Miami Univ. for erecting a womsn's dormitory. Patton & Miller, Archts., 153 Lassalle St., Chicago, Ill.

Reading, Pa.—Two schools are to be erected, one to cost $22,000, the other $14,000. Architect, H. S. Head, 536 Penn St.

Allentown, Pa.—Ritter & Smith, 113 S. 7th St., is stated to have submitted the lowest bid for erecting the main building of Muhlenberg College, for $85,040.

Baldwin, Pa.—Bids are wanted Apr. 15 for $60,000 school bonds. Address N. Hogue, P. O., Fair Haven, Pa.

Greenville, Pa.—The Bd. of Educ. is stated to have purchased a site on Mercer St. for a school, to cost $35,000.

Darby, Pa.—The plans of E. H. Kirkpatrick are stated to have been accepted for the Ridge Ave. School, a 2-story, 68x09-ft. brick structure.

St. Clair, Pa.—W. D. Hill, of Pottsville, is preparing plans for a 4-room brick school, to cost $11,000. Bids for its erection will be received by the School Bd. Apr. 19.

Britton, S. D.—Bids will be received Apr. 6 by Geo. L. Baker, Clk. Bd. of Educ., for furnishing material and erecting a school; separate bids will be received for heating. Fremont D. Orff, Archt., Minneapolis, Minn.

Two Rivers, Wis.—The plans of Van Ryn & De Geleke, of Milwaukee, are stated to have been selected for a school to be erected here, to cost $35,000.

Reedsburg, Wis.—It is stated that bids are wanted Apr. 20 for erecting a brick school. J. P. Devoe, Clk. Bd. Educ.

STREET CLEANING AND GARBAGE DISPOSAL.

Pasadena, Cal.—It is reported that an incinerator is to be established by the city northwest of the city limits.

Chicopee, Mass.—Bids are wanted Apr. 6 for collecting the garbage of said city for the year commencing May 1, 1903. Richd. D. De Witt, Secy. Bd. of Health.

Duluth, Minn.—Local press reports state that the Health Bd. is considering the granting of a franchise for the removal of garbage.

Warren, Pa.—Mr. Knabb, Chmn. St. Com., recommends the construction of a garbage disposal plant and the construction of new sewers.

Ottawa, Ont.—It is stated that bids will be received Mar. 31 by J. C. Grant, Chmn. Water Wks. Com., for furnishing 4 street sprinkling carts. Newton J. Ker, City Engr.

GOVERNMENT WORK.

San Diego, Cal.—Capt. R. H. Rolfe, Q. M., U. S. A., writes that the following contracts have been awarded, bids for which were opened Feb. 9: For erecting a hospital, Schaniel Bros., San Diego, $22,000; plumbing, R. Dalziel, Jr., San Francisco, $9,880; heating, E. D. Hough, Los Angeles, $11,805, and wiring Hubbard Hillbrow Electrical Co., San Diego, $3,093.

Washington, D. C.—Secy. Root is reported to have approved plans recommended by the Army Engr. Bd. for extension of jetty at mouth of Columbia River. The plans contemplate extending the existing jetty 2½ miles out to sea. The engineers calculate that a channel of 40 ft. will be given across the bar with the completion of the work projected, and the estimated cost is $2,260,000. Congress has authorized the expenditure of $1,500,000 for improvements at the mouth of the Columbia.

The plans of Baldwin & Pennington, of Baltimore, Md., are stated to have been accepted for the mess hall and dormitory to be erected at the U. S. Soldiers' Home, Washington; probable cost of building complete and equipped will be $1,000,000.

Bids are wanted Apr. 4 for constructing a 4-room school at Howard and Emory Sts., at Ft. Reno, D. C. John Biddle, Comr., D. C.

Ft. Barrancas, Fla.—Bids are wanted Apr. 20 for constructing several buildings at this post. W. E. Cole, Q. M.

Ft. Riley, Kan.—Capt. G. O. Cress, Q. M., writes that all bids received Mar. 3 for constructing 2 double sets of Non.-Comm. Staff quarters have been rejected.

Ft. Sheridan, Ill.—Bids are wanted Apr. 3 for wiring of buildings, installing electric fixture and erecting pole lines on the reservation for electric lighting this post. Maj. W. H. Miller, Q. M., U. S. A., 415 Pullman Bldg., Chicago.

Ft. Howard, Md.—The following are the contracts awarded for constructing sea wall, filling, etc., at this post, bids for which were received by Capt. Wm. E. Horton, Q. M., Baltimore, on Mar. 20: The Filbert Paving & Const. Co., Baltimore, for the sea wall, at $7.42 per cu. yd. concrete in place; Sanford & Brooks Co., for filling in swamp, at 25 cts. per cu. yd., and Geo. W. Miller, for drain pipes, at 35, 47, 63 and 73 cts. per lin. ft. Contractors all of Baltimore.

Ft. Washington, Md.—Bids are wanted Apr. 16 for constructing cement sidewalks at this post. Geo. H. McManus, Constructing Q. M.

Boston, Mass.—Bids are wanted Apr. 20 for dredging in Beverly and Manchester Harbors, Mass. Capt. Harry Taylor, Corps Engrs., U. S. A.

The following bids for dredging in (*a*) Little Harbor, (*b*) Exeter, (*c*) Lamprey, and (*d*) Cocheco Rivers, N. H., were received by Capt. Harry Taylor, Corps Engrs., U. S. A., Mar. 16: Bay State Dredging Co., *a*, 25 cts.; *b*, .815 cts.; *c*, 95 cts.; *d*, 68 cts. and .675 cts. Simon J. Donovan, *d*, 65 cts. Eastern Dredging Co., *a*, 35 cts. and 30 cts.; *b*, $1 and 95 cts.; *c*, $1 and 95 cts.; *d*, 68 cts. and 67 cts. Harries & Letteney Co., *a*, .2675 cts. Bidders all of Boston.

Bids are wanted Apr. 25 for furnishing Portland cement, sand and broken stone. Capt. Harry Taylor, Corps Engrs., U. S. A.

Marquette, Mich.—Bids will be received at the U. S. Engr.'s Office, Duluth, Minn., Apr. 24 for furnishing broken stone and sand, as advertised in The Engineering Record.

Ft. Snelling, Minn.—Bids are wanted Apr. 8 for constructing several buildings at this post. Geo. E. Pond, Ch. Q. M., St. Paul.

Portsmouth, N. H.—Bids will be received Mar. 31 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Portsmouth, a quantity of iron, locks, hoisting engine, electric elevator, etc. A. S. Kenny, Paymaster Gen., U. S. Navy, Washington.

Ft. Hancock, N. J.—Bids are wanted Apr. 18 for repairing bulkhead, sand filling, and additions to riprap wall. Address John M. Dunn, Q. M.

Cincinnati, O.—The following bids for building Dam No. 1, with Abutment and Protection, Big Sandy River, W. Va., and Ky., were opened Mar. 17, by Maj. E. H. Ruffner, Corps Engrs., U. S. Army—*a*,* Sheridan-Kirk Contract Co., Valley View, Ky.; *b*, E. Brown Baker, Morgantown, W. Va.; *c*, W. H. Loutban. Horace Shields, Hamilton, O.; *d*, Folz & Jonte, Cincinnati:

	a	*b*	*c*	*d*
Piling (round), 400 ft.	$0.50	$0.50	$0.40	$1.00
Cofferd'm timb., 422,000 ft.	40.00	35.00	47.50	61.00
Cofferd'm fill., 8,000 cu yds.	.70	.75	1.10	1.50
Riprap, 1,200 cu. yds.	2.00	2.50	1.60	2.00
Earth exc., 20,400 cu. yds.	.42	.50	1.00	.63
Rock excav., 100 cu. yds.	2.00	3.00	4.00	3.00
Bolt holes, 1,600 lin. ft.	.40	.25	.30	.40
Concrete, 5,400 cu. yds.	5.00	6.00	4.75	4.00
Perman't timb., 60,500 ft.	60.00	70.00	70.00	75.00
Iron work, 281,500 lbs.	.065	.075	.065	.0725
Embankment, 1,900 cu. yds.	.50	1.00	.45	.40
Puddling, 500 cu. yds.	3.00	2.00	4.00	2.00
Square pavg., 1,750 sq. yds.	3.00	3.00	3.00	2.25
Rough pavg., 1,200 sq. yds.	2.50	2.50	2.00	1.50
Removal of old cofferdam.	500.	1,000.	1,200.	1,500.

Totals: *a*, $94,616; *b*, $104,768; *c*, $111,093; *d*, $108,878.

*Awarded contract, according to press reports.

Portland, Ore.—Bids are wanted Apr. 30 for 475,000 tons of stone for extension of jetty at mouth of Columbia River, Ore., and Washington. Capt. W. C. Langfitt, Corps Engrs., U. S. A.

Philadelphia, Pa.—Bids are wanted Apr. 17 for repairing roofs on 3 iron storehouses at the Schuylkill Arsenal. Address Depot Quartermaster.

Galveston, Tex.—According to local press reports, Col. C. S. Riche, Corps Engrs., U. S. A., has recommended the acceptance of the bid of J. M. O'Rourke & Co., of Galveston, for the Galveston jetty work; also the bid of Moore & Seibert, of Texas City, for building the jetties at the mouth of Brazos River. The detailed bids, showing cost of work and approximate amount of material to be used, are as follows: Galveston jetties—J. M. O'Rourke & Co., South jetty, $2.59 per ton—total cost, $103,600; North jetty, $3.89 per ton, or a total of $486,250. Brazos River jetties—Moore & Seibert, on 7,000 tons of riprap, $3.14 per ton, or $21,980; on 7,500 tons of riprap, $3.95 per ton, or $29,625; on 80,000 lin. ft. of logs at 35 cts., or $28,000. Grand total, $79,605. He is also reported to have recommended the acceptance of Henry Clay Ripley's bid for the improvement of Arkansas Pass.

Ft. Hunt, Va.—Bids are wanted Apr. 16 for constructing cement sidewalks at this post. Geo. H. McManus, Constructing Q. M., Ft. Washington, Md.

Burlington, Vt.—The following bids for repairing breakwater were received by Capt. Harry Taylor, Corps Engrs., U. S. A., Boston, Mass., Mar. 16—*a*, John Cashman, Quincy, Mass.; *b*, Daly & Hannan Dredging Co., Ogdensburg, N. Y.; *c*, Lawler Bros., Charlestown, Mass.:

Items and quantities.	*a*	*b*	*c*
Old superstr. rem., 1,500 lin. ft.	$7.00	$8.00	$6.00
Concr. in place in parapet, 1,850 cu. yds.	8.00	9.00	10.00
Concr. in footing blks., 1,140 cu. yds.	9.00	10.00	13.00
Concr. on decking, 500 cu. yds.	7.00	9.00	10.00
Concr. in bags, 100 cu. yds.	10.00	9.00	10.00
Stone blks. in coping and under footing blks., 680 cu. yds.	10.00	5.50	25.00
Riprap stone, 100 cords	7.00	10.00	3.00
Timber and plank, 110,000 ft.	40.00	38.00	45.00
Tie rods, 1½"x16 ft., 149	7.00	4.00	6.00
Tie rods, 1⅛"x10 ft., furnished by U. S., 100	4.00	1.00	5.00
Tie rods, 1⅛"x10 ft., furnished by contractor, 50	6.00	2.00	6.00
Use of plant, 100 hrs.	4.00	6.00	10.00
Totals	$54,103	$55,766	$73,264

Ft. D. A. Russell, Wyo.—Bids will be received until Apr. 23 by Capt. W. S. Scott, Constructing Q. M., Cheyenne, Wyo., for constructing, plumbing, heating, gas-piping and electric wiring several buildings at Ft. D. A. Russell.

NEW INDUSTRIAL PLANTS.

John Shrader, 108 W. Main St., New Albany, Ind., is erecting a 3-story, 140x80-ft. factory, and will install a power plant of 50 to 60-H.-P. capacity.

The Pennsylvania Air Brake Co., Washington, Pa., is having plans prepared for a plant for making interchangeable railway brakes, and expects to turn out 500 sets of freight car brakes daily. The plant will include a 400x600-ft. machine shop and the necessary foundries. The power plant will consist of gas engines of 300-H.-P., direct-connected to direct-current generators of 220-volt current, and the whole plant will be electrically driven. H. G. Manning, Pres.

The Columbia Cotton Oil Co., Magnolia, Ark., will erect a 2-press mill, and is in the market for a 16x36-in. Corliss engine and two 16-ft. boilers of 60-in. diameter. J. L. Davis, Secy.

Harris & Harrington, Washington, N. J., are having plans prepared for a 128x43-ft. clock case factory, with a 3-compartment dry kiln and engine and boiler house.

The Headley Glass Co., Fairmount, Ind., will erect a 30-blower blow-over tank, with producers, flattening ovens and lehrs, at Terre Haute, Ind. A 45-H.-P. automatic engine and two 100-H.-P. boilers will be required.

The Alabama Chemical Co., Moses Bldg., Montgomery, Ala., has been organized, with a capital of $300,000, and proposes to erect a plant to have an annual output of about 35,000 tons of commercial fertilizer. The main building will be 200x600 ft., and the acid chambers and furnace rooms will be 100x300 ft.; there will be other smaller buildings. John W. Huger, Pres.

Whyte Bedford, Blythe, Miss., is interested in the erection of a 60-ton cottonseed-oil mill. An electric light plant and possibly water works will also be installed.

The Cincinnati, O., Electric Motor Co., 327 East 6th St., will erect a new plant, probably 2-story and 60x800 ft., at Norwood, O.

The Norton & Cole Machinery Co., Sixth and Carr Sts., Cincinnati, O., boilers, engines and machinery, has bought 11½ acres at Norwood, O., and will erect buildings, 80x300 ft., with traveling crane full length, railroad switch running full length inside and a 20-ton swinging crane for unloading heavy equipment outside. It is expected in the future to increase the length of the building to 600 ft.

The Troy, Tenn., Roller Mills will erect a mill to have a daily capacity of 75 bbls. J. O. Bennett, Secy. & Treas.

The Brown Furniture Co., Salisbury, N. C., is preparing to build a new factory and is in the market for woodworking machinery. The company will use the engine and boiler it now has.

The Ivey Mills, Hickory, N. C., will erect a cotton mill to contain about 8,000 spindles and 200 looms, and to cost about $85,000. The power plant will have a capacity of about 300-H.-P.

The Messenger Mills Corporation will erect a cotton mill on the Pacific coast, which will include a 2-story mill and a 1-story weave-shed with saw-tooth roof. The power plant will have a capacity of about 1,200-H.-P. It has not been decided whether steam or electric transmission of water power will be used. Geo. E. Shaw, Putnam, Conn., Secy.

The Herron-Brady Pump & Foundry Co., Chattanooga, Tenn., will erect a plant to make improved pumping machinery for mills, mines, furnaces and factories, and ordinary and high-duty water-works pumping engines, and will run in connection therewith a large foundry for making high-grade gray iron castings for general trade. The machine shop will be 2 stories, 75x150 ft. and have a traveling crane of 30-ft. span. The foundry will be 100x150 ft., and equipped with a traveling crane of 40-ft. span, two cupolas, power elevator, etc. There will be a separate pattern house and office building.

The Merrell-Soule Co., Syracuse, N. Y., will erect a factory and warehouse building 285 ft. long, of slow-burning brick, the warehouse to be 3-story and the factory 5-story. Small motors of 162-H.-P., to be furnished by the Syracuse Lighting Co., will probably be installed.

The Goss Printing Press Co., 16th St. and Ashland Ave., Chicago, is erecting a 3-story, 240x86½-ft. addition to its plant.

The Donovan Wire & Iron Co., 507-515 Water St., Toledo, O., has purchased 7 acres on the main line of the Wheeling & Lake Erie Ry., and is erecting a 200x65-ft. foundry, 200x70-ft. structural shop, 2-story, 30x65-ft. pattern shop, 2-story pattern safe 40 ft. square, and a 2-story, 30x40-ft. office building. The buildings are to be of brick and steel construction and electricity will be the motive power. The company will continue to operate its present plant for light iron work, wire work, bank and office fixtures.

The Jewett Typewriter Co., Des Moines, Ia., intends to erect a new factory, but plans have not been completed.

MISCELLANEOUS.

Oceanside, Cal.—See "Water."

Baltimore, Md.—Bids will be received Apr. 1 by the Bd. of Awards for dredging. Thos. G. Hayes, Pres.; N. H. Hutton, Harbor Engr.

Brooklyn, N. Y.—The Morse Iron Works is reported interested in the construction of an immense dry dock at the foot of 57th St.

New York, N. Y.—Bids will be received Apr. 3 (extension of date) by McDougall Hawkes, Comr. of Docks, for furnishing material for dredging the East and Harlem Rivers.

Bids will be received Apr. 7 by Thos. Sturgis, Fire Comr., for furnishing and delivering plumbing material, iron and steel, 20 hot water tanks, etc.

The following bids were opened at the office of the Fire Dept. Mar. 25, for furnishing labor and materials required in constructing and delivering a steel fireboat: John F. Walsh, Jr., 60 Morton St., $77,450; Alex. Miller & Brother, 46 W. 95th St., $76,700 (awarded contract); N. Y. Shipbuilding Co., Camden, N. J., $73,000.

Harrisburg, Pa.—The Select Council has passed and the Mayor has signed the ordinance appropriating $250,000 for park purposes.

Philadelphia, Pa.—The following bids were opened Mar. 23, by Wm. C. Haddock, Dir. Pub. Wks., for deepening the Schuylkill River: Bowers Hydraulic Dredging Co., Camden, N. J., $12 per cu. yd. for rock removal, $2 for wreckage, 52 cts. per cu. yd. for removal of other material and $7,500 for old wharf; time, 20 mos. Am. Dredging Co., Phila., $10 for rock, $1 for wreckage, 50 cts. for other material, and $5,500 for old wharf; time, 18 mos.

Honolulu, H. I.—Bids will be received Apr. 30 by Henry E. Cooper, Supt. of Pub. Wks., for dredging a portion of Honolulu harbor. Plans and specifications on file at the office of Welch & Co., 220 California St., San Francisco, Cal.

BUSINESS NOTES.

The Riter-Conley Mfg. Co. is now installing at Allegheny and Leetsdale, Pa., 1,600 H.-P. in Westinghouse gas engines of the vertical single-acting type. Three are of 280 H.-P. direct connected to polyphase generators, to supply current for light and power in the new shops at Leetsdale, Pa. Potosina Electric Co., San Luis, Potosi, Mex., are installing 1,225-H.-P. producer gas power plant, supplying the City of Mexico with electric light and power; horizontal double-acting engines used. Pittsburg Screw & Bolt Co., 245 H.-P. for generator driving. McClintock-Marshall Construction Co., Rankin, Pa., 585 H.-P. Marshall Foundry Co., Pittsburg, Pa., 375 H.-P. Consolidated Gas Co., Long Branch, N. J., 608 H.-P. North Baltimore (O.) Elec. Light & Power Co., 250 H.-P. Light and power plants at Sistersville, W. Va., and Hutchinson, Ky., 125-H.-P. each. The machinery was furnished by Westinghouse, Church, Kerr & Co.

Gaylord & Eltapenc Co., Binghamton, N. Y., steam and electrical engineers, announce that they will open a branch house at Scranton, Pa., April 1, where a specialty will be made of high-pressure steam construction. Philo W. Butler will be manager of the branch, and James H. Gaylord will have charge of construction work.

The Kewanee, Ill., Boiler Co. has opened a branch office and warehouse in St. Louis, to be in charge of G. A. Wells.

The Smith & Thayer Co., 234-236 Congress St., Boston, maker of the Winchester steam and hot-water heater, has appointed T. Howell Johnson as its New York representative, and will soon open a New York office.

The York Mfg. Co. reports the following among recent orders: O. Sands, Chicago, 30-ton refrigerating machine; Hazen Confectionery Co., Cambridge, Mass., 10-ton refrigerating machine; W. S. Garfield & Co., Pensacola, Fla., 25-ton ice-making machine and 13-ton freezing and distilling system; Polar Wave Ice & Fuel Co., St. Louis, increase of 100-ton ice plant recently contracted for to a 200-ton plant; Chicago Cold Storage & Warehouse Co., two 175-ton refrigerating machines; Spring Lake Ice & Water Co., Madisonville, Ky., 20-ton ice-making plant; Norfolk, Va., Cold Storage & Ice Co., addition of a 100-ton ice-making plant; Coshocton, O., Ice & Cold Storage Co., 15-ton ice-making plant; Industrial Cold Storage & Ice Co., Philadelphia, two 175-H.-P., cross-compound, condensing refrigerating machines and compression sides; Schwarzschild & Sulzberger, Chicago, 200-ton, cross-compound, condensing refrigerating machine; 10-ton ice-making plants to Gainesville, Ga., Ice Co., and Rawls, Henry, Holmes, Parkman & Calhoun, Mt. Olive, Miss.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Dayton, O., Arcade Co., a direct-connected unit; Pennsylvania Co., 175-H.-P. engine, which is direct-connected to a Westinghouse generator, for the 14th St. Station, Chicago.

The Otis Elevator Co. has been awarded a contract for eighteen electric elevators equipped with the push-button system of control. These elevators are to be installed, one each, in a row of private residences now being constructed for F. Ambrose Clark on 74th St., between Central Park West and Columbus Ave., New York. The Franklin Institute recently awarded the John Scott Legacy Medal and Premium to the company for perfecting this type of elevator.

The Steel Protected Concrete Co., Philadelphia, has just received an order from Mobile, Ala., for 14,600 ft. galvanized steel curb bars for use in connection with recently awarded contracts in that city.

The Philadelphia Pneumatic Tool Co. has secured a contract from the Lake Shore & Michigan Southern Ry. Co. to supply all the pneumatic hammers used in the new Collinwood shops and on the entire system for a period of one year. The company has also received large orders for chipping and riveting hammers and drills from the Wabash, the Delaware & Hudson and the Central of New Jersey Railroads.

The Power Specialty Co., 126 Liberty St., New York, has received an order from the Wellman-Seaver-Morgan Engineering Co. for a superheater similar to one installed in Oct., 1901, from the Enterprise Mfg. Co., Philadelphia, for three superheaters to be exact duplicates of one installed in Oct., 1902, and from E. Keeler & Co. for two superheaters to be installed in the Jersey Shore plant of the Williamsport Passenger Ry. Co.

A. Leschen & Sons' Rope Co., manufacturer of wire rope and aerial wire rope tramways, with headquarters at 920 to 932 North First Street, St. Louis, Mo., has just opened an office and warehouse at 1717-1723 Arapahoe St., Denver, Colo., where it will carry a full stock of its various grades of wire rope and likewise manila rope, etc. This gives the company four branch offices and warehouses at New York City, Chicago, San Francisco, and the Denver office above referred to.

The New York Continental Jewell Filtration Co. has recently received, through its Chicago office, the following contracts for filtration plants, the capacities given being in gallons per day of 24 hours: Vicksburg, Miss., Water Works Co., 3,000,000; Beaumont, Tex., Water Co., 3,000,000; Anheuser-Busch Brewing Assoc., St. Louis, Mo., 2,000,000; California & Hawaiian Sugar Co., San Francisco, Cal., 600,000; Michigan Central Ry. Co., Kensington, Ill., 500,000; Michigan Central Ry. Co., Montrose, Can., 500,000; Chicago, Milwaukee & St. Paul Ry. Co., Ottumwa Junction, Ia., 200,000. The company has also received orders for its filters from the Illinois School for the Deaf, Jacksonville, Ill.; Standard Mfg. Co., Cleveland, O.; St. Marys, O., Woolen Mfg. Co.; Blackstone Library, Chicago; Chandler & Rudd, Cleveland, O.; Faultless Laundry Co., Kansas City, Mo.; Model Family Laundry, Parkersburg, W. Va.; Moslers' Laundry, Lima, O.; Empire Brewing Co., Brandon, Man.; Crystal Springs Water Co., Steubenville, O.; Coca Cola Bottling Co., Little Rock, Ark.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER WORKS.	
Mar. 30.	Pipe, etc., Kansas City, Mo., Adv. Mar. 28.	Mar. 28
Mar. 31.	Washington, D. C., Adv. Mar. 21.	Mar. 21
Apr. 1.	Boulder, Colo.	Mar. 21
Apr. 1.	Christianburg, Va.	Mar. 21
Apr. 1.	Clearfield, Pa.	Mar. 14
Apr. 1.	Toronto, Ont., Adv. Feb. 28 to Mar. 14.	Feb. 28
Apr. 2.	Cleveland, O., Adv. Mar. 28.	Mar. 28
Apr. 2.	Yonkers, N. Y.	Mar. 21
Apr. 2.	Brooklyn, N. Y.	Mar. 21
Apr. 3.	Toledo, O.	Mar. 28
Apr. 3.	Joliet, Ill.	Mar. 21
Apr. 3.	Weir, Atlantic City, N. J., Adv. Mar. 28.	Mar. 28
Apr. 3.	Cleveland, O.	Mar. 14
Apr. 3.	Brookville, O.	Mar. 14
Apr. 6.	Fargo, N. D.	Mar. 28
Apr. 6.	Richmond, Va.	Mar. 28
Apr. 6.	Jacksonville, Fla.	Mar. 28
Apr. 6.	Fargo, N. D.	Mar. 14
Apr. 7.	Latonia, Ky.	Mar. 28
Apr. 7.	Biloxi, Miss.	Mar. 21
Apr. 7.	Truman, Minn.	Mar. 21
Apr. 8.	Brooklyn, N. Y.	Mar. 28
Apr. 9.	Pipe, Boston, Mass., Adv. Mar. 28.	Mar. 28
Apr. 9.	Dyersburg, Tenn.	Mar. 28
Apr. 14.	Tower, Marshall, Tex.	Mar. 28
Apr. 15.	Enfield, N. H.	Mar. 28
Apr. 15.	Wilmington, O.	Mar. 28
Apr. 16.	Cleveland, O., Adv. Mar. 28.	Mar. 28
Apr. 20.	Oakland City, Ind.	Mar. 21
Apr. 27.	Winnipeg, Man., Adv. Mar. 7.	Mar. 27
May 1.	Chinook, Mont.	Feb. 7
May 12.	Toronto, Ont.	Mar. 21
———	Quincy, Mass.	Mar. 28
———	Lonaconing, Md.	Mar. 28
	SEWERAGE AND SEWAGE DISPOSAL.	
Mar. 30.	Sandusky, O.	Mar. 28
Mar. 30.	Scranton, Pa.	Mar. 28
Mar. 30.	Peoria, Ill.	Mar. 28
Mar. 30.	Toledo, O.	Mar. 21
Mar. 30.	Corry, Pa.	Mar. 14
Mar. 30.	South Bethlehem, Pa. Adv. Feb. 28 to Mar. 21.	Feb. 28
Mar. 31.	Walkerville, Ont.	Mar. 28
Apr. 1.	Burlington, Kan.	Mar. 28
Apr. 1.	North Braddock, Pa.	Mar. 28
Apr. 1.	Los Angeles, Cal.	Mar. 28
Apr. 1.	Tacoma, Wash.	Mar. 14
Apr. 2.	Cleveland, O.	Mar. 14
Apr. 2.	Cincinnati, O.	Mar. 14
Apr. 3.	Salem, O.	Mar. 14
Apr. 3.	Glassport, Pa.	Mar. 28
Apr. 4.	Plymouth, Mass., Adv. Mar. 28.	Mar. 28
Apr. 6.	Sheboygan, Wis.	Mar. 28
Apr. 6.	Ottumwa, Ia.	Mar. 28
Apr. 6.	Boone, Ia.	Mar. 28
Apr. 6.	Vicksburg, Miss.	Mar. 28
Apr. 6.	Madrid, Ia.	Mar. 14
Apr. 6.	Canton, O.	Feb. 28
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. 7.	Corinth, N. Y., Adv. Mar. 28.	Mar. 28
Apr. 7.	Culpeper, Va.	Mar. 28
Apr. 8.	Canajoharie, N. Y.	Mar. 28
Apr. 9.	Bridgeport, Conn.	Mar. 28
Apr. 13.	Toledo, O.	Mar. 28
Apr. 14.	Columbus, O., Adv. Mar. 28.	Mar. 28
Apr. 15.	Glenville, O.	Mar. 28
Apr. 28.	Cape May, N. J.	Mar. 28
Apr. —	Crookston, Minn.	Feb. 21
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
———	Port Huron, Mich.	Mar. 14
	BRIDGES.	
Mar. 30.	Washington, D. C., Adv. Mar. 7 to 28.	Mar. 7
Mar. 31.	Benwood, W. Va.	Mar. 28
Apr. 1.	Atlantic City, N. J.	Mar. 14
Apr. 2.	Erie, Pa., Adv. Mar. 21.	Mar. 21
Apr. 4.	Buffalo, N. Y., Adv. Mar. 28.	Mar. 28
Apr. 6.	Montgomery, Ala.	Mar. 28
Apr. 6.	Painesville, O.	Mar. 28
Apr. 6.	San Luis Obispo, Cal.	Mar. 28
Apr. 6.	Petrolea, Ont.	Mar. 21
Apr. 6.	Grand Forks, N. D.	Mar. 21
Apr. 7.	New York, N. Y.	Mar. 21
Apr. 8.	Crawfordsville, Ind.	Mar. 28
Apr. 11.	Akron, O.	Mar. 28
Apr. 13.	San Bernardino, Cal.	Mar. 21
Apr. 14.	Columbus, O.	Mar. 14
Apr. 14.	Boston, Mass., Adv. Mar. 28.	Mar. 28
Apr. 16.	Scottsdale, Pa.	Mar. 28
Apr. 20.	Janesville, O.	Mar. 28
May 4.	Quincy, Cal.	Mar. 28
	PAVING AND ROADMAKING.	
Mar. 30.	Albany, N. Y.	Mar. 28
Mar. 30.	St. Paul, Minn.	Mar. 28
Mar. 31.	Beloit, Wis.	Mar. 21
Mar. 31.	Waukesha, Wis.	Mar. 14
Mar. 31.	Toms River, N. J.	Mar. 7
Mar. —	San Diego, Cal.	Jan. 31
Apr. 1.	Wilmette, Ill.	Mar. 28
Apr. 1.	Brooklyn, N. Y.	Mar. 21
Apr. 1.	Dunkirk, N. Y.	Mar. 14
Apr. 2.	Chicago, Ill.	Mar. 28
Apr. 2.	Philadelphia, Pa.	Mar. 28
Apr. 2.	Jersey City, N. J.	Mar. 28
Apr. 2.	Cleveland, O.	Mar. 28
Apr. 3.	Grand Rapids, Mich.	Mar. 28
Apr. 3.	New Brighton, N. Y.	Mar. 28
Apr. 3.	Salem, O.	Mar. 14
Apr. 4.	Greenville, O.	Mar. 14
Apr. 6.	Williamsport, Ind.	Mar. 21
Apr. 6.	Houston, Tex.	Mar. 28
Apr. 6.	New Bedford, Mass. Adv. Mar. 7, 14, 28.	Mar. 7
Apr. 6.	Vallejo, Cal.	Feb. 21
Apr. 7.	Tampa, Fla.	Mar. 28
Apr. 7.	New York, N. Y.	Mar. 28
Apr. 7.	Celina, O.	Mar. 21
Apr. 9.	Ironton, O.	Mar. 28
Apr. 10.	Napoleon, O.	Mar. 28
Apr. 10.	Windsor, Ont.	Mar. 14
Apr. 10.	Tacoma, Wash.	Mar. 14
Apr. 11.	Youngstown, O.	Mar. 28
Apr. 13.	Cincinnati, O.	Mar. 28
Apr. 13.	Columbus, O.	Mar. 28
Apr. 13.	Houston, Tex.	Mar. 18
Apr. 13.	Toledo, O.	Mar. 21
Apr. 14.	Trenton, N. J.	Mar. 28
Apr. 14.	St. Louis, Mo.	Mar. 28
Apr. 14.	Massillon, O.	Mar. 28
Apr. 15.	Glenville, O.	Mar. 28
Apr. 15.	Des Moines, Ia.	Mar. 28
Apr. 15.	Traverse City, Mich. Adv. Mar. 14 to 28.	Mar. 14
Apr. 16.	Williamsport, Pa., Adv. Mar. 28.	Mar. 28
Apr. 16.	Findlay, O.	Mar. 21
Apr. 18.	Salem, O.	Mar. 28
Apr. 18.	Evansville, Ind.	Mar. 14
Apr. 20.	Cincinnati, O.	Mar. 28
Apr. 20.	New Albany, Ind.	Mar. 28
Apr. 21.	Nevada, Mo.	Mar. 28
Apr. 21.	Cincinnati, O.	Mar. 28
Apr. 21.	Shawnee, Okla. Ter., Adv. Mar. 21, 28.	Mar. 21
Apr. 27.	Lafayette, Ind.	Mar. 28
Apr. 28.	Cape May, N. J.	Mar. 28
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
	POWER, GAS AND ELECTRICITY.	
Mar. 31.	Binghamton, N. Y.	Feb. 28
Apr. 1.	Baltimore, Md.	Mar. 28
Apr. 1.	Quincy, Ill.	Mar. 21
Apr. 2.	Boston, Mass.	Mar. 21
Apr. 4.	Ft. Pickens, Fla.	Mar. 21
Apr. 6.	Webster Groves, Mo.	Mar. 21
Apr. 6.	Berkeley, Cal.	Mar. 21
Apr. 7.	Copenhagen, Denmark	Feb. 28
Apr. 7.	Oneida, N. Y.	Feb. 7
Apr. 8.	Ft. Rosecrans, Cal.	Mar. 21
Apr. 13.	Columbus, O.	Mar. 28
Apr. 15.	Wilmington, O.	Mar. 28
Apr. 15.	Liverpool, N. S.	Mar. 28
	GOVERNMENT WORK.	
Mar. 31.	Portsmouth, N. H.	Mar. 28
Apr. 1.	Ft. Greble, R. I., Adv. Mar. 14, 28.	Mar. 14
Apr. 1.	Grand Rapids, Mich., Adv. Mar. 7 to 28.	Mar. 7
Apr. 2.	Tompkinsville, N. Y.	Mar. 21
Apr. 2.	Wilmington, Del.	Mar. 14
Apr. 2.	Philadelphia, Pa., Adv. Mar. 7 to 28.	Mar. 7
Apr. 3.	Ft. Sheridan, Ill.	Mar. 28
Apr. 4.	Montgomery, Ala.	Mar. 28
Apr. 4.	Washington, D. C.	Mar. 28
Apr. 4.	Montgomery, Ala., Adv. Mar. 7 to 28.	Mar. 7
Apr. 4.	Charleston, S. C.	Feb. 28
Apr. 6.	San Francisco, Cal.	Mar. 21
Apr. 6.	Ft. Ethan Allen, Vt., Adv. Mar. 21, 28.	Mar. 21
Apr. 6.	New York, N. Y., Adv. Mar. 21, 28.	Mar. 21
Apr. 6.	Ft. Riley, Kan., Adv. Mar. 14 to 28.	Mar. 14
Apr. 6.	Ft. Caswell, N. C., Adv. Mar. 14 to 28.	Mar. 14
Apr. 6.	Minneapolis, Minn.	Mar. 14
Apr. 8.	Ft. Snelling, Minn.	Mar. 28
Apr. 8.	New York, N. Y., Adv. Mar. 28.	Mar. 28
Apr. 8.	Port Townsend, Wash. Adv. Mar. 21, 28.	Mar. 21
Apr. 8.	Richmond, Ky.	Mar. 14
Apr. 9.	San Francisco, Cal.	Mar. 21
Apr. 9.	Mobile, Ala.	Mar. 14
Apr. 9.	Biloxi, Miss.	Mar. 21
Apr. 10.	Ft. Mansfield, R. I.	Mar. 21
Apr. 10.	Port Townsend, Wash., Adv. Mar. 21.	Mar. 21
Apr. 11.	Petoskey, Mich., Adv. Mar. 14 to 28.	Mar. 21
Apr. 11.	Marquette, Mich., Adv. Mar. 14 to 28.	Mar. 14
Apr. 11.	Chattanooga, Tenn., Adv. Mar. 7 to 28.	Mar. 7
Apr. 13.	Ft. McKinley, Me., Adv. Mar. 28.	Mar. 28
Apr. 14.	Portland, Me., Adv. Mar. 21, 28.	Mar. 21
Apr. 14.	Washington, D. C., Adv. Mar. 14 to 28.	Mar. 14
Apr. 15.	New York, N. Y., Adv. Mar. 21, 28.	Mar. 21
Apr. 15.	Ft. Greble, R. I., Adv. Mar. 21, 28.	Mar. 21
Apr. 15.	Norfolk, Va.	Mar. 21
Apr. 15.	Pineridge, S. D.	Mar. 21
Apr. 16.	Ft. Washington, Md.	Mar. 28
Apr. 16.	Ft. Hunt, Va.	Mar. 28
Apr. 17.	Philadelphia, Pa.	Mar. 28
Apr. 17.	St. Augustine, Fla. Adv. Feb. 21, Mar. 7, 21, 28.	Feb. 21
Apr. 18.	Ft. Hancock, N. J.	Mar. 28
Apr. 20.	Boston, Mass.	Mar. 28
Apr. 20.	Ft. Ringgold, Tex., Adv. Mar. 28.	Mar. 28
Apr. 20.	Ft. Barrancas, Fla.	Mar. 28
Apr. 20.	New York, N. Y., Adv. Mar. 21, 28.	Mar. 21
Apr. 22.	New York, N. Y., Adv. Mar. 28.	Mar. 28
Apr. 22.	Nashville, Tenn., Adv. Mar. 21, 28.	Mar. 21
Apr. 23.	New York, N. Y., Adv. Mar. 28.	Mar. 28
Apr. 23.	New London, Conn., Adv. Mar. 28.	Mar. 28
Apr. 23.	Ft. D. A. Russell, Wyo.	Mar. 28
Apr. 24.	Marquette, Mich.	Mar. 28
Apr. 25.	Ft. Gaines, Ala., Adv. Mar. 28.	Mar. 28
Apr. 25.	Boston, Mass.	Mar. 28
Apr. 28.	Denver, Colo., Adv. Mar. 28.	Mar. 28
Apr. 30.	Portland, Ore.	Mar. 28
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 15.	Manila, P. I., Adv. Mar. 14 to 28.	Mar. 14
	BUILDINGS.	
Mar. 30.	Church, Warren, Pa.	Mar. 28
Mar. 30.	Pub. Bldgs., New Orleans, La.	Mar. 28
Mar. 30.	School, Brooklyn, N. Y.	Mar. 21
Mar. 30.	School, New York, N. Y.	Mar. 21
Mar. 30.	School, Long Island City, N. Y.	Mar. 21
Mar. 30.	School, New Brighton, S. I. N. Y.	Mar. 21
Mar. 31.	Hotel, Menasha, Wis.	Mar. 28
Mar. 31.	School, Minneapolis, Minn.	Mar. 28
Mar. 31.	Pub. Budg., Alexandria, La.	Mar. 7
Mar. 31.	Court House, Billings, Mont.	Mar. 14
Apr. 1.	Warehouse, Des Moines, Ia.	Mar. 28
Apr. 1.	School, Oxford, O.	Mar. 28
Apr. 1.	Court house, Russellville, Ky.	Mar. 28
Apr. 1.	Court house, Corsicana, Tex.	Mar. 28
Apr. 1.	School, Bayonne, N. J.	Mar. 21
Apr. 1.	Hospital, Charlottetown, P. E. I.	Mar. 21
Apr. 1.	Residence, Cheyenne, Wyo.	Mar. 21
Apr. 1.	Hotel, Dayton, O.	Mar. 14
Apr. 1.	School, Grand Forks, N. D.	Mar. 7
Apr. 1.	Hospital, Muskegon, Mich.	Feb. 28
Apr. 1.	Elevators in bus. bldgs., Tacoma, Wash.	Feb. 21
Apr. 2.	Pub. Bldg., Philadelphia, Pa.	Mar. 28
Apr. 2.	Church, Casselton, N. D.	Mar. 28
Apr. 2.	School, St. Paul, Minn.	Mar. 21
Apr. 2.	Hotel, Bemidji, Minn.	Feb. 21
Apr. 3.	Library, Taunton, Mass.	Mar. 28
Apr. 3.	Hospital, Columbus, O.	Mar. 14
Apr. 4.	School, Peoria, Ill.	Mar. 28
Apr. 4.	Church, Sault Ste. Marie, Ont.	Mar. 28
Apr. 4.	Jail, Louisville, Ky.	Mar. 14
Apr. 4.	School, Mayville, N. D.	Mar. 14
Apr. 6.	School, Britton, S. D.	Mar. 28
Apr. 6.	Court house, Troy, N. C.	Mar. 28
Apr. 6.	Bus. Bldg., Chanute, Kan.	Mar. 28
Apr. 6.	Church, Delano, Minn.	Mar. 28
Apr. 6.	School, Brooklyn, N. Y.	Mar. 28
Apr. 6.	School, Cincinnati, O.	Mar. 21
Apr. 6.	Library, Eau Claire, Wis.	Mar. 21
Apr. 6.	School, Cleveland, O.	Mar. 14
Apr. 7.	Court house, Webster, S. D.	Mar. 21
Apr. 7.	Jail, Morristown, Tenn.	Feb. 28
Apr. 8.	Library, Des Moines, Ia.	Mar. 28
Apr. 8.	City Hall, Athens, Ga., Adv. Mar. 28.	Mar. 28
Apr. 8.	Hospital, Yankton, S. D.	Mar. 28
Apr. 9.	Pub. Bldg., Redfield, S. D.	Mar. 28
Apr. 9.	Bus. Bldg., St. Marys, O.	Mar. 28
Apr. 9.	School, Sheldon, Ga.	Mar. 28
Apr. 9.	Htg. System in Pub. Bldg., Xenia, O., Adv. Mar. 21, 28.	Mar. 21
Apr. 9.	Htg. Court house, Centerville, Ia.	Mar. 21
Apr. 14.	School, Mansfield, O.	Mar. 28
Apr. 15.	School, New Bedford, Mass.	Mar. 28
Apr. 15.	Library, Olney, Ill.	Mar. 28
Apr. 15.	Court house, Corsicana, Tex.	Mar. 14
Apr. 16.	Court house, Monroeville, Ala.	Mar. 28
Apr. 16.	Pub. Bldg., Lisbon, O.	Mar. 28
Apr. 19.	School, St. Clair, Pa.	Mar. 28
Apr. 20.	Library, Jacksonville, Fla.	Mar. 28
Apr. 20.	School, Cleveland, O.	Mar. 28
Apr. 20.	School, Reedsburg, Wis.	Mar. 28
May 4.	Court house, Abbeville, Ga.	Mar. 21
May 8.	Htg. Court house, Shakopee, Minn.	Mar. 28
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21, 28.	Mar. 21
———	Court house, Wray, Colo.	Mar. 21
	MISCELLANEOUS.	
Mar. 31.	St. Sprinkling, Ottawa, Ont.	Mar. 28
Apr. 1.	Dredging, Baltimore, Md.	Mar. 28
Apr. 1.	R. R. work, Vancouver, Wash.	Mar. 28
Apr. 1.	Cement, Baltimore, Md.	Mar. 21
Apr. 1.	Supplies, Brooklyn, N. Y.	Mar. 21
Apr. 3.	Dredging, New York, N. Y.	Mar. 28
Apr. 6.	Garb. Disp., Chicopee, Mass.	Mar. 28
Apr. 7.	Supplies, New York, N. Y.	Mar. 28
Apr. 8.	El. Ry. franchise, Visalia, Cal.	Mar. 28
Apr. 9.	Hospital Equip., Johnson City, Tenn., Adv. Mar. 21, 28.	Mar. 21
Apr. 10.	El. Ry. franchise, Hanford, Cal.	Mar. 28
Apr. 13.	St. Ry. franchise, Los Angeles, Cal.	Mar. 21
Apr. 13.	El. Ry. franchise, Whittier, Cal.	Mar. 14
Apr. 14.	R. R. Work, Beckley, W. Va.	Mar. 21
Apr. 17.	Harbor work, Quebec, Que.	Mar. 28
Apr. 20.	St. R. R. franchise, San Jose, Cal.	Mar. 28
Apr. 20.	Harbor Improv., Falmouth, Jamaica.	Mar. 21
Apr. 30.	Dredging, Honolulu, H. I.	Mar. 28
May 2, '04	R. R., Oodnadatta, So. Australia.	Feb. 21

PROPOSALS.

Tenders for Lime Recovery Plant.

MANUFACTURE OF LIME FROM SLUDGE.

Sealed proposals, addressed to the chairman of the Fire, Water and Light Committee for the supply of a recovery plant for the lime used in the water softening process; will be received at the office of the undersigned up to 8.30 P. M. on Monday, April 27.

Full information and a sample of the lime sludge will be furnished intending bidders upon application to H. N. Ruttan, City Engineer.

Each proposal must be accompanied by an accepted cheque or cash deposit for the sum of $500, which will be subject to forfeiture in case of failure on the part of the contractor to enter into a written contract if called upon to do so.

The city reserves the right to reject any or all tenders or to accept any bid which appears advantageous to the City of Winnipeg.

C. J. BROWN, City Clerk.

City Clerk's Office, Winnipeg, March 21st, 1903.

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Beginning with this issue The Engineering Record will contain four more reading pages than it has hitherto. It will be the constant aim of the editors to fill all the pages with material of interest and value. Space will be available for suitable contributions from our friends, and "Letters to the Editor" and "Inquiries" will be received with pleasure. Early intelligence for the contracting news and personal columns are always acceptable.

The General Theory of Flexure.

There is no other one stress condition which is so frequently found in engineering practice as that of flexure, nor is there any one of greater importance in engineering design either from a theoretical or practical point of view, if, indeed, any distinction whatever can be drawn between those points of view. As a natural result of this fact engineering literature has teemed with treatments of various applications of flexure from Euler's time, or earlier, to the present. Abstract mathematical analyses and mere "rule of thumb" methods have been employed in order to reach formulae or other results capable of affording to the structural practitioner all that he requires in dealing with pieces of material of whatever kind subjected to bending or bending in combination with other stress conditions. Doubtless much benefit has been derived from those many-sided attacks on the general problem, but it is a rather remarkable fact that in all structural operations of a practical character the simple formulae for what is really the special case of a straight beam subjected to parallel loading normal to its axis are essentially all that are ever used.

One of the most elaborate and elegant of late analyses of the general case of flexure is that of Professor L. J. Johnson, member of the Boston Society of Civil Engineers, published in the Journal of the Association of Engineering Societies, for May, 1902, which in the main follows the general methods of Müller-Breslau, although, as stated, advantage has been taken of different papers by Mohr, Land, and other authorities. He uses both analytic and graphical methods of analysis and resorts, also, to the Kernel method to make a perfectly general solution for cases of both pure flexure and those of combined flexure and direct stresses of tension or compression. Every practitioner interested in a thorough treatment of simple or combined flexure will find much of practical value in Professor Johnson's paper, although it must be admitted that any reader who has not well in hand advanced methods of analysis will be somewhat handicapped by any lack of mathematical facility. In order to show the thoroughly practical character of these investigations, the author treats the case of a Z-bar purlin in a sloping roof subjected to vertical loading. The results of this treatment demonstrate clearly, if such a demonstration were needed, that the problem is completely solved for such a case or any other of a general character. It must be borne in mind, however, in dealing with all such analytical problems that what is needed is not involved or highly refined processes which, while carrying the stamp of extreme accuracy, are after all approximate and possibly even loosely approximate, in view of the actual conditions in which a member like that of a roof purlin is found. As a matter of fact, and as Professor Johnson himself indicates, a roof purlin is not generally free to bend in the plane of slope of the roof, that freedom existing only in a direction normal to that slope. This condition alone makes the utmost nicety of refinement of formulae no more nearly accurate than the simplest flexure formulae of the class ordinarily employed.

Again, both in Professor Johnson's analysis and in every one, we believe, ever proposed to reach the highest degree of accuracy through advanced methods of analysis, the condition of pure flexure unaffected by changes of length of span or piece by longitudinal stresses has been assumed. This in itself in some of the most important practical cases is a source of gross error. As a matter of fact an accurate theory of combined simple flexure and direct stress, for many cases found by the engineer in his practice, is yet to be written, although there are approximate methods of treatment which are probably near enough for all ordinary purposes. The usual formulae employed in the design of eye-bars or other tension members and columns are approximate only, and while they are sufficiently near for the usual cases of engineering practice, they fall far short of giving all that can be desired.

Finally, as has before been observed in these columns, the common theory of flexure is treated in all but a very few text or other books as a pure assumption in which the real conditions of application of the theory are entirely lost. Phenomena of flexure are considered and the designs of beams or girders are made as if the common theory of flexure were accurately applicable for all lengths of span. In reality that theory can only be applied with accuracy to beams whose lengths in reference to their depths are far greater than those frequently found in engineering practice. It is a matter of common recognition that the application of the common theory of flexure to the bending of pins in pin-connected bridges is a crude procedure, but fully justified by the fact that there is no other procedure available, compensation being made for the obvious errors of theory by the use of suitable empirical quantities. It is not so commonly recognized, however that in many solid beams, like those of timber with lengths commonly employed, the ordinary formulae of flexure are loosely approximate at best, and the same observation may be made in connection with many plate girders constantly used, especially in bridge construction.

It will be obvious to a careful thinker that what is most needed at the present time in connection with the general theory of flexure is not so much an enhanced refinement of analytic treatment in the use of the ordinary, recognized theory of flexure, but the determination of formulae which will express with reasonable accuracy and simplicity the actual stress conditions in a great class of structural members commonly employed in engineering. In this respect engineering science has made exceedingly little progress for fifty years. There has been much development in the applications of formulae based upon hypotheses employed for more than half a century. Indeed, the fundamental flexure formulae as developed by Rankine have scarcely been improved upon since his time, and, consequently, there is a real hiatus in respect to the recognition of true stress conditions as now found. If the flexure of short beams and of columns such as are ordinarily employed in engineering practice could be accurately treated and expressed with reasonable simplicity, a long step in advance would be taken in reference to the theory and design of those members, but that end cannot be attained by excessive refinement of formulae based upon old and inaccurate hypotheses.

Students of the American Institute of Electrical Engineers.

On March 27 the board of directors voted to extend certain privileges of the Institute to young men regularly pursuing studies in electrical engineering in the universities and technical schools or through the help of correspondence schools or privately. At the beginning of the year local meetings of the Institute were established at fourteen technical colleges, and other branches have been formed having no connection with the schools. The papers and discussions presented at the monthly meetings of the Institute in New York are furnished to the branches and read at the local meetings ten days or two weeks later. Papers by the local members may also be presented. The privileges extended are attendance at meetings of the Institute except such business meetings as relate to the management of the Institute; receiving the regular announcements and printed copies of monthly transactions; and purchasing the semi-annual bound volumes of the transactions at $3.50 per copy, or such other price as may hereafter be fixed. The conditions are endorsement by one member or associate; recommendation by the board of examiners, and approval by the board of directors; an annual advance payment of $3.00; and enrollment by the secretary as a student of the American Institute of Electrical Engineers. No student, however, shall have these privileges for more than three years, and these privileges may be withdrawn from any student, at any time, by a majority vote of the directors.

The Sanitary District of Chicago has assumed direct control of the work on the Randolph Street bridge, and will continue the construction, charging it to the contractor. The American Bridge Company has the contract for the superstructure, but its work was stopped recently, owing to trouble with its employes. At the last meeting of the drainage board Chief Engineer Isham Randolph was authorized to employ the same men to continue the work, so that it may be finished within three weeks.

Enlarging and Remodeling the Manhattan Life Building.

The building at 64-66-68 Broadway running through to 15-17-19 New Street, for the Manhattan Life Insurance Company, was the first of the very tall buildings of New York City to be erected with the steel cage construction, and is notable for being the first building ever erected on pneumatic caisson foundations with transverse cantilever girders extending the full width of the building by which the eccentric column loads are all made concentric with the foundations. This building was commenced in 1892, and when completed in May, 1893, it occupied a 67x125 foot lot. The external side walls vary in thickness from 2 feet 8 inches at the bottom to 12 inches at the top, being heavier, however, than is necessary under the present building laws and in fact, almost strong enough without the support of the steel cage construction.

On the east, or New Street side, there are eighteen stories and on the Broadway side seventeen stories above the ground with a main roof 242 feet from the curb. In the center of the Broadway front a tower 30 feet square and 34 feet high rose two stories above the main roof level, and was surmounted by a smaller circular tower with a tall dome and lantern reaching to a total height of 350 feet from the curb to the base of the flagstaff. The tower was flanked by low domes at the corners of the building, and the front was symmetrically panelled and decorated with belt courses, columns and arches. The motive was developed from the center entrance arch and tower and dome construction, and the design was of Italian renaissance, the Broadway front being faced with limestone and the other walls with brick, trimmed, on the New Street front, with terra cotta.

All the walls are independent of the floors and are carried on girders connected to the columns at every story, except the Broadway front of stone masonry, which is built on separate footings independent of the steel framework.

The steel construction is of standard design without many unusual features. The main columns are cast iron up to the sixth floor and riveted steel above that level, all of them having rectangular cross sections. Wind bracing was provided by angle iron knee braces between the columns and the wall girders above the fifth floor. Below that level these braces are omitted to avoid the imposition of bending stresses on cast iron columns.

Special floor girders are introduced at the second story to allow the upper sections of side wall columns there to overhang the lower ones. There are longitudinal trusses in the fourteenth story to avoid the use of obstructing columns in a portion of the thirteenth story, and there are lattice girders in the seventeenth story to receive the base of the 100-foot tower and distribute its weight and wind pressure through the framework of the building below this level.

At the base of the tower in the eighteenth floor or roof level of the Broadway front, there was built a rectangular framing of lattice and plate girders with floor beams having their upper surface covered with a solid floor of steel trough construction, giving great solidity and lateral rigidity for the connections of the four main columns at the corners of the tower, which were made with special cross sections built up of channels and angles and were braced together with horizontal and diagonal members which virtually formed braces on all faces of the tower.

At the twentieth floor level the columns supported an overhanging platform of beams and girders on which there was a concentric circular ring about 24 feet in outside diameter which received the feet of sixteen latticed columns with I shaped cross sections. These columns extended vertically for 27 feet to the twenty-first floor level and thence curved inwards to form the framework of the dome roof and abutted at the upper ends against the web of a plate girder drum 5¾ feet in diameter which supported the angle iron framework of the lantern about 15 feet high. The walls of the dome and tower were built with fireproof blocking and stiffened laterally with horizontal angles riveted to the columns and ribs. The dome and tower were proportioned to resist a wind pressure of 30 pounds per square foot of vertical surface exposed and the connections to the solid floor at roof level and to the main columns below were proportioned for the heavy pressures and tension strains thus developed.

Messrs. Kimball and Thompson were the architects for the original building. Mr. Chas. O. Brown was the consulting engineer, Sooysmith & Company were the contractors for the foundations and the Pencoyd Bridge Company was the contractor for the structural steel work, the design and erection of which were described in the issues of The Engineering Record for Jan. 20, Aug. 18, Nov. 17 and Nov. 24, 1894, and Oct. 27, 1895.

Recently the Manhattan Life Insurance Company acquired the property at the north of their present building, running through from Broadway to New Street with a frontage of 26 feet on each street, for the purpose of extending the building for the introduction of a new battery of elevators. After determining the general plan, the front was studied out in two ways; one to make an entirely independent front on Broadway, not attempting to follow the old design, and the other to extend the front in the same design by removing the north pavilion of stone work and widening the arcade between the two pavilions, changing the center of the tower and dome, making it elliptical in shape, and thereby bringing all of the fixtures to the same center, and uniformly treating the whole of the old and new property.

The first plan was rejected owing to the fact that it would make too narrow a building and would not give any increased facilities in the tower; the second one was adopted because it retained the motive of the original design, increased the magnitude of the building and made it more complete. The main entrance, owing to existing leases cannot yet be shifted, but when this is done there will be nothing left to indicate that an addition has been made. Such an addition would scarcely be possible for such a high and massive building if it were not that caisson foundations exist in the old portion and new caissons were sunk for the new portion. In changing the tower the main ribs were kept in their original position until the lattice columns and ribs of the new portion were in place and diagonally braced; then four of the old ribs were removed and the connecting girders and bracing riveted.

The interior arrangement and the steel framework of the extension were designed to conform in most respects with the original building and were of standard construction, presenting special features chiefly in the connections with the old building. The difficulty of thus making a radical change in the dimensions and proportions of the building, notable for its special design, was increased by the change of the relative dimensions, which made the new work actually wider and apparently more massive than the old. All the cut stone face masonry in the northern panel of the front was carefully removed, each stone numbered to correspond with location diagrams and stored in order. The special steel members of the panel construction were similarly removed and marked ready for re-erection in the corresponding positions on the face of the extension.

When the new columns and girders were completely erected, the face work in the center panel of the original front was extended by duplication for a distance of about 26 feet and joined to the front of the side panel, which had been previously removed and then re-erected on the new frame. The entire plan involved little disturbance of any part of the existing building below the level of the main roof, further than is required by tearing out the north wall and connecting the old and new floor systems, and it has now progressed to completion of the work without material disturbance of any of the tenants who occupied the whole of the building, excepting two stories which are used by the owners for their general offices.

Above the seventeenth story the tower was used for dining-rooms for the Manhattan Life Insurance Company and 6,000 feet of space for rental; the radical changes in its construction required it to be vacated and the whole tower was thoroughly disarranged by its conversion into the new one. This will amount to rebuilding it, since the extension will be so large in proportion to the old tower that it will be equivalent to building several new main floors across the end of the building, and these must be connected with the whole structure and their columns must be built up in extension of those already existing in the lower stories. This involves the erection of a considerable number of floor beams and the re-arrangement and re-inforcement of some of the old ones, as is indicated by the diagrams for the tower construction.

This enlargement of the building provides for an advantageous re-arrangement of, and addition to, the elevator shafts and main halls, enabling the former to be moved to the north side of the building and the latter to be extended from them to the longitudinal wall of the light court, thus making much more convenient, attractive and roomy entrances for the suites of offices in the different stories, and adding on each floor 1,230 feet of rental space, as indicated in the plan of the eighth floor which is typical of all floors from it to the eighteenth. The floors below it are similar, except that their area is increased by the addition of that part of the light court extending out to the roof line where the side walls diverge, and for the special arrangement of rooms in the seventh and eighth stories, which are devoted to the Insurance Company's offices, and in the lower stories which are divided for banks and other purposes and include the main entrance at street level.

In the cellar the boiler plant has been removed from the old to the new part and, together with the new elevator plant, which has been installed there, occupies all the space. In the eighteenth floor, which is at the level of the main roof, the extension forms an L with the lower stories of the enlarged tower. The story runs through the full depth of the building to New Street, but terminates about 30 feet from the Broadway front so as to clear the corner dome. This affords one large office on New Street and three on Broadway. The nineteenth story consists of the lower part of the tower and an extension about 10 feet long towards New Street to include three western-most elevators. The twentieth story is wholly contained in the second section of the tower and, like the twenty-first and twenty-second stories, which have the same length and breadth, does not communicate with the main elevators terminating at the eighteenth story, but is provided with a single elevator near the center of the tower. Above this level the floors are indi-

cated in the elevations and plans of the tower framing, but are not intended for office purposes.

Except for the beam connections to old building, the new steel framework is an independent structure and its weight is carried entirely by a new system of foundations. These consist of thirteen steel pneumatic caissons sunk about 60 feet below the Broadway curb through quicksand, gravel and bouiders to the solid rock. Those adjacent to the old building are cylindrical with diameters of 5½ to 6½ feet, and are set in convenient positions not always very close to the old wall. Those on the opposite side are all rectangular, the largest being 6 feet wide and 16½ feet long, and are set as close as possible to the party line. They are filled with concrete, the top of which is covered in every case with a tier of steel grillage beams from 12 to 24 inches deep set close together and distributing the column loads uniformly over the surface of the concrete.

The columns are all included in two transverse rows close to the side lines of the new lot, and in order to permit their location so far beyond the centers of the caissons they are seated on the opposite extremities of the cantilever girders with bearings on the center points of the caissons, as shown in the general plan and section of the cellar. The columns balance each other on the cantilevers and are in stable equilibrium with large factors of safety. The cantilevers are all box girders from 36 to 40 inches deep and are all made with quadruple webs and reinforced top and bottom flange cover plates 24 or 26 inches wide. The details of these girders correspond to those shown in the half view of girder 5-10, which, however, is not so heavy as girder 3-12 which carries a load of 525 tons from column 3 and 876 tons from column 12 with respective lever arms of about 4½ and 2½ feet between the centers of the columns and the centers of the girder bearings on the piers.

This girder has each of its three webs reinforced with several plates riveted to it, making a total combined thickness of 2½ inches. The webs are stiffened for about 8 feet at each end by 4x3-inch vertical angles about 8 inches apart, and the eight 6x8x¾-inch flange angles are reinforced by four 26x½-inch full length cover



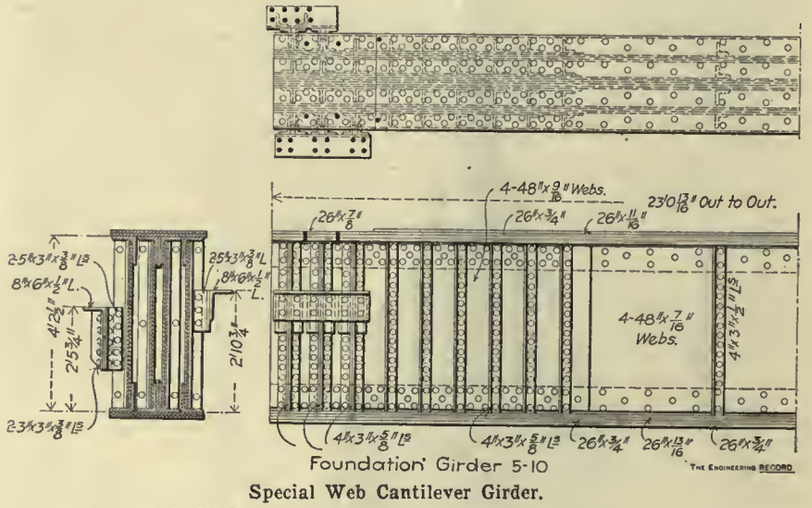
ORIGINAL AND EXTENDED BROADWAY FRONT OF MANHATTAN LIFE BUILDING, NEW YORK.

plates. The details of the girder correspond essentially to those of girder 5-10 and like it, it carries at one end horizontal shelf angles riveted to lugs on the flanges of the web stiffener angles to provide seats for the sets of 12x20-inch I-beams, which supoprt the lower stories of the outer wall. The girder weighs about 10 tons and was shipped whole from the bridge shop and lowered to position from the street on inclined skids.

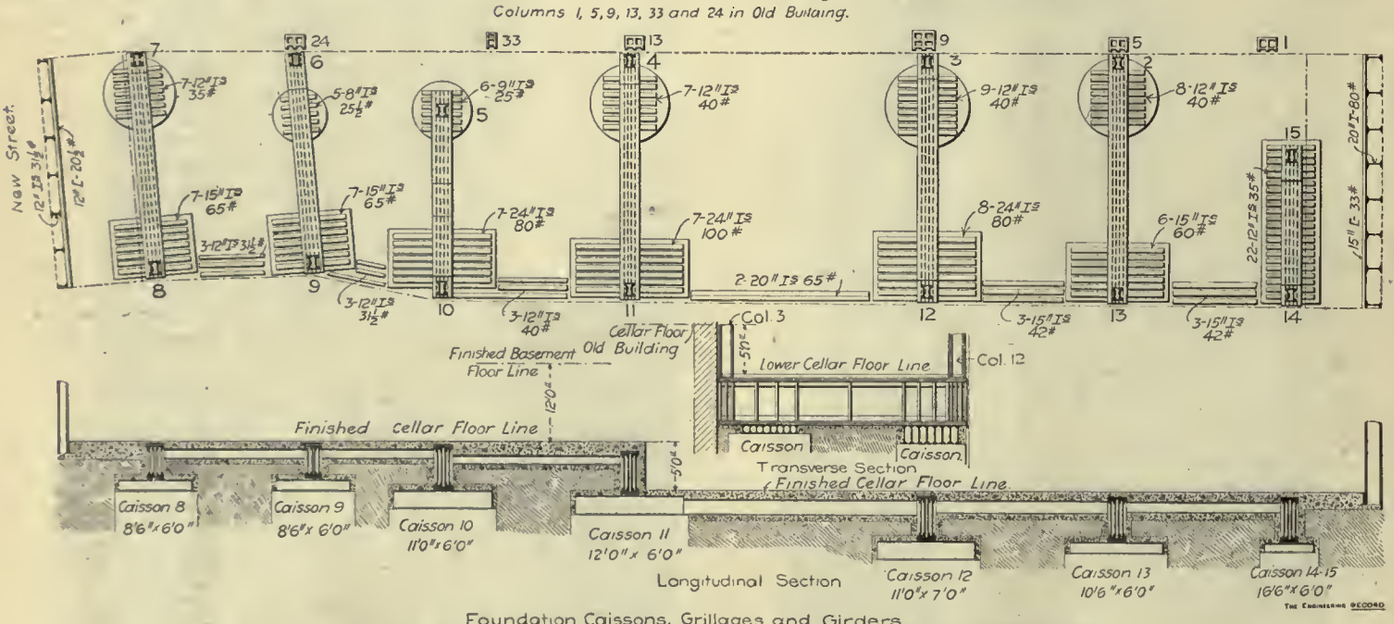
An unusual detail of all the foundation cantilever girders is that the web reinforcement plates are riveted together in sets of two or three which are riveted to the insides of the flange angles. The backs of the vertical flanges of the angles are not in any case riveted to the web plates as is usual in girder work. For the center web, which has two flange angles in both top and bottom chords, each pair of angles is riveted together back to back with an 8x½-inch full length vertical reinforcement or filler plate between them and a set of two or three web plates, as the case may be, is riveted to each side of the web of the T shaped section thus made. This produced a double web with an open space 2 inches wide between the backs of the webs. The side webs are each made with a single flange angle, top and bottom, similarly riveted to the web plates. All the girders and the spaces between them are filled solid with concrete, and covered with 12 inches of concrete enclosing the top flanges of the girders and forming the cellar floor.

Opposite the elevator shaft there is a narrow light court, as indicated on the beam plan, panels of floor load, and on the three outer wall faces the floor beams are connected on the center lines of the columns. Single beams or channels are set in the planes of their outer faces to carry the wall masonry, and in some cases have 10-inch horizontal plates riveted to the outside of the top flange with their outer edges supported on bent angle knee braces to the wall girder webs so as to carry the brick work. At the seventeenth floor the beams and girders are extended half way across the old building for a distance of about 19 feet back from the Broadway front. Another new column is started there from the old structure and three story lengths to add to the rigidity of the building and promote the convenience of erection.

The beam and girder connections have horizontal angles across the top and bottom flanges and the latter are reinforced where necessary by flanged bearings on the ends of vertical distributing angles. All beams and girders are riveted to the columns through both sides of both flanges, but have no web-connection angles to the columns. The wall girders, which are offset from the center lines of the columns so that their centers are in or beyond the faces of the columns, are supported, as shown in the



Special Web Cantilever Girder.



Foundation Caissons, Grillages and Girders.

PLAN AND SECTIONS OF SUBSTRUCTURE, MANHATTAN LIFE BUILDING.

which extends down to the first story. Below that level the wall is continuous across the side of the building in the plane of the exterior columns, and the basement story of it is carried on a pair of 20-inch I-beams supported directly on the foundation caissons for columns 11 and 12. The side walls in the basement are carried on girders resting upon the grillage beams of the caissons; these are also bedded in cement.

The superstructure of the extension has fifteen main columns in two transverse rows about 23 feet apart on centers and from 15 to 30½ feet apart in the rows. To them are connected transverse rolled and riveted girders from 12 to 27 inches deep supporting the longitudinal I-beams from 8 to 12 inches deep and from 4 to 7 feet apart, which carry the flat arched floor of terra cotta. On the side towards the old building, the columns are connected by single channels, which have to carry only half the beams are partly supported by connections to the columns of the original structure.

By a system of connections to the old columns the construction of the fronts is so arranged that no injury will be occasioned and no distortion will be noticeable if there should be unequal settlement between the old and new work. This was found to be absolutely necessary from the fact that the construction of the stone work was such that the most trifling shrinkage of materials even would show in the fronts. The main columns are all built with closed rectangular cross sections composed of two 12-inch channels and two or more 14-inch cover plates, and thus differ from those of the old building, which have similar cross sections constructed with plates and angles with webs and covers made of multiple plates, or even reinforced by parallel webs to receive exceptionally heavy loads. They were also made in detail, on brackets which are made with wide flanges of vertical angles riveted to the cover plates or to other angles which, with them, form the equivalents of Z-bars outstanding from the webs of the column channels.

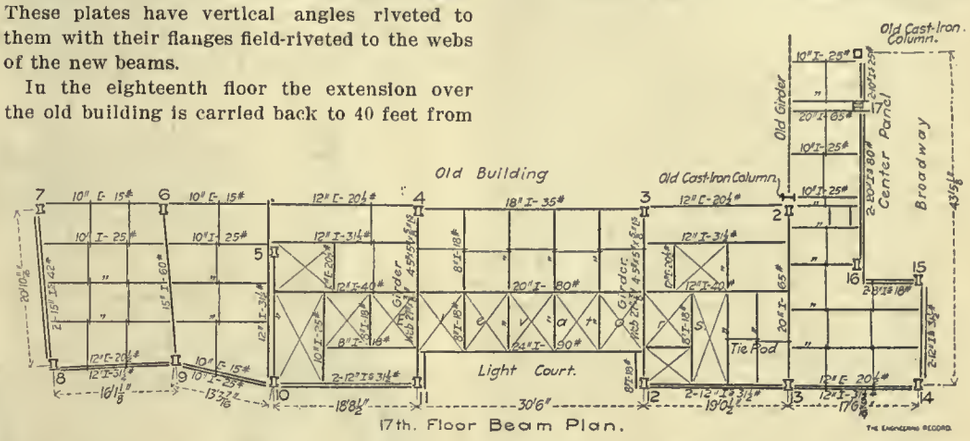
The column splices are made with single jaw plates shop-riveted to the upper ends of the lower sections and have horizontal flanges and diaphragm plates to distribute the bearing only when the transverse dimensions of the successive lengths of columns differ materially. The side of the splice which is opposite to the shop-riveted jaw plate is made with a pair of 8x6-inch vertical angles instead of cover plates. These angles enclose the corner of the columns and are field-riveted to both sections. They are intended to give greater rigidity to the joint than would be afforded by splice plates and where the widths of the columns change, they require less weight of filler plates. Where the

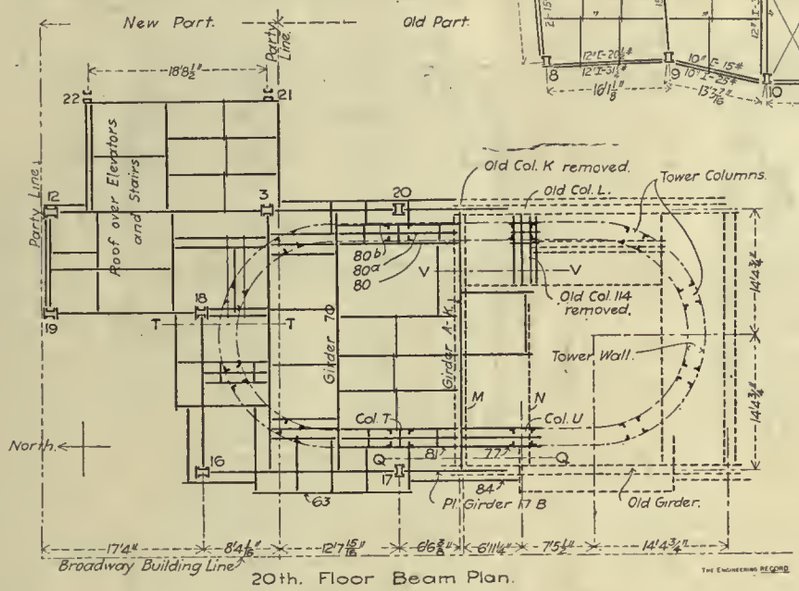
new girders are connected to the riveted columns in the upper part of the old structure, the detail is similar to that of the new columns and the connection angles are field-riveted to the columns through holes ratcheted in place.

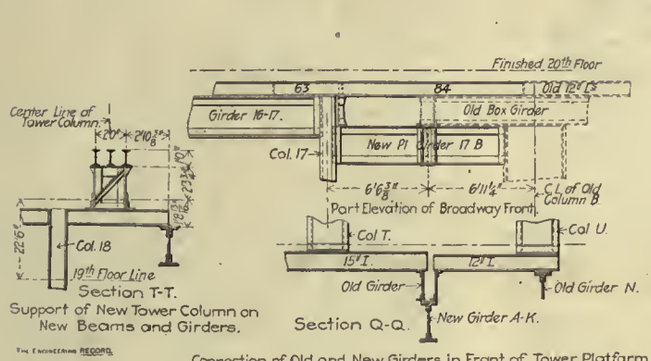
New girder 1-5 has an intermediate support across the top of old column 1 which is made, as shown in the detail, by field-riveting it to horizontal flange angles at the top of the old column web and to side shelf angles with their flanges bearing on vertical distributing angles. In cases where floor beams and girders are connected to the old cast iron columns in the lower stories, long vertical plates are attached to the columns by a very liberal number of bolts, which are tapped through the sides of the closed section or have nuts screwed up on the accessible flanges, as shown in the cross section detail. These plates have vertical angles riveted to them with their flanges field-riveted to the webs of the new beams.

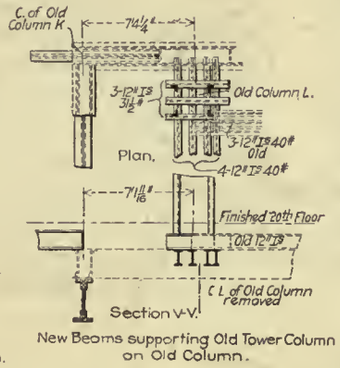
In the eighteenth floor the extension over the old building is carried back to 40 feet from the Broadway street line and the front is recessed 11 feet from it to form the panel between the side domes. Several new columns are added or the lower ones are continued in offset positions, and the beams and girders are combined with those of the original structure. The arrangement of the nineteenth floor beams corresponds to that of the eighteenth, except for the change in location of the columns and the omission of girders on account of the corner dome. The new transverse floor beams are also continued further across the Broadway front into the framework of the original tower.

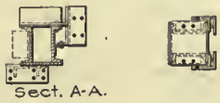
In the twentieth floor the beam plan is wholly different and comprises only the beams and girders for the new portion of the tower and for the small portion of the nineteenth story which extends over the shafts of the elevators and stairs serving it. In the diagram of this plan all of the columns, except 3, are special above the seventeenth story. It was impossible to locate the columns for the upper part of the tower on the centers of the lower story columns, and it was therefore necessary to provide eccentric supports for them, which involved some elaborate combinations of beams and girders, as shown in the detail plans and sections. In general the outer columns are connected by plate girders and these support single or double web intermediate girders transverse to the Broadway front. The columns in the curved end of the tower are carried by sets of short longitudinal and transverse I-beams

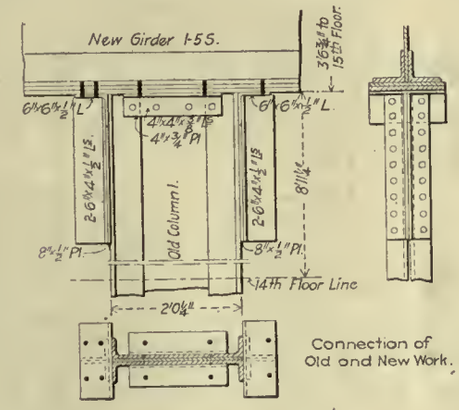




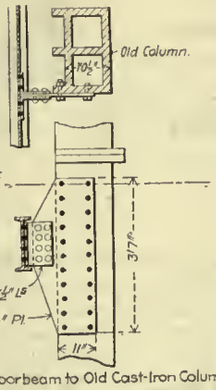


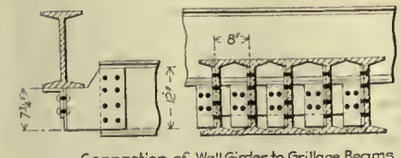


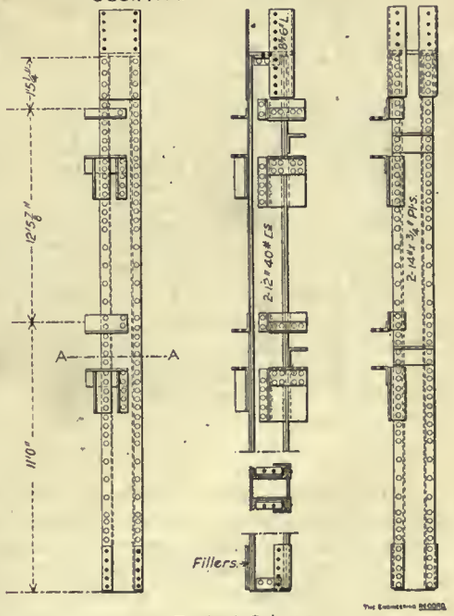










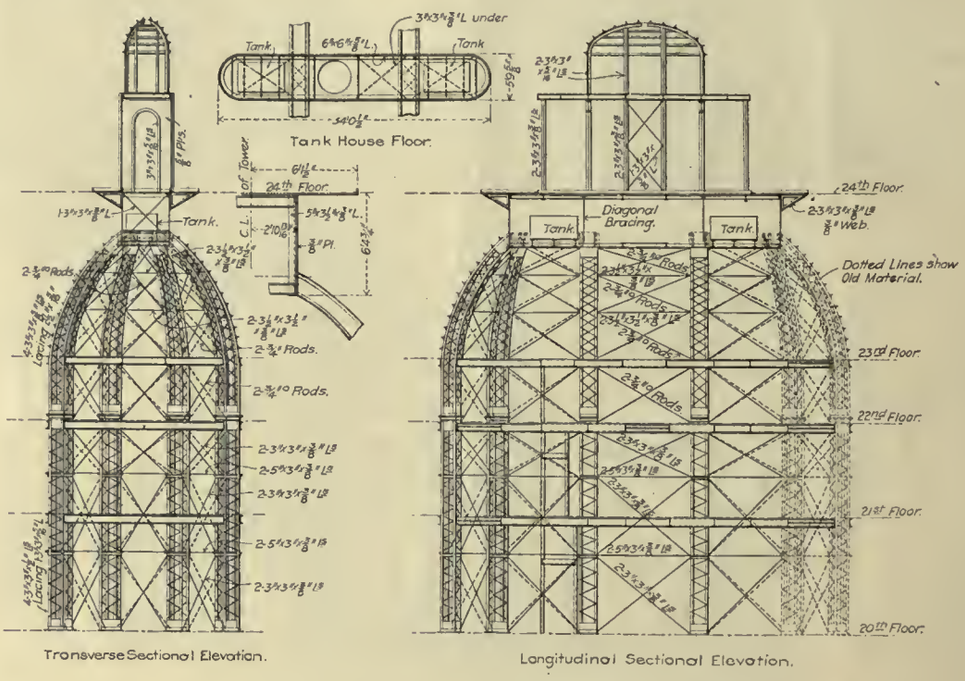


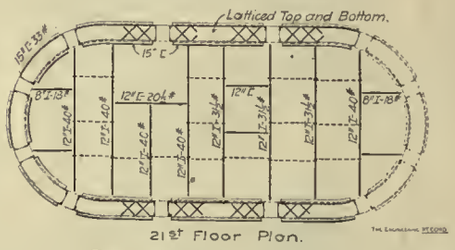
BEAM AND COLUMN DETAILS, MANHATTAN LIFE BUILDING.

supported on short pedestals from the main girders and columns, as indicated in the section T-T.

In the Broadway front of the tower the old construction will, as already described, be eventually retained in the south end, and replaced and extended by new work on the north end. The original girder B will then be supported on old column B and on the new girder A-K, which will be web-connected to another new girder 17-S at right angles to it, supported on the old column B and the new column 17. This system of girders together with the new girder 16-17 and the transverse plate girders A-K and T-O will carry the 12 and 15-inch longitudinal I-beams which are in the line of, and support the columns in the front wall of the tower. The corresponding rear columns will be carried more simply by a set of three 15-inch I-beams 80, directly connected to the main transverse girders. The new tower column in the rear wall adjacent to old main column L will be carried on a system of secondary transverse and longitudinal beams supported from the new girders A-K and the old girders, as indicated by the detailed section V-V and corresponding plan, thus enabling the old column 114 to be removed. In these plans the old and new members are distinguished by drawing the former with dotted and the latter with full lines, the girders in the general plan being in all cases represented by single center lines. The new girders all have 30-inch webs and 6x6-inch or 6x4-inch flange angles, which, in some cases, are reinforced with single 14-inch cover plates.

The upper part of the re-constructed tower has twelve duplicate columns about 28 feet high which are 2 feet square and are each made with four 3x3-inch angles latticed on all sides. They have horizontal base plates seated on the beam supports previously described, and are connected by horizontal angles continuous around the tower, as shown in the twenty-first floor plan, and by X-bracing of pairs of 3x3-inch angles in the panels between wall beams and horizontal struts, thus corresponding to the original construction, distinguished by dotted lines in the elevations of the tower. The twenty-second and twenty-third floor beam plans correspond essentially to that of the twenty-first floor. Above the twenty-third floor the horizontal cross section of the tower rapidly diminished on account of the inward curves of the dome ribs which are essentially extensions of the vertical tower columns. They abut at the tier between the twenty-third and twenty-fourth floors, as shown in the detail, on a solid plate girder drum about 34 feet long, 4¾ feet wide and 6½ feet deep. The top of the drum is covered by a solid horizontal steel plate projecting 3 feet beyond it and supported at the outer edges by solid-web cantilever brackets. This platform receives the vertical posts made of pairs of 3x3-inch angles which form the skeleton of the lantern. The space between the twenty-fourth floor and the next lower beam ties is utilized for two 6x4x3-feet steel tanks for the water supply of the whole building.

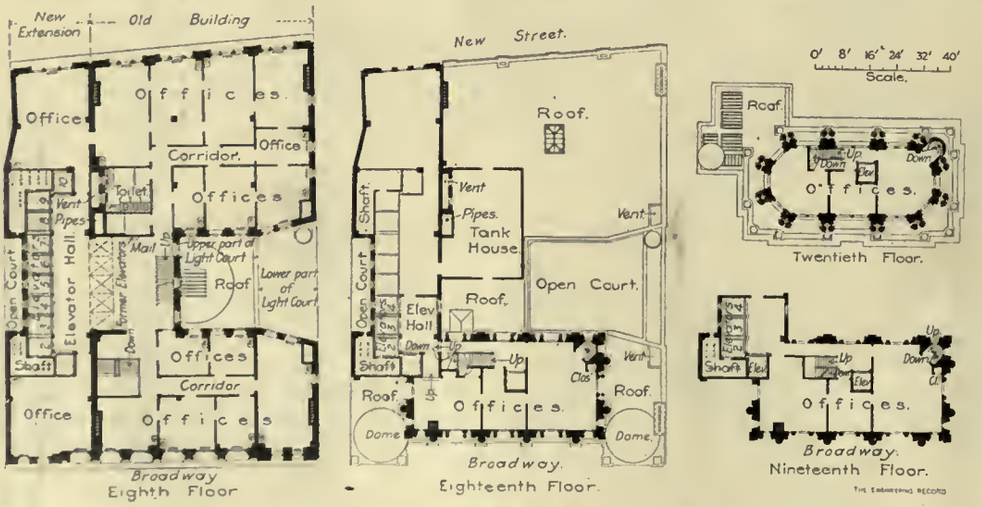




Dome and Tower Framing.

The removal of the old building which occupied the site of the extension was commenced in May, 1902. The erection of the steel work was begun in August, 1902, and is now finished. The extension will be ready for tenants next May 1, although very difficult and tedious work is involved in changing the elevators from the old to the new location without interrupting the service. This will probably be done by installing six of the new elevators before any change is made with the old ones. The plumbing and water supply systems of the building will also be considerably modified by combination with the new ones installed for the extension, and this will be accomplished without inconvenience to the tenants.

Mr. G. K. Thompson is the architect for the new work and to him acknowledgment is made for data concerning it. Messrs. Boller and Hodge were the consulting engineers for the steel, which was built by the Hecla Iron Works. Messrs. Arthur McMullin & Company were the contractors for the pneumatic caisson foundation work, and Messrs. R. Deeves & Son the general contractors.



Plans of Enlarged Floors.

Four Steam Turbines for direct connection to alternators of 5,500 kilowatts capacity are to be built by the British Westinghouse Electric & Manufacturing Company, Ltd., for the Metropolitan District Railway Company, of London, Eng. Each unit is designed to carry an overload of 50 per cent., or a maximum output of 8,250 kilowatts, or about 11,000 horse-power. The turbines will be 29 feet long, 14 feet wide and 12 feet high, while the overall length of both turbine and generator will be 51 feet 9 inches. The steam pressure will be 165 pounds per square inch, and the speed 1,000 revolutions per minute.

Waste of Water due to Cold Weather is thus referred to in the 1902 report of Mr. George T. Ingersoll, superintendent of water works, Schenectady, N. Y.: "The daily amount of water pumped up to the second week in December was approximately 5,750,000 gallons. This amount was increased 2,125,000 gallons the first 72 hours of the cold wave. By the generous use of the newspaper columns and starting out six additional inspectors this amount was reduced a little over a million gallons, or to be plain, we are still pumping 7,000,000 gallons of water daily. This amount is a million gallons above the rated capacity of the pumps." This wasteful, temporary excessive pumpage could not be carried on if it were not for the ice being gorged in the river, thereby setting the water back and reducing the suction lift by one-half.

The Buffalo Breakwater System.

The outer harbor of Buffalo, N. Y., is formed by a series of breakwaters 4.3 miles long, inclosing an area in the east end of Lake Erie of 470 acres over 18 feet in depth, and a total harbor area of about 1,000 acres. Various types of construction have been used in the different parts of this system, and in connection with a necessarily condensed description of the latest portions a brief history of Buffalo Harbor and its protective works is of considerable interest. Buffalo Creek was the early harbor of the port of Buffalo. In its natural condition it was shallow and closed, for most of the year, by a gravel bar at its mouth.

The original project for improvement was adopted in 1826, and provided at first for the construction of piers on the north and south sides of Buffalo Creek at its mouth to protect the entrance. Subseqnently, as a protection to the creek and its entrance against lake storms, a masonry sea wall 5,400 feet long and a sand-catch pier of piles and stone 870 feet long, were built along the lake shore south of the harbor entrance. Just north of the Buffalo Creek Entrance Channel are Erie Basin and Black Rock Harbor, formed by two breakwater structures located near the shore of Lake Erie and Niagara River, at its head. These breakwaters were built by the State of New York many years ago. The southerly one, known as the State Breakwater, and inclosing the Erie Basin, is a substantial stone structure. The northerly one, known as the Bird Island Pier, is a timber crib structure protecting the upper end of Black Rock Harbor, a waterway 3½ miles long, lying along the Niagara River front, and built in connection with the Erie Canal. An artificial waterway beginning at the head of the entrance channel to Buffalo Creek and extending thence southerly about 2½ miles where it enlarges into the Lehigh Valley Basins, is known as the City Ship Canal. These four water areas, Buffalo Creek, City Ship Canal, Erie Basin and Black Rock Harbor, form the inner harbor of Buffalo.

The necessity for an outer harbor was apparent as far back as 1840. In 1868 a detached breakwater, about 2,500 feet lakeward from the Buffalo light-house, to extend south a distance of 4,000 feet, was proposed and adopted; and in 1874 it was determined to extend it to a total length of 7,608 feet. This breakwater now has its full proposed length, the final extension of 806 feet having been built in 1893. It was built of timber cribwork, filled with stone, and runs parallel with the shore and about 3,000 feet from it. In 1874 it was also proposed to build a shore arm at the southern end of this breakwater, the inshore end to consist of pile work, with cribs in deeper water. Upon reaching the 16-foot contour in the lake this shore arm was planned to continue toward the breakwater at an angle of 45 degrees with the shore and to overlap the south end of the breakwater, leaving an opening of 150 feet. In 1886 a project was approved for replacing with concrete the superstructures of the wood and stone breakwaters as soon as they became badly decayed. The project of 1874 provided for an outer harbor less than half the size of the present outer harbor and its inadequateness to the needs of Buffalo was apparent before the project was carried out.

In 1895 a new project was recommended by a Board of Engineers, U. S. Army, which, after final revision by Major Thomas W. Symons, Corps of Engineers, U. S. Army, was adopted. It consisted in the abandonment of the shore arm of the project of 1874, a part of which had been constructed and wrecked by storms, and the extension of the breakwater all the way to Stony Point, with a single 600-foot harbor entrance near the southern end. The river and harbor act of 1896 appropriated the funds to carry out this project, and added to it by providing for the construction of a further length of the sand-catch pier, extending it to the established pierhead line, a total of 1,147 feet. The river and harbor act of 1899 further provided for the construction of a breakwater north of the Buffalo Creek entrance in order to protect the entrance to Erie Basin and Black Rock Harbor, which would complete the breakwater chain needed to protect the entire Buffalo waterfront. These projects have now been carried out, and will be described in what follows, beginning with the northerly structure, known as the North Breakwater:


ONTARIO
NIAGARA RIVER.
Fort Erie
Bird Island Pier
North Breakwater 2200'
Timber and Concrete.
Breakwater Light House
Buffalo Light House
Old Breakwater 1825
Timber and Concrete 1827
Pile Work
Old Pier
Sand Catch
Pier
Old Pier
Old Pier
Old

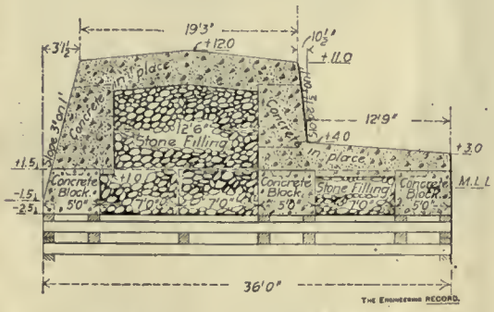
panying plan of the harbor, and is a part of the so-called Stony Point extension, begun in May, 1897, according to the plans of Major T. W. Symons. A typical section of this breakwater as constructed, accompanies this article. This type of construction was used because of the instability of the clay lake bottom, its permanency and its comparative cheapness, as stone could be easily obtained from nearby Canadian quarries, and gravel suitable for the center of the structure could be obtained in large quantities by dredging from the bed of the Niagara River near the International Bridge.

This breakwater is built in about 30 feet of water, and is founded directly on the natural bottom of the lake, which is almost entirely a soft clay with sand and gravel streaks in places and a thin layer of soft sand on top. The axial line of the breakwater was determined by two large range targets, one located on the old breakwater and the other on the shore at Stony Point. Clusters of piles were driven along the line of the axis as reference points for the deposit of materials, and cross ranges were built at 1,000-foot intervals to determine exactly where each scow-load was placed. The first work of construction was the placing of two lines of small rubble stone on the lake bottom, one along each side of the axis of the breakwater. This material was deposited either by hand or from dump scows, and formed ridges having a center height of 5 or 6 feet. Next the gravel was deposited from dump scows, between these two ridges and the rubble stone ridges and the gravel hearting were carried up to elevation -10, and above this elevation they were covered with large rubble stone.

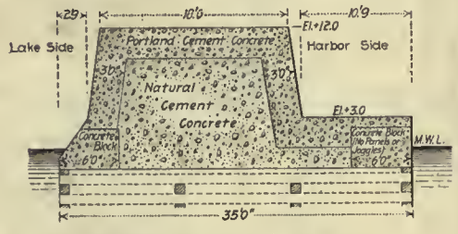
On the lake side the first course of the revetment stones was placed at elevation -15, resting against a heavy offset composed of large blocks of stone laid flat. Above this the revetment stones were laid with their faces perpendicular to the surface of the breakwater. On the lake side the heavy rubble was not prepared for the revetment stones above the elevation of about 12 feet below water level at first, this being done to allow partially loaded scows to get closer to the work when unloading in the center of the breakwater. The revetment stones were then brought up to somewhat less than 6 feet below the surface. On the harbor side at elevation -10 a horizontal bed was prepared for the triangular shaped skewback stones which formed the first course of the revetment on that side. The heavy rubble stonework forming the foundation for the revetment stones was filled in to the proper slope, before the revetment stones were placed, by dropping stone from the edge of a deck scow anchored with its sides parallel to the axis of the breakwater. The leveler in charge of this work was furnished with a table showing the required depth for every 2 feet horizontal interval, and by constant sounding with a pole a very even slope was obtained. Below the surface the revetment stones were laid with great care, as it was essential both for the looks and stability of the structure that the first courses be parallel to the axis of the breakwater and the spaces between the stones be as small as possible. Each stone, after being lowered into position, was inspected through a water telescope before the chains were slacked, thus securing accuracy of position without employing divers. Three water telescopes were used, 7 feet 4 inches, 9 feet 10 inches, and 12 feet 4 inches in length, respectively. They were weighted so as to float about 2 feet out of water. A plane object glass 13 inches in diameter and ½ inch thick was used for each.

Five floating derricks, with a lifting capacity of 20 tons were used for setting the revetment and capping stones. Their hulls ranged in size from 28x90x8½ feet to 34x111x11 feet. Three of the derricks had 60-foot steel latticed booms, one had a 75-foot boom, and the smallest had a 50-foot stiffened wooden boom. The two largest derricks were built on dump scows, the coamings having been torn out and a floor built over the pockets. In order to facilitate the taking of soundings, a special scow was constructed which permitted the taking of four sections every time the scow was lined up. The scow was built as a catamaran, each hull being 10x120 feet in size and 3 feet deep, and the two separated by a 10-foot space. Four laborers and a leadsman were reqnired to operate the scow. Soundings were taken every 5 feet across each section.

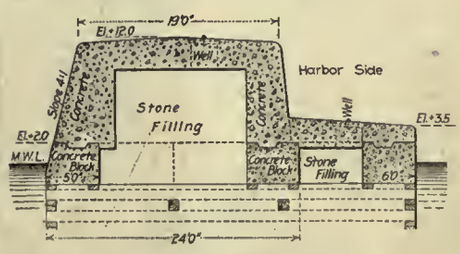
A very complete record was kept of all the material deposited in the breakwater, so that it was known exactly where every scow load was dumped. The work was divided into 1,000-foot sections, piles being driven on the line of the axis at these stations and also on each side for the cross ranges. The arrangement of the intermediate ranges was changed each season. During the season of 1897 piles were driven at the foot of the side slopes at 200 and 250-foot intervals, but toward the end of the work the piles were driven on the axis and not closer together than 500 feet, as it was found that a shorter interval interfered with the dumping from the gravel scows, which were 175 feet long. During the dumping, the longitudinal position of the scows was determined by means of galvanized wire cables. Some of these cables were 1,000 feet or more in length and every 20 feet was marked by a wooden float. The shorter lines were marked by small brass tags at 10-foot intervals. For measuring the quantities of the various material used in the work, which were paid for by the ton, all the scows and canal boats were provided with glass gauges and graduated scales to determine their draft. Several deck scows were built especially for this work, and careful measurements of them were made and elaborate tables prepared showing the displacement for every hundredth of a foot.



Superstructure, North Breakwater.



Solid Superstructure, Old Breakwater.



Shell Superstructure, Old Breakwater.

The greater part of the stone was obtained from a quarry owned by the contractors at Windmill Point, Ontario, about 5 miles west of the Buffalo breakwater light. This stone was a dark gray limestone weighing about 166 pounds per cubic foot. During the first season some of the rubble stone was obtained from quarries along the line of the Erie Canal near Lockport and Albion, N. Y. The Lockport limestone weighs about 165 pounds per cubic foot and the Medina sandstone from Albion, about 152 pounds per cubic foot, the voids for each being about 50 per cent. The gravel hearting for the breakwater was obtained by dredging in the Niagara River near the International Bridge. About 36 cubic yards of the gravel were used per linear foot of the structure, and as the contract price for the gravel was 13 cents per cubic yard, and that for the rubble stone, 80 cents per ton of 2,000 pounds (1 ton = .88 cubic yard), the saving in the cost of the structure by the use of the gravel is evident. The contract price for the revetment and capping stone was $1.25 per ton. The cost of this type of breakwater complete was $125.00 per linear foot. The contractors were Messrs. Hughes Brothers & Bangs, of Syracuse, N. Y. The resident engineer was Mr. Emile Low, M. Am. Soc. C. E.

In making the preliminary estimates for this breakwater it was expected that the whole structure would settle into the underlying mud, and the quantities in the estimate provided for a settlement of abont 10 feet at the edges and 15 feet in the center. As the work proceeded it was found that the expected settlement did not take place, the total settlement at any place not exceeding a foot or two. On December 10, 1902, when but three days more were required to complete the entire 7,261 feet, a length of about 1,000 feet near the southern end sank 10 to 14 feet into the clay, during a violent storm. Five days after, 300 feet more, just south of the other section, went down. The location of this settled portion is shown in the enlarged plan of the Stony Point extension, together with the details of the borings along this section. The portion that went down was built during the past season; and the inference is that the clay bottom at the settled portion has less bearing power than that to the north, where the structure has stood without settling for from 1 to 5 years. This inference is strengthened by the fact that the preliminary borings show that the mud beneath the standing parts contains strata of sand, hard sand, gravel, etc., while these strata are entirely absent from the bottom beneath the settled part of the breakwater, where only soft red clay was found.

The settlement was a peculiar one, in that only the rear portion of the breakwater settled, leaving the front from the water line lakeward in place and apparently undisturbed. The accompanying sketch shows the structure as it now is, and as it is proposed to rebuild it. The movement was apparently a settling and sliding landward under the pounding of the terrific seas and yielding of the clay bottom.

In repairing the settled portion of the breakwater it is proposed to place rip-rap along the harbor slope to make it about equal to the lake slope. The original contractors have agreed to reset all the capping stone that can be economically saved, and arrange the settled portion properly as a foundation for the new superstructure, for which work they are to receive their actual force account, plus 15 per cent., and a fair rental for the derrick boats, etc. All additional materials will be furnished at the original contract prices.

Timber-Crib and Concrete-Capped Breakwater on Stony Point Extension.—This portion of the Buffalo breakwater system, on which construction began at the same time as the rubble mound breakwater, consists of two parts, one 2,739 feet long, forming with the rubble mound section a continuous stretch of breakwater 10,000 feet long, and the other 2,803 feet long, extending from the South Harbor Entrance to the shore at Stony Point. The parts of this structure that have been left with timber superstructure and the parts where a concrete shell has been used are shown on the accompanying enlarged plan of the Stony Point extension. Originally this whole 5,542 feet of breakwater was composed entirely of timber work filled with stone. This type of construction was used at this point in preference to the rubble mound type in order that vessels might moor alongside of it.

them being 540 feet long and the other 576 feet long. The banquette, middle deck and parapet on the harbor side were 6, 10 and 12 feet respectively above mean lake level. This breakwater was completed on October 27, 1900. It had been considerably damaged by a storm, which was practically a hurricane, in the middle of September, and during an unusually severe storm of November 21, 1900, the timber superstructure for a considerable length was badly wrecked.

About 1,800 feet of this damaged superstructure was replaced with a concrete shell and stone filling, of a section shown in an accompanying illustration. The concrete blocks on the lake side were about 7.2 feet long, 5 feet high and 8 feet broad at the base, weighing 18.92 tons. On the harbor side they were 12 feet long, 4 feet high and 4½ feet wide, weighing 15.28 tons. The blocks were moulded with suitent of each other. The two 7-foot cross wall blocks were placed at the end of every 36-foot section of the structure, and a third cross block connecting the two rows of blocks on the harbor side was formed in place every 36 feet as the work progressed, it being found that a made-up block could not be used for this on account of the width not being uniformly 36 feet, due to necessary corrections of alignment.

In building this concrete superstructure the old timber work was first removed, and the top timbers of the cribs brought to a uniform elevation 2 feet below mean lake level. Upon this foundation the blocks were then placed, together with the loose stone filling. The recessed or joggle channels in the ends of the blocks were then filled with concrete, after which the laying of the concrete in place was begun. The banquette, containing in a 36-foot length 54.55 cubic yards, was the first to be



NORTH BREAKWATER DURING CONSTRUCTION.



ROUNDING OFF THE END OF THE STONE BREAKWATER.



SOUTH HARBOR BREAKWATER, STAGES OF CONSTRUCTION.



JUNCTION OF STONE AND TIMBER BREAKWATERS.

Instead of founding the cribs for this breakwater directly on the soft clay bottom of the lake a trench 30 to 40 feet deep below lake bottom, and 60 feet wide at the bottom, was dredged to rock bottom. This trench was backfilled to a depth of 30 feet with gravel, and about 8 feet of rubble stone was placed on top of the gravel as a foundation for the timber cribs. In the portion between the rubble mound section and the South Harbor Entrance there are sixteen cribs, one 60 feet long, 36 feet wide and 22 feet high, and the others of the same width and height but 180 feet long. The short crib was placed with its length perpendicular to the axis of the breakwater at its southern end. Upon this substructure was built a superstructure of similar construction—timber cribwork filled in with stone—in five sections, four of

able recesses for properly bonding them together and to the concrete in place above them. The superstructure was built in 36-foot lengths, making five sections to each crib. Except for the cross wall blocks which cover the joints between the adjacent cribs, the 180-foot sections of this breakwater are almost independ-

laid. Then the front and rear parapet walls were laid, and the filling stone brought up to the level of the under side of the parapet deck. The parapet walls contained 81.04 cubic yards, and the parapet deck 99.19 cubic yards.

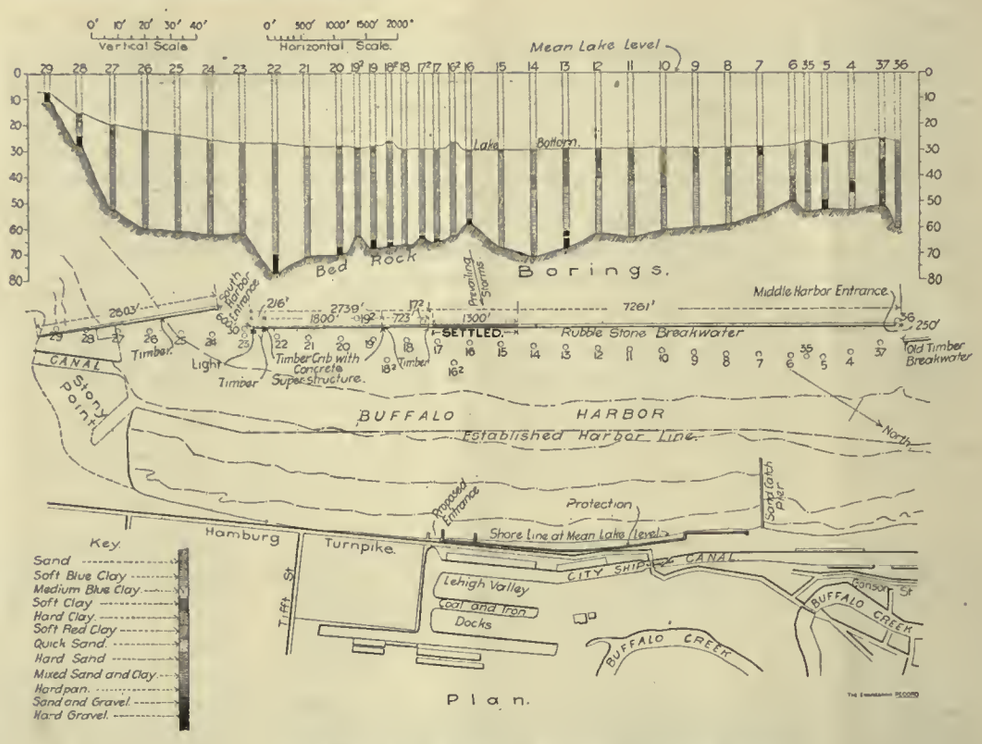
A single batch of the concrete to be deposited in mass consisted of Lehigh Portland ce-

Table Showing Unit Costs of Buffalo Breakwaters.

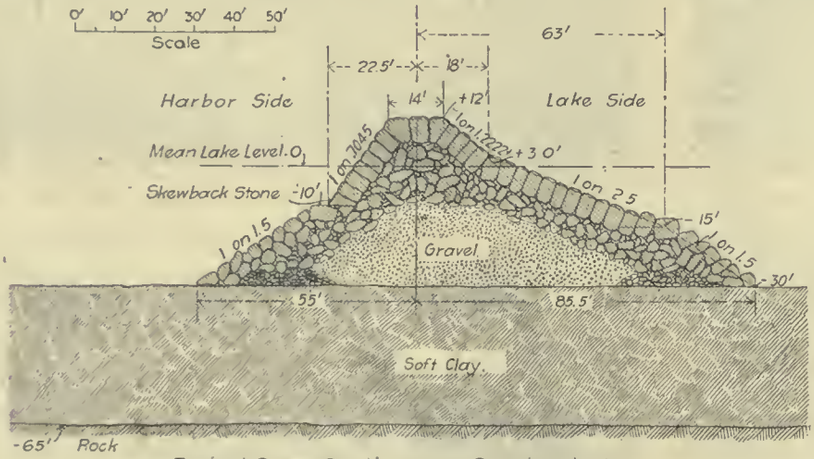
	Whole structure per lin. ft.	Superstructure per lin. ft.	Filling stone per ton.	Concrete blocks per cu. yd.	Concrete in place per cu. yd.
Old U. S. Breakwater (original)	$100.00 to 160.00	..	..	..	..
Old U. S. breakwater (solid concrete superstructure, 1889)	..	$110.19	..	..	$9.19
Old U. S. breakwater (solid concrete superstructure, 1891)	..	108.32	..	..	8.21
Old U. S. breakwater (concrete shell superstructure)	..	72.26	$0.66	$6.64	6.64
North breakwater (36 ft. section)	131.58	56.34	.69	7.10	5.65
North breakwater (24 ft. section)	70.99	46.02	.69	7.10	5.65
Rubble Mound breakwater	125.00	..	..	..	..
South Harbor, timber crib, including riprap (original)	166.00	..	..	..	..
South Harbor (concrete shell superstructure)	..	108.49	.80	10.00	9.40

ment, 5.4; gravel, 5.4; sand grit (sand and fine gravel), 10.8, and unscreened broken limestone, 21.6; making a total of 43.2 cubic feet. The amount of water for each batch averaged about 3½ cubic feet, making a wet quaking mixture. For the concrete blocks the same proportions were used, but the size of the batch was 28.8 cubic feet. One force of men was employed in making the concrete, alternating between moulding the blocks and laying the concrete in mass. About 15 batches an hour were deposited in the banquette and parapet walls, and 20 batches an hour in the parapet deck. The top of the parapet deck and banquette was finished off with 3 to 4 inches of concrete consisting of 1 part cement, 2 parts sand and 1 part gravel, this surface layer being placed directly on top of the fresh coarse concrete and thoroughly tamped into it.

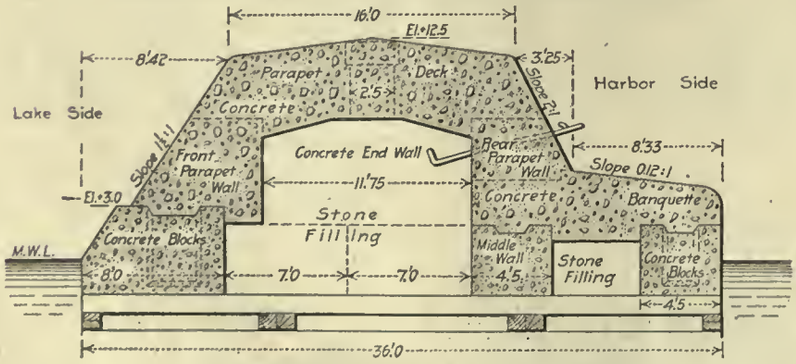
This structure, like the rubble mound breakwater, was constructed according to the designs of Major T. W. Symons, Corps of Engineers, U. S. A. The resident engineer was Mr. Emile Low, M. Am. Soc. C. E. Mr. J. C. Quintus, M. Am. Soc. C. E., was also connected with this work. The contractor was The Buffalo Dredging Co., of Buffalo, N. Y. A comparative table showing the costs of the various parts of the breakwater system accompanies this article. The prices given are exclusive of engineering and office expenses. The total amount expended by the United States government on the improvement of Buffalo harbor up to June 30, 1902, was $4,549,819.08, and to this must be added the cost of the North Breakwater, $238,436.81, which includes both the cost of construction and maintenance, making the total expenditure $4,788,255.89.



Plan and Profile of Stony Point Extention, Showing Borings.



Sections of Original Stone Breakwater, and Settled Portion.



Concrete Superstructure, Stony Point Extention.

The Engineering Department of the University of Michigan is making more rapid gains in the number of students than any other department. There are now 600 engineering students.

The Western Passenger Association has established the rate of one fare plus two dollars for a round trip to St. Louis during the dedication ceremonies of the World's Fair, which are to take place April 30 and May 1 and 2. This action is expected to be followed by the Eastern railway associations.

The United States Steel Corporation, during the past week, has effected the amalgamation of three of its principal constituent corporations, by filing a merger agreement with the Secretary of State of New Jersey. The Carnegie Company, the National Steel Company and the American Steel Hoop Company have been consolidated under the name of the Carnegie Steel Company. The capital stock of the new company will be $63,000,000, only one-quarter the combined capital of the old companies. This step is in a direction opposite to that of the stock inflation which has been so prominent a feature in many of the merger operations of recent years. Economy of corporate expenses is said to be the reason for the move.

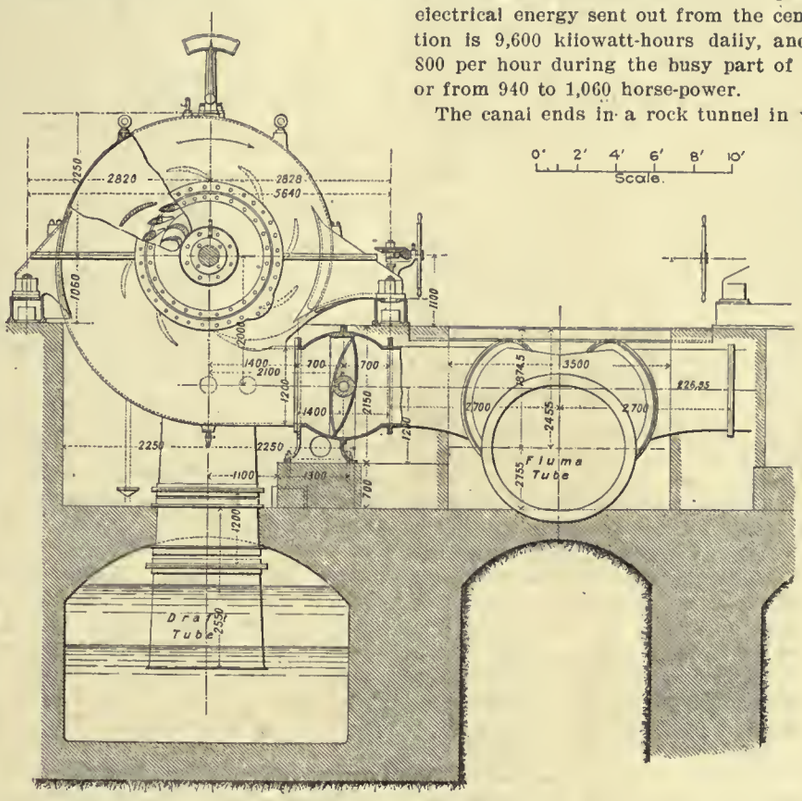
An Open Switch on the Northwestern Elevated Railway, Chicago, caused the motor car of a south-bound express train to jump the track just south of the Fullerton Avenue station on the afternoon of March 27. Before the train could be stopped two more coaches were derailed, although as it was moving slowly it stopped about 25 feet from the switch. None of the passengers were hurt. The wrecking crew worked until a late hour in the night to remove the cars. Two motor trains on the Brooklyn, N. Y., elevated system collided at Sands and Adams Streets on the afternoon of March 31, derailing one car, and practically demoralizing the entire Brooklyn Rapid Transit system both elevated and surface, for the rest of the evening.

The Valtellina Hydro-Electric Power Plant.

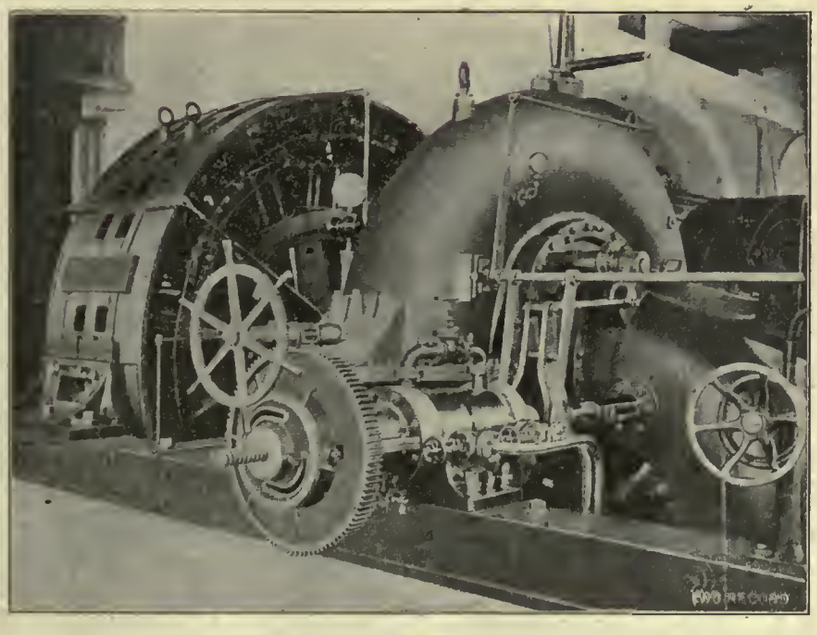
The notable three-phase, high-voltage, Ganz system electric railway known as the Valtellina line is served with power from a water-power electric plant which, though built along lines that may be held as representing a general European practice, possesses a number of points of interest. The railway is now about 67 miles in length, running for a part of that distance along Lake Como in Lombardy. The power plant has been erected near Morbegno and utilizes a fall in the Adda River. The following account is taken in part from a recent issue of "The Engineer" of London.

In locating the diverting works, advantage was taken of a gravel island in the bed of the river, the gravel having proved to afford a solid foundation. A dam was sunk in the gravel, blocking up entirely one branch of the river and sweeping diagonally across the other branch, not more than a few inches above normal high water level.

At the end of this dam three gates, each of 18½ feet span, and permitting a maximum depth of 7½ feet of water to pass them, give passage to the surplus water into the lower reach of the natural bed of the river. The gates are iron structures, and are raised and lowered by overhead cranes, according to whether the river is in flood or at low level, so that the extreme variation of level in the power canal is from 8.2 to 6.5 feet depth of water, and gives never less than about 2 feet depth over the sill of the intake. The intake to the power canal is at right angles to these gates and parallel to the natural bed. It is 111.5 feet long, and is protected by a grid of flat iron bars inclined 30 degrees from the vertical, and with the flat faces of the bars set with a horizontal deviation, such as tends to prevent the inflow of ice and debris and to throw it off down stream.



Elevation of One of the Turbines.



ONE OF THE GENERATING UNITS.

From the intake the canal starts immediately in tunnel, in a curve of 114.8 feet radius. It is almost a mile long, for the most part through solid rock. Of a total length of three miles, the canal has fourteen tunnels with a combined length of two miles. It has concreted floor and walls and is 13.12 feet wide at the floor line and 14.43 feet at water level. In tunnels the roof is arched to a circular arc of 9.58 feet radius. At the point of issue from the long tunnel, an overflow into the bed of the river is provided, which steadies the canal flow below this point. Near the power-house another overflow of larger size is built, capable of taking the total flow when the turbine flumes have to be emptied for cleaning or repair.

The watershed of the Adda above the intake has an area of about 1,000 square miles, and gives a minimum winter flow in the river of about 880 cubic feet per second. The total fall from the intake to the highest level in the turbine tailrace is 106.91 feet, of which 15.7 feet are spent on the canal gradient of 1 per 1,000 throughout the 15,740 feet total length, and another 1.6 feet is otherwise lost. This leaves 89.6 feet available fall from the top-level in the flume to the tail-race; which, with 880 cubic feet flow, gives 9,000 theoretical water horse-power. It is reckoned that over 7,000 horse-power will be developed by the turbines from this water consumption. Each of the three turbines now installed, is designed for 1,500 horse-power normal, with a 2,000 horse-power overload capacity, while the fourth, still to be laid down, is of double this size. The four together will thus be of 7,500 normal, and 10,000 maximum horse-power. It must be remembered that the 880 cubic feet is the minimum winter water-flow, the summer flow being considerably greater, while the summer railway passenger traffic is at least twice as heavy as that to be served in the winter. At present the electrical energy sent out from the central station is 9,600 kilowatt-hours daily, and 700 to 800 per hour during the busy part of the day, or from 940 to 1,060 horse-power.

The canal ends in a rock tunnel in which is formed the settling basin of the penstock, 23 feet wide, 82 feet long, with a sloping floor, giving 19.7 feet depth at its forward end, where sludge and debris are collected, and discharged over a sill, surmounted by an iron grating, with 9.8 feet of water over it. From here the water enters two steel flume tubes of 8.2 feet inside diameter. These run straight down the hill side at 45 degrees inclination to the horizontal and are 223 feet long. In the power house they rise to the inlet casings of the turbines, each tube branching in two and supplying two turbines. Near their upper ends, where the water pressure is light, these tubes have packed gland expansion joints. Their upper ends are flanged and riveted to an iron plate built into the masonry of the penstock, the under sides of the tubes being open for inspection right up to this flange-joint.

The power house is a spacious building 170 feet long by 72 feet wide and 50 feet high. Each turbine discharges by its own draft-tube, whose mouth is kept well below the lowest water level in the tail-race. This is a wide, open basin delivering directly into the bed of the river Adda.

The turbine units are mounted on one horizontal shaft, carried on two main bearings, with the alternator between them and the turbine wheel overhanging. The end of the turbine shaft is, of course, steadied in the stuffing-box of the turbine casing, but this takes no bearing load. Further, the turbine shaft is prolonged in a small size extension to the governor housing, where it drives the governor and has a small extra bearing; but this again takes none of the weight of the wheel nor any

of the working forces. In regard to the overhang it must be remembered that the working pressures of the water are nearly uniformly distributed round the crown of rotating blades, and, therefore, have zero, or only a small single resultant productive of pressure at the bearings. Their resultant is a torque or couple of equal and opposite forces. Practically the same may be said of the mechanical forces between the armature and field of the alternator. So that the main-bearing pressures are really due only to the dead weight of the revolving parts and of the water filling, at any one instant, the crown wheel. The two main bearings have a combined length of 8 feet 2 inches, and a diameter of 12 inches. Each is lubricated by three loose rings dipping into the oil chamber, and has a cooling-water circulation through the shell of the plummer block. This cooling is not required, it is stated, under present working conditions.

The turbine is inward flow, discharging the water horizontally parallel to the shaft, and the slightly expanding draft tube is immediately turned downwards. It dips 22 feet below the turbine center to some 18 inches below the lowest water-level in the tail-race. The diameter over the tips of the blades of the wheel is 5 feet 3 inches, and the normal speed is 150 revolutions per minute. A vertical spindle ball governor controls the entrance of water to the turbine. A relay pump pumps oil into an ordinary hydraulic accumulator, the pump being driven by an overhung crank on the extension of the turbine shaft. The oil pressure is maintained at six atmospheres, the flow from the pump escaping by a by-pass into a reservoir when the accumulator is full, whence it passes again to the suction of the pump. From the accumulator the oil is supplied to one or other end of the horizontal relay cylinder, whose piston and piston-rod thrust forwards or backwards through a small angle, the ring commanding the crown of pivoted entrance guide-blades which admit water to the wheel. The centrifugal governor regulates the admission of pressure-oil to one or other end of the relay cylinder by means of a slide valve. There is also hand-wheel control of this crown of guide blades, as well as a screw gear for opening and closing the main butterfly water valve.

The exciter dynamo is mounted direct on the other end of the main shaft, with a small outside bearing. The fields of the three exciters are excited by a small auxiliary dynamo driven by a small auxiliary turbine, which is also used for other work. A rheostat is inserted in the exciting circuit, whereby the field of the alternator may be regulated from the switchboard. Furthermore a small horizontal-spindle centrifugal-ball governor inserts an extra resistance in the field of the exciter dynamo if the velocity passes beyond the limit of 250 revolutions per minute, at which the voltage of the alternator would have become 25,000. The alternators are, however, capable of running for half an hour at 30,000 volts without becoming heated to such an extent as to incur injury. The exciter voltage is 49 to 50, and the current varies from 300 to 450 amperes, averaging 350. The normal voltage of the alternators is 20,000, and it varies between 17,000 and 22,000. A short circuit produces a current six times the normal. The alternators and electrical station apparatus were built by Messrs. Schuckert & Company, of Nürnberg, and the turbines, motor cars, transformers and the line work by Messrs. Ganz & Company, of Buda Pesth.

Four men suffice to take entire charge of the hydraulic canal, including the regulation of the intake gates. The central station plant runs for 18 to 20 hours per day, and is served by three shifts of three men each, plus two fitters, or eleven men in all. The charge of the transmission line is in the hands of a foreman and three fitters, besides one watchman at each transformer station. Each train is accompanied by two men, each of whom alternately undertakes the duties of motorman or driver and of conductor.

The yearly working cost of the power station, inclusive of the canal, has been found to be $6,513, this covering wages, materials, and repairs. The similar cost for the line transmission, including the 3,000-volt contact wires, is $8,262. The total is thus $14,775. The energy consumption on the line is 67½ watt-hours per ton-mile; and the above $14,775 being the working cost of 3,500,000 kilowatt-hours, one kilowatt hour costs under 0.42 cent and 1,000 ton-miles 28.3 cents, without including interest, maintenance—beyond ordinary repairs—and sinking fund on capital outlay.

Fire in an Iron and Steel Frame Building.

The Roosevelt Building, Broadway and Thirteenth Street, is a 110x110-foot eight-story and basement building used for commercial, manufacturing and warehouse purposes. It had unprotected cast iron interior columns 8 inches in diameter and steel wall columns. The floor and roof were of hollow tile segmental arches between 10-inch I-beams supported on double 12-inch I-beam girders. The lower flanges of the beams and girders were protected by plaster on expanded metal furring set close to the steel without enclosed air space. The floors were covered with 1-inch boards nailed to wooden strips bedded in concrete filling. The ceiling was plastered direct on the under side of the floor arches. There was a central elevator and stair shaft and a rear elevator and a rear stair shaft, all enclosed with hollow tile partitions having wooden doors and large windows glazed with thin glass in each story. Both sets of stairs had iron strings and stone treads without reinforcing webs. The basement, first, second, fifth and seventh stories were occupied with stocks of clothing on wooden tables. The third and sixth stories were used for the manufacture of suspenders and neckwear, the fourth story for storing spool and embroidery silks and the eighth story for a tailor's cutting department.

Early in the morning of Feb. 26, 1903, part of the building and contents was injured or destroyed by a severe fire which was made the subject of investigation by the Continental Insurance Company of New York. Their special inspector and trained engineer made a report to President Henry Evans in which he described the construction of the building substantially as above noted, the extent of the damage, and, in conclusion the lesson to be learned from the standpoint of the insurance company: He defined the building as belonging to the "class commonly designated as fireproof buildings with unprotected iron work occupied for mercantile and like manufacturing purposes." The report goes on to say that—

The first warning of the fire was given by the pneumatic (automatic) alarm with which the building was equipped. As near as can be determined, it started in rear part of the southern half of the sixth floor amongst a quantity of drummers' trunks, samples, etc. It evidently spread very rapidly and ascended the central stair and elevator shaft referred to (which was practically not cut off except by thin glass windows with wooden sashes) and entered each of the floors above. The sixth and seventh floors were divided in about the center (north of the stair shaft) by 2-inch hollow tile partitions plastered ½-inch on each side, and these succeeded admirably in confining most of the fire on these floors to the southern half, but in this portion the stock loss was about total on each floor. In the eighth floor the fire raged more fiercely than on the others, and produced the most disastrous results. Five of the cast-iron columns supporting the roof broke off clean about 2 feet from the top, and all of the remaining columns were badly warped and twisted; likewise part of the framework of the outer walls, where the protection had been pulled off by the falling of the roof beams. The giving way of the columns caused the entire roof excepting about one-third of the area in one corner to fall, and in doing so one section of it fell through the eighth floor, making a hole in the same about 12x15 feet, and landed on the seventh floor, which sagged considerably (where hit) from the increased load but remained intact. Part of the roof dropped on the stair landing in the central shaft referred to and fell straight down through the building, carrying each landing with it in succession. The iron work in the sixth and seventh floors appears to be in good condition, and structurally the building does not appear to be seriously damaged below the eighth floor, with the exception of the two broken floors where the roof fell through. The exterior walls being chiefly of brick and terra cotta, damage to them was slight. Had they been of stone the loss would probably have been much larger. Loss on building estimated at from 25 to 30 per cent.

While this fire is probably the most important that has occurred in this class of risks in New York, it can hardly be considered as teaching any new lesson, but rather as demonstrating and emphasizing the opinions universally held by insurance engineers; firstly, that vertical openings not thoroughly enclosed in fireproof material are an extremely vital defect and make an otherwise well built building practically at the mercy of any fire once well under way, and, secondly, that unprotected iron-work is a dangerous thing, never to be depended upon. The floor arches withstood the extreme heat of the fire satisfactorily, and it can be stated to a certainty that had the elevators and stairways been enclosed according to underwriters' standards, and the ironwork been protected, the same fire under the same conditions would not have spread beyond the floor upon which it originated.

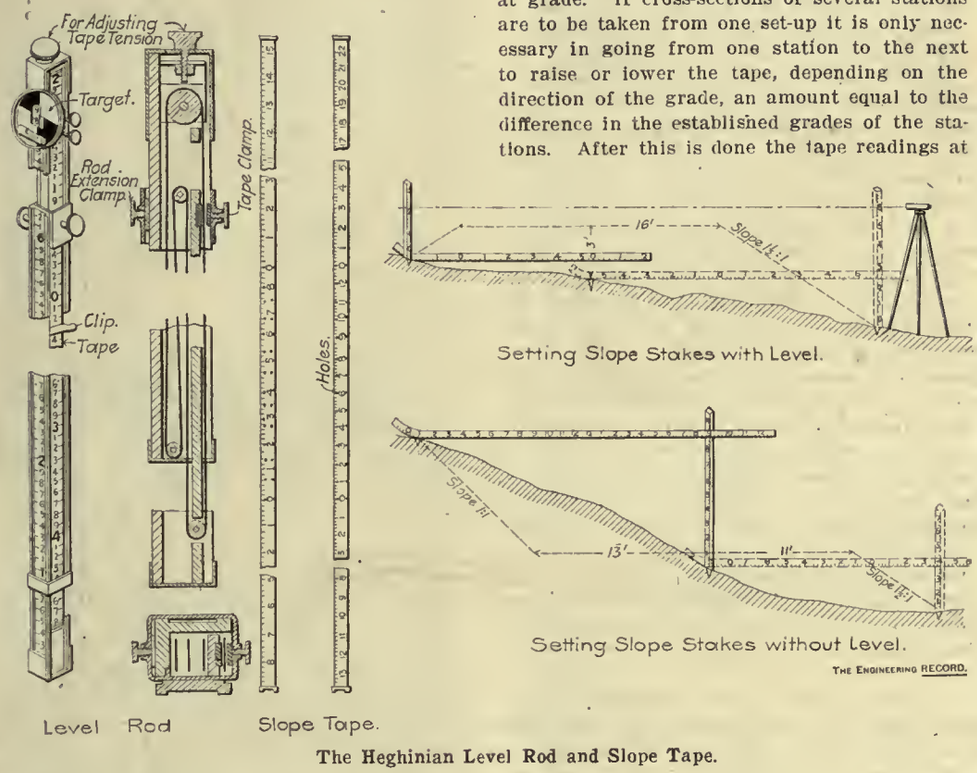
Another point the fire emphasizes is the necessity of at least two stairways in all buildings of this class and the importance of having the treads rest on an iron web or plate, as called for under the new laws. It will be noted that one stairway in this risk was made a wreck by the falling of the roof, and had it not been for the second stairway escape would have been entirely cut off for the firemen and there would have been no way to fight the blaze except from adjoining buildings. From an insurance standpoint, a fireproof building with unprotected ironwork and floors not cut off, when filled with merchandise, is scarcely better than an ordinary building; and as far as the stocks in such buildings are concerned, they are hardly as desirable, if all on one floor, as when in an ordinary building of medium height. The floors of a fireproof building act as a reverberating furnace and stocks contained therein are liable to be most effectually cremated, but if they be distributed over several floors properly cut off, only that proportion on the floor where the fire originated should suffer.

The Baltimore & Ohio Railroad has secured 60,000 square feet of space in the Transportation Building at the World's Fair, St. Louis, and will make an extensive exhibit of the evolution and development of the world's railways.

A Rod for Rapid and Accurate Leveling.

There has recently been designed a new type of level rod, by the proper setting of which, cut, fill, or elevations are read directly from the rod wherever it is held, without the necessity for continual additions and subtractions. This rod is of especial advantage for any work where the elevations of many points are to be taken at a single set-up of the instrument, as in cross-sectioning; but the simplicity of taking turning points with this rod makes it a marked improvement over the ordinary types of rod for every kind of leveling work.

The construction of the rod is shown in the accompanying cuts. It is an extension rod composed of two L-shaped pieces, made to slide on each other much like any other rod. The graduations on the rod are practically the same as for the Philadelphia rod; and it can at any time be used in exactly the same way as the Philadelphia rod. At both ends of each part of the new rod is a roller over which passes an endless tape, its distinguishing feature, which appears at the outside only along one side of the rod. The tape is gradnated to feet,



The Heghinian Level Rod and Slope Tape.

tenths, and hundredths from a zero both ways; the numerals on one side of the zero being printed in red and those on the other side in black in order to distinguish between them. The tape is an unusually strong "metallic" tape and can be easily moved up or down until any numeral comes to any desired point. It can then be clamped to the rod, and by means of a screw at the top of the rod, which controls the yoke carrying the upper roller, the tension of the tape can be regulated. The clamp for the tape and that by which the two sections of the rod are clamped together are arranged on opposite sides of the rod, and the clamping of one does not interfere with the use of the other. A small level and a vernier are provided on the face of the target, and attached to the target on the tape side of the rod is another vernier, reading both up and down, by which the tape can be set exactly; while a hand is arranged in a convenient position to indicate to the rodman which way to move the tape in certain cases.

For ordinary leveling a grade elevation (either that to which it is desired to reduce the natural surface or one at about the mean of the natural surface) is chosen as a datum. The grade elevation is then subtracted from the elevation of the bench mark from which the start is made, this being the only computation that is required. The rod is then held on the bench mark and if the difference is positive the tape is shifted so that the number below zero representing it comes into the line of sight; while if the difference is negative the corresponding number above zero is set. The tape is then clamped, thus completing the operation known as rod setting. After this, no matter where the rod is held it will give directly the difference in elevation between that point and the assumed grade, values on one side of the zero giving the cut and those on the other side fill.

For example, in cross-sectioning for a roadbed the elevation of the finished surface at the given point would be assumed as the datum, and all readings on the tape above zero represent the exact fill, while all below zero represent the cut. If the tape reading were exactly zero it would indicate that that point was exactly at grade. If cross-sections of several stations are to be taken from one set-up it is only necessary in going from one station to the next to raise or lower the tape, depending on the direction of the grade, an amount equal to the difference in the established grades of the stations. After this is done the tape readings at the next station give directly the cut or fill there as if there was no change of grade. This operation can be quickly and easily performed by fixing the target at a distance below the metal band near the top of the rod equal to the difference in elevation between the two stations. Then, if the tape is to be lowered, any convenient form of clip that can be attached securely to the tape is fastened to it with its horizontal edge in contact with the metal band on the rod and the tape is then lowered until the edge of the clip is in line with the zero on the target vernier. A similar operation will be performed if the tape is to be raised. The difference of the vernier readings at the first and last stations is equal to the total change of grade between the stations, thus furnishing at once a check on the accuracy of the entire work.

With this level rod there need be no figures at all recorded in the notes in going from one set-up to the next. All that is necessary is to attach to the tape the clip already mentioned, so that its edge is placed directly on the line of sight as the rod is held for the foresight on the turning point. Then for the backsight the tape is unclamped and simply shifted till the same edge of the clip again comes into the line of sight, when the tape is clamped again and all readings under these conditions give as before the cut or fill or the elevation referred to the same datum that was used for the previous set-up. It is thus seen that all labor of computing heights of instrument and elevations with the accompanying likelihood of errors, is eliminated. A form for the notes as compared with what would be used with an ordinary level rod accompanies this description.

Grade = 97.50

Sta	+	H. I.	−	El.	Cut.	Fill.
B.M.				96.31		
	6.42	102.73				
A			7.7	95.0		2.5
B			3.2	99.5	2.0	
T.P.			10.16	92.57		
	1.02	93.59				
C			3.4	90.2		7.3

Form of Notes for Ordinary Rod.

Grade = 97.50
B.M. = 96.31
R.S. + 1.19

Sta.	Cut.	Fill.
A		2.5
B	2.0	
T.P.		4.93
C		7.3

For New Rod.
THE ENGINEERING RECORD.

In case it is desired to run the profile of only a single line, as in laying out a pipe line, the line of sight of the transit is made parallel with the finished grade, which can be done very quickly by means of the clip on the tape. After the proper rod setting has been made, wherever the rod is held on the line of sight it will give the cut or fill at that point. Advantages are also claimed for this rod for stadia work.

In connection with this new form of level rod Mr. G. G. Heghinian, its inventor, has also devised a special form of tape to facilitate the setting of slope stakes. One side of this tape is graduated in feet and decimals, and on the other side the divisions are 1½ feet long, for use with a 1½ to 1 side slope. The tape contains two zeros on each side 13 feet apart, the zeros on one side being directly opposite those on the other side. The numbering extends from these zeros in both directions toward the ends. If the width of the roadbed or embankment is less than 26 feet, it is necessary to shorten the distance between the zeros to one-half the roadbed. When this is to be done the extra length is formed into a loop and passed through a flattened ring, being held in this position by a wire key passed through holes in the tape, which holes are placed for this purpose at every foot mark between the zeros. It is proposed to arrange a small pocket at the bottom of the level rod (not shown in the cut) in which can be placed the flattened ring and wire key when not in use, as well as the clip for the rod tape. The use of the tape is illustrated in two of the accompanying cuts. The upper one shows its use in connection with a level, and the lower one its use without the instrument.

In using this slope tape in connection with a level and the new rod, the proper rod-setting is made, and in the case of the 16-foot road-bed shown in the cut, the distance between the zeros on the slope tape is then shortened to 8 feet so that the effective distance between them represents half of the road-bed, zero being at the center. The tape is held horizontal, and the rod is moved in or out until the reading of the instrument on the rod tape and that on the "1½" side of the slope tape at their intersection are the same, which indicates the point to drive the slope stake. In the illustration given, the readings are 2 feet on one side and 6 feet on the other. The "1½" side of the tape is the one shown in the cut.

In the second method illustrated, the level and the leveler are dispensed with entirely and an ordinary rod can also be used. The illustration shows a section where there is both cut

and fill, the center having a fill of 1 foot and the width of half road-bed on the cut side being 13 feet and on the fill side 11 feet. For the fill side the distance between the zeros of the slope tape is shortened to 11 feet, and one man holds the tape with the figure representing the center fill (in this case 1 foot) on the center line. The man with the rod holds the other end of the tape with the "1½" side in view and moves out from the center until with the tape held horizontal and the rod vertical, the reading on both at their intersections is the same (4 feet in the figure). The position of the rod under those conditions indicates where to drive the slope stake.

In setting the stake at the other side of the center line the two men keep the same relative positions. In this case the 1 to 1 side of the tape is used, and as there is a 1 foot fill at the center the tape is held at 1 foot less than the half width of the road-bed (13 feet). If there had been a 2 foot cut at the center instead of a 1 foot fill the tape would have been held at the point 2 feet the other side of the zero. While one man holds the rod vertically on the center line and the tape horizontally, the other man, grasping the tape at the 1-foot mark and holding it on the surface, moves outward until the reading on the tape and that on the rod at their intersection coincide (in this case 9 feet). The 1-foot mark on the tape then indicates the proper position of the slope stake. A little study of these cases will indicate the geometrical reasons for the operations performed. Where the sections are entirely in cut or entirely in fill the work of setting the slope stakes by this method is of course much simpler than in side hill work, although under any conditions it would seem to be an improvement over the methods ordinarily employed. The inventor of this rod and tape is Mr. Garabed Geo. Heghinian, an Armenian and a graduate of Massachusetts Institute of Technology, at present connected with the Bureau of Highways, Brooklyn, N. Y. The rod is being made by Schwencke, Kirk & Company, of New York City.

The Distinction between Repairs and Improvements, and a Proposed Classification of Railroad Maintenance of Way Expenses.

Abstract of paper by Walter G. Berg, presented to the American Railway Engineering and Maintenance of Way Association, at the Fourth Annual Convention in Chicago, March 17, 1903.

All maintenance of way accounting systems are largely dependent, as far as the detail classification of the expense items is concerned, on the action taken by, and individual understanding of, the various officers of the maintenance of way department. Hence a discussion of the principles and questions connected with the various classes of work and expense groups, will not only serve to direct attention to the proper differentiation of the various expenses of the department for use in making valuable comparisons and general grouping of expenses already incurred or for forecasts for the future, but will tend to promote a more general and uniform practice, and thus make comparisons between different railroads of practical value. Such a discussion should also be of value to those charged with the management of other classes of works.

The terms Improvements, Additions, Betterments, Extraordinary Expenses, Maintenance Account, Capital Expenditures, etc., are used to-day frequently without positive or uniform meaning. The effect of the determination and ultimate disposition in the general accounts of certain of these classes of expenditures is so far-reaching and affects the general financial results to such an extent that it would seem desirable to establish clear definitions and uniform practice. The grouping of maintenance of way expenses must be such as to show clearly what items are in the nature of improvements on the property as distinguished from maintenance proper. There must be a clear separation of all items of what might be called irregular work, i. e., not actual maintenance, and further such division of the actual maintenance items as to give valuable comparative information on a uniform basis for each division of a road and for any particular period or periods under consideration.

Where expenses are not properly grouped, it is impossible to draw valuable conclusions as to the operating efficiency, to make comparisons, or to satisfactorily explain any unusual variations in expenses for any section of road or period. Without such grouping, the irregular work and extra expenses dependent on contingencies of all kinds occurring at any moment in railroading, will effectually block any attempt to readily ascertain correct unit costs of maintenance proper, to make comparisons and forecasts of practical value.

The distinctive divisions of maintenance of way expenditures are: Current Repairs, regular annually recurrent repairs; Contingent Repairs, large emergency expenditures due to sundry contingencies, such as severe storms, floods, accidents, etc.; Special Repairs, minor items, not distinctly regular repairs, but necessarily permanently chargeable to maintenance account; Extraordinary Repairs, extensive renewals or large non-annually recurrent repairs; Betterments, increase in value due to permanent improvements of existing facilities; and Additions, additions and new work not charged in first instance to construction. The fundamental principle or system advocated is that these divisions should be separated into two general groups, Repairs and Improvements, embracing respectively the first four and the last two, each of these six divisions to be subdivided into the ten officially prescribed ledger-accounts of the Interstate Commerce Commission, or into a number of special ledger-accounts conforming to the present practice of each company, thereby not disturbing the existing ledger-account system, but simply sub-grouping the accounts differently. The summary statement of all groups, sub-divided to the usual ledger-accounts, would give the total maintenance of way expenses the same as the present summary statement, but there would be in addition the valuable sub-statements for each group of expenses.

In order that the question of the proper definition and grouping of maintenance of way expenses and the working out of a practical accounting system should be handled in an authoritative and conclusive manner, so as to bring tangible results and influence the railroad companies to adopt the best and most practical system, thereby securing greater uniformity throughout the country, it is considered desirable and recommended that the American Railway Engineering and Maintenance of Way Association appoint a special committee on this subject, with the idea that a report from such a committee of representative and competent members, if subsequently adopted by the association, would serve as the incentive to an association of accounting officers or the American Railway Association to treat the subject in a more authoritative and official manner. The following definitions are given to cover the various groups proposed for the proper classification of maintenance of way expenses:

Repairs shall represent all expenses for the regular maintenance of the property.

Current Repairs shall consist of regular, constant, annually recurrent expenditures for repairs and sundry minor work, required regularly from year to year to maintain in an economical and efficient manner the physical condition of the property and keep the track and structures in shape and safe for operation, embracing all charges for superintendence, labor, materials and sundry items, in the nature of fixed expenses, regular forces, or customary material purchases, necessarily required for the regular maintenance of the property and the safety of the track and structures; provided, such charges are not in the nature of large expenditures incurred for unusual, unforeseen contingencies, for large special requirements not distinctly repair work or not uniform on all sections of a road, or for extensive non-annually recurrent repairs or renewals.

Contingent Repairs shall consist of unusual, unforeseen expenditures due to severe storms, floods, fire, accidents and casualties of all kinds, necessitating expensive emergency work and, in many cases, subsequent extensive repairs or renewals; provided, such work is not of such a comparatively small nature as to belong properly to the uniform and routine work of the regular maintenance of way forces, even if the expense is caused by an unforeseen contingency.

Special Repairs shall consist of such minor items, necessarily permanently chargeable to maintenance account, even if not distinctly repair work, which items if charged to current repairs would tend to vitiate the comparative statistical value of the current repairs account, or which items are too small and the work too insignificant to warrant charging to extraordinary repairs or classing as a permanent improvement to the property.

Extraordinary Repairs shall consist of large non-annually recurrent repairs or extensive renewals in the nature of maintaining the property; provided, such work does not constitute a betterment or addition.

Improvement shall represent all expenses which create a specific, permanent, physical improvement, tending to increase the value of the railroad property as a whole, in the form of a betterment or an addition to the property.

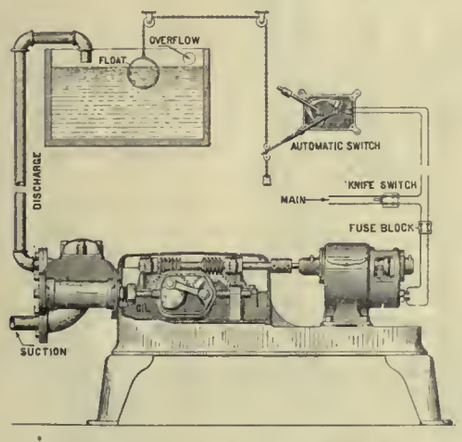
Betterments shall consist of any permanent betterments to the existing property and facilities, constituting an actual, distinct, positive, permanent, physical improvement, tending to increase the value of the railroad property as a whole, the charge to cover in all cases only the difference in cost of the new improved structure or facility and the estimated cost of replacing the old unimproved structure or facility, the term betterments to apply in general to work such as replacing bridges with a more permanent character of materials, strengthening bridges for increased loading, rebuilding buildings, structures, auxiliary appliances and facilities of various kinds on a larger scale and with a better class of materials, increase of track mileage due to re-arrangement and remodeling of existing yards and track layouts, stone ballasting, etc.; provided, the work in question does not consist merely of extensive repairs or remodeling and changing of existing facilities producing no visible extension or important enlargement of such facilities.

Additions shall consist of any permanent addition to the existing property and facilities, constituting a distinct, separate, new, permanent, physical improvement, tending to increase the value of the railroad property as a whole, such as new roadbed, tracks, bridges, buildings, structures, or other auxiliary appliances and fixtures, etc.; provided, such addition or improvement is not in the nature of repairing, renewing, replacing, changing or remodeling any existing facility.

An Automatic Electric Pumping Plant.

The accompanying illustration shows in the form of a diagram a system of pumping suitable for a service such as is required in a dwelling building. Its chief features are its portable character and its so-called transmitter, the latter an interesting device for changing the rotary motion of an electric motor to the reciprocating motion of the ordinary pump operation. In short, it is an electrically driven pumping outfit mounted on a single base which itself can be arranged with legs, as indicated. The control of pumping can be made automatic; for example, the supply of current to the motor can be turned on or off to maintain a constant water level in an elevated tank, by means of a float connected to an automotic switch. The pump has been brought out by the Automatic Electric Pump Company, of 170 Broadway, New York.

The power of the motor is transmitted from the shaft through double worms to double worm gears, and from cranks on one of the gears to yoke pieces, which are connected to the piston rods of the pumps. The double worms and gears are, of course, provided to eliminate end thrusts, and the whole mechanism, which constitutes the transmitter, is enclosed in a case containing oil to secure positive and permanent



lubrication of the working parts. The idea of the mechanism is to obtain a direct connection of motor and pump without the intervention of belts, spur gearing or generally noisy devices. The water cylinders are of the standard double-acting duplex type and the pistons have flexible packing. The pumps are at present made in sizes of 2x3 to 4¾x5 inches, pump cylinder dimensions, with motors of ¼ to 3 horse-power and capacities of 7 to 69 gallons per minute.

Steam Turbine Plants for Electric Railways.

Steam turbine generating plants of an extensive character are planned by the Massachusetts Electric Companies, which control some 860 miles of electric railways in New England. According to Mr. C. F. Bancroft, electrical engineer of the companies, four power stations are to be built, as follows, all employing direct-connected turbine-electric generators working with superheated steam and under a vacuum: At Fall River, Mass., three 3,000-horse-power units; at Quincy Point, Mass., four 3,000-horse-power units; at Danvers, Mass., three 3,000-horse-power units; and at Newport, R. I., three 1,000-horse-power units. The turbines are of the Curtis vertical type, manufactured by the General Electric Company, and each is to carry at the upper end of its shaft a General Electric alternator. The 3,000-horse-power turbine will operate at 750 revolutions per minute, taking steam at 175 pounds pressure at the turbine nozzle, and will be 12 feet in diameter at the base, 19 feet high and weigh 190,000 pounds. The generating apparatus is guaranteed to stand 100 per cent. overload momentarily and 50 per cent. overload for two hours. The Newport station will be furnished with the Schmidt system of superheating the steam and have an equipment of Aultman & Taylor water-tube boilers, Green economizers, Hunt coal and ash handling machinery and Wheeler surface condensers, with centrifugal circulating pumps and Edwards triplex air pumps. These turbines are to drive 500-kilowatt 2,500 volt generators at 1,800 revolutions per minute. Each turbine will be 7 feet 8 inches in diameter at the base.

The Hotel Belmont, New York.

One of the newest and most elaborate hotels in New York is the Hotel Belmont, at 42nd Street and Park Avenue. It is interesting on account of the difficulties of construction, the provision for improved service, the completeness of mechanical equipment and the structural design, which corresponds in most respects to the standards for tall steel cage office buildings, and was described and illustrated in The Engineering Record of February 7. The location of the hotel opposite the Grand Central Station and its proximity to the New York Rapid Transit Railway make it especially convenient for travelers, and these circumstances have been a factor in determining some features of its design and arrangement. The Rapid Transit Subway runs through one corner of the lower stories so as to take about one-fifth of the area of four of them and practically encloses the east and north sides, preventing access to the street and light there. This leaves no opportunity for service entrances except on 41st Street, where the right has been purchased from the city to extend the underground stories 30 feet from the curb line to the center of the street, thereby securing excellent and abundant facilities to receive supplies. It was desired to provide for all storage, machinery installation, operating plant and the general service of the house below the street level; and as much of the space was lost through the encroachments of the subway, it was necessary to carry the excavation down to a great depth and build five stories below the sidewalk level.

The lowest story, 60 feet below the curb, has bunkers on the south side for the storage of about 800 tons of coal, received from chutes in 41st Street. The remainder of this story is occupied with the power plant, elevator, machinery, pipes, ducts, etc. The engine room is unusually high with a gallery on the west side at the level of and connecting with a mezzanine floor in the north side of the building, occupied by the ventilating apparatus. The next floor above is at about the level of the subway tracks and is devoted principally to the laundry and to storage, as indicated in the general cross section of the building. The next story, which is two flights down from the street, has a large area for the servants' dining-rooms, kitchens, toilet rooms, etc., and from it is an entrance to the subway station, adjacent to which there are barber shops, chiropodists and other offices of a public nature. The next story is one flight below the street, and has a kitchen for the main dining-room, a 60x125-foot restaurant, a café and bar-room, and a passage to a gallery above the subway, by which guests of the hotel can reach the Grand Central Depot under cover.

The rotunda floor, next above, is about at street level and contains the 50x100-foot main dining-room and the spacious entrance lobby, which have heights of about 26 and 30 feet in the clear respectively. Adjacent to the dining-room is a palm room with an elaborate domed roof, 30 feet in diameter, supported on columns. There is a mezzanine floor communicating with the dining-room galleries and serving as an overflow for guests and for the smoking and writing rooms; and there are also service rooms with galleries, telegraph and telephone offices, etc. The street floor is made with two levels conforming to the different grades of 41st and 42d Streets, and a corresponding offset in the floor is made in the story below. The dining-room ceiling, which corresponds to what is known as the second floor, is part of tier G of the beam construction, which provides for long-span girders over the unobstructed lobby and dining-room. The second story is devoted to state apartments, banquet rooms, parlors and a few large suites, and has other rooms of ordinary dimensions which do not require large unobstructed spaces as might be erroneously inferred from the longitudinal section. The third and succeeding stories are arranged in about seven hundred and fifty suites, each of which includes a bath room. The upper story is intended principally for servants' lodgings.

The equipment of the hotel includes a 1,700-horse-power battery of five Babcock & Wilcox boilers, four Fitchburg engines of 1,200 horse power, two 750-kilowatt direct-connected General Electric motors, and eleven Otis elevators. Four elevators for freight and five for passengers are located in a single shaft and operated by hydraulic apparatus, and two in another part of the building are operated by electricity and intended for servants' use, running below the second floor only. Five are for service below the rotunda floor. The steam heating systems will be both direct and indirect, and ventilation will be provided by four Sturtevant fans which will draw in fresh air and will force it throughout all parts of the building below the street level. Another set of four exhaust fans at the roof will discharge the foul air from the various ventilation ducts. There will be an ammonia ice plant with a capacity of seventy-five tons daily.

The water supply will be purified by four large filters and will be pumped to roof tanks, and thence distributed through the building under gravity pressure. A garbage cremator will be installed in the lowest story and all the house refuse will be delivered to it through a special elevator from which the cars will run to the cremator down an inclined gallery. Trenches have been left in the rock bottom of the excavation and filled with loose stone to provide drainage channels under the solid concrete floor of the cellar, through which the ground water will be conducted to a steel sump 10 feet below the cellar floor level. The interior construction of the building is fireproofed throughout; the street fronts will be faced with granite and limestone up to the fourth floor and with red Harvard brick trimmed with terra-cotta above. The main entrance is on 42d Street and the ladies' entrance is on Park Avenue. The total cost of the hotel is estimated at approximately $2,500,000, besides the cost of the site, which was probably as much as $1,000,000.

The United States Civil Service Commission will hold an examination on May 5 and 6 for the position of civil engineer and superintendent of construction, with special reference to filling a vacancy at Fort Snelling, Minn., salary $1,500. The examination is open to all citizens of the United States over 20 years old. For particulars address Mr. J. H. Gates, secretary, Board of Postal Examiners, Hartford, Conn.

Ventilating and Heating in the Palace of the Crown Prince of Japan.

The palace of the Crown Prince of Japan, at Tokio, the equipment of which was prepared in this country under the supervision of the Imperial Architect, Tokuma Katayama, is now nearly completed and will shortly be ready for occupancy. Although but two stories in height it is the highest building in Japan, as was stated in a description of the steel work given in The Engineering Record for April 7, 1900. It should be added, however, that the stories are unusually high, the cornice being nearly 60 feet from the ground. The heating and ventilating equipment was designed and erected by Messrs. Walker & Chambers, of New York City, and makes use of American apparatus entirely.

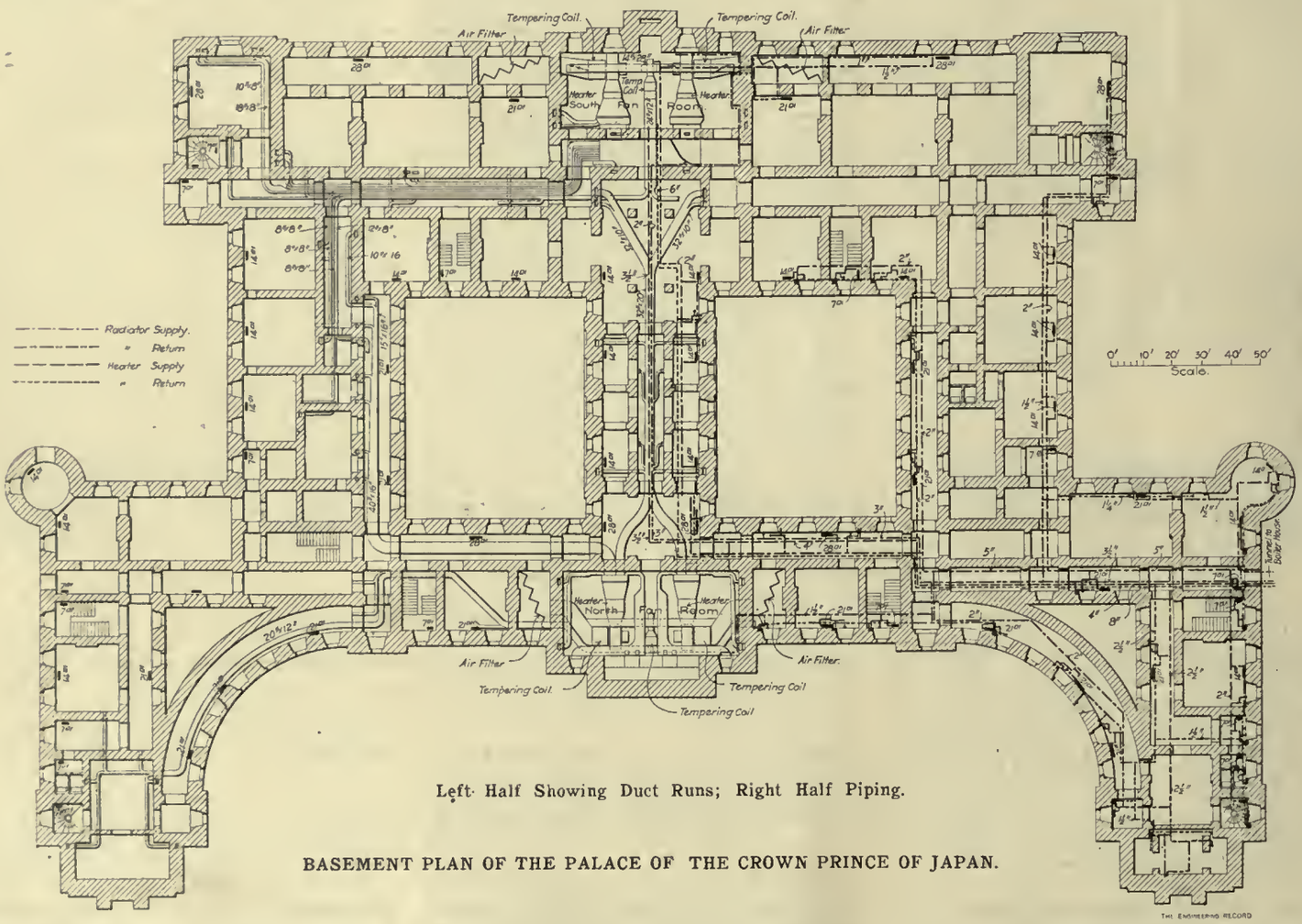
In extreme dimensions the building is 270x400 feet, including the wings at the two front corners, and encloses four courts, two rectangular ones near the center 62x75 feet, and two nearly triangular in the wings. The main entrance is at the middle of the front or north side, two smaller entrances are in either end wing at the front, and a fourth entrance is at the middle of the south side. A center line from front to rear of the building divides it into two equal and symmetrical parts, even the room arrangement in the two halves being practically identical but reversed, consequently in the accompanying cuts but half of a single plan is shown in each case.

The palace is supplied with light, heat and power, by a boiler and engine plant in a separate building. The wiring and piping are brought from the plant to the west end of the building through an underground tunnel and are thence distributed along the ceiling of the basement to the bases of the various risers which are run in chases in the walls. Three different schemes are used for the warming, some locations being heated by direct radiation alone, others by the heated fresh air for their ventilation, while still others combine the use of direct radiation and warm-air heating. For example, all ventilation in the basement is by merely tempered air and gives no assistance to the heating as afforded by the direct radiators; the large dining room, ball room, main halls and rooms that will be occupied by Their Highnesses are heated and ventilated at the same time by warm air; and the halls, corridors and several of the rooms on the first and second floors are provided with radiators as well as heated air for ventilation. The fans for the fresh air supply are all arranged so that they may be used in summer to furnish cool outdoor air directly to the rooms with which they communicate.

Exhaust steam from the engines and pumps is employed for the heating, being brought through the tunnel in a 10-inch main and divided into two separate systems after entering the palace; one for the radiators, fed by a 5-inch branch; and the other for heaters in the fan discharges, by an 8-inch branch. Similarly in returning to the boiler house the return mains of the two systems are united into a single 6-inch main. The pipes of the two systems have been installed in comparatively large sizes so that a pressure never above 3 pounds will be sufficient to furnish the required temperature of 68 degrees in the coldest weather common to that region, namely, 25 degrees above zero.

The fresh air supply for the ventilating is furnished by six fans; four large ones for the warm air supply to the upper floors and two smaller ones for the tempered air supply to the basement. The fans are located in two groups, one at the front of the basement and the other at the rear, each consisting of two large fans and one small one. On each side of the two fan rooms there is a fresh air room from which the fans draw their supply. Each room is divided diagonally by a vertical air filter of cheese-cloth, supported on a zigzag wood frame, to give it large area, the members of which are hinged to make it easily removable. The inlet windows, protected by heavy wire screens of open mesh, are in the exterior walls, front and rear, and the fan intakes open from the chamber on the opposite side of the filter. Two filters have been provided for each air room so that while one is removed for cleaning the other may be used. The larger fans connect through 60x60-inch ducts to the nearest air room and the smaller fans draw half of their supply through a 30x12 or a 28x14-inch duct from each side.

The four fans for the warm air supply are direct-driven by motors and each has a wheel



BASEMENT PLAN OF THE PALACE OF THE CROWN PRINCE OF JAPAN.

72 inches in diameter, running at 238 revolutions per minute, and capable of discharging 26,000 cubic feet of air per minute. Each fan has a tempering coil in its intake containing 1,000 square feet of surface and a set of heater coils in its discharge that has a total surface of 600 square feet. By means of a by-pass under the heater a portion of the tempered air may be delivered without additional heating to the air chamber beyond. The two of these fans which are in the rear fan room supply all of the smaller rooms on the first and second floors that have mechanical ventilation, through a system of individual ducts, one for each register, the entire distance from the fan. The other two fans at the front of the basement supply the state dining room, ball room, halls and corridors through two trunk-and-branched systems, one for each half of the building with a branch for each flue. Both systems are de-

signed to change the air in the rooms they supply six times per hour and to discharge it at a sufficiently high temperature to heat the rooms to 68 degrees. All of the separate ducts have mixing dampers at their connection to the air chamber, which are thermostatically controlled from the rooms affected, so that the required temperature for each room may be obtained independently of all others. On the systems of the other two fans the mixture adjustment is made by a single damper in the trunk near the heater and any further regulation must be accomplished by a volume adjustment through the damper that is provided at the point where each branch leaves the trunk duct. Doors are placed in the ducts near each damper to give access to the latter and allow for cleaning the duct.

At the fans the ducts are made of a size to suit the fan discharge outlets and are immediately reduced until the various flues or discharge inlets into the rooms are reached, when they are enlarged to lower the velocity of the air. The ducts are proportioned so that the velocity of the air through those in the basement will not be greater than 1,350 feet per minute, and the vertical flues so that it will be about 450 through them, excepting in the cases of the flues to the ball room and dining roo where a higher velocity will be maintained on account of the height of the registers in those rooms. In no room is the air introduced at a height of less than 10 feet, but whether it is above or not is determined in most cases by the finishing and decoration of the walls, the registers being made to harmonize as far as possible with the decorations. The ventilating registers are all placed near the floor line and open directly into the vent flues. Where the rooms contain fireplaces the chimneys serve as ventilating flues, otherwise regular flues are installed and lead to the attic where exits allow the air to escape.

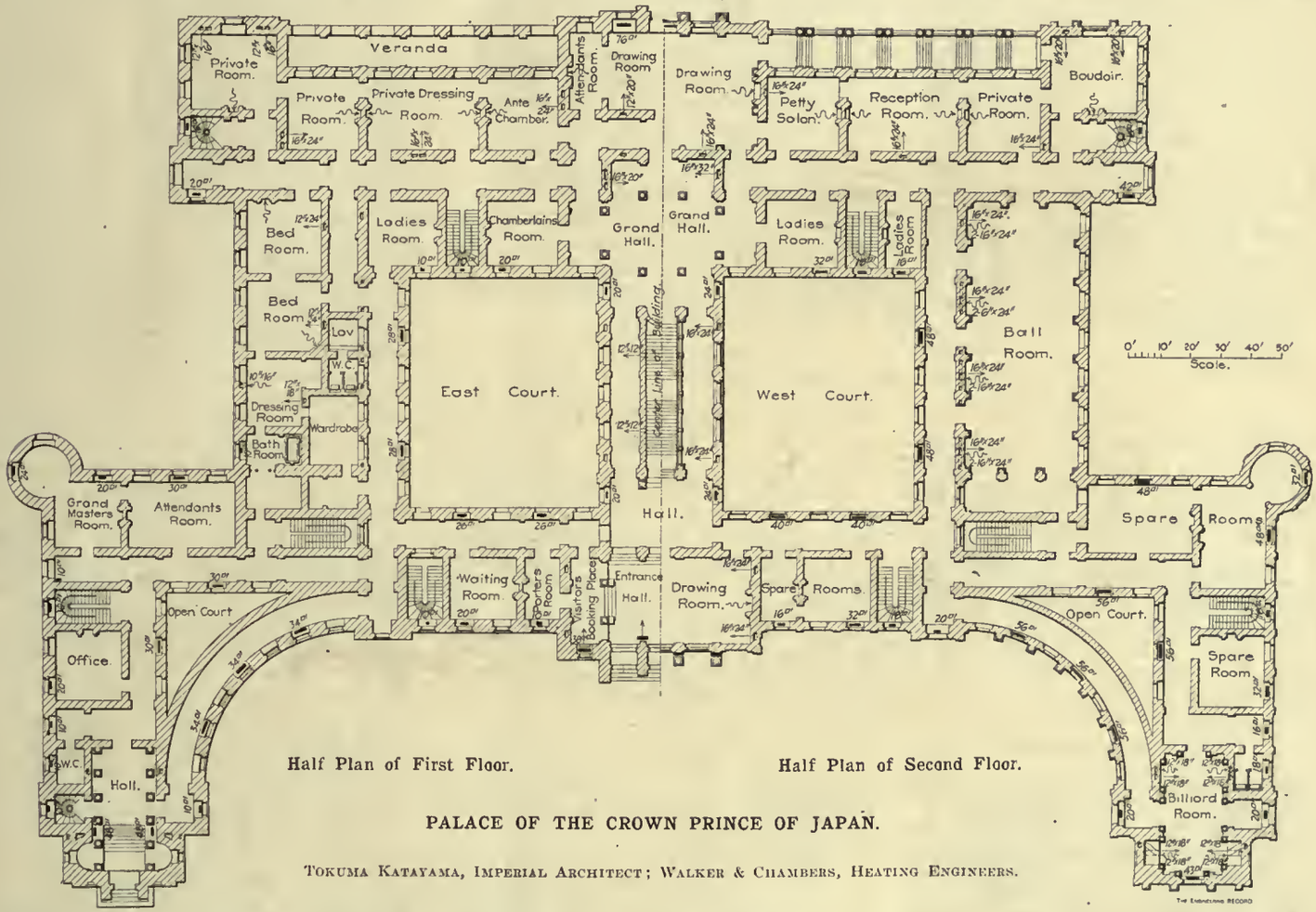
The two similar but smaller fans which serve the separate system of ventilation with which the basement is furnished are located in the two fan rooms, one being in the front room between the two fans for the hall, corridor and large room ventilation, the other between the two at the rear which supply the small rooms and state apartments. These are also Sturtevant fans, direct-connected to motors, and are encased in steel housings 72 inches high. The fan wheels are 42 inches in diameter and run at a speed of 375 revolutions with a capacity of 6,500 cubic feet of air per minute. Each has a thermostatically controlled tempering coil containing 300 square feet of surface, but no heater coils, for, as was stated, the ventilation is not depended upon to do any heating. The ducts are on two trunk-and-branched systems with dampers at the start of each branch fitted with quadrants to conveniently regulate the velocity, and are proportioned to change the air in the basement rooms four times per hour, the air being discharged at just 68 degrees.

The removal of the vitiated air from the attic where the vents of the building discharge, is dependent on the pressure of the fresh air supply, no exhaust fans being used except in the serving room on the second floor adjoining the small dining room. This is a disk fan, 36 inches in diameter, direct-connected to a C & C motor running at 300 revolutions per minute, and serves the purpose of preventing the odors of cooking from escaping into the dining room.

For the heating of the building by steam 197 direct radiators are used, having a total of 4,667 square feet of surface and divided among the different floors as follows: Basement, 1,071 square feet in 69 radiators; first floor, 1,587 square feet in 68 radiators; second floor, 2,009 square feet in 60 radiators. The radiators in the basement are all of the Colonial pattern as manufactured by the American Radiator Company and are hung on the walls at a sufficient height to ensure proper draining. The radiators on the upper floors are usually installed under the windows, most of them being the American Radiator Company's National pattern. The connecting of the radiators is on the ordinary two-pipe arrangement with thermostatic control by diaphragm valves on both the supply and return ends of the radiators. The general layout of the piping in the basement by which all of the risers are connected is shown on the right half of the basement plan. The main steam pipe is 5-inch, the main return 3½-inch, the supply connections on the radiators are 1 or 1¼-inch, and the returns ¾ or 1-inch. The supplies and returns follow the same general lines and connect, as has been said before, to the boiler plant through a tunnel. In the basement the main return lines are run in trenches, the branches being run overhead along the basement ceiling until they reach a convenient point when they drop to the trench, making a sealed water line system throughout. The trenches are built of iron frames with cast iron cover plates and are for the most part 12 inches wide, but where the larger pipes and two returns run are 18 inches wide.

The radiators and the heater coils of the fans are all provided with Jenkins Bros. air valves which are piped into a separate air system that follows the same course as the supplies and returns. The air connections are ⅛-inch and tie into a 1-inch main line along the basement ceiling, which is carried back to the point where the pipes enter from the boiler plant.

The thermostats in the rooms, which are used for the regulation of both the hot air and steam supply, are placed about 5½ feet from the floor, may be adjusted to any temperature between 60 and 80 degrees by a detachable key, and are expected to operate, to either open or close the apparatus they control, for a variation of 1 degree in the room temperature. For the distribution of the compressed air for the opera-



Half Plan of First Floor. Half Plan of Second Floor.

PALACE OF THE CROWN PRINCE OF JAPAN.

Tokuma Katayama, Imperial Architect; Walker & Chambers, Heating Engineers.

tion of the diaphragms, galvanized iron pipe or armored lead tubing is used. The compressed air is supplied by an electric air compressor of 1 horse-power, which is furnished with a governor for automatically starting and stopping it. For emergency use there is also a duplex steam air compressor in the boiler house, having 4x4x4-inch cylinders and a governor similar to the one just mentioned.

Inquiries.

Questions and answers of interest to readers may be published under this heading. Replies are solicited and should be addressed to The Engineering Record.

Scaling of Brick Walls.

Sir:—About eleven years ago there was erected in this city a first class building, the exterior side walls of which were faced entirely with pressed brick made at Vallejo, Cal. These brick are very hard and of a good color, somewhat resembling Roman brick, but have given a great deal of trouble each winter by reason, it is thought, of their absorption of water during rainy weather, which if followed by a frost, causes the brick to scale off, in some cases from ½ to 1 inch in thickness. Silicate of potash has been tried with indifferent results as a preventive of the absorption. In fact, nearly everything has been suggested, but up to this time no satisfactory remedy has been found. I should feel very much indebted if some of your numerous staff of engineer correspondents could suggest some mixture to coat this brick with, which would prevent their disintegration by reasons heretofore given.

"Architect."

Portland, Oregon, March 25, 1903.

Oil Tar Pavements.

Sir:—The undersigned would like information through the columns of The Engineering Record as to experience with pavement made by the use of gravel and oil tar. The local gas company is about to build another gas holder, and has about 200 or 300 barrels of tar in the bottom of the old holder. Our gas is oil gas, and the tar is soft, but when boiled down becomes quite hard.

Yours truly,

Superintendent, Board of Public Works.

March 27, 1903.

Letter to the Editor.

Tunneling by Freezing.

Sir:—I have read with much interest your articles on methods proposed for subaqueous tunneling and your editorial discussion on the same subject. In the latter, solicitude is expressed that in the use of the freezing process, difficulty may be experienced by the workmen in enduring the cold temperatures within the excavation. It is quite practicable to suspend freezing at places where excavation is in progress and to maintain at such places a comfortable temperature; but were no warming of this kind done, the conditions would be only like those in mining drifts in frozen material in the Klondyke region, where men work without difficulty—in fact, work in the deep shafts sunk by the freezing process has been far more comfortable than on the surface works carried on in winter in the higher latitudes all around the world.

You also suggest that there might be difficulty in excavating the frozen material to the extent necessary, without cracking or breaking through the frozen wall outside, which is relied upon to prevent collapse. To avoid this would take far less precaution than is constantly required to avoid accident in pneumatic work. The thickness of the frozen wall can at all times be known by drill holes or by temperature observations taken in pipes previously inserted for this purpose. Much of the excavation of frozen material can be most economically done by special chipping devices utilizing the electric or pneumatic chipping tools now in common use, or by thawing tools somewhat like those used in mining in the Klondyke, by which the frozen material may be taken out in blocks if desired. Or, if blasting be used as is the practice in freezing shaft work (which covers the entire question), it should be borne in mind that the material will naturally and invariably yield and blow inward where there is no resistance as it is solidly backed up on the outside.

I have thought that it might be of interest to comment on these two points since they are brought up. Many interesting questions arise in studying the application of the freezing process to tunneling, especially as there are generally several alternative ways of accomplishing each step. Of the many apparent difficulties and objections that have presented themselves during the development of the designs, there have been none for which, upon full consideration, an absolutely satisfactory solution, has not been found; and it is not too much to claim that among the various plans which have been presented, the freezing process is the one which, in addition to rendering feasible a foundation of piles driven from the surface, meets the conditions of the problem with the greatest certainty of results sought.

Yours truly,

Charles Sooysmith.

New York, March 30, 1903.

Extension of the Sanitary District of Chicago.

Bills have been introduced in the Illinois General Assembly to extend the corporate limits of the Sanitary District of Chicago, and to grant additional powers to the same. It is proposed to annex the Calumet and Evanston territories to the sanitary district. The latter is to be accomplished by constructing a channel connecting Lake Michigan at Evanston with the North branch of the Chicago River. A pumping plant will be established at Wilamette, with a capacity of 60,000 cubic feet a minute. It is estimated that the total cost of the pumping plant and the channel will be $3,000,000. The flow of the Calumet River is to be diverted through a channel which will connect with the main drainage canal in the Sag Valley. Controlling works are to be established at the lake end for regulating purposes at times of high water. The estimated cost of this improvement is $11,000,000.

On the completion of the Thirty-ninth Street sewer, about 85 per cent. of the sewage of Chicago will be diverted into the drainage canal. However, unless the sanitary district is given the power to deflect the remaining 15 per cent. of the sewage from the Evanston and Calumet territories, the entire outlay of $40,000,000 thus far made will not accomplish a maximum of good. The Evanston sewage contaminates the Lake View water supply, while the Hyde Park supply is made dangerous by the Calumet and South Chicago sewage. Health Commissioner Reynolds states that the polluted water supply is the chief factor in causing typhoid and similar diseases in Chicago; and this demonstrates the urgent necessity for the fullest development of the purpose and intent of the sanitary district law. It is not enough to have created a sanitary district which is still a fragment. The only real benefit of the drainage channel thus far has been its effect in reducing the frequency with which the main river is flushed out into the lake. The canal is not a failure. Its plan simply must be consummated in its entirety.

The other bill, already referred to, is an act to authorize the Sanitary District of Chicago to construct water power plants at Lockport and at Joliet, and to exercise the power to levy an additional tax for three years by which to raise $4,000,000 for the installation of the former. Chief Engineer Randolph estimates that the canal is capable of developing 44,000 horsepower; and that the board could install a power plant at Lockport at a cost of $2,750,000, which would yield an annual income of $681,000; and at Joliet for $990,000, capable of an annual income of $426,000, at the lowest figures—a minimum yearly return of $1,107,000 on a maximum investment of $3,740,000, which would mean 25 per cent.

An Automatic Outside Train Brake.

An automatic outside brake for signaling and stopping trains without any co-operation from the engine driver, is quite fully described in "Consular Reports" for February. Both the Swiss and Austrian governments have experimented with it, at speeds ranging from 30 to 60 miles per hour, and the results are stated to have been satisfactory. There are two parts to the apparatus, one on the track and the other on the engine. The lower or track apparatus is connected with all signals, points, curves, etc., so that when it is necessary to stop the train the lower contact lever is caused to project into the track of the contact lever of the upper apparatus on the locomotive, and by touching it, operates the brake mechanism. The lever on the track may be set by means of a wire operated by hand or by electricity. The apparatus may be adjusted for complete braking or for only partial. By means of a signal whistle at the time of operation the engine driver is warned and can himself hasten the braking of the train from the locomotive. The entire arrangement is brought into position for action again by pneumatic power.

Another device for accomplishing the same purpose is described by Consul-General Frank H. Mason, of Berlin, in "Consular Reports" for March. This is the joint invention of Messrs. Hubert Pfirmann and Max Wendorf. A light T-rail is laid between the rails of the track, forming an electrical conductor, and under the center of the forward part of the engine is hung an electrical apparatus inclosed in a case occupying about a cubic foot of space. The instrument is connected with a contact shoe which slides along the third rail, and by wires with a telephone and electric alarm bell in the cab, and a red incandescent lamp which is lighted by the same impulse that rouses the alarm bell into action. A further improvement of the device sets the electric brakes on the train simultaneously with the alarm signal. Last November some successful preliminary tests of this apparatus were made on the line from Frankfort to Hanau, Germany—in every case the driver of the engine stopped being able to learn by means of the telephone what was the exact cause of the obstruction. The alarm bell did not cease to ring until the obstruction was removed.

The Illinois and Indiana Coal-Carrying railroads advanced soft coal rates to Chicago ten cents a ton on April 1, the contention being that this is merely a restoration of the old tariff. While an advance of ten cents does not look large, yet it means an increase in the revenues of the roads of many thousands of dollars.

Water Supply and Distribution in the Corn Exchange Bank Building, New York.

The old building of the Corn Exchange Bank, William Street, New York, is eleven stories high and is principally used for offices by lawyers, bankers and commission merchants. It has recently been extended by the construction of a steel-cage fireproof addition covering an adjacent lot of about 6,000 square feet area and having twenty stories above the street level, as described in The Engineering Record of June 14, 1902. The erection of the steel work was commenced in August, 1902, and completed in November, and the building is now ready for tenants.

The water supply and distribution systems provide for the service usual in such buildings, and the details correspond with those which have been frequently illustrated in descriptions of modern office buildings published in these columns. There is a multiple supply from the street mains, which is pumped through an air pressure tank and the roof tank, and is supplied for all purposes under direct automatic pump pressure, the system being somewhat peculiar in the arrangement by which the gravity pressure from the roof tank is connected with the air pressure in the pump chamber and the action of both systems is united. Water is received through a new service from the street main and this supply is combined with the original supply for the old building, and a storage of about 10,000 gallons is provided and connected with the former storage of 3,000 or 4,000 gallons in the old building so as to provide for any short interruption in the street supply. The water is used without filtration. The pressure is maintained by two steam pumps, and cross connections are made by which these pumps are interchangeable with those of the boiler feed.

Simplicity was especially considered as to the arrangement of the principal mains and the system presents no elaborate or complicated features. The operation and essential features of the supply, distribution and control are indicated by the general diagram, which is a conventional sketch not made to scale and not showing the actual position or arrangement of the apparatus. The supplies from the old and new service pipes are separately metered, connected and discharged through a ball cock into a cylindrical suction tank 10 feet in diameter and 9 feet high, made of ¼-inch steel plates and 2x3-inch angles. It has a galvanized steel cover with locked hinge door and is painted three coats of zinc inside and outside and finished with Pegamoid paint outside. It is raised a few inches above the cellar floor to give access to the gate valve on the 6-inch suction pipe, which has a flange connection to it and is run under the floor to the house and fire pumps and is extended to the feed water pumps. The pumps are set close together and deliver through long radius bends to a 6-inch steel main that receives a return branch from the boiler feed pumps and enters the bottom of the pressure tank. This is a 5½-foot vertical steel cylinder 8 feet high which is also supported a few inches above the floor. In service it is intended that this tank shall have the upper part filled with air to act as a cushion for the pumps and to maintain the pressure under varying discharge. The air supply is indicated by a gauge glass and can be controlled by the pressure pipe from the top, which is connected to an air pump. It has, opposite the inlet, a flanged outlet with a 6-inch delivery pipe connected, as shown in the details, to a horizontal main which supplies the distribution pump, and the attic tank has a gate and check valve controlling the branches to the fire line stand-pipes and street connection.

A single 4-inch pipe serves as both supply and delivery for the roof tank, through the bottom of which it has a flange connection and rises inside to the top, where it discharges through a ball cock. A horizontal branch just above the bottom of the tank serves as an outlet for the tank and is provided with a check valve opening towards the riser. Water can enter the tank through the ball cock and not through the check valve, and can leave it from the check valve and not from the ball cock. By this arrangement the pump can be operated at high pressure without danger of overflowing the tank through the check valve, through which the distribution system will be automatically supplied if the pump is not in service. This tank is about 6 feet in diameter and 20 feet long and is supported in special

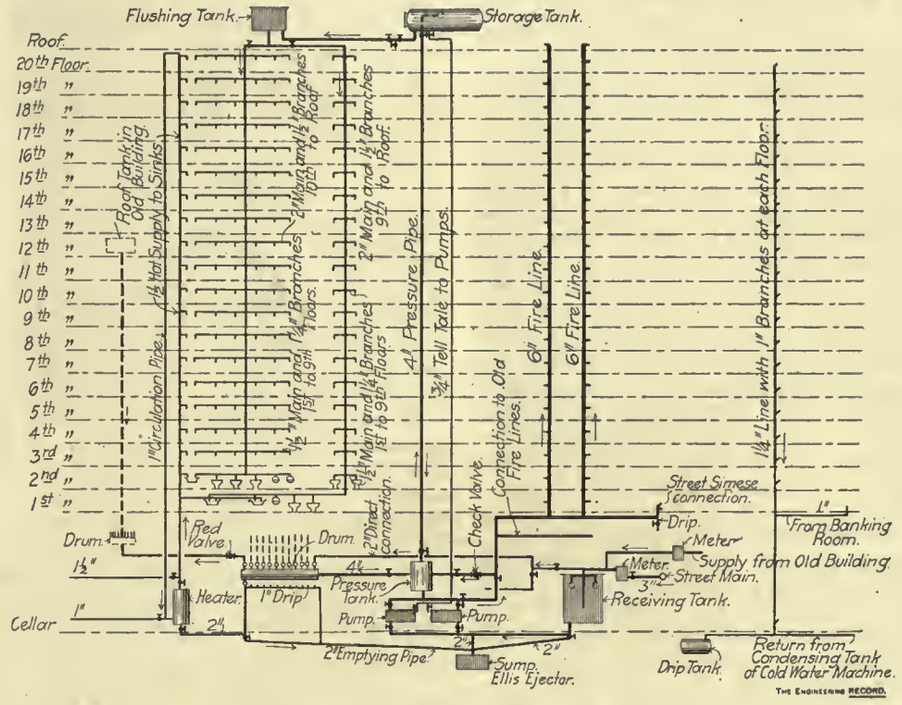
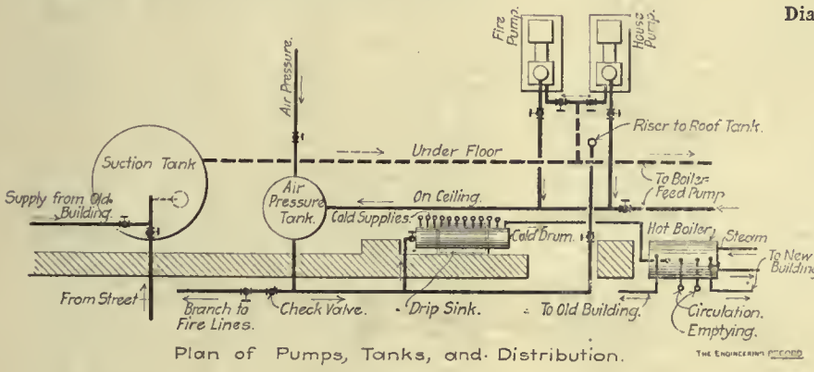
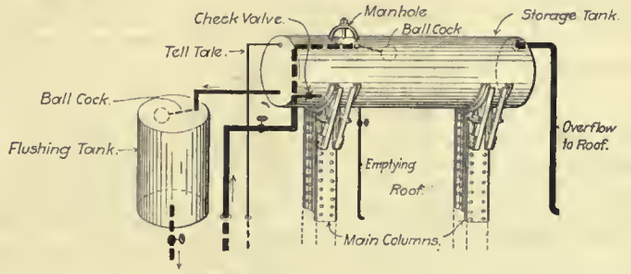
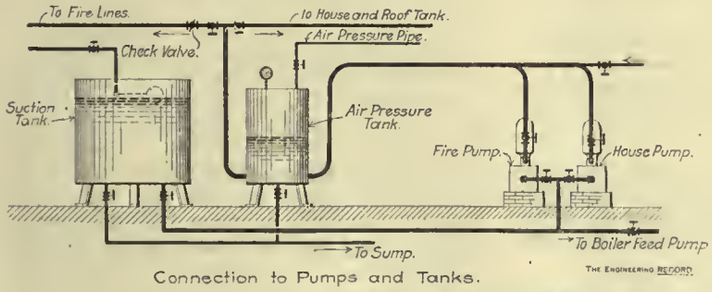


Diagram of Water Supply and Distribution.

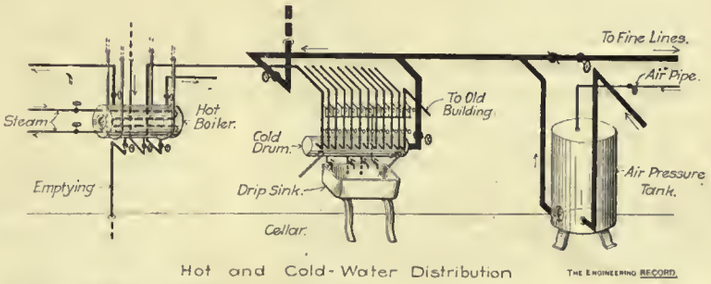


Plan of Pumps, Tanks, and Distribution.





Connection to Pumps and Tanks.



Hot and Cold-Water Distribution

GENERAL ARRANGEMENT AND DETAILS OF PUMPS, TANKS AND DRUMS.

steel saddles riveted to the tops of two of the main columns of the building which extend above the roof level for this purpose. The

Between the pressure tank and the riser to the roof tank the pressure main has a 6-inch branch to a 24x60-inch horizontal distribution drum made of ⅜-inch flange steel and tested to a pressure of 300 pounds per square inch. It has twelve horizontal outlets from which pipes from 1¼ to 2 inches in diameter are run to the different house lines. Of these one supplies the old building and another the hot water boiler. All of them have the usual controlling and emptying valves and have a drip pipe discharging into the engineers sink directly beneath the drum. The drum is supported on curved pipe brackets drilled into the partition wall. Near it, suspended from the ceiling, is a 3x6-foot horizontal hot water boiler with a 2-inch inlet on the under side and two 2-inch outlets on the upper side. It has a 150-foot coil of 1½-inch brass steam pipe and is provided with a Johnston thermostat to open and close the steam valves when the temperature of the water reaches the required limits. One of the outlets supplies the old building and the other supplies the janitor's slop sinks throughout the new building and has a 1-inch return circulation pipe with a separate connection with the boiler independent of the cold water inlet.

There are two 6-inch fire line stand-pipes reaching above the roof, each provided with a branch in every story, including the cellar, and another on the roof, making 46 in all. Each branch is valved and has 50 feet of linen hose on swinging reels set in niches lined with galvanized iron and closed by a locked door with galvanized iron sash and plate glass front. The line is extended horizontally to the street, where it terminates above the sidewalk with a Siamese connection for a fire engine service and has a check valve preventing back pressure on the pumps.

All pipes throughout the building are of extra heavy galvanized steel tested to 500 pounds pressure at the shops and to 150 pounds pressure after erection, except fire lines which are tested to 300 pounds after erection. All hot water pipes are jacketed with Monarch sectional covering 1 inch thick. All cold water pipes in the cellar and under the floor are insulated to prevent freezing and condensation, and are covered with canvas with three coats of white lead paint. The roof tank in the old building is retained, but is supplied upwards from the old drum through a reducing valve on the branch from the new distribution drum. A similar connection is made between the old and the new hot water supplies. The building is expected to contain about 1,500 tenants, is equipped with about 300 washbasins in the offices, and has two toilet rooms in each story. Messrs. Robertson and Potter were the architects, and Mr. T. J. Byrne was the contractor for the plumbing and water supply systems.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual Convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 93 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers.. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Personal Notes.

Mr. Wallace Skutt has been elected highway commissioner at Concord, Mich.

Mr. W. J. Wetherbee has been chosen superintendent of waterworks of Leominster, Mass.

Mr. F. M. Ashmead has been appointed engineer of right of way of the Pennsylvania Railroad, at Buffalo, N. Y.

Mr. R. M. Crosby has been appointed master mechanic of the Oelwein terminal of the Chicago Great Western Railroad.

Mr. T. J. Dawson has been appointed assistant superintendent of the Lake Shore & Michigan Southern Railway, at Elkhart, Ind.

Mr. A. F. Parker has tendered his resignation as city engineer of Ogden, Utah, on account of insufficient compensation.

Mr. R. R. Lang, city clerk of Stratford, Ont., will receive applications until April 15 for the position of city engineer of that city.

Mr. A. L. Parsons has received his appointment as civil engineer in the U. S. Navy and has been ordered to Mare Island, Cal.

Mr. George A. Soper, Assoc. M. Am. Soc. C. E., has been retained to act as sanitary expert to the city of Ithaca, N. Y., during the summer.

Mr. J. A. McGrew has been appointed engineer of maintenance of way on the eastern division of the Fort Wayne, Cincinnati & Louisville Railroad.

Mr. Frank H. Stephenson has resigned as assistant engineer on the Metropolitan Water & Sewerage Board of Boston to accept a position with Mr. Allen Hazen, St. Paul Building, N. Y. City.

Mr. W. A. Baehr, for the past four years superintendent of the gas department of the Denver Gas & Electric Co., has resigned to become chief engineer of the Laclede Gas Light Co., of St. Louis, Mo.

Mr. Glenn D. Holmes, formerly connected with the Bureau of Filtration in Philadelphia, has been appointed assistant engineer of the New York water supply commission, with office at Fishkill, N. Y.

Mr. George T. Slade has resigned as general superintendent of the Erie Railroad to succeed Mr. F. E. Ward as general superintendent of the Great Northern Railway. He is succeeded by Mr. George Van Keuren.

Mr. W. C. Loree, division engineer at Chicago of the Baltimore & Ohio Railroad, has been appointed general superintendent of the Pittsburg system of the road. He will be succeeded by Mr. Thomas J. Foley.

Mr. H. M. Ueberroth is superintendent of the Bethlehem Consolidated Water Company, at South Bethlehem, Pa., Mr. Charles Wehr having been elected water superintendent at Bethlehem, Pa., and not as stated last week.

Mr. Frank Beckwith, former engineer of the Illinois lines of the Chicago, Burlington & Quincy Railway, has been appointed principal assistant engineer of the Lake Shore & Michigan Southern Railway, with headquarters at Cleveland.

Mr. W. S. Lee, Jr., has been appointed chief engineer of the Catawba Power Co., Rock Hill, S. C., and on that account has resigned as chief engineer of the Columbus Power Co., at Columbus, Ga., of which company, however, he will remain consulting engineer.

Mr. J. E. Schwitzer has been appointed division engineer of the central division, Canadian Pacific Railway, with headquarters at Winnipeg; and Mr. A. S. Dawson has been appointed to a similar position on the western division, with headquarters at Calgary, Alberta, Can.

Mr. Edson F. Gallaudet, three years foreman in the hull engineering department of the Cramp Ship Building Co. at Philadelphia, has resigned to accept an executive position with the National Cash Register Co., of Dayton, Ohio. He is a graduate of Yale in the class of 1893.

Mr. Bion J. Arnold, at a joint meeting of the Chicago Branch of the American Institute of Electrical Engineers and the Western Society of Engineers at the Art Institute in Chicago, March 24, presented a resume of his recent report on the Chicago transportation problem.

Mr. George F. Rowell, Assoc. M. Am. Soc. C. E., formerly a member of the editorial staff of this journal, has resigned as assistant engineer of the Pennsylvania Water Co., at Pittsburg, to become assistant engineer with the Susquehanna Canal & Power Co., 1402 Continental Trust Building, Baltimore, Md.

The following assistant superintendents of the State Department of Public Works of New York have been reappointed by Superintendent C. S. Boyd: Mr. John N. Parker, of Schenectady, for the eastern division; Mr. Thomas Wheeler, of Utica, for the middle division; and Mr. Houston Barnard, of Rochester, for the western division.

The Commissioners of the Connecticut River Bridge and Highway District have completed the organization of the engineering department for the construction of the masonry bridge at Hartford, Conn., by the appointment of Mr. Edwin Dwight Graves, M. Am. Soc. C. E., as chief engineer, Mr. A. P. Boller, M. Am. Soc. C. E., as consulting engineer, and Mr. Edmund M. Wheelwright of Boston as consulting architect.

Mr. A. Gordon Jones, superintendent of the Washington division of the Southern Railway, at Alexandria, Va., has been appointed assistant to the general superintendent of the system, and Mr. W. G. Choate, formerly of the Denver & Rio Grande Railroad, succeeds him as superintendent. Mr. A. Ramseur has been transferred to Asheville, N. C., and Mr. H. A. Williams succeeds him as superintendent, at Lawrenceville, Va.

Obituary Notes.

Albert G. Bogert, formerly a prominent builder in New York City, died at his home in Nyack, N. Y., March 24, aged 86.

Charles C. Webber, a mechanical engineer of Springfield, Mass., committed suicide March 24, in that city. He was a native of Norwalk, Conn., was 67 years old, and had supervised the construction of many heating and power plants.

W. H. Henderson, in charge of Government dredging work in the Fall River, Mass., harbor, committed suicide March 29 in that city. It is believed that despondency due to ill health was the cause. He was about 35 years of age.

Trade Publications.

With the approach of the summer season the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., is issuing folder No. 4,011 and special publication No. 7,006 describing fan motors of the swivel and trunnion type, in both bracket and wall forms and designed for direct and alternating current.

A catalogue describing the American and Advance types of sectional steam and hot water boilers and giving useful tables of dimensions, capacities, etc., has been received from the makers, the Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y.

Mr. Charles F. Johnson, 908 Ellicott Square, Buffalo, N. Y., is sending out for March, No. 1 of Vol. 1 of Johnson's Equipment Bulletin, which will be of special interest to those desiring to buy or sell engines, boilers, motors, generators, rails or cars.

"Little Drops of Water" is a pamphlet supporting the meter system as opposed to the flat rate system of municipal water supply and incidentally introducing the reader to the Keystone water meter manufactured by the Pittsburg Meter Co., East Pittsburg, Pa.

Bulletins Nos. 33 and 34, for February and March, from the Crocker-Wheeler Co., Ampere, N. J., contain descriptions of two modern factories. The first, No. 33, entitled "Electricity as a Motive Power for Machine Shops," is an abstract of an article by William Burlingham, in "Machinery," September, 1902. The second is an abstract of an article in The Engineering Record of January 3, 1903, descriptive of the Alsen's American Portland Cement Works.

The Cross oil filter for purifying lubricating oil is described at length in a catalogue issued by the Burt Mfg. Co., Akron, O. In this filter the oil percolates through waste to remove heavy impurities, then is made to pass upward through water in a finely divided state, the remaining impurities separating by gravity, and finally is forced through a second stratum of filtering material into a chamber from which it is drawn for use. The filter is made in sizes for 5 to 500 gallons per day. The Burt exhaust head, described in a separate catalogue, is one in which the steam is subjected to a reversal of direction three times before escaping, and which is specially designed to preclude the liability of blowing out globules of water after their separation.

From the Publication Bureau of the General Electric Co., Schenectady, the following have been received: Bulletin No. 4,308, on generators for electroplating, electrotyping and other electrolytic work; No. 4,311 on rotary converters for railway systems; No. 4,312, on fuse plug cabinet panels; and 4,314 on the meridian lamp, a new type of incandescent lamp, of about 50 candle power, designed to cover a field for which the arc light is too large and the ordinary incandescent lamp too small. With the foregoing were also received, Flyer No. 2,111, on commutator brushes for Brush arc generators, price list No. 7,572, on parts of the L-4 controller, revised indexes for flyers and price lists, and a beautifully illustrated catalogue on fan motors for direct and alternating current, in bracket, desk and suspended types, fixed or mounted with swivel and trunnion.

The York Mfg. Co., York, Pa., has published an extensive list of ice making and refrigerating plants, which it has erected in the last five years, with their locations and capacities.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 25, 28, 29 and 30.

WATER.

Los Angeles, Cal.—The Ocean Park Water Co., of Los Angeles, has been incorporated; capital, $50,000. J. H. Claudius, S. P. Channell, and others, of Los Angeles, are the directors.

Golden, Colo.—The Farmers' Reservoir & Irrigation Co. is reported to be about ready to construct its reservoir, which will cover 1,623 acres in Jefferson County. The greatest depth of the new reservoir will be 126 ft., with an average depth of 6 ft. The capacity will be 40,962,478 cu. ft. of water. Jos. Stanley and Thos. B. Croke are among the incorporators of this company.

Colorado Springs, Colo.—K. M. MacMillan, City Clk., writes that the contract for constructing a high line reservoir (bids opened Mar. 23) has been awarded to Ord & Scoope, of Colorado Springs, for about $13,000.

Florence, Colo.—The Fremont Mining & Development Co. is reported incorporated, to construct a reservoir 1½ miles long and 1 mile wide. It will have a capacity of about 2 billion gals. G. D. Cummings and J. F. Torrence, of Florence, are among the incorporators.

New Haven, Conn.—Extensions of pipe line are contemplated by the New Haven Water Co. in West Haven. It is proposed to extend the water supply from Savin Rock to Oyster River.

Wilmington, Del.—Lewis K. Davis, of Indianapolis, Ind., is stated to have been selected as engineer to have charge of constructing the new Porter Reservoir, to be built by the Water Dept.

Washington, D. C.—Bids for filter materials and work for Aqueduct filtration plant were opened Mch. 31 by Lt. Col. A. M. Miller, Corps Engrs., as follows: A, excavation; B, embankment under filters; C, other embaakment; D, filling over filters; E, puddle; F, seeding; G, sodding; H, concrete in floors; I, concrete in walls; K, concrete in piers; L, concrete in vaulting; M, granolithic pavt.; N, placing materials in 29 filters; O, drainage of roofs for 29 filters. The totals are given for tenders covering all items which include, in addition to those tabulated, piping and drainage systems and the furnishing of filter materials. Cowardin, Bradley, Clay & Co. only bid on items A-O, inc., total, $989,694. Frank B. Jones, Phila., did not bid on central underdrains and interior drainage system, and his total was $1,947,387. Talty & Allen, Washington, D. C., bid on items A to G, inc., total $415,845, as did The Cranford Pavg. Co., Washington, total, $443,460. T. A. Gillespie Co., N. Y. City, bid $53,750 for the steel pipe system. The following bids were received for, *a*, 42,300 cu. yds. filter gravel; *b*, 140,200 cu. yds. filter sand: L. E. Smoot, Washington, *a*, $2.75; *b*, $2.65. Jas. W. Bain, Norfolk, Va., *a* and *b*, $2.74. Wm. H. Wile, S. 4th St., Phila., *a* and *b*, $3.09. Chas. G. Smith & Son, Washington, *a*, $3.47. Such details as may not be given here may be found in the record of the letting of Feb. 20, in this column, Feb. 28.

Items and quantities.	Cowardin, Bradley, Clay & Co., Richmond.	Brennan Constn. Co., Washington.	Mosler & Summers, Buffalo.	D. J. McNichol, Phila.	Cont. Jewell Filtr. Co., New York.	McArthur Bros. Co., New York.	P. J. Carlin & Co. Brooklyn.
A, 880,000 cu. yds....	$0.30	$0.35	$0.36	$0.32	$0.33	$0.33	$0.40
B, 65,400 cu. yds....	.30	.40	.40	.48	.40	.40	.50
C, 46,700 cu. yds....	.30	.34	.30	.48	.50	.40	.40
D, 123,400 cu. yds....	.30	.40	.35	.50	.30	.50	.40
E, 2,000 cu. yds....	1.00	3.60	3.50	4.00	3.50	1.50	5.00
F, 31 acres.....	75.00	100.00	100.00	100.00	100.00	100.00	100.00
G, 9,700 sq. yds....	.25	.40	.35	.55	.50	.39	.40
H, 39,300 cu. yds....	4.50	5.00	5.00	5.50	5.00	4.95	5.00
I, 26,300 cu. yds....	5.10	5.40	6.25	6.25	5.25	5.05	6.00
K, 8,200 cu. yds....	6.00	6.40	6.25	7.00	6.00	6.00	7.00
L, 37,400 cu. yds....	6.50	7.70	6.75	6.50	6.00	6.50	8.00
M, 35,000 sq. yds....	.90	.89	1.10	1.27	.90	.80	.90
N, per filter.....	200.00	250.00	375.00	73.00	225.00	230.00	60.00
O, per filter.....	266.00	450.00	330.00	573.00	550.00	156.00	500.00
Totals	...	$1,871,418	$1,871,025	$1,862,447	$1,765,780	$1,872,693	$1,934,812

Prophetstown, Ill.—The question of constructing water works, at a cost of $27,000, is reported under consideration.

Topeka, Kan.—Bids will be received Apr. 7 by the Bd. of Trus. of State Charities and Corrections at the Topeka State Hospital for furnishing material for constructing the well for additional water supply at the Topeka Hospital. John F. Stanton, Archt., State House. Chas. Yoe, Secy.

Donaldsville, La.—The Com. appointed to consult with engineers regarding the present water works are stated to have reported that the cost of remodeling same will be about $40,000. Alderman Chas. A. Maurin is Chmn.

Gardiner, Me.—Freeman Patten, Fred. Danforth and Henry Richalds have been elected Trus. of the Gardiner Water Dist. recently formed by act of State Legislature to supply Gardiner, Randolph and Farmingdale with water.

Brunswick, Me.—The citizens voted Mar. 21 to accept the act of State Legislature to form the Brunswick and Topsham Water District, and $600 was appropriated for surveys to determine a suitable supply. A driven well system is proposed on Brunswick Plains.

Brewer, Me.—J. W. Cartwright, Jr., Secy. Public Works Co., writes that no plans have as yet been prepared for the stand pipe to be constructed in connection with the water works.

Williamsburg, Mass.—Bids were opened Mar. 24 for building 2 dams, laying pipe, etc., E. C. & E. E. Davis, Northampton, Engrs.: A. G. Tomasello, Boston, $20,144; H. W. Warner, Florence, Mass., $19,889; H. B. Hooker & Son, Rochester, N. Y., $24,704; J. Vaughn, Stamford, N. Y., $16,810; C. H. Eglee & Co., Boston, $23,101; Kiely & Gleason, Northampton, $23,246; W. J. McCarthy, Somerville, Mass., $31,699; T. P. Conroy, Woburn, Mass., $12,921; C. U. Taylor, Wellesley, Mass., $19,497; Wm. Orlando, Belchertown, Mass., $17,723. The detailed bid of T. P. Conroy was as follows: 7,035 cu. yds. dry earth at 25 cts.; 1,930 cu. yds. puddled earth at 40 cts.; 16 M. ft. sheet piling at $20; 1,150 sq. yds. rip rap at 75 cts.; 500 sq. rds. clearing and grubbing at $2; 300 cu. yds. rubble masonry at $6; 19,776 ft. 8-in. pipe laid at 16 cts.; 8,604 ft. 6-in. pipe at 14 cts.; 4,992 ft. 4-in. pipe at 12 cts.; 500 cu. yds. rock excavation at $1.80. Bids were also received for pipes, and specials, as follows: Hitchcock Supply Co., Springfield, Mass., $24,506; Chas. Millar & Sons, Utica, N. Y., $22,921; R. D. Wood & Co., Phila., $22,149; M. J. Drummond, New York, $22,387; U. S. C. I. P. & F. Co., Phila., $22,874; Reading Fdy. Co., Reading, Pa., $22,304; Warren F. & M. Co., New York, $22,671. The detailed bid of R. D. Wood & Co. is as follows: 12 tons 12-in. pipe, 474 tons 8-in. and 146 tons of 6-in. at $31.40; 55 tons 4-in. pipe at $31.90; 10 tons specials at $55. The Chapman Valve Co., Indian Orchard, Mass., was lowest bidder for 40 6-in. hydrants and 10 4-in. hydrants at $20.94.

Springfield, Mass.—All bids received Mar. 24 for furnishing the year's supply of castings were rejected and new bids will be received by the Bd. of Superv.

Lawrence, Mass.—The cost of constructing the new filter for which preliminary surveys have been made will be about $60,000.

Uxbridge, Mass.—The Com. on Water Supply, recently appointed by the town to investigate the present system and report at a future meeting a more adequate supply, has organized with Gideon M. Aldrich as Chmn. The committee is empowered to engage the services of an engineer.

Saginaw, Mich.—It is stated that bids are wanted Apr. 15 for $10,000 water bonds. Frank M. Totten, City Compt.

Grand Rapids, Mich.—City Engr. Anderson estimates the cost of water main extensions in several wards at $52,264, and for the South End standpipe $15,000.

Flint, Mich.—City Engr. Hall is stated to have submitted to Council an estimate of the value of the water works plant now owned and operated by the Flint City Water Works Co. He has also submitted an estimate of the expense of duplicating the above plant at the present prices of material and labor, placing the figures at $235,000.

Two Harbors, Minn.—F. E. Evans, Village Recorder, writes that Pastoret & Lunz, of Two Harbors, have received the contract for a stone building for the pumping and electric station, at $22,450, bids for which were opened Mar. 23.

Lake Crystal, Minn.—It is reported that bonds have been voted for water works.

Minneapolis, Minn.—The Council Water Works Com. is reported to have instructed the City Engineer to secure bids for 4,686 tons of castings, 100 tons of lead and 183 tons of special castings.

Duluth, Minn.—Bids will be received Apr. 10 by the Bd. of Water and Light Comrs. for furnishing and laying 6, 10 and 12-in. water pipe, amounting to in all about 8,505 ft.; also 3,630 ft. 4-in. gas pipe.

New Ulm, Minn.—Bids will be received Apr. 6 by Louis Schilling, City Clk., for opening 9 blocks of trenches, refilling and laying of mains, connecting same, placing gates, hydrants, etc.

Meridian, Miss.—The city is reported to have purchased property near the plant of the present water works as a site for a reservoir.

Great Falls, Mont.—The following bids were received on Mar. 23 for water pipe and specials: Crane Ordway Co., of St. Paul, Minn., $20,745, and the Great Falls Iron Works, Great Falls, $20,539 (awarded contract). The detail of the successful bidder was as follows: For 308 tons of 6-in. c. l. pipe, $50 per ton; 96 tons of 8-in. c. l. pipe, $49.95 per ton, and 9,310 lbs. specials, 3½ cts. per lb.

Twin Bridges, Mont.—T. T. Black and others are reported interested in an extensive system of irrigation.

Dillon, Mont.—Edwin Norris, City Clk., writes that Frank Kelsey, of Salt Lake City, Utah, is the engineer who will have charge of the proposed water works construction, estimated to cost $60,000.

Niles City, Mont.—The question of enlarging the city water works is reported under consideration.

Rockport, Mo.—Wm. T. Buckham, City Clk., writes that it was voted Mar. 3 to issue $7,000 bonds for water works and electric light improvements.

St. Louis, Mo.—Local press reports state that the Bd. of Pub. Improv. on Mar. 24 awarded the following contracts: 4,525 tons of water pipe, to the U. S. Cast Iron Pipe & Foundry Co., of Chicago, Ill., $146,031; 450 tons of special castings, to the Magnetic Foundry Co., of St. Louis, $26,055; 192 stop valves, Michigan Brass & Iron Works, Pittsburg, Pa., $9,536; 400 fire plugs, Pluger & Henger Mfg. Co., $9,210; laying water pipes north of Market St., John O'Donnell, $27,308, and laying water pipes south of Market St., Patk. O'Donnell, $25,965.

Kansas City, Mo.—The proposition of the Kansss t'ity Jockey Club to lay 10,000 lin. ft. of 6-in. water mains and 1,000 ft. of 4-in. mains at its own expense has been accepted by the city, and work will be commenced on the construction at once; probable cost of work is about $14,000.

Greenville, N. H.—This city has been granted an enabling act to construct wster works.

Newark, N. J.—Local press reports state that bids will be received by the Bd. of Wks. May 7 for the construction of 2 gate houses at Cedar Grove reservoir.

Trenton, N. J.—The Water Comrs. have decided to lay a 16-in. water main on E. Hanover St.

Bayonne, N. J.—The Council has authorized City Surveyor Smith to prepare plans for a 24-in. main on the west side.

Perth Amboy, N. J.—Contracts for furnishing and delivering about 1,734 net tons of 24-in. c. i. pipe and 16 net tons of 24 and 16-in. special castings, f. o. b., at S. Amboy and Erneston, for which bids were received by City Council Mar. 23, have been awarded to R. D. Wood & Co., at $28.80 and $53 per ton, respectively. Jos. G. Burns is Supt. of Water Wks.

Camden, N. J.—The Council on Mar. 25 awarded the contract for moving the 10 million gal. pump, with new foundation, pipes, etc., to Boardman & Dallett, of Philadelphia, Pa., for $11,896.

New York, N. Y.—The Bd. of Estimate is stated to have voted to authorize Water Comr. Monroe to expend $45,000 to install meters in hospitals and public institutions.

Clayton, N. Y.—The citizens are reported to have voted Mar. 17 to extend the water works.

Plattsburgh, N. Y.—The Bd. of Pub. Wks. is stated to have approved plans for the improvement of the municipal water works. The plans provide for 13,075 ft. of new water mains and 30 hydrants; probable cost, $20,000.

Batavia, N. Y.—See "Power Plants, Gas and Electricity."

Utica, N. Y.—T. E. McGarr, of Albany, Secy. State Lunacy Comn., writes that the contract for a water tank, tower, foundation and connection at Utica (bids opened Mar. 4), has been awarded to Albany Material & Constr. Co., of Albany, for $3,507.

Schenectady, N. Y.—The Water Comrs. have decided to secure bids for pipe and work required in extension of mains and improvements at the pumping station in Rotterdam.

Cando, N. D.—H. Spinner, City Aud., writes that it is proposed to construct water works, at a cost of $9,000.

Collinwood, O.—Bids are wanted Apr. 13 for $15,000 water works bonds. E. F. Maybach, Village Clk.

Toledo, O.—Willis F. Brown, 55 Law Bldg., has been engaged to mske plans for a submerged line across the Maumee River at Toledo, O. The work consists of a 20-in. main laid 30 ft. below the water surface, a distance of approximately 2,000 ft.

Cleveland, O.—Bids are wanted Apr. 9 for furnishing 1 75-H.-P. horizontal tubular boiler and for mechanical stokers for 2 75-H.-P. horizontal tubular boilers; also, Apr. 24, for furnishing and delivering f. o. b. cars 200 4 and 6-in. fire hydrants for the Water Wks. Division of the Dept. of Pub. Wks. Chas. P. Salen, Dir. Pub. Wks.

Bids are wanted Apr. 27 for furnishing and delivering 248 tons of manhole rings and covers, for the Water Wks. Division of Dept. Pub. Wks. Chas. P. Salen, Dir. Pub. Wks.

Lancaster, O.—Contracts are stated to have been awarded by the Water Works Trus. as follows on bids opened Mar. 25: To J. B. Clow & Sons, of Chicago, Ill., for pipe at $30.25 per ton and specials at 3 cts. per lb. and to the Bessemer Gas Engine Co. for an engine and pump, for $5,200.

Adams, Orc.—J. E. Stanfield, City Recorder, writes that it was voted Mar. 20 to construct water works.

Clearfield, Pa.—J. B. Nevling, Secy. Clearfield Water Co., writes that bids received Apr. 1 for completing the collecting reservoir were not satisfactory, and no contract was let.

Allentown, Pa.—Local press reports state that the following bids were opened by the Bd. of Water Comrs. Mar. 24 for a 10,000,000-gal. pump: Allentown Rolling Mills, 115-million ft. lbs. duty, $23,200. Holly Mfg. Co., of Rockport, N. Y., 145-mil. ft. lbs. duty, $40,900; 138-mil. ft. lbs. duty, $34,500. H. R. Worthington, New York, 8-mil. gal., $29,150; 100-mil. duty, $25,975; 115-mil. duty, $33,125. Snow Steam Pump Wks., Buffalo, N. Y., 135-mil. duty, $35,386; 130-mil. duty, $28,766; 155-mil. duty, $45,175; 145-mil. duty, $37,088; 155-mil. duty, $52,134; 145-mil. duty, $46,586. Barr Pumping Engine Co., Philadelphia, 160-mil. duty, $60,000; 130-mil. duty, $50,000; 125-mil. duty, $45,000; 75-mil. duty, $30,000.

New Castle, Pa.—Local press reports state that the New Castle Water Co. will expend about $70,000 in improvements. D. H. Amsbary, Local Mgr.

Nanticoke, Pa.—A press report states that the Nanticoke Water Co. will soon construct a dam that will hold about 500,000,000 gals. of water.

Allegheny, Pa.—Bids are wanted Aug. 1 for erecting a brick pumping station on Bway., 15th Ward. D. L. Fulton, Dir. Dept. Pub. Wks.

Chattanooga, Tenn.—The Senate has passed the bill authorizing this city to issue $700,000 water works bonds.

Junction, Tex.—R. J. Hand, Secy. and Supt. Llano River Irrigation & Milling Co., writes that it is proposed to construct an irrigation system, to irrigate 20,000 acres of land. Canal to be 20 ft. wide, 4 ft. deep, and 21 miles long.

Delrio, Tex.—Maxcy & Anderson, Binz Bldg., Houston, have been employed by G. Bedell Moore, and associates, of San Antonio, to prepare plans and specifications for the development of a complete irrigation scheme on the Rio Grande, including pumping plant and the development of the San Felipe Springs at Delrio; probable cost of work, $250,000.

Elgin, Tex.—J. O. Smith, City Clk., writes that it was voted Mar. 26 to issue bonds for the construction of water works.

Mt. Pleasant, Tex.—The following bids for constructing water works were received by S. P. Founders, Mayor, Mar. 23: R. J. Gorman & Co., Dallas, $19,953; General Municipal Constr. Co., Dallas, $22,890; McQuatters Plumbing & Machine Co., Hillsboro, $19,004 (awarded contract). Geo. M. Roberts, City Secy.

Wharton, Tex.—The City Council is reported to be considering the question of constructing water works.

Richfield, Utah.—The stockholders of the Sevier Valley Canal Co. are stated to have accepted the proposition of J. M. Billingsley and others to enlarge the canal from its source at Sevier River to a point called Jerico, just this side of Joseph, for the purpose of increasing the flow of water sufficient to furnish power for an electric plant.

Richmond, Va.—Bids are wanted Apr. 6 for furnishing 40 6 to 24-in. gate valves, 40 valve boxes, 758 16, 20 and 24-in. c. i. pipes, 42,000 lbs. special castings, etc. Chas. E. Bolling, Supt. City Water Wks.

North Yakima, Wash.—The Northern Pacific Ry. Co. (W. L. Darling, Ch. Engr., St. Paul, Minn.) is reported to have surveyors at work resurveying the old Leadbetter ditch, in the eastern end of this county, for the development of 40,000 acres of land.

Seattle, Wash.—Bell & Price are stated to have secured the contract for water mains in 1st Ave. for $12,680.

Walla Walla, Wash.—The Water Com. of City Council has reported in favor of a gravity system from Thomas Springs, to cost $100,000. A special election for voting bonds will probably soon be called.

Fairmont, W. Va.—According to local press reports there is a movement on foot here by a company, of which ex-Gov. Chas. T. O'Ferrall is attorney, to bore an artesian well and erect two tanks of 60,000 gals. capacity each, to supply Fairmont with water.

La Cross, Wis.—The Water and Sewer Com. is stated to have decided to lay water mains and sewers in portions of the city where new pavement is to be laid.

Cheyenne, Wyo.—The Big Horn Development Co. is reported formed to construct a storage reservoir near the headwaters of Shoshone River, with a capacity of 70,000,000 cu. ft., and an irrigation canal, 80 miles in length, to reclaim 250,000 acres lying between Shoshone and Gray Bull River, in Big Horn County.

Ft. D. A. Russell, Wyo.—Bids will be received until May 2 by Capt. W. S. Scott, Constructing Q. M., Cheyenne, for furnishing material and sinking from 2 to 6 tubular deep wells at Ft. D. A. Russell.

Rossland, B. C.—H. B. Smith, C. E., is reported to have formed a company which will deliver 7,000,000 gals. of water daily, the scheme to cost $100,000.

Chilliwack, B. C.—L. W. Paisley and Geo. Marshall, appointed by Town Council on the question of municipal water works, recommend the installation of a gravity system, and a by-law is to be submitted to the ratepayers at an early date as to whether this system shall be adopted or a bonus offered to a private company to provide a water works, and the development also of electricity for lighting and power purposes, the bonus to be $10,000.

Brandon, Man.—The city has received a promise from Premier Rohlin, of Manitoba, that it shall have authority to issue $50,000 to be used for water works and $40,000 for street improvements.

Shediac, N. B.—W. A. Russell, of Shediac, is reported interested in the construction of water works, to cost about $30,000.

Port Arthur, Ont.—The Town Council is about to submit a by-law to the ratepayers asking for $91,000 for the installation of a water works. Jas. McTeigue, City Clk.

Hamilton, Ont.—The Council is reported decided to submit to a vote of the people the question of issuing bonds as follows: For a reservoir, $27,000; for the Wellington St. bridge, $8,000; for good roads, $50,000, and for Ferrie St. work, $15,000.

Kingston, Ont.—Dr. Bryce, Provincial Medical Health Officer, is reported to have recommended to the Bd. of Health the installation of chemical filters.

SEWERAGE AND SEWAGE DISPOSAL.

Pasadena, Cal.—S. J. Edwards and T. D. Allin have secured contracts for sewer work in East Pasadena, at $11,775 and $8,285 respectively. Herman Dyer, City Clk.

Los Angeles, Cal.—Local press reports state that bids will be received May 15 by the City Council for $2,180,000 bonds to be used for sewers, bridges, schools, etc.

New Britain, Conn.—H. B. Hooker & Son, of Rochester, N. Y., have secured the contract for constructing Sections 2, 3 and 4 of the New Britain Disposal Works.

New Haven, Conn.—Bids are wanted Apr. 8 for constructing sewers in portions of 4 streets. C. W. Kelly, City Engr.

Moscow, Idaho.—The Sewerage Comn. is reported to have employed Otto Welle, of Spokane, Wash., to make a preliminary survey and prepare plans for a system of sewerage; probable cost of work, $75,000. It has been decided to put in septic disposal tanks.

Peoria, Ill.—The estimated cost of constructing the Grant St. sewer, otherwise known as Sewer District No. 1, is reported to be $33,000.

Jacksonville, Ill.—It is proposed to construct pipe sewers, from 12 to 20 inches in diameter, in 5 streets.

Herscher, Ill.—The matter of issuing $10,000 sewerage bonds is reported under consideration.

Maywood, Ill.—It is stated that bids are wanted Apr. 10 for constructing the So. 15th St. sewer system. C. Manch, Pres. Bd. Improv.; R. E. Williams, Engr., Rm. 711, La Salle St., Chicago.

Terre Haute, Ind.—Bids will be received Apr. 10 by the Bd. of Pub. Wks. for constructing a pipe sewer in a portion of alley between Willow and Osborne Sts. S. C. Beach, Secy.

Rushville, Ind.—Oglesby & Kelley, of Rushville, are stated to have petitioned the Council for a franchise to construct a sewerage system.

Rushville, Ind.—This city contemplates putting in a complete system of sewers.

Dubuque, Ia.—The Council has passed resolutions providing for the extension of 15th and 16th Sts. storm sewers. C. F. Arendt, City Recorder.

Burlington, Kan.—The sewer letting, which was to have been on Apr. 1st, has been postponed, but bids will be asked for later. Engineers, Burns & McDonnell, Postal Telegh. Bldg., Kansas City, Mo.

Olathe, Kan.—Bids will be received Apr. 14 by the City Council for furnishing material and constructing 4,980 ft. 8 to 24-in. pipe sewer and 8 manholes in lateral Dist. No. 2 of main sewer Dist. No. 1. C. F. Garwood, City Clk.

Baltimore, Md.—The Com. on Sewers has reported favorably on the ordinance appropriating $30,000 for the continuation of the Eagle St. sewer through Carroll Park; also for a sewer in the bed of Lanvale St.

Springfield, Mass.—D. J. Curtis & Son are stated to have secured the contract for the year's supply of sewer brick at $8.45 per 1,000, and E. S. Decker & Co. for the year's supply of sewer pipe.

Detroit, Mich.—The Council Sewer Com. is stated to have approved the estimate of $34,000 for a sewer on High St. and $18,000 for the Cadillac Ave. sewer.

Minneapolis, Minn.—Bids will be received Apr. 6 by the Bd. of Co. Comrs. for furnishing about 50 tons 12 to 44-in. iron or steel culvert pipe. Hugh R. Scott, Co. Aud.

Minneapolis, Minn.—The Council Sewers Com. on Mar. 23 voted to recommend the construction of sewers for this season at a cost of $88,547.

Crookston, Minn.—N. A. Hoffard, Co. Aud., writes that the date of opening of bids for constructing Judicial Dist. No. 1 and Polk Co. Drsinage Ditch No. 2 has been postponed to May 2. Bids were to have been opened on Mar. 25.

Kansas City, Mo.—R. J. & J. M. Boyd Const. Co., of Kansas City, has secured the contract for sewer work in Sewer District No. 235 for $8,041.

St. Louis, Mo.—The House of Delegates has passed the Blackstone sewer bill, which carries an appropriation of $120,000 for the construction of the sewer.

Atlantic City, N. J.—A charter has been granted to the Pleasantville Sewerage Co., 1421 Atlantic Ave., Atlantic City; capital, $100,000. Incorporators: Wm. W. Bowker, Louis A. Repetto and Chas. V. O'Donnell.

Newark, N. J.—The Bd. of Wks. has adopted ordinances providing for the construction of sewers in numerous streets.

Trenton, N. J.—Bids will be received Apr. 21 by the Common Council for constructing a sewer in portions of 3 streets. C. Edw. Murray, City Clk.

Summit, N. J.—A press report states that Engr. Ehle, of the joint sewer work, has submitted a report of his investigations and work thus far. It showed that the work inside the city as originally proposed with a pumping station would cost $90,000, and the cost to Summit of tunneling Hobart Gap, a scheme considered in the event of Morristown joining in the joint sewer, would be $200,000, but such a plan would eliminate the pumping station, which would cost about $7,500 per yr. to maintain.

Brooklyn, N. Y.—The following bids were opened Mar. 25 by J. Edw. Swanstrom, Boro. Pres., for sewer in 50th St. between 6th and 8th Aves., etc.—*a*, Albert M. Fragner; *b*, John O'Grady; *c*, Frank J. Gallagher; *d*, McCauley & Somerville; *e*, P. J. Murray:

Brick sewer:	*a*	*b*	*c*	*d*	*e*
42-in., 214 ft..	$7.00	$8.00	$6.96	$7.50	$6.50
36-in., 1,842 ft..	6.00	6.50	6.64	6.50	5.00
30-in., 1,302 ft..	5.00	6.00	5.80	5.50	4.00
15-in. pipe, 90 ft..	2.00	2.00	3.50	2.75	2.50
12-in. pipe, 1,400 ft.	2.20	1.75	2.47	2.50	1.90
41 manholes	33.00	40.00	33.50	50.00	40.00
27 recog. basins..	120.00	100.00	97.50	150.00	140.00
Plank., 28,000 ft..	20.00	20.00	25.00	18.00	20.00
Concr., 5 cu. yds.	7.00	10.00	7.50	5.00	6.00
Br. Mas., 5 cu. yds.	10.00	8.00	9.50	10.00	9.00

Totals: *a*, $27,000; *b*, $29,077; *c*, $29,840; *d*, $31,166; *e*, $24,749.

The following bids were opened Mar. 25 by J. Edw. Swanstrom, Boro. Pres., for sewer in Foster Ave., from E. 9th St. to Flatbush Ave., etc.—*a*, Abbot-Gamble Co.; *b*, John J. Creem; *c*, Michael J. Dady; *d*, J. Chas. Weschler:

Brick sewer:	*a*	*b*	*c*	*d*
132-in., 550 ft.....	$63.00	$50.00	$50.00	$50.00
120-in., 3,860 ft.....	43.50	36.00	44.50	40.00
66-in., 10 ft.	20.00	20.00	20.00	20.00
60-in., "A," 1,100 ft...	9.50	7.00	10.00	15.00
60-in., "B," 50 ft.....	19.00	20.00	20.00	15.00
54-in., 2,670 ft.	10.00	7.00	17.00	10.00
48-in., 10 ft.	10.00	10.00	15.00	10.00
42-in., 40 ft.	9.50	10.00	13.00	10.00
36-in., egg, 2,650 ft....	10.00	5.50	11.00	10.00
36-in., circular, 10 ft..	9.50	10.00	10.00	10.00
30-in., 1,620 ft.	8.50	4.50	8.40	7.00
120-in. concr.-steel, 600 ft.	49.00	40.00	50.00	37.00
18-in. pipe, 100 ft.....	5.00	2.50	4.00	3.00
15-in. pipe, 40 ft.....	5.00	2.00	3.75	3.00
12-in. pipe, 90 ft.....	5.00	2.00	3.50	2.00
Manhole A, 1	350.00	600.00	200.00	600.00
Manholes B, 73	75.00	100.00	90.00	60.00
Manholes C, 3	65.00	35.00	70.00	50.00
Recog. basins, 9	100.00	100.00	100.00	150.00
Planking, 645,000 ft. ...	26.50	20.00	20.00	20.00
Sheeting, 1,340,000 ft. ..	20.00	20.00	12.00	18.00
Concrete, 5 cu. yds.	15.00	5.00	6.50	10.00
Brick masonry, 5 cu. yds.	15.00	10.00	12.00	15.00

Totals: *a*, $363,218; *b*, 289,705; *c*, $378,106; *d*, $330,915.

Bids will be received Apr. 8 by J. Edw. Swanstrom, Pres. Boro. of Brooklyn, for furnishing and delivering, housing and trimming 4,350 bbls. quicklime at the several sewage disposal works in the 26th and 31st Wards.

Cayuga, N. Y.—The citizens are stated to have voted to issue bonds for a main sewer in E. State St.

East Syracuse, N. Y.—The State Senate is reported to have passed the bill legalizing the issue of $50,000 bonds to construct a sewer in this village.

Cleveland, O.—Bids are wanted Apr. 9 for constructing sewers in portions of 5 streets; also Apr. 23 for constructing sewers in portions of 3 streets. Chas. P. Salen, Dir. Pub. Wks.

Bids are wanted Apr. 13 for furnishing and delivering 20,000 lin. ft. 15-in. sewer pipe for the Water Wks. Division of the Dept. Pub. Wks. Chas. P. Salen, Dir. Pub. Wks.

Sandusky, O.—Bids are wanted Apr. 9 for furnishing material and constructing sewers through certain lands. Alex. M. Wagner, City Clk.

Cincinnati, O.—Bids are wanted Apr. 22 for constructing sewers with appurtenances on portions of 4 streets. Robt. Allison, Pres. Bd. Pub. Service.

Zanesville, O.—The City Engr. is reported to have been authorized to prepare plans for a sewerage system in the 7th Ward.

Toledo, O.—Wm. McMahon is stated to have secured the contract for constructing Sewer No. 884, for $7,067.

Tamaqua, Pa.—W. F. Leopold, City Secy., writes that nothing definite has yet been done in regard to constructing a sewerage system and the paving of Broad St. Nels Nelson, Chmn.

Slatington, Pa.—Bids will be received Apr. 13 by John J. Paules for constructing a sewer in a portion of Main St. and Middle alley. G. T. Oplinger, Boro. Engr.

Chattanooga, Tenn.—The Senate has passed the bill authorizing the issue of $200,000 street and sewerage bonds.

Houston, Tex.—F. L. Dormaut, City Engr., is stated to have completed plans for a sewerage system for the 3d and 4th Wards, which will require the laying of about 10 miles of pipe.

Ogden, Utah.—On Mar. 26 the City Council passed a notice of intention to build 38 ½ blocks of sewer, at an estimated cost of $55,000. A. F. Parker, City Engr.

Alexandria, Va.—The Council is reported to have passed the resolution providing for an appropriation of $6,000 for the construction of a sewer under Royal St.

Spokane, Wash.—Plans for sewerage work involving an extension of underground drainage to the North Side have been completed by City Engr. A. F. Gill and filed with City Council; the cost of the improvement is estimated at about $90,000.

Tomah, Wis.—Bids will be received until May 15 by the Lemonweir River Drainage Dist. of Monroe and Juneau Counties, for digging for the mains and laterals for said district. Address Wm. S. Fryer, Tomah.

Green Bay, Wis.—The City Council is stated to have decided to expend about $65,000 for improvements to sewers.

La Crosse, Wis.—See "Water."

Cheyenne, Wyo.—About 3,000 ft. of sewers will be laid in the spring. W. D. Pease, City Engr.

Ft. D. A. Russell, Wyo.—Bids will be received by Capt. W. S. Scott, Constructing Q. M., Cheyenne, Wyo., until May 1 for furnishing material and laying about 1,850 ft. of 6-in. sewer at Ft. D. A. Russell.

Woodstock, Ont.—The citizens are reported to have voted to expend $20,000 for the construction of a trunk sewer for the southern portion of the city and for the installing of the septic tank system of sewage disposal.

BRIDGES.

Los Angeles, Cal.—See "Sewerage and Sewage Disposal."

New Haven, Conn.—The Secy. of War has authorized the construction of a stationary bridge, 15 ft. above water, at Kimberly Ave., estimated to cost $160,000.

Burnside, Conn.—Engr. C. Henry Olmstead is surveying and preparing plans for a stone arch bridge, to be built across Hockanum River at Fobes St., for which an appropriation of $10,000 was made, at a recent town meeting.

Washington, D. C.—The following bids were opened on Mar. 27 at the U. S. Engr.'s Office, Washington, for the construction of a highway bridge across Potomac River at Washington—A. Penn Bridge Co., Beaver Falls, Pa., $1,315,300; B, Arthur McMullen, New York, N. Y., $1,091,210; C, Pennsylvania Steel Co., Philadelphia, Pa., $1,109,000; D, Scherzer Rolling Lift Bridge Co., Chicago, Ill., $985,000, $980,000, and $990,000. The Scherzer bids were not in accord with specifications, and will probably not be considered. The bids on miscellaneous items were as follows: Dredging, per cu. yd., A, 50 cts.; B, $1; C, $1.05; D, 75 cts. Foundation piles in place, per lin. ft., A, 50 cts.; B, 30 cts.; C, 22 cts.; D, 35 cts. Fender piles in place, lin. ft., A, 40 cts.; B, 30 cts.; C, 25 cts.; D, 35 cts. Yellow pine timber in place, per M. ft., A, $65; B, $40; C, $40; D, $50. Concrete, per cu. yd., A, $8; B, $8; C, $8; D, $8 and $10. Squared granite backing, per cu. yd., A, $28; B, $25; C, $32; D, $20. Rock face granite ashlar, per cu. yd., A, $32; B, $30; C, $32; D, $27.

Rock Island, Ill.—Plans and specifications are being prepared for a 50-ft. span, pony lattice bridge, to be erected over the Canal at Hake's Island. Wallace Treichler, City Engr.

Chicago, Ill.—E. G. Shumway, Secy. South Park Comrs., writes that the designs of P. J. Weber, 277 Dearborn St., were selected for a bridge to be constructed in Jackson Park.

Randolph, Ill.—Press reports state that the Chicago Great Western Ry. will expend about $3,000,000 in improvements this season, including nearly $400,000 for replacing wooden bridges with steel structures, improvements in the yards at Randolph, and general extensions of sidings and yard facilities. F. R. Coates, Ch. Engr., St. Paul, Minn.

Decatur, Ill.—It is stated that a $6,000 bridge is to be built across Sangamon River.

Spencer, Ind.—Bids will be received Apr. 22 by the Bd. of Co. Comrs. for constructing an iron wagon bridge across White River, between Owen and Monroe Counties. Geo. East, Secy.

Indianapolis, Ind.—It is stated that bids are wanted by the Co. Comrs. until Apr. 16 for constructing 6 bridges in this county.

Covington, Ind.—Bids will be received Apr. 17 by the Bd. of Co. Comrs. for constructing 4 iron bridges, 1 across Coal Creek, to be 150 ft. long, with a 16-ft. roadway. Geo. A. Law, Chmn.

Marshalltown, Ia.—Mayor Jones has appointed Councilmen Greene, Webster and Kirby as a committee of three with power to employ an engineer to work with the City Engr. and prepare plans and specifications for the Central St. viaduct.

Bangor, Me.—Mayor Beal in his inaugural address mentioned the need of an additional bridge across Kinduskeag Stream, from Broad St. to Exchange St. If constructed will be a steel truss, draw span structure, about 250 ft. in length.

Flintstone, Md.—Bids will be received Apr. 15 by the Co. Comrs. for constructing a steel and cement bridge. D. P. Le Fevre, Co. Engr., Cumberland.

Sharpsburg, Md.—The Norfolk & Western R. R. Co., it is stated, will this summer replace the iron bridge across Potomac River, between Sharpsburg and Shepherdstown, W. Va., with a stone structure. C. S. Churchill, Ch. Engr., Roanoke, Va.

Newton Center, Mass.—See "Railroads."

Salem, Mass.—Bids will be received Apr. 10 by the Com. on Jefferson Ave. Bridge, for constructing a steel bridge over the tracks of the Boston & Maine R. R. at Jefferson Ave. C. H. Danforth, Clk.

Jackson, Mich.—Local press reports state that the Bd. of Pub. Wks. has been authorized to receive bids, including plans and specifications, for a concrete bridge to be built at E. Main St.

Grand Rapids, Mich.—Bridge bonds amounting to $50,000 have been sold.

Plainwell, Mich.—E. J. Tobin & Co., of Jackson, are reported to have secured the contract for constructing a cement concrete bridge across Kalamazoo River, in this city, at $20,500.

Saginaw, Mich.—Competitive plans will be received Apr. 16 by the Bd. of Pub. Wks. for constructing a full deck lift bridge to be built at Genesee Ave., to have a 90-ft. clear span and 40-ft. roadway. R. W. Roberts, City Engr.

Bloomington, Neb.—It is stated that bids will be received by the Co. Comrs. at Lincoln until Apr. 21 for constructing a steel bridge across Republican River, south of Bloomington. John Parker, Co. Clk.

Tintonfalls, N. J.—The Co. Bd. of Freeholders has decided to build an iron bridge across the dam at Tintonfalls, at a cost of between $6,000 and $8,000.

Delaware, N. J.—It is stated that the Delaware, Lackawanna & Western R. R. Co. is having plans prepared for a bridge to be built across Delaware River, in Delawnre, at a probable cost of $100,000.

Elizabeth, N. J.—F. R. Long & Co., of Hackeusack, are reported to have secured the contract for constructing a concrete steel arch bridge at Irvington Ave., for $7,212.

New York, N. Y.—Bids will be received Apr. 9 by Gustav Lindenthal, Comr. of Bridges, for furnishing material and plant necessary to construct the masonry pedestals on top of the tower foundations of Manhattan Bridge No. 3, in the Boroughs of Manhattan and Brooklyn. Cost, according to report, about $200,000.

Amsterdam, N. Y.—Reports state that plans are being prepared in the State Engr.'s Office for a lift bridge to be built at Church St., in this village.

Kingston, N. Y.—Press reports state that the West Shore R. R. Officials will in the near future construct a viaduct across Rondout Creek, near Wilbur. The structure will 1,228 ft. long; flooring, 155 ft. above water, and to cost about $175,000.

Troy, N. Y.—Local press reports state that a bill is before the Legislature authorizing the incorporation of the Troy & Colonie Bridge Co., for the purpose of constructing and maintaining a toll bridge over Hudson River, from Hutton St., Troy, to some point in the village of Green Island. Incorporators: Benhart Marks, William V. R. Irving, John N. Blais, F. W. Battershall and others.

Mt. Vernon, O.—Press reports state that bids will be received Apr. 15 by the Co. Aud. for $40,000 bridge bonds.

Cleveland, O.—Bids will be received Apr. 18 by the Co. Comrs. for furnishing material and constructing a masonry arch bridge over Euclid Creek in Euclid Township. J. C. Dorn, Clk.

Dayton, O.—Bids are wanted Apr. 25 for furnishing material for constructing the masonry abutments; also for constructing the bridge across Wolf Creek in Madison Township. T. J. Kauffman, Co. Aud.

St. Marys, O.—The Newcastle Bridge Co., Newcastle, Ind., is reported to have received the contract for constructing a bridge at South St., for $9,148.

Steubenville, O.—Plans and specifications have been filed with the Secy. of War by the Steubenville Bridge Co., for the bridge to be built by said Co. across Ohio River at Steubenville.

Columbus, O.—It is stated that the Pittsburg, Cincinnati, Chicago & St. Louis R. R. Co. proposes to build a viaduct at Reed Ave., this city. E. B. Taylor, 4th Vice-Pres., Pittsburg, Pa.

Dayton, O.—F. M. Turner, City Engr., has been directed to prepare an estimate for a railroad bridge across Lexington Ave., 50 ft. in length.

The City Engr. has been instructed to prepare plans and specifications for the approaches to the new Main St. bridge. The bridge is to be paved by the People's Ry. Co. Frank Nusbaum, Ch. Engr., P. Ry. Co., Dayton, O.

Asher, Okla. Ter.—A bill has been signed by the Governor authorizing the building of a bridge across So. Canadian River, in this city.

Wilkesbarre, Pa.—City Engr. Ingham is preparing plans for a bridge to be constructed between North Wilkesbarre and the East End.

Philadelphia, Pa.—According to local press reports the contract for constructing a bridge across the P. & R. R. R. tracks, at 17th St., and also for constructing 1 across the Richmond branch of the P. & R. R. R. tracks, at Stockley Ave., has been secured by McGraw & Gray. For list of bids received see The Engineering Record of Mar. 28.

Beaver, Pa.—The Beaver Falls & New Brighton Bridge Co. has been incorporated to build bridges across Beaver Creek in Beaver Co. Capital, $20,000. Incorporators: W. A. Park, of Rochester; Richard S. Holt, of Beaver; John Warren, of Beaver Falls, and others.

Nanticoke, Pa.—It is stated that the Pennsylvania R. R. Co. is contemplating the building of a bridge below the present bridge at Nanticoke. W. H. Brown, Ch. Engr., Philadelphia, Pa.

McKeesport, Pa.—It is stated that City Engr. Frank F. Hallam, of McKeesport, in conjunction with the Pittsburg, McKeesport & Connellsville St. Ry. Co., is completing arrangements for the construction of a $20,000 steel viaduct across White St., to replace present wooden structure.

Providence, R. I.—It is proposed to construct a highway bridge over R. R. tracks. One abutment built. Bids for the other will be asked for by the Comrs. of Pub. Wks. Superstructure will be built by N. Y., N. H. & H. R. R. Co. C. M. Ingeraoli, Jr., Ch. Engr., New Haven, Conn.

Chamberlain, S. D.—Articles of incorporation have been filed with the Secretary of State by the Missouri River Bridge Co., at Chamberlain, for the purpose of constructing and maintaining either a pontoon or stationary bridge across the river at that point. Capital, $25,000. Incorporators: W. L. Montgomery, of Chamberlain; John H. Keene, of Kirkwood, Ill., and others.

Houston, Tex.—Local press reports state that the building of a bridge across the bayou, at either Main or Travis St. is being considered. If built at Main St., the cost, according to the City Engr., will be about $200,000.

Roby, Tex.—Reports state that it has been voted to issue $19,000 bonds for bridge purposes.

Spokane, Wash.—It is reported that the Co. Comrs. and the City Officials are considering the building of a bridge across Latah Creek, at a cost of $86,000, instead of a $26,000 wooden bridge, as at first proposed.

Fredericton, N. B.—Bids will be received until May 18 by the Dept. of Pub. Wks., at Fredericton, for building the steel superstructure of Oromocto highway bridge, in Lincoln Parish, Sunbury Co., N. B. C. H. LaBillois, Ch. Comr.

Hamilton, Ont.—See "Water."

PAVING AND ROADMAKING.

Fresno, Cal.—It is proposed to pave 5 blocks with asphalt. I. Tellman, City Engr.

Vallejo, Cal.—It is stated that bids are wanted Apr. 26 for paving 6,000 sq. yds. with asphalt. A. P. Noyes, City Engr.

Hoopeston, Ill.—This city proposes to lay about 25,000 yds. of brick paving.

North Manchester, Ind.—Grossnickle & Bridges are stated to have received the contract for a mile of brick paving. Probable cost, $50,000.

Richmond, Ind.—The City Council contemplates paving with brick on portions of North D St. and Ft. Wayne Ave.

Terre Haute, Ind.—Bids are wanted Apr. 14 for improving certain streets and laying cement walks. S. C. Beach, Secy. Bd. Pub. Wks.

Marion, Ind.—It is stated that bids are wanted by the Council until Apr. 14 for paving 16,000 sq. yds. with brick and until May 5 for paving 45,000 sq. yds. with brick. T. E. Petrie, City Engr.

Cedar Rapids, Ia.—The City Council has passed a resolution providing for the paving of a portion of 1st Ave. with asphalt. Geo. L. Mentzer, City Recorder.

Boone, Ia.—About 3,000 yds. brick paving will soon be considered by City Council. Chas. D. Russell, City Engr.

Waterloo, Ia.—Local press reports state that bids will be received by the City Council until Apr. 10 (readvertisement) for paving with brick on portions of several streets, in all about 70,000 sq. yds. H. C. Schultz, City Clk.

Atchison, Kan.—Bids will be received Apr. 10 for paving South 6th St. About 25,000 cu. yds. grading, 10,700 lin. ft. cement curbing, 5½x20 in., 15,900 sq. yds. 2 course brick paving on sand foundation will be required. Fred. Giddings, City Engr.

Louisville, Ky.—It is stated that bids are wanted Apr. 20 for paving with asphalt on a portion of E. 11th St. J. B. F. Breed, City Engr.

Shreveport, La.—The City Council has voted favorably on the proposition to expend $533,000 in street paving.

Portland, Me.—Geo. N. Fernald, Comr. Pub. Wks., writes that the contract for furnishing about 6,870 sq. yds. granite paving blocks (bids opened Mar. 25) has been awarded to Maine & New Hampshire Granite Co., of Portland, at $1.30 per sq. yd. Total bid, $8,921.

Annapolis, Md.—See "Government Work."

Medford, Mass.—$15,000 has been appropriated for the construction of Playstead Road, a parked roadway 90 ft. wide. Wm. Gavin Taylor, City Engr.

Lansing, Mich.—Bids are wanted Apr. 13 for paving Franklin Ave. with brick about 1,350 ft. on a gravel foundation. H. A. Collar, City Engr.

Crystal Falls, Mich.—The Council is reported to have under consideration the purchase of a stone crushing plant.

Kalamazoo, Mich.—Bids are wanted Apr. 17 for paving portions of South and Park Sts. and Park Pl. with Trinidad sheet asphalt, in all about 22,820 yds. John De Visser, City Clk.

St. Paul, Minn.—Bids will be received Apr. 6 by the Bd. of Pub. Wks. for paving with asphalt on a portion of 6th St., estimated to cost $22,783; also grading portions of Hawthorn Ave. R. L. Gorman, Clk.

The Bd. of Pub. Wks. has approved the paving of a portion of 3d St., at an estimated cost of $13,000.

Duluth, Minn.—City Engr. Patton estimates the cost of paving on a portion of E. Superior St. as follows: Vitrified brick, $33,378; tar macadam, $34,486; sheet asphalt, $42,340.

St. Louis, Mo.—Bids will be received Apr. 14 by the Bd. of Local Improv. for grading, curbing with granite, reconstructing and paving with bituminous macadam portions of 9 streets. Hiram Phillips, Pres.

Jersey City, N. J.—Bids will be received Apr. 7 by the Bd. of Street and Water Comrs. for grading and improving, by laying about 51,000 sq. ft. cement walk, in Lafayette Park; also for improving by paving with about 2,425 sq. yds. asphalt a portion of Harrison Ave. Geo. T. Bouton, Clk.

The Street and Water Bd. has adopted specifications, prepared by Ch. Engr. Van Keuren, for asphalting Harrison Ave., from Bergen Hill to the Boulevard.

Union Hill, N. J.—The Council is considering paving a portion of Blum Pl., and has authorized the Town Engr. to prepare plans and specifications for paving a portion of Lekis St.

Newark, N. J.—Local press reports state that the following were the lowest bids received Mar. 26 for paving on portions of several streets: Barber Asphalt Paving Co., with asphalt on Irving and Ann Sts., at $9,664 and $12,000 respectively; with brick on the same streets, Newark Paving Co., at $10,276 and $12,661 respectively; J. R. Shanley, using granite on the 3 following streets: Hartford St. at $13,422, Madison Ave., $22,579, and Hoyt St., $10,376; Van Buren St., Jas. Seme, with granite at $12,618.

Schenectady, N. Y.—C. W. Trumbull, City Surveyor, writes that the following bids for grading, curbing and paving State St. were received by Common Council Mar. 25: Northern N. Y. Asphalt Paving Co., of Troy, $22,400; Schenectady Contracting Co., Schenectady, $21,500 (awarded contract). The successful bidder bid for brick and asphalt pavement, each $2.20 per sq. yd. and 92½ cts. per lin. ft. for curb.

Solvay, N. Y.—Press reports state that bids will be received Apr. 20 for $50,000 sidewalk bonds.

Brooklyn, N. Y.—The following bids were opened Apr. 1 by J. Edw. Swanstrom, Boro. Pres., for granite block pavt. (tar and gravel joints) on concrete foundation—*a*, Sterling Constr. Co.; *b*, J. Chas. Weschler; *c*, Dennis Norton; *d*, John O'Grady; *e*, Wm. Fitzgerald; *f*, M. F. Hickey; *g*, Haley & Keegan:

Meserole St.—Union Ave. to Waterbury St.

Bidders.	Granite, sq. yds.	Relay, sq. yds.	Concr., cu. yds.	N. curb, ft.	O. curb, ft.	N. bridge-stone, sq. ft.	O. bridge-stone, sq. ft.
	7,690	*40*	*1,620*	*6,770*	*350*	*450*	*170*
a	$2.85	$0.30	$4.80	$0.90	$0.30	$0.80	$0.10
b	2.90	.50	5.50	1.10	.60	.90	.50
c	2.90	.30	5.50	.88	.30	.80	.20
d	3.00	.01	5.00	.85	.01	.85	.01
e	2.69	.10	3.98	.80	.10	.50	.05
Prospect Ave.—7th to 11th Aves.							
	14,960	*20*	*2,780*	*1,800*	*4,390*	*770*	*200*
a	$2.78	$0.30	$4.90	$0.90	$0.30	$0.80	$0.10
f	2.75	.40	5.00	.90	.35	.90	.30
c	2.75	.10	3.98	.85	.25	.65	.10
e	2.85	.30	5.50	.88	.30	.78	.20
Ralph Ave.—Macon St. to St. Mark's Ave.							
	8,690	*160*	*1,775*	*6,320*	*390*	*1,590*	*600*
b	$3.10	$0.50	$6.00	$1.00	$0.70	$1.00	$0.50
c	3.25	.10	4.25	.90	.30	.80	.10
c	2.88	.30	5.75	.93	.30	.80	.20
a	2.97	.30	5.25	.90	.30	.80	.10
Green St.—West St. to end of pavt.							
	7,900	*30*	*1,565*	*4,350*	*480*	*330*	*120*
b	$3.00	$0.50	$6.00	$1.00	$0.70	$0.80	$0.50
e	2.67	.10	3.75	.80	.18	.70	.05
d	2.90	.01	5.00	.85	.20	.90	.20
c	2.85	.30	5.50	.93	.30	.80	.20
g	3.25	.60	5.20	.90	.30	.80	.40
a	2.85	.30	5.00	.90	.30	.80	.10

Brooklyn, N. Y.—The following bids were opened Apr. 1 by J. Edw. Swanstrom for wood block pavt. on concrete found. in Butler and other streets—*a*, U. S. Wood Preserving Co. (total, $59,564.50); *b*, Eppinger & Russell Co.:

Bidders.	3" wood pavt., 1,390 sq yds.	4" wood pavt., 14,500 sq. yds.	Relay, 180 sq. yds.	Concrete, 2,600 cu. yds.	N. curb, 6,320 ft.	O. curb, 2,070 ft.	Man. covers, 45.
a	$1.75	$2.20	$0.35	$6.95	$0.90	$0.40	$20.
b	2.05	2.40	.25	7.00	.85	.42	18.

The following bids were opened at the same time for asph. block pavt. on concrete found.—*a*, Hastings Pavt. Co.; *b*, Continental Asph. Pavg. Co.:

26th St.—3d to 5th Aves.

Bidders.	Asph. bl., sq. yds.	Adj. pavt., sq. yds.	Concr., cu. yds.	N. curb, ft.	O. curb, ft.	Covers.	Totals.
	4,720	*20*	*740*	*2,430*	*400*	*15*	
a	$1.66	$0.40	$6.00	$0.98	$0.45	$15.	$15,070
b	1.69	.40	6.40	.95	.43	15.	..
Bushwick Ave.—Montrose Ave. to McKibben St., etc.							
	5,750	*110*	*900*	*3,200*	*170*	*2*	
a	$1.74	$0.40	$6.00	$1.00	$0.45	$15.	$18,756
b	1.69	.40	6.40	.95	.43	15.	18,665

Brooklyn, N. Y.—The following bids were opened Apr. 1 by J. Edw. Swanstrom, Boro. Pres., for Medina sandstone pavt. (cement joints) on concrete foundation—*a*, Interstate Pavg. Co.; *b*, James Quinn; *c*, C. Chas. Weschler; *d*, George & Farrell; *e*, Dennis Norton; *f*, John O'Grady:

Kingsland Ave.—Meeker to Meserole Aves., etc.

Bidders.	Med. pavt., sq. yds.	Relay, sq. yds.	Concrete, cu. yds.	N. curb, 5,770 ft.	O. curb, 960 ft.	Med. brge. stone, sq. ft.	O. brgstone, sq. ft.
	15,430	*90*	*2,920*	*5,770*	*960*	*1,850*	*570*
a	$2.65	$0.30	$6.25	$0.85	$0.30	$0.85	$0.35
b	2.74	.10	4.85	.98	.25	.85	.25
e	3.00	.50	6.00	.70	1.00	1.50	.50
d	2.84	.35	6.00	.95	.50	.70	.20
c	2.95	.30	5.75	.93	.30	.85	.20
Cook St.—Manhattan Ave. to Bogart St., etc.							
	12,820	*150*	*2,490*	*6,920*	*700*	*1,730*	*400*
f	$2.85	$0.20	$5.00	$0.90	$0.20	$0.85	$0.20
c	2.90	.50	5.50	.90	.60	.90	.50
e	2.95	.30	5.75	.93	.30	.85	.20
a	2.65	.30	6.25	.85	.30	.85	.35
Degraw St.—Van Brunt St. to East River, etc.							
	7,630	*80*	*1,550*	*5,350*	*110*	*1,240*	*370*
c	$3.10	$0.50	$6.00	$1.00	$0.70	$1.00	$0.50
e	2.90	.30	5.50	.88	.30	.80	.20

New York, N. Y.—Bids will be received Apr. 14 by Jacob A. Cantor, Pres. Boro. Manhattan, for regnisting, grading and paving 23,650 sq. yds. with bitulithic pavement.

New York, N. Y.—Bids will be received Apr. 9 by Edw. M. Grout, Compt., for $2,500,000 bonds, to be expended as follows: Dept. of Docks and Ferries, $1,000,000; repaving of streets, $1,000,000; rapid transit railroad, $500,000.

Bids will be received Apr. 9 by the Bd. of Park Comrs. for paving with 7,145 sq. yds. asphalt the walks in St. Mary's, Melrose and McComb's Dam Parks, Boro Bronx. Wm. R. Willcox, Chmn.

Niagara Falls, N. Y.—Local press reports state that the Warren Bros. Bituminous Macadam Paving Co. has received the contract for paving Niagara Ave., at $14,000.

Newburgh, N. Y.—Everett Garrison, City Engr., writes that the following bids were received Mar. 23 for furnishing material and paving with brick and macadam on Bway.—*a*, The Russell Contracting Co., N. Y. City (awarded contract); *b*, F. A. Mslette, Geneva, N. Y.; *c*, Miles-Fehr Contracting Co., Easton, Pa; *d*, Frank Pidgeon, Saugerties, N. Y.; *e*, Michael F. Dollard, Albany, N. Y.:

Bidders	Brick paving. 1—5,000 sq. yds.	2—800 sq. yds.	3—3,150 sq. yds.	4—800 sq. yds.	Telford macadam, 15,000 sq. yds.	Macadam grouted, 1,000 sq. yds.	New curb, 4"x16", 3,100 ft.	New curb, 5"x20", 1,200 ft.	Total.
a	$2.838	$2.76	$2.70	$2.63	$1.25	$0.184	$0.53	$0.67	$50,052
b	2.63	2.59	2.70	2.61	1.28	0.30	0.74	1.02	50,601
c	2.81	2.71	2.69	2.58	1.23	0.55	0.80	0.98	51,430
d	2.58	2.48	2.58	2.48	1.75	1.60	0.85	0.95	59,143
e	2.79	2.70	2.79	2.79	1.65	1.85	0.90	1.15	59,493

1—6-in. Port. cem. conc. foundation, cemented joints; 2—same, sand joints; 3—8-in. grouted Telford found., cemented joints; 4—same, sand joints.

Rochester, N. Y.—The lowest bid received, according to local press reports, for paving with trap rock macadam in Central Park was from H. N. Cowles at $30,763. Engr.'s estimate, $27,000. Bids were also received on brick and asphalt pavement—Whitmore, Rauber & Vicinus being the lowest on brick, at $30,189, and the Rochester Vulcanite Co. on asphalt, at $28,797.

Syracuse, N. Y.—The City Engr. intends laying about 6 miles of brick and asphalt pavement.

Seneca Falls, N. Y.—The Bd. of Superv. has authorized the issue of $6,000 bonds for the purpose of building a road between this village and Waterloo. Total cost, $12,000, the State to pay the remaining $6,000.

Salem, O.—Bids are wanted Apr. 17 for $10,500 paving bonds; also Apr. 18 for paving with asphalt block portions of 3 streets. Geo. Holmes, City Clk.

Glenville, O.—Bids are wanted Apr. 15 for grading and paving with asphalt or bituminous macadam on a portion of St. Clair St. B. F. Davies, Jr., Village Clk.

Cincinnati, O.—Evan Evans is reported to have secured the contract for paving on a portion of Hill St., at $12,444.

The Bd. of Pub. Service has passed a resolution to improve Grandin Road from Madison Ave. to the southeastern terminus at an estimated cost of $9,400.

Plans and specifications have been adopted by the Bd. Pub. Service for street and sewer improvements in Dorsey St. It will be paved with brick. Total cost, $13,587.

Chester, Pa.—Bids will be received Apr. 6 by C. G. Neal, Chmn. Com. on Sidewalks, for curbing and paving the city pavements.

Tamaqua, Pa.—See "Sewerage and Sewage Disposal."

Lansdowne, Pa.—Bids will be received Apr. 10 by H. L. Warren, Boro. Secy., for grading, macadamizing or telfording with stone portions of 6 streets; also for constructing a culvert on Windermere Ave. Robt. P. Green, Boro. Engr., No. 1226 Stephen Girard Bldg., Philadelphia.

Erie, Pa.—Local press reports state that bids received Mar. 21 for paving with brick on 16th St. have been rejected, the lowest being $14,950, and considered too high. It is also stated that new bids will be received until Apr. 6. Benj. E. Briggs, City Engr.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Seguin, Tex.—A bill has passed the Legislature authorizing the Guadalupe Co. to issue $50,000 bonds for road purposes.

Galveston, Tex.—It is proposed to lay 27,300 sq. yds. of vitrified brick—18,500 sq. yds. to be laid by contract and 8,800 sq. yds. by day labor. C. G. Wells, City Engr.

Salt Lake City, Utah.—According to local press reports the City Engr. will soon receive bids for paving with asphalt on a portion of Brigham St.

Norfolk, Va.—It. E. Steed, Committee Clk., writes that it was voted Mar. 24 to issue $140,000 bonds for street improvements in the 7th Ward.

La Crosse, Wis.—The City Council will, according to reports, lay street paving, to cost about $13,000.

Brandon, Man.—See "Water."

Winnipeg, Man.—Contracts for asphalt for street paving bids opened Mar. 3 have been awarded as follows: To the U. S. & Venezuela Co., New York, N. Y., from 100 to 200 tons Venezuela Lake at $30.50 per ton; the Warren Bituminous Paving Co., Toronto, Ont., from 100 to 200 tons "Acme" at $27 per ton, and Isaac Anderson, Buffalo, N. Y., from 100 to 200 tons "Angelos" at $25.10 per ton, all f. o. b. cars, Winnipeg.

Stratford, Ont.—Bids will be received Apr. 16 by Angus Smith, City Engr., for constructing about 2¾ miles of broken-stone roadway.

Hamilton, Ont.—See "Water."

Montreal, Que.—Bids will be received Apr. 9 by L. O. David, City Clk., for furnishing and delivering refined artificial asphalt and carbonate of lime, or lime dust required by the Road Com. during the year 1903.

POWER PLANTS, GAS AND ELECTRICITY.

San Francisco, Cal.—Local press reports state that the Mutual Electric Co. will construct new power plant on Folsom and Spear Sts.

Whitewater, Colo.—Haskell & Schwalbach, of Grand Junction, are reported to have prepared plans for a power dam to be constructed at Whitewater.

Atlanta, Ga.—Local press reports state that 2 bids, one from J. F. Lester and the other from the Georgia Ry. & Electric Co. were received by Council Mar. 23. Mr. Lester's bid provided for the construction of a $450,000 electric light plant. By yearly payments in 15 yrs. the city is to own this plant. The Georgia Ry. & Electric Co. agreed to furnish lights under contract as follows: 1 yr., arc lights at $110 ea.—incandescents, $49.75: 3 yrs., $82.50 and $33.75, and 7 yrs., $79.50 and $21.75.

Decatur, Ill.—It is stated that the Decatur Gas & Electric Co. will install a heating plant.

Indianapolis, Ind.—The Indianapolis Gas Co. will soon replace its artificial gas plant on S. Pennsylvania St. with an immense plant, to be constructed near North Indianapolis. John R. Pearson, Gen. Mgr.

Noblesville, Ind.—The City Council is stated to have granted a franchise to Thos. Griffin to construct an electric light plant.

Mapleton, Ia.—It is reported that J. R. Welch and others propose constructing a gasoline light and heating plant.

Jewell, Ia.—F. G. Snyder & Co. will install a gas plant at once, according to reports.

Guthrie, Ky.—According to reports this town is anxious to secure an electric light plant, and offers a bonus of $1,000 cash, lease a site upon which to erect said plant for 20 yrs. without consideration, release the plant from municipal taxes for 5 years and a 20-yr. franchise free. R. F. Warren, Town Clk.

Bowling Green, Ky.—Jackson & Omberg, of Dyersburg, Tenn., are reported to have been employed to prepare plans, estimates, etc., for an incandescent electric light plant in conjunction with the street lighting system already being operated by the city.

Harrodsburg, Ky.—J. H. Cochran, of Louisville, is stated to have been employed by City Council to prepare plans for an electric light plant to cost $18,000.

Clinton, La.—The Town Council is stated to have granted the Clinton Electric Light & Ice Co. a franchise to establish an electric light and ice plant.

New Orleans, La.—The City Council has passed an ordinance authorizing Comptroller Tujague to advertise for bids for the construction of a municipal electric lighting and power plant. This means that the city proposes to light the streets and provide power for the public buildings by electricity generated in its own plant.

Annapolis, Md.—The Independent Electric Light & Power Co. is about to petition the City Council for a franchise. H. Lewensohn, of Baltimore, is the promoter and manager.

Marlboro, Mass.—The Marlboro Gas Light Co. has petitioned the State Bd. of Gas and Electric Light Comrs. for permission to increase its capital $25,000 for improvements and extensions.

River Rouge, Mich.—The Council is reported to have appointed a committee to investigate the question of constructing an electric light plant.

Ishpeming, Mich.—The Negaunee & Ishpeming St. Ry. & Electric Co. is about to erect here another gas holder. A. B. Miner, Mgr., Ishpeming.

Buhl, Minn.—The citizens are reported to have voted to construct an electric light plant.

Fairfax, Minn.—The citizens are reported to have voted to issue $20,000 bonds for an electric light plant and city hall.

Caledonia, Minn.—The citizens are reported to have voted to establish a city lighting plant.

Duluth, Minn.—See "Water."

Winona, Minn.—The Winona Ry. & Light Co. is reported to have decided to expend about $100,000 in improvements, which will include the rebuilding of the present lighting and power plant.

Jackson, Miss.—The Dirs. of the Jackson Light Co. will soon let contracts for the construction of its plant. This company was recently incorporated with a capital of $25,000.

Vicksburg, Miss.—A correspondent writes that the Vicksburg Sanitarium will install a small electric light and heating plant. H. M. Street, of Vicksburg, is reported interested.

Vicksburg, Miss.—See "Electric Railways."

St. Louis, Mo.—Local press reports state that the North American Co., now controlling the Laclede Gas Co., will extend the mains to all parts of the city, expending about $2,000,000 in improvements.

St. Joseph, Mo.—The Fin. Com. of Council is in favor of voting $200,000 bonds this summer to be used in extending the capacity of the city electric light plant.

Rockport, Mo.—See "Water."

Great Falls, Mont.—Bids are wanted Apr. 20 for furnishing, delivering and installing electrical fixtures, including lamp posts, chandeliers, brackets, newel lights, lamps, etc., for the court house. Fred. L. Hill, Clk., Bd. Co. Comrs.

Plattsmouth, Neb.—The City Council is stated to have granted Chas. C. Parmele a franchise for a plant to manufacture electric light, gas and heat.

Buffalo, N. Y.—The Frontier Electric Lighting Co., of Buffalo, formed by interests connected with the Buffalo Gas Co., was incorporated Mar. 26 to operate in Buffalo and the towns of Tonawanda, Cheektowaga and West Seneca; capital, $800,000. Directors: Alex. C. Humphries and Stephen Peabody, of N. Y. City; Howard L. Clark, of Providence, R. I.; Robt. L. Fryer, of Buffalo, and others.

Binghamton, N. Y.—Archt. I. G. Perry, 3 Chenango St., estimates the cost of the county heating and lighting plant at $16,766.

Brocton, N. Y.—The citizens are stated to have voted Mar. 7 to construct an electric light plant at a cost of about $10,000.

St. Regis Falls, N. Y.—The St. Regis Light & Power Co. has been incorporated with a capital of $50,000. Directors: W. T. O'Neil and W. B. Babcock, of St. Regis Falls.

Rochester, N. Y.—Bray & Alhaugh, of Rochester, are stated to have secured the contract for building a storage dam across Oak Orchard Creek ravine, for A. L. Levett, which is to develop 3,000-H.-P., for electric transmission.

Batavia, N. Y.—The Horseshoe Lake Improvement Co. has been incorporated, with a capital of $250,000, by Chas. D. Hodges, of Batavia; Chas. L. Hunt, of Rochester, and others. It proposes buying real estate, including Horseshoe Lake and Seven Springs, the construction of water works to supply this village, to develop electricity, to operate a refrigerating plant and ice machine, and to establish a health and amusement resort.

New York, N. Y.—Bids will be received Apr. 9 by the Park Bd. for erecting a new wing for a heating, power and electric light plant for the American Museum of Natural History. Wm. R. Willcox, Chmn. Bd. of Park Comrs.

The People's Illuminating Co. has been incorporated to supply electricity in Manhattan and the Bronx boroughs; capital, $25,000. Directors: C. C. Freeman and H. C. Eldert, of Brooklyn, and W. L. Worrall, of New York.

Hammondsport, N. Y.—The citizens are stated to have voted to light the village by electricity at $1,350 per yr.

Garden City, L. I., N. Y.—The Corporate Electric Co. has been incorporated, with a capital of $300,000, to manufacture electricity for light, heat and power purposes in Garden City and the five boroughs of New York City. Directors: Harold S. Recknagel and Walter L. Worrall, of New York, and C. C. Freeman and Henry C. Eldert, of Brooklyn.

Cooperstown, N. D.—W. F. Ballard and Frank J. Becker are stated to have secured a franchise for an electric light plant.

Edgerwood, N. D.—Ralph Maxwell is stated to have petitioned for a franchise for an electric light plant.

Dayton, O.—The stockholdera of the Miami Valley Gas & Fuel Co. are stated to have authorized the directors to investigate at once and negotiate propositions with detailed plans, specifications and cost of constructing a plant to manufacture gas to meet the demand of consumers in Dayton.

Cincinnati, O.—The Dirs. of the Cincinnati Gas & Electric Co. have decided to increase the capital of the company $1,000,000. The new stock will be sold by the company, as the money is needed to pay for extensions and improvements.

Sandusky, O.—The City Council has granted the Logan Natural Gas & Fuel Co. a franchise to lay and maintain a system of gas pipes in Sandusky.

Eugene, Ore.—The Lane County Electric Co. has been incorporated, with a capital of $100,000, by D. A. Paine, J. F. Robinson, and others. This company absorbs the Eugene Electric Light Co., and proposes establishing an electric plant at Springfield to generate electricity to supply light for Springfield and Eugene.

North Yamhill, Ore.—F. L. Trullinger writes that bids will be received in June for an electric power plant, to cost about $15,000.

Mifflinburg, Pa.—The Council is reported to have voted to construct a $10,000 electric light plant.

Tunkhannock, Pa.—The Tunkhannock Electric Light Co. is stated to have purchased property on Tunkhannock Creek and the work of constructing the power plant will begin about July 1st.

North East, Pa.—The North East Electric Light & Power Co. has been incorporated, with a capital of $10,000, to supply light, heat and power. Incorporators: Henry Watts, of Buffalo, N. Y., and C. C. Hill, of North East.

Rapid City, S. D.—Frank M. Lockhart and W. H. Chambers are stated to have secured a franchise for an electric light plant.

El Reno, Okla. Ter.—See "Electric Railways."

Richfield, Utah.—See "Water."

Norfolk, Va.—A charter has been granted to the Economist Lighting Co. to manufacture and supply light, heat and power by means of electricity; capital about $1,000,000. Saml. B. Lawrence, of New York, N. Y.; Henry C. Everdell, New York, N. Y., and Jas. W. Wilcox, of Norfolk, are directors.

Colemans Falls, Va.—Gleaves & Co., of Lynchburg, are stated to have secured the contract for the construction of a dam and power-house at Colemans Falls for the Bedford Pulp and Paper Co.; contract reported to amount to about $100,000.

Monroe, Wash.—S. A. Buck is reported to have petitioned for a franchise for an electric light plant.

Seattle, Wash.—It is stated that bids are wanted May 9 for $590,000 municipal lighting plant bonds. John Ripinger, City Compt.

Monroe, Wash.—S. A. Buck is stated to have petitioned for a franchise for an electric light plant.

Burlington, Wis.—The Burlington Electric Light & Power Co., of Burlington, has been incorporated, with a capital of $50,000, by Leonard J. Smith and Clarence E. Partee.

Fond du Lac, Wis.—The Village Bd. of North Fond du Lac is stated to have decided to issue bonds for a municipal lighting plant.

Marinette, Wis.—C. B. Pride, of Appleton, is reported to have completed plans ordered by the Isaac Stephenson Co., of Wells, Mich., for a power plant to be built at Chandler Falls, on Escanaba River; the cost of the dam is estimated at $30,000, and of the complete electric plant and transmission line to Wells and Escanaba, $200,000

Sheboygan, Wis.—See "Electric Railways."

Chilliwack, B. C.—See "Water."

Copenhagen, Denmark.—Bids will be received May 12 (extension of date) by the Lighting Dept. for a 3,000,000 cu. ft. gas holder for the Copenhagen Gas Wks.

Winnipeg, Man.—The City Engr. is reported to have been authorized to report on the approximate cost of machinery, etc., necessary to supply electricity for light and power by means of both steam and water power.

The Great Falls Power Co., the Lac du Bonnet Co., and the Keewatin Co., three water power companies, are reported to be seeking franchises in this city.

ELECTRIC RAILWAYS.

Santa Ana, Col.—The City Council has granted the Newport Beach & Santa Ana Electric R. R. Co. a franchise to operate on certain of the streets of the city.

Washington, D. C.—The Great Falls & Old Dominion Electric R. R. Co. is reported organized to construct an electric railway from the Georgetown end of the Aqueduct Bridge to Great Falls, Va. It will be about 12 miles in length.

Wallace, Idaho.—Plans are being discussed for the construction of an electric railway to connect Wardner, Wallace, Burke and Mullan. Elmer Hughes, of Missoula, Mont., is said to be interested.

Princeton, Ill.—The City Council has granted a franchise to the Illinois Valley Traction Co. to operate in Princeton. The company will extend from Ladd to Princeton, a distance of 14 miles. L. W. Johnson, Supt., La Salle.

Jacksonville, Ill.—H. M. Havenhill, of Jacksonville, is securing the right of way between Jacksonville and Winchester for an electric railway.

Anderson, Ind.—The plans for the addition to the power house of the Union Traction Co. at North Anderson are reported completed. Geo. F. McCulloch, Gen. Mgr., Indianapolis.

Dixon, Ill.—The Dixon, Rock Falls & Southwestern Electric Ry. Co. has been incorporated, with a capital of $50,000, to construct an electric railway from Dixon to Rock Island, via Rock Falls. Incorporators: O. E. Maxson, A. S. Goodell, and others, of Rock Falls, Ill.

New Castle, Ind.—The Co. Comrs. have granted a franchise to Gus Hodges, of the Richmond-Anderson Electric Ry.

Sioux City, Ia.—R. A. Talbot has applied to the Co. Comrs. for a franchise for the construction of an electric railway from South Sioux City to Homer.

New Orleans, La.—Northern capitalists are considering the question of building an electric railway in the Lake Pontchartrain District. J. F. O'Shaughnessy, of New York, N. Y.; A. P. Bradstreet, of Waterbury, Conn., and U. Goodwin Reed, 107 Washington St., Boston, Mass., are reported interested.

Vicksburg, Miss.—J. C. Schaffer, of Chicago, Ill., and S. R. Hughes, Vicksburg, Miss., have sold their (the controlling) interest in the Vicksburg Power & Mfg. Co., which includes the street railway and electric light plant, to H. K. Johnson, of Natchez, Miss.; $100,000 in bonds it is understood will be floated, and the street railway system improved and extended.

Springfield, Mass.—The Springfield & Eastern R. R. Co. has petitioned the Selectmen for a location of tracks beginning at Moran's Bridge, and extending to the Ludlow line.

Greenfield, Mass.—The Greenfield & Deerfield St. Ry. Co. has petitioned the State R. R. Comrs. for authority to increase its capital to $130,000. The proceeds are to be used for refunding its floating debt and for additional equipment.

Hillsdale, Mich.—The Common Council has granted a franchise to Peter P. Ducet for an electric railroad through Hillsdale. The proposed road is to be built from Adrian to Hillsdale.

Highland Park, Mich.—The Grand Rapids, Grand Haven & Muskegon Electric Ry. will be extended to Highland Park. A $50,000 hotel is to be built at the Highland Park. J. D. Hawks, Pres., Peninsula Bank Bldg., Detroit.

Hampstead, N. H.—A charter for the Hampstead & Haverhill St. Ry. has been granted by Legislature. Among those interested are: Isaac Randall, Jas. W. Sanborn, and others, all of Hampstead.

Cohoes, N. Y.—The Schenectady Ry. Co. is said to be considering the advisability of extending its Watervliet and Troy Division to Cohoes. C. C. Lewis, Ch. Engr., Schenectady.

New York, N. Y.—See "Paving and Roadmaking."

El Reno, Okla. Ter.—The City Council has granted S. F. Roberts and H. R. Canon, of El Reno, and John A. Bell and H. H. Carson, of Nashville, Tenn., a franchise for the construction of an electric railway and electric light system here. The line will extend to Ft. Reno and Darlington Agency.

Philadelphia, Pa.—The executive committee of the Philadelphia Rapid Transit Co. has awarded the contract for that portion of the Market St. Subway between 15th and 22d Sts. to E. D. Smith & Co.

Plans for the extension of tracks of the Philadelphia Rapid Transit Co. in various sections of the city have been approved by the Bd. of Surveyors.

Quakertown, Pa.—The Philadelphia & Lehigh Valley Traction Co. is making preparations to install another engine and generator in the power house at Quakertown. Sam. Harris, Gen. Mgr., Allentown.

Lebanon, Pa.—The Lebanon Valley St. Ry. Co. is securing rights of way for the projected new line to Schaefferstown.

Meadville, Pa.—The Geneva-Meadville Electric Ry. Co. is seeking a franchise in Meadville. The company has secured the right of way from Geneva, O., to Linesville and surveyors are now at work between Linesville and Meadville.

Carlisle, Pa.—Rights of way have been secured by the Star Traction Co. for its line, beginning at Mechanicsburg and passing through Kollertown, Shepherdstown, Bowmansville, Siddonstown, Mt. Pleasant, Dillsburg and Wellsville. J. H. Foreman, Pres., Carlisle; J. E. Phillips, Secy., York.

Spearfish, S. D.—The Black Hills & Spearfish Valley Electric Ry. Co. has been incorporated, with a capital of $2,500,000, to build an electric railway from Spearfish to Belle Fourche, and to Lead and Deadwood, a total distance of about 2 miles. Directors: Hiram Dotson, Milton C. Conners, and others, of Spearfish.

Waco, Tex.—Col. John L. Spurlin, of Hamilton, is reported interested in a plan to build an electric railway from Waco to Hamilton.

Ballard, Wash.—Fred E. Sander, of Seattle, has petitioned the City Council for a street railway franchise, which he proposes building between Ballard and Everett.

Sheboygan, Wis.—It is stated that a contract with the J. H. Collins Construction Co., of Chicago, Ill., to construct the proposed electric railway from Sheboygan to Elkhart Lake through the city of Plymouth and to Waldo, has been closed by J. M. Saemann and Gustav Schage, of Sheboygan; William Saemann, of Plymouth, and Peter Brickbauer, of Elkhart Lake. The contract also includes, according to reports, the complete equipment for the power to light the city of Sheboygan and for furnishing power for the different manufacturing plants.

Howard, Wis.—The Shawano-Green Bay Traction Co. has secured a franchise through Howard.

Goderich, Ont.—The Huron, Bruce & Grey Electric Ry. Co. is said to have acquired a portion of the Falls Reserve, with the intention of developing the power electrically.

Hamilton, Ont.—Clarke, Cowan, Bartlet & Bartlet, barristers, of Windsor, have applied for the incorporation of a company to construct an electric or steam railway from Hamilton to Collingwood and Simcoe.

Montreal, Que.—Plans are being prepared for an electric railway from Montreal to Three Rivers, a distance of 95 miles. The capital of the company will be $500,000. Jacques Bureau, of Three Rivers; A. Cuthbert, of Berthierville; F. O. Lamarche and L. O. Hétu, of Montreal, are interested.

It is announced that $100,000 will be spent by the Montreal St. Ry. Co. in the repair of its lines in the city during the coming spring and summer, and that the improvements embrace comprehensive track renewals.

RAILROADS.

Opelika, Ala.—Rights of way are stated to have been secured for an extension of the Seaboard Air Line in East Alabama. The line is intended to branch through Russell County with terminals in Opelika, which is the distributing point for all East Alabama. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

San Francisco, Cal.—It is stated that the Santa Fe R. R. Co. intend establishing a line to connect its Humboldt County properties with this city. R. B. Burns, Ch. Engr., Los Angeles.

Ft. Bragg, Cal.—The Ft. Bragg & Southeastern R. R. Co. has been incorporated to construct a railroad about 100 miles in length, commencing at Ft. Bragg and running in a southerly and southeastern direction to Healdsburg and building branches to lumber mills contiguous; capital, $2,000,000. Incorporators: R. H. Swayne, Miles Standish, and G. B. Shaw.

Pueblo, Colo.—The Colorado & Wyoming R. R. Co. is reported to have decided to build new tracks connecting its various lines. John T. Kebler, Gen. Supt., Denver.

Decatur, Ga.—According to press reports the Florida Southern will soon become part of the Atlantic Coast Line (E. B. Pleasants, Ch. Engr., Wilmington, N. C.). About 40 miles of new track will be built, of which one-half will be in Decatur, Ga., and the remainder in the neighborhood of Punta Gorda.

Muskogee, Ind. Ter.—Surveyors are reported to be locating the line of the Ozark & Cherokee Central Ry., to run from Muskogee via Ft. Gibson, Ind. Ter., to Joplin. The line will be 130 miles long. E. W. Boynton, Ch. Engr., Fayetteville, Ark.

Boone, Ia.—The contract for the construction of a section of the Newton & Northwestern Ry. between Boone and Newton, a distance of 50 miles, has been granted to E. S. Balch & Co.

Topeka, Kan.—Plans are now under way which will probably result in an extension of the Missouri Pacific R. R. from Topeka, Kan., to Irving, Kan., a distance of 75 miles. E. A. Gould, Gen. Supt., St. Louis, Mo.

Baton Rouge, La.—According to press reports a contract has been closed between the Shreveport & Red River Valley R. R. Co., and Winston Bros., of Minneapolis, Minn., and Lee & Craney Bros., of Kansas City, Mo. The work includes 3,500,000 yds. of work, the contract calling for an expenditure of nearly a million dollars. Work will commence at once. Headquarters of contractors will be at Baton Rouge, and work of grading will commence at Baton Rouge and extend a distance of 50 miles up Mississippi River.

Newton Center, Mass.—It is probable that the abolition of grade crossings through Newton Center and Newton Highlands will soon be decided upon. The plans propose a change in grade of double tracks of Boston & Albany R. R. (Walter Shepard, Ch. Engr., Boston) for a distance of nearly 2 miles; 8 streets of widths varying from 40 to 90 ft. will cross the depressed track by steel bridges and one street will pass under a steel railroad bridge.

Thief River Falls, Minn.—The Great Northern R. R. Co. is stated to have decided to extend its line from Thief River Falls, a distance of about 30 miles. A. H. Hoagland, Ch. Engr., St. Paul.

Biloxi, Miss.—The Biloxi, Waynesboro & Cahawba Valley R. R. Co. has been incorporated, by L. Lopez, Sr., W. K. M. Dukate, and others. The proposed line, if built, will pass out of Mississippi through Wayne County and penetrate the coal fields in Alabama.

Laurel, Miss.—The Mobile, Jackson & Kansas City R. R. Co. is about to construct a line from Laurel to the Tennessee State line. Col. F. B. Merrill, Pres.

Buffalo, N. Y.—Surveys are about completed for the extension of the Buffalo & Susquehanna R. R. from Wellsville to Buffalo. Henry Herden, Ch. Engr., Galeton, Pa.

Wilmington, N. C.—A charter is stated to have been granted to the Elizabeth City and Carolina Through Line, a company which proposes building a line from Wilmington to Elizabeth City. R. G. Grady and S. P. McNair, of Wilmington, are among the incorporators.

Crestline, O.—A press report states that the Pittsburg, Ft. Wayne & Chicago division of the Pennsylvania Lines will expend about $250,000 this summer for improving the Crestline yards. A large roundhouse and freight station will be erected and about 5 miles of new track will be put in. Thos. Rodd, Ch. Engr., Pittsburg, Pa.

Collinwood, O.—Among the improvements to be made on the Lake Shore R. R. this spring and summer will be an extension and general improvement of the Collinwood yards at a cost of $350,000. E. A. Handy, Ch. Engr., Cleveland, O.

Baker City, Ore.—An ordinance has passed second reading granting a franchise to the Oregon & Idaho Central R. R. Co.

Franklin, Pa.—A corps of engineers have begun surveys for the permanent location of the route for a double-track railroad between Franklin and Brookville, for the Brookville & Clearfield R. R. Co., of which Gen. Chas. Miller, of Franklin, is Pres.

Uniontown, Pa.—J. W. Patterson, Ch. Engr., is reported to have been authorized to prepare plans for the construction this spring of the Greene County R. R. to Uniontown, at a cost of $7,500,000.

New Castle, Pa.—The New Castle & Eastern R. R. Co. has been incorporated, with a capital of $100,000, to build a line from here to Rose Point, Pa. E. N. Ohl, Pres.; E. F. Norris, Secy.

The Buffalo, Rochester & Pittsburg R. R. is planning to build yards on the west side of Mahoning River between this city and Mahoningtown. J. M. Floesch, Ch. Engr., Rochester, N. Y.

Bon Air, Tenn.—L. R. Wright & Co., of Macon, Ga., are stated to have secured the contract for the Bon Air extension of the Nashville, Chattanooga & St. Louis R. R. from DeRossett to Eastland; probable cost of work, $110,000.

Maryville, Tenn.—The Southern Ry. Co. is about to ask for bids for the construction of the 65-mile line from Maryville, Tenn., through the Blue Ridge Mountains, to a connection with the Southern's main line in North Carolina. W. H. Wells, Ch. Engr., Washington, D. C.

San Angelo, Tex.—It is reported that surveys are being made for a 500-mile branch line of the Kansas City, Mexico & Orient R. R. from San Angelo, Tex., to the Rio Grande at Laredo. M. P. Paret, Ch. Engr., Kansas City, Mo.

Corinne, Utah.—The Utah Construction Co. is stated to have secured the contract for the construction of 15 miles of the Malad Valley branch north from Corinne to the Garland sugar factory; estimated cost of this work placed at $100,000.

Grantsburg, Wis.—The Northern Pacific R. R. Co. will, according to reports, construct a line from Grantsburg, Wis., to Iron River. W. L. Darling, Ch. Engr., St. Paul, Minn.

Cheyenne, Wyo.—The Union Pacific R. R. Co. is stated to have decided to build 144 miles of second track in Wyo. The company will expend $20,000,000 in cutting tunnels and reducing grades. J. B. Berry, Ch. Engr., Omaha, Neb.

Quebec, Que.—According to press reports Canada is to have another transcontinental railway. Its terminals will be at Quebec in the East and Port Simpson, B. C., in the West. It will run parallel with the Canadian Pacific, but will be from 200 to 400 miles further north. It will be called the Trans-Canada Ry. The Dominion Government has granted the promoters a charter.

PUBLIC BUILDINGS.

Greenville, Ala.—Dobson & Bynum, of Birmingham, are stated to have been awarded the contract for erecting the Butler County Court House, for $36,000.

Texarkana, Ark.—Bids are wanted Apr. 22 for erecting a jail and jailer's residence. Sidney Stewart, Archt., Texarkana.

Merced, Cal.—It is stated that bids are wanted Apr. 14 for erecting a county jail.

San Francisco, Cal.—T. P. Ross, Mutual Life Bldg., is stated to have completed plans for an edifice for the West Side Christian Society; estimated cost, $37,000.

Waterbury, Conn.—A correspondent writes that bids are being received by Chickering & O'Connell, Archts., of Manchester, N. H., for a $50,000 church and a $20,000 residence for Rev. J. J. Curtin, of Waterbury.

Alton, Ill.—The Trus. of the Methodist Church will remodel the edifice, at a cost of $16,000.

Kewanee, Ill.—Bids are wanted Apr. 9 for erecting the St. Paul's Evangelical Lutheran Church. Address Rev. H. E. Jacobs, Pastor.

Logansport, Ind.—Q. A. Myers, Secy., writes that the contract for erecting the Carnegie Library (bids opened Mar. 25) has been awarded to John E. Barnes & Sons, of Logansport, for $28,260.

Liberty, Ind.—It is reported that the Rev. J. J. Wade will receive bids Apr. 15 for erecting a brick and Bedford stone Catholic Church, to cost $20,000.

Greenfield, Ia.—Bids are wanted Apr. 9 for erecting a 2-story brick sheriff's residence and jail building, including steam heating, residence plumbing, etc. Liebbe, Nourse & Rasmussen, Archts., Des Moines. W. R. Turner, Chmn. Bd. of Supervs.

Stuart, Ia.—Bids are wanted Apr. 6 for erecting a Congregational Church. Prescott & Co., Archts., Marshalltown, Ia.

Iola, Kan.—A $50,000 court house will probably be erected in Allen Co. A. W. Howland, Chmn. Bd. Co. Comrs.

Great Bend, Kan.—Bids are wanted Apr. 21 for erecting a sheriff's residence and jail. J. C. Holland & Squires, Archts., Topeka. Address Co. Clk.

New Orleans, La.—Bids will be received Apr. 10 by Wm. C. Stubbs, State Comr., Audubon Park, New Orleans, for erecting the ancient Cabildo building for the Louisiana Purchase Exposition in St. Louis.

Holyoke, Mass.—Bids are wanted Apr. 18 for erecting a church and parish house for St. Paul's parish. Wm. T. Towner, Archt., 157 Summer St., Boston. Edwin Burgin, Secy. and Treas. Bldg. and Finance Com.

Marlboro, Mass.—Peabody & Stearns, 53 State St., Boston, are stated to have prepared plans for the Carnegie Library to be erected here, at a cost of $35,000.

Fairfax, Minn.—See "Power Plants, Gas and Electricity."

Atlantic City, N. J.—The Bd. of Trus. of the Carnegie Library are stated to have approved plans for a 2-story limestone structure to be erected at Pacific Ave. and Illinois St., to cost about $55,000.

New York, N. Y.—Bids will be received Apr. 17 by the Bd. of Health for furnishing material for completing a Nurses' Home at the Riverside Hospital, North Brother Island, Boro. Bronx. Ernst J. Lederle, Ph. D., Pres.

Plans are stated to have been filed for a 6-story brick hospital to be erected at Ave. C and 16th St., at a cost of $350,000. Architects, Smith, Westervelt & Austin, 7 Wall St.

It is stated that plans have been filed for a 3-story brick public library to be erected at 67th St. and 1st Ave.; estimated cost, $70,000. Babb, Cook & Willard, Archts., 3 W. 29th St.

A permit is stated to have been issued for the erection of a 6-story brick nurses' home, at 31 E. 71st St., for the Presbyterian Hospital; estimated cost, $300,000. Jas. B. Baker, Archt., 156 5th Ave.

Bids will be received Apr. 9 by the Bd. of Park Comrs. for furnishing material for erecting a comfort station in Morningside Park at 114th St. Wm. R. Willcox, Chmn.

Columbus, O.—The plans of Frank L. Packard, Hayden Bldg., are stated to have been accepted for the Ohio Building, to be erected on the grounds of the La. Purchase Exposition at St. Louis, Mo.; estimated cost, $55,000.

Gallipolis, O.—Bids will be received Apr. 23 by the Bd. of Trus. of the Ohio State Hospital for Epileptics at the office of Frank L. Packard, Archt., Columbus, for furnishing material for erecting cottages "A" to "E" inclinded; also farmhouse for the Ohio State Hospital for Epileptics, at Gallipolis. A. P. Ohlmacher, M. D., Secy.

Greensburg, Pa.—Bids are wanted Apr. 16 for erecting a courthouse at Main and West Pittsburg Sts. John H. Brown, Co. Compt.

Pittsburg, Pa.—J. E. & A. L. Pennock, of Philadelphia, are stated to have received the contract for the erection of the Allegheny General Hospital in this city; estimated cost, $600,000.

It is stated that Andrew Carnegie has given this city an additional $1,550,000 for the purpose of enlarging and extending the Carnegie Library.

Plans are stated to have been prepared for the 3-story brick Pittsburg Free Dispensary building to be erected at Federal St. and Verona Alley; probable cost, $50,000. R. M. Trimble, Archt., Ferguson Bldg.

Union, S. C.—It is stated that bids are wanted Apr. 15 for erecting the 1st Presbyterian Church. Wheeler & Runge, Archts., Charlotte, N. C.

Nashville, Tenn.—It is stated that the Addison Ave. Cumberland Presbyterian Society will build a $20,000 church. Rev. J. E. Clark, Pastor.

BUSINESS BUILDINGS AND DWELLINGS.

Birmingham, Ala.—It is stated that a 12-story brick office building will be erected here, to cost about $450,000. J. W. Golucke & Co., Archts., Watts Bldg.

Fresno, Cal.—Fayville & Co., of San Francisco, will erect a 5-story building, 175x150 ft.

Boise, Idaho.—The Odd Fellows of the city are stated to have decided to erect a 4-story building at 9th and Idaho Sts.; probable cost, $100,000.

Lewiston, Idaho.—J. K. Dow, of Spokane, Wash., has prepared plans for a $50,000 Opera House for Lewiston.

Libertyville, Ill.—Wm. G. Kreig, of Chicago, is stated to have prepared plans for a 2-story bank building to be erected here, at a cost of $35,000.

Alton, Ill.—The Alton Banking & Trust Co. has selected Victor J. Klutho, of St. Louis, Mo., to prepare plans for its office building, to cost about $250,000. Bids will be asked about Apr. 15.

Portland, Ind.—It is stated that the Knights of Pythias will erect a 4-story structure here, to cost about $20,000.

South McAlester, Ind. Ter.—The Missouri, Kansas & Tex. R. R. Co. (E. M. Collins, Gen. Supt., St. Louis, Mo.) and the Choctaw, Oklahoma & Gulf Ry. Co. (F. A. Molitor, Ch. Engr., Little Rock, Ark.) are stated to have decided to erect a union depot here, to cost $45,000.

Centerville, Md.—H. A. Hill, of Trenton, N. J., is stated to have been selected to prepare plans for a 2-story brick building for the Centerville National Bank.

Springfield, Mass.—The Homestead Publishing Co. will erect a 3-story brick and stone block. Mill construction. F. R. Richmond, Archt.

Grand Rapids, Mich.—The Lake Side Club is reported to have decided to erect a building at Reed's Lake, at a cost of $50,000.

Grand Haven, Mich.—W. A. Chapel, of Grand Rapids, is preparing plans for an opera house and armory, to cost about $20,000. It will be of brick and stone, 66x132 ft. Address Capt. S. S. Dickenson, Grand Haven.

Highland Park, Mich.—See "Electric Railways."

St. Paul, Minn.—The Criterion Theater Co. (John Burrichter, Pres.) is reported incorporated, with a capital of $50,000, to erect a theater here. H. G. Carter, Archt., Minneapolis.

St. Louis, Mo.—It is stated that Schwarzchild & Sulzberger Packing Co. will erect a market house at Bway. and Montgomery St., and another at 21st and Poplar Sts.; probable cost of the 2 structures, $200,000.

York, Neb.—Bids will be received Apr. 10 by the Bldg. Com. for furnishing material and erecting the Y. M. C. A. building. W. D. Mead, Jr., Chmn.

Jersey City, N. J.—Walter Hankin is reported to be preparing plans for an 8-story brick hotel to be erected at Harrison and Bergen Aves., for J. C. Appleby; probable cost, $175,000.

Toledo, O.—The Broadway Savings Bank Co. is stated to have accepted plans prepared by Geo. Mills & Co., Gardner Bldg., for an office building, to cost $32,000.

Dennison, O.—It is stated that bids are wanted by T. Lanning until Apr. 16 for erecting a brick business block, 55x125 ft.

Crestline, O.—See "Railroads."

Chillicothe, O.—D. H. Roche, Pres. Masonic Temple Co., writes that the contract for erecting the Masonic Temple (bids opened Mar. 20) has been awarded to D. W. Henkl, of Athens, for $52,500.

Columbus, O.—Hugh E. Smith & Bros. are stated to have accepted the plans of Wilbur T. Mills, 73 Wesley Blk., for the market house to be erected at High St. and 1st Ave., at a cost of $150,000.

Baker City, Ore.—The Knights of Pythias of this city are reported to be considering the erection of a 3-story brick building, at 1st and Washington Sts.; probable cost, $25,000.

Ellwood City, Pa.—The Baltimore & Ohio R. R. (I. G. Rawn, Gen. Supt., Pittsburg) and Pittsburg & Lake Erie R. R. (J. A. Atwood, Pittsburg, Ch. Engr.) are preparing to erect a $50,000 union depot at Ellwood City.

Philadelphia, Pa.—It is stated that John W. De Long will erect a 4-story brick building at 8th St. and Germantown Ave.; estimated cost, $25,000.

Chester, Pa.—Plans are stated to have been completed for the Pennsylvania R. R. depot to be erected here; probable cost, $100,000. Wm. Wallace Atterbury, Gen. Mgr., Philadelphia.

San Antonio, Tex.—The International & Great Northern R. R. Co. (Leroy Trice, Gen. Mgr., Palestine) is reported to be considering the erection of a depot here, to cost about $100,000.

Tacoma, Wash.—F. H. Goss Constr. Co., of this city, is stated to have received the contract for erecting the 3-story building at 11th and C Sts., for $50,000.

Spokane, Wash.—L. L. Rand, Rookery Bldg., has prepared plans for a 3-story brick building for F. P. Hogan.

L. L. Rand, Rookery Bldg., and J. K. Dow, Peyton Bldg., are preparing plans for a $50,000 temple for the Masonic Assoc.

Milwaukee, Wis.—It is stated that A. C. Clas will erect a 6-story brick, 44x134-ft. apartment house at 9th St. and Grand Ave.

Cheyenne, Wyo.—The Masonic Temple recently burned will be rebuilt at a cost of $20,000.

SCHOOLS.

San Francisco, Cal.—Fred. C. Jones is stated to have submitted the lowest bid, $36,899, for erecting the Sunnyside School.

Los Angeles, Cal.—See "Sewerage and Sewage Disposal."

Torrington, Conn.—The Bd. of Educ. is stated to have decided to erect 2 8-room schools at Main and Elm Sts., and Litchfield and Albert Sts., respectively; estimated cost of both structures, $60,000.

Decatur, Ill.—Bids will be received Apr. 14 by the Bd. of Educ. of Decatur School Dist. for rebuilding Church St. school. M. G. Patterson, Archt. E. A. Castman, Clk.

Bridgeport, Ill.—The Bd. of Educ. is stated to have decided to enlarge the Walterville School, at a cost of $45,000.

Alexandria, Ind.—Bids will be received Apr. 13 by the Bd. of Educ. for constructing a high school; bids will also be received on same date for a steam heating plant (blower system) for said school. Kramer & Harpster, Archts., Findlay, O. A. F. Sala, Secy.

Nottingham, Ind.—Bids will be received Apr. 13 by A. W. Sours, Trus. of Nottinghsm Township School, for erecting a 1-story brick school in Dist. No. 10.

Edmond, Ind. Ter.—The Governor is stated to have signed the bill providing for an appropriation of $40,000, for the Normal School to be erected here.

Lexington, Ky.—The plans of H. L. Rowe, Northern Bank Blk., are stated to have been accepted by the Bd. of Educ. for a school for white children; estimated cost, $27,000.

Greenfield, Mass.—H. E. Pray & Co., of this city, are stated to have received the contract for erecting the high school, for $35,618.

Olivia, Minn.—Bids are wanted Apr. 27 for erecting a high school. Address J. M. Peckinpaugh, Clk.

Virginia, Minn.—The citizens are stated to have voted to issue $30,000 bonds for a high school to be erected here.

Minneapolis, Minn.—Bids will be received Apr. 16 by the Com. on Ways and Means of the City Council for $200,000 school bonds. Joshua Rogers, City Compt.

McComb City, Miss.—Bids are wanted Apr. 7 for $25,000 school bonds. J. Dock Harrell, City Clk.

Jefferson City, Mo.—The Senate is stated to have passed a bill providing for an appropriation of $150,000 for the erection of the Missouri Blind School.

Schenectady, N. Y.—Local press reports state that bids will be received Apr. 20 by the Bd. of Educ. for erecting 2 grade schools.

New York, N. Y.—Blake & Williams, 211 W. 20th St., have secured contracts for ventilating Schools No. 1, Boro. of Richmond, and No. 142, Boro. of Brooklyn, at $18,120 and $20,880 respectively; bids opened Mar. 30. Lustbader & Glantz secured the contract for constructing the coal vault at Girls' High School, Boro. of Brooklyn, for $9,633. The lowest bid received Mar. 30 for installing passenger elevators in Morris High School, Boro. of Bronx, was that of the Standard Plunger Elevator Co., 1 Bway., for $14,900.

Bids will be received Apr. 13 by C. B. J. Snyder, Supt. of School Bldgs., for installing electric light wiring, fixtures and electric bell system in School No. 6; also for sanitary work in School No. 31, Boro. Bronx.

Long Island City, L. I., N. Y.—All bids received Mar. 30 for the general construction of School No. 84, Boro. of Queens, were rejected. Lowest bid submitted by Geo. Hildebrand, 1004 Bway., New York, N. Y., for $199,500. C. B. J. Snyder, Supt. School Bldgs., N. Y. City.

Valley City, N. D.—The Trus. of the Valley City Normal School are stated to have awarded the contracts for the Science Hall as follows: Erection, Johnson & Power, of Fargo, $31,498; plumbing, E. J. Harrington, of Fargo, $1,387; heating, Fargo Plumbing Co., Fargo, $4,982.

Hamilton, O.—Press reports state that Geo. W. Barkman will receive bids May 1 for erecting a 10-room school for St. Joseph's Catholic Church, to cost $25,000.

Mansfield, O.—Bids will be received Apr. 23 by H. B. Cave, Clk. of Bd. Educ. for furnishing material and installing a mechanical steam heating plant in the new addition to the present high school.

Washington, Pa.—Walker & Slater, of this city, are stated to have received the contract for erecting the library for Washington and Jefferson College; probable cost, $50,000.

So. Bethlehem, Pa.—It is stated that a 3-story brick, 186x70-ft. Science building will be erected for the Lehigh University by Prof. H. Williams, Jr., of Andover, Mass., at a cost of $65,000.

Windber, Pa.—Bids are wanted Apr. 7 for erecting a 10-room school. Address F. P. Reiche, 39 and 40 Suppes Blk., Johnstown.

Reading, Pa.—Bids will be received until Apr. 9 by the Com. on Bldgs. and Sites for erecting a 3-story 12-room school on 10th St. and a 4-room school at Cotton and Maple Sts. F. Roland, Jr., Secy.

Walla Walla, Wash.—The Bd. of Educ. is stated to have purchased a site for a high school to be erected here, to cost about $50,000.

Tacoma, Wash.—It is stated that a 3-story building will be erected at Ainsworth and 6th Aves., for the Puget Sound University; probable cost, $25,000.

Sarnia, Ont.—Bids, including plans and specifications, will be received Apr. 25 for a low-pressure steam-heating plant for a 6-room school on Devine St. J. W. Smith, Chmn. Management Com. Bd. Educ.

STREET CLEANING AND GARBAGE DISPOSAL.

Los Angeles, Cal.—Dr. Donelson has recommended to the Bd. of Health that a garbage plant be purchased, to cost about $25,000.

Marion, Ind.—Mayor Kiley is stated to have received from the Toledo Development Co. an offer to construct a garbage crematory in Marion.

Burlington, Ia.—Bids will be received Apr. 6 by the City Clk. for hauling and disposing of city garbage for the year 1903.

West Springfield, Mass.—Bids will be received Apr. 7 by the Bd. of Selectmen for sprinkling streets for the current year covering approximately, 15,000 lin. ft. H. E. Schmuck, Chmn.

New Rochelle, N. Y.—The New Rochelle Disposal Co. is reported organized to collect ashes, garbage and rubbish.

Buffalo, N. Y.—Bids are soon to be asked for street cleaning, garbage collecting and disposal.

Newburgh, N. Y.—Bids are wanted Apr. 7 for collecting and removing swill and garbage from various streets of the city for a period of 1 year. D. J. Coutant, City Clk.

Chester, Pa.—Bids will be received Apr. 6 by M. S. Hatton, Chmn. Street Com., for removing and disposing of garbage, dead animals, etc.

Lancaster, Pa.—Thos. L. McMichael is stated to have secured the contract for collecting the garbage for 1 year, at $1.65 per ton.

La Crosse, Wis.—Bids will be received Apr. 15 by the Comrs. of Pub. Wks. for furnishing f. o. b. cars the city with 2 750-gal. steel or wood sprinkling wagons complete with truck spring gear, Archibald patent wheels and 6-in. tires. H. J. Beckwith, Chmn.

GOVERNMENT WORK.

San Francisco, Cal.—Bids are wanted Apr. 24 for installing hot water heating plants in quarters at Ft. Miley and Ft. Baker. C. P. Miller, Ch. Q. M.

Norwich, Conn.—Bids will be received until May 6 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (except heating apparatus and electric wiring and conduits) of the U. S. Post Office at Norwich.

Chicago, Ill.—The following bids were opened on Mar. 20 at the Treas. Dept., U. S. Life Saving Service, Washington, D. C., for constructing a life-saving station at south pier of Chicago River, Chicago: Warner Constr. Co., Chicago, $9,984; Crown Constr. Co., Chicago, $11,795; R. J. B. Newcombe, Manistee, Mich., $11,543, and Hoetz & Co., Grand Rapids, Mich., $14,747.

Rock Island, Ill.—It is stated that plans for the new storehouse to take the place of the burned structure at Rock Island Arsenal are being prepared in the draughting rooms of the local post. It will be of brick and steel.

Richmond, Ky.—Bids will be received until Apr. 27 (extension of date) by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for completing the U. S. Post Office building at Richmond.

Annapolis, Md.—Bids will be received Apr. 8 by H. C. Taylor, Chief of Bureau of Navigation, Navy Dept., Washington, D. C., for paving at the U. S. Naval Academy, Annapolis; also on Apr. 10 for dredging at U. S. Naval Academy.

St. Paul, Minn.—Maj. R. L. Hoxie, Corps Engrs., U. S. A., writes that the following contracts have been awarded: To the St. Paul Foundry Co., of St. Paul, for Tainter gates and accessories, for $11,100, to be delivered at St. Paul, and to J. H. Webster, assignee, Variety Iron Wks. Co., Cleveland, O., for hinges and accessories, for $4,600, to be delivered at Cleveland, O.

Ft. Snelling, Minn.—The lowest bid received for the construction of the new spur track on the Ft. Snelling reservation is stated to have been submitted by M. J. Peppard & Co., of Minneapolis, for $14,800.

Boston, Mass.—Bids will be received by Capt. Harry Taylor, Corps Engrs., U. S. A., Boston, Mass., until May 1 for dredging in Narrows of Lake Champlain, Vt., and Plattsburg Harbor, N. Y.

Brooklyn, N. Y.—The following bids were received at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., Mar. 28, for constructing an addition to building No. 41, at the Navy Yard, Brooklyn: J. B. & J. M. Cornell Co., $53,400; Snare & Triest, $55,212, and Ryan & McFerran, $52,737. Bidders all of New York.

New York, N. Y.—The following bids for dredging in Harlem River, N. Y., were received by Col. Amos Stickney, Corps Engrs., U. S. A., Mar. 25; price given per cu. yard: R. G. Packard Co., 130 Pearl St., New York, 43 cts.; P. Sanford Ross, Inc., Jersey City, N. J., 33 cts.; Morris & Cummings Dredging Co., 17 State St., New York, 32½ cts.

Cherokee, N. C.—Bids are wanted Apr. 16 for furnishing material for constructing a steam heating plant at the Cherokee school. Address A. C. Tanner, Acting Comr. of Indian Affairs, Washington, D. C.

Ft. Lincoln, N. D.—The lowest bids opened on Mar. 23 by Geo. E. Pond, Ch. Q. M., St. Paul, Minn., for erecting a hospital at this post were those of P. M. Hennessey, of St. Paul, for construction, $15,103, and for heating, Jos. A. Hurley, of St. Paul, at $3,365.

Charleston, S. C.—Bids will be received Apr. 18 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D.C., for constructing about 8,100 ft. of railroad at the Navy Yard, Charleston.

Ft. Fremont, S. C.—Bids are wanted Apr. 22 for constructing administration building at this post. Address Quartermaster.

Springfield, S. D.—Bids are wanted Apr. 21 for furnishing material and constructing an addition to dormitory, constructing water and sewer system; also for removing and refitting buildings at the Indian Boarding School. Address W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

Chattanooga, Tenn.—Capt. H. J. Slocum, U. S. Cavalry, Q. M., writes that Nicholas Ittner, of Atlanta, Ga., received the contract for constructing the brick hospital at Chickamauga Park (bids opened Mar. 11), including heating, plumbing and gas piping, for $59,472.

Memphis, Tenn.—Bids are wanted May 4 for constructing (including plumbing, electric wiring and conduits) the extension of the U. S. custom house, court house and post office at Memphis. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Norfolk, Va.—Bids will be received Apr. 30 at the Engineer's Office, U. S. A., Custom House, for rock removal and constructing riprap dam in Roanoke River near Weldon, N. C.

Ft. Lawton, Wash.—Bids are wanted Apr. 23 for constructing, including steam heating, plumbing and gas piping, 1 field officers' quarters and 1 double set each of Captains', Lieutenants' and non-commissioned officers' quarters at this post. Address G. S. Bingham, Q. M., U. S. A., Seattle.

Wheeling, W. Va.—Capt. W. E. Craighill, Corps Engrs., U. S. A., writes that no bids were received on Mar. 27 for building a power house, except foundation, at Dam No. 6, Ohio River, near Merrill, Pa.

Bids for furnishing and delivering cement for Ohio River dams, at *a*, Dam No. 4, 3,500 bbls.; *b*, Dam No. 6, 2,500 bbls.; *c*, Dam 13, 10,000 bbls., and *d*, Dam 18, 16,000 bbls., were opened here Mar. 23 by Capt. Geo. A. Zinn, Corps Engrs., U. S. A., price given per bbl.: Atlas Portland Cement Co., New York, N. Y., *a*, $2.34; *b*, $2.34; *c*, $2.34; *d*, $2.34. Castalia Portland Cement Co., Pittsburg, Pa., *a*, $2.42; *b*, $2.37.

Ft. D. A. Russell, Wyo.—See "Water" and "Sewerage."

NEW INDUSTRIAL PLANTS.

The Pine Product Construction Co., Fayetteville, N. C., will erect a plant at once, and will install a 25-H.-P. vertical boiler, 15-H.-P. engine, pump and other machinery. The company will erect plants throughout the turpentine section.

John F. Guyton, Guyton, Miss., contemplates erecting a cotton gin, and is in the market for an engine of about 40-H.-P., boiler of about 50-H.-P., and other necessary machinery. Prices are desired F. O. B. Ingomar, Miss.

The John Deere Plow Co., St. Louis, Mo., will erect two 6-story buildings, one to be 300x110 ft., and the other 90x300 ft. The buildings are to be separated by an area of 20 ft., and connected by steel bridges. Electric power plant sufficient to operate six large elevators and machinery for making vehicles will be installed.

The Camden & Philadelphia Soap Co., Camden, N. J., will probably erect a 5-story and basement main building, a power house to contain two 100-H.-P. boilers, and a large brick stable.

W. P. Ingram, Taylorsville, N. C., has formed a small company to make building material and do general shop work, and is in the market for an engine and boiler and woodworking machinery.

The Pacific Coast Co., Seattle, Wash., is constructing new coal shipping bunkers, roundhouse and machine shop. The work will be done by the company's men.

The United States Packing Co., 210 Coronado Building, Denver, Colo., is in the market for 500 refrigerator cars and three 75-ton ice machines, to be delivered at Pueblo, Colo.

The American Shredder Co., Madison, Wis., has been organized, with a capital of $100,000, to make the J. J. Power corn self-feeder and corn husker and shredder. Plans for the initial buildings include a 250x80-ft. main building of brick, with the necessary office and sheds. It is probable that electric motors will be installed.

The Sioux City, Ia., Boiler & Sheet Iron Works are having a 40x90-ft. building, with office, tool-room and stock sheds, erected. Electric power will be used.

Wm. J. Dunn, Fall River, Mass., will erect a 4-story, 140x50-ft. brick mill, to cost about $50,000. Louis G. Destremps, Archt.

Johnson, King & Co., Macon, Ga., will erect a 4-story and basement, 42x140-ft. candy factory, and will probably install a 100-H.-P. boiler.

The Pease Car & Locomotive Works are receiving bids for the construction of a plant, to cost about $1,500,000, at Hegewisch, Ill. The buildings include a 2-story, 200x400-ft. erecting house of iron, a 2-story, 96x156-ft. brick power house, and a 150x300-ft. planing mill.

The Bemis Bro. Bag Co., 1422-24 St. Louis Ave., Kansas City, Mo., has lessed quarters, and will use electricity for power.

F. Felkel, civil engr. and archt., 419 House Bldg., Pittsburg, is now receiving bids for a steel conatruction foundry for the Eagle Fdy. & Mach. Co., 1025 So. Canal St., Allegheny City, Pa. It is irregular in shape, having frontages of 77¼ and 70⅔ ft. and a depth of 143½ ft. There is to be a 20-ton 40-ft. span traveling crane, a 5-ton 15-ft. span traveling crane, a 72 and a 48-in. cupola, an elevator, core ovens, etc.

MISCELLANEOUS.

Chicago, Ill.—The Senate has passed a bill empowering Lake View to issue bonds to the amount of $1,000,000 for the purpose of enlarging Lincoln Park in Chicago.

Noblesville, Ind.—Thos. Griffin will construct a 16-ft. dam across White River, 4 miles north of city.

Tekamah, Neb.—It is stated that bids are wanted Apr. 7 for constructing a ditch 8,146 ft. long. C. G. Clark, Co. Clk.

New York, N. Y.—See "Paving."

New York, N. Y.—Bids were opened Mar. 27 by McDougall Hawkes, Com. Docks, for building Pier No. 99 at E. 49th St. and East River. The lowest was that of Augustin Walsh, for $15,500, and 45 cts. per cu. yd. for Class H., which was recommended for award.

Bids will be received Apr. 9 by the Bd. of Park Comrs. for furnishing material for erecting iron fences at St. Mary's, St. James' and Melrose Parks, in Boro. Bronx; also on same date for furnishing and delivering fine screened gravel equal to the quality known as Roa Hook gravel and broken limestone where required in Hamilton Fish and Tompkins Sq. Parks. Wm. R. Willcox, Chmn.

Buffalo, N. Y.—Local press reports state that the Wharves & Harbor Com. of the Bd. of Aldermen on Mar. 26 decided to let contracts for 5 sections of the work of dredging Buffalo Harbor and River to the Buffalo Dredging Co., at a total cost of $312,000. The 6th section, the low bid on which is $129,000, was held over two weeks.

Bids will be received Apr. 11 by F. W. M. Heerwagen, City Compt., for $25,961 grade crossing bonds.

Winnipeg, Man.—The J. H. Ashdown Hardware Co. has secured the contract for cement (bids opened Mar. 3 for from 15,000 to 20,000 bbls.) at $2.575 cts. per 100 lbs.

BUSINESS NOTES.

The Cross oil filter, manufactured by the Burt Mfg. Co., Akron, O., will be used at the World's Fair, St. Louis, in the present power plant. The Cross filter was also used by the Omaha, Charleston, Paris and Buffalo exhibitions.

The Union Switch & Signal Co. writes that it has been given a contract for the largest interlocking installation ever placed in America, and probably much the largest in the world, for the St. Louis Terminal. The Westinghouse electro-pneumatic system will be adopted, and the contract calls for 258 working levers, with 51 spare levers, which will perform 748 functions.

The Nernst Lamp Co., of Pittsburg, Pa., is to open an office in the National Life Building, Chicago, on April 1. Armour & Co. are making tests at the Union Stock Yards, Chicago, of the Nernst lamp, manufactured by the Nernst Lamp Co., of Pittsburg. The town of Rouse's Point, N. Y., has lately adopted 3-glower Nernst lamps for street lighting. Deere & Co., of Moline, Ill., is displacing, at the end of a seven months' trial of the Nernst lamp, its arc and incandescent lights. The large machine shop of this company, completed last July, is lighted by multiple glower Nernst lamps. Another Deere interest, the Velle Carriage Co., of Moline, has installed a hundred Nernst lamps of the three and six glower types.

The Glasgow (Scot.) Corporation, which is a municipal concern, has contracted with the British Westinghouse Electric & Mfg. Co., Ltd., for the electric motor equipment of 100 cars, costing approximately $87,645.

The Pittsburg offices of the Buffalo Forge Co. have been removed to 607 House Building, corner of Smithfield and Waters Sts. Pittsburg sales district will continue in charge of H. D. Wilson, M. E.

The Smith & Thayer Co., Boston, Mass., will open a New York office in the Fuller Building.

The firm of Mackenzie & Quarrier, New York, has been incorporated under the name of Mackenzie, Quarrier & Ferguson, and will remove its offices to 114 Liberty Street. The firm will continue to represent the Harrisburg Foundry & Machine Works.

The Lord & Burnham Co., Irvington-on-Hudson, N. Y., horticultural architects and builders and steam and hot-water heating engineers, have nearly completed a galvanizing plant in connection with their works, and intend in the future to galvanize nearly all iron-framed tables and beds made by them. The galvanized framework will not require painting and the additional cost over the cost of painting is not large.

Following the contract recently placed with the New York Continental Jewell Filtration Co. by Cornell University, of Ithaca, N. Y., the company has been awarded the contract for the entire city supply at Ithaca. The company has also received a large order from the Producers' Powder Co., Ashburn, Mo., for a New York gravity type of filter.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Institute for Blind, Janesville, Wis., engine for a direct-connected unit; Mineral Point, Wis., Zinc Co., engine for direct-connected unit.

Dodge & Day, engineers, of Philadelphia, have been commissioned to report on motor equipment for the Firth-Sterling Steel Co., of Pittsburg.

The Stanley Electric Mfg. Co., through its Montana office, has sold to the Bismarck Nugget Gulch Consolidated Mining Co. a complete power equipment consisting of inductor alternators, induction motors, hot wire voltmeters and ammeters, lightning arresters and the attendant controlling and regulating apparatus.

Among recent orders secured by the American Blower Co., Detroit, Mich., are mentioned the following: Heating apparatus for Colorado Fuel & Iron Co., Redstone, Colo.; Compensating Pipe Organ Co., Battle Creek, Mich.; Jeanesville, Pa., Iron Works; Canadian Pacific round house, Ft. William, Ont.; Land Title Bldg., Philadelphia, Pa.; University of Pennsylvania Laboratory, Philadelphia; and Troy, N. Y., school; mechanical draft apparatus for the United States Mint, Denver, Colo.; Charlotte, N. C., St. Ry., Light & Power Co.; New Prague, Minn., Flouring Mill Co., and Lafayette, Ind., Hominy Mills.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Apr. 6.	Richmond, Va.	Mar. 28
Apr. 6.	Jacksonville, Fla.	Mar. 28
Apr. 6.	Fargo, N. D.	Mar. 14
Apr. 6.	Valves, Richmond, Va.	Apr. 4
Apr. 6.	New Ulm, Minn.	Apr. 4
Apr. 7.	Latonia, Ky.	Mar. 28
Apr. 7.	Biloxi, Miss.	Mar. 21
Apr. 7.	Truman, Minn.	Mar. 21
Apr. 7.	Topeka, Kan.	Apr. 4
Apr. 8.	Portland, Ore.	Mar. 28
Apr. 8.	Brooklyn, N. Y.	Mar. 28
Apr. 9.	Pipe, Boston, Mass., Adv. Mar. 28.	Mar. 28
Apr. 9.	Dyersburg, Tenn.	Mar. 28
Apr. 9.	Cleveland, O.	Apr. 4
Apr. 10.	Duluth, Minn.	Apr. 4
Apr. 10.	Pipe, etc., Falmouth, Mass. Adv. Apr. 4.	Apr. 4
Apr. 14.	Tower, Marshall, Tex.	Mar. 28
Apr. 15.	Enfield, N. H.	Mar. 28
Apr. 15.	Wilmington, O.	Mar. 28
Apr. 16.	Cleveland, O., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 20.	Oakland City, Ind.	Mar. 21
Apr. 24.	Cleveland, O.	Apr. 4
Apr. 24.	Minneapolis, Minn.	Apr. 4
Apr. 27.	Willipeg, Man., Adv. Mar. 28, Apr. 4.	Mar. 27
Apr. 27.	Cleveland, O.	Apr. 4
May 1.	Chinook, Mont.	Feb. 7
May 2.	Ft. D. A. Russell, Wyo.	Apr. 4
May 7.	Newark, N. J.	Apr. 4
May 12.	Toronto, Ont.	Mar. 21
Aug. 1.	Allegheny, Pa.	Apr. 4
———	Quincy, Mass.	Mar. 28
———	Lonaconing, Md.	Mar. 28
	SEWERAGE AND SEWAGE DISPOSAL.	
Apr. 6.	Minneapolis, Minn.	Apr. 4
Apr. 7.	Corinth, N. Y., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 7.	Culpeper, Va.	Mar. 28
Apr. 8.	Canajoharie, N. Y.	Mar. 28
Apr. 8.	New Haven, Conn.	Apr. 4
Apr. 9.	Bridgeport, Conn.	Mar. 28
Apr. 9.	Cleveland, O.	Apr. 4
Apr. 9.	Sandusky, O.	Apr. 4
Apr. 10.	Terre Haute, Ind.	Apr. 4
Apr. 10.	Maywood, Ill.	Apr. 4
Apr. 13.	Toledo, O.	Mar. 28
Apr. 13.	Cleveland, O.	Apr. 4
Apr. 13.	Slatington, Pa.	Apr. 4
Apr. 14.	Columbus, O., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 14.	Olathe, Kan.	Apr. 4
Apr. 15.	Amsterdam, N. Y., Adv. Apr. 4.	Apr. 4
Apr. 15.	Glenville, O.	Mar. 28
Apr. 21.	Trenton, N. J.	Apr. 4
Apr. 22.	Cincinnati, O.	Apr. 4
Apr. 23.	Cleveland, O.	Apr. 4
Apr. 28.	Cape May, N. J.	Mar. 28
May 1.	Ft. D. A. Russel', Wyo.	Apr. 4
May 2.	Crookston, Minn.	Apr. 4
May 15.	Tonah, Wis.	Apr. 4
Apr. —	Crookston, Minn.	Feb. 21
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
———	Port Huron, Mich.	Mar. 14
	BRIDGES.	
Apr. 7.	New York, N. Y.	Mar. 21
Apr. 8.	Crawfordsville, Ind.	Mar. 28
Apr. 9.	New York, N. Y.	Apr. 4
Apr. 10.	Salem, Mass.	Apr. 4
Apr. 11.	Akron, O.	Mar. 28
Apr. 11.	Buffalo, N. Y., Adv. Apr. 4.	Apr. 4
Apr. 13.	San Bernardino, Cal.	Mar. 21
Apr. 14.	Columbus, O.	Mar. 14
Apr. 14.	Boston, Mass., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 15.	Flintstone, Md.	Apr. 4
Apr. 16.	Saginaw, Mich.	Apr. 4
Apr. 16.	Scottsdale, Pa.	Mar. 28
Apr. 16.	Indianapolis, Ind.	Apr. 4
Apr. 17.	Covington, Ind.	Apr. 4
Apr. 18.	Cleveland, O.	Apr. 4
Apr. 20.	Janesville, O.	Mar. 28
Apr. 21.	Bloomington, Neb.	Apr. 4
Apr. 22.	Spencer, Ind.	Apr. 4
Apr. 25.	Dayton, O.	Apr. 4
May 4.	Quincy, Cal.	Mar. 28
May 18.	Fredericton, N. B.	Apr. 4
	PAVING AND ROADMAKING.	
Apr. 6.	New Bedford, Mass. Adv. Mar. 7, 14, 28, Apr. 4.	Mar. 7
Apr. 6.	St. Paul, Minn.	Apr. 4
Apr. 6.	Chester, Pa.	Apr. 4
Apr. 6.	Erie, Pa.	Apr. 4
Apr. 7.	Tampa, Fla.	Mar. 28
Apr. 7.	New York, N. Y.	Mar. 28
Apr. 7.	Celina, O.	Mar. 21
Apr. 7.	Jersey City, N. J.	Apr. 4
Apr. 9.	Ironton, O.	Mar. 28
Apr. 9.	New York, N. Y.	Apr. 4
Apr. 9.	Montreal, Que.	Apr. 4
Apr. 10.	Napoleon, O.	Mar. 28
Apr. 10.	Windsor, Ont.	Mar. 14
Apr. 10.	Tacoma, Wash.	Mar. 14
Apr. 10.	Atchison, Kan.	Apr. 4
Apr. 10.	Lansdowne, Pa.	Apr. 4
Apr. 10.	Waterloo, Ia.	Apr. 4
Apr. 11.	Youngstown, O.	Mar. 28
Apr. 13.	Cincinnati, O.	Mar. 28
Apr. 13.	Columbus, O.	Mar. 28
Apr. 13.	Houston, Tex.	Mar. 18
Apr. 13.	Toledo, O.	Mar. 21
Apr. 13.	Lansing, Mich.	Apr. 4
Apr. 14.	Trenton, N. J.	Mar. 28
Apr. 14.	St. Louis, Mo.	Apr. 4
Apr. 14.	Massillon, O.	Mar. 28
Apr. 14.	Terre Haute, Ind.	Apr. 4
Apr. 14.	New York, N. Y.	Apr. 4
Apr. 14.	St. Louis, Mo.	Apr. 4
Apr. 14.	Marion, Ind.	Apr. 4
Apr. 15.	Glenville, O.	Apr. 4
Apr. 15.	Des Moines, Ia.	Mar. 28
Apr. 15.	Traverse City, Mich. Adv. Mar. 14 to 28.	Mar. 14
Apr. 16.	Williamsport, Pa., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 16.	Stratford, Ont.	Apr. 4
Apr. 16.	Findlay, O.	Mar. 21
Apr. 17.	Kalamazoo, Mich.	Apr. 4
Apr. 18.	Salem, O.	Mar. 28
Apr. 18.	Evansville, Ind.	Mar. 14
Apr. 18.	Salem, O.	Apr. 4
Apr. 20.	Cincinnati, O.	Mar. 28
Apr. 20.	New Albany, Ind.	Mar. 28
Apr. 20.	Louisville, Ky.	Apr. 4
Apr. 21.	Nevada, Mo.	Mar. 28
Apr. 21.	Cincinnati, O.	Mar. 28
Apr. 21.	Shawnee, Okla. Ter. Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 26.	Vallejo, Cal.	Apr. 4
Apr. 27.	Lafayette, Ind.	Mar. 28
Apr. 28.	Cape May, N. J.	Mar. 28
May 5.	Marion, Ind.	Apr. 4
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
	POWER, GAS AND ELECTRICITY.	
Apr. 6.	Biloxi, Miss.	Mar. 28
Apr. 7.	Oneida, N. Y.	Feb. 7
Apr. 8.	Ft. Rosecrans, Cal.	Mar. 21
Apr. 8.	Gowanda, N. Y., Adv. Apr. 4.	Apr. 4
Apr. 9.	New York, N. Y.	Apr. 4
Apr. 10.	Duluth, Minn.	Apr. 4
Apr. 13.	Columbus, O.	Mar. 28
Apr. 15.	Wilmington, O.	Mar. 28
Apr. 15.	Liverpool, N. S.	Mar. 28
Apr. 20.	Great Falls, Mont.	Apr. 4
May 11.	Toronto, Ont., Adv. Apr. 4.	Apr. 4
May 12.	Copenhagen, Denmark	Apr. 4
Jun. —	North Yamkill, Ore.	Apr. 4
	GOVERNMENT WORK.	
Apr. 6.	Ft. Ethan Allen, Vt. Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 6.	New York, N. Y., Adv. Mar. 21, 28.	Mar. 21
Apr. 6.	Ft. Riley, Kan., Adv. Mar. 14 to Apr. 4.	Mar. 14
Apr. 6.	Minneapolis, Minn.	Mar. 14
Apr. 8.	Ft. Snelling, Minn.	Mar. 28
Apr. 8.	New York, N. Y., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 8.	Port Townsend, Wash. Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 8.	Annapolis, Md.	Apr. 4
Apr. 9.	San Francisco, Cal.	Mar. 21
Apr. 9.	Mobile, Ala.	Mar. 14
Apr. 9.	Biloxi, Miss.	Mar. 21
Apr. 10.	Ft. Mansfield, R. I.	Mar. 21
Apr. 10.	Port Townsend, Wash., Adv. Mar. 21.	Mar. 21
Apr. 10.	Annapolis, Md.	Apr. 4
Apr. 11.	Petoskey, Mich. Adv. Mar. 14 to Apr. 4.	Mar. 21
Apr. 11.	Marquette, Mich. Adv. Mar. 14 to Apr. 4.	Mar. 14
Apr. 11.	Chattanooga, Tenn., Adv. Mar. 7 to 28.	Mar. 7
Apr. 13.	Ft. McKinley, Me. Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 14.	Portland, Me., Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 14.	Washington, D. C. Adv. Mar. 14 to Apr. 4.	Mar. 14
Apr. 15.	New York, N. Y., Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 15.	Ft. Greble, R. I., Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 15.	Norfolk, Va., Adv. Mar. 21, Apr. 4.	Mar. 21
Apr. 15.	Pineridge, S. D.	Mar. 21
Apr. 16.	Ft. Washington, Md.	Mar. 28
Apr. 16.	Ft. Hunt, Va.	Mar. 28
Apr. 16.	Cherokee, N. C.	Apr. 4
Apr. 17.	Philadelphia, Pa.	Mar. 28
Apr. 17.	St. Augustine, Fla. Adv. Feb. 21, Mar. 7, 21 to Apr. 4.	Feb. 21
Apr. 18.	Ft. Hancock, N. J.	Mar. 28
Apr. 18.	Charleston, S. C.	Apr. 4
Apr. 20.	Boston, Mass.	Mar. 28
Apr. 20.	Ft. Ringgold, Tex., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 20.	Ft. Barrancas, Fla.	Mar. 28
Apr. 20.	New York, N. Y. Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 20.	Ft. McKinley, Me., Adv. Apr. 4.	Apr. 4
Apr. 21.	Springfield, S. D.	Apr. 4
Apr. 21.	Ft. Dade, Fla., Adv. Apr. 4.	Apr. 4
Apr. 22.	New York, N. Y., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 22.	Nashville, Tenn., Adv. Mar. 21, 28.	Mar. 21
Apr. 22.	Ft. Fremont, S. C.	Apr. 4
Apr. 23.	Ft. D. A. Russell, Wyo.	Mar. 28
Apr. 23.	New York, N. Y., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 23.	New London, Conn. Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 23.	Ft. Lawton, Wash.	Apr. 4
Apr. 24.	Marquette, Mich., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 24.	Port Townsend, Wash., Adv. Apr. 4.	Apr. 4
Apr. 24.	San Francisco, Cal.	Apr. 4
Apr. 25.	Ft. Gaines, Ala., Adv. Mar. 28.	Mar. 28
Apr. 25.	Boston, Mass.	Mar. 28
Apr. 27.	Richmond, Ky.	Apr. 4
Apr. 28.	Denver, Colo., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 30.	Portland, Ore.	Mar. 28
Apr. 30.	Washington Barracks, D. C. Adv. Apr. 4.	Apr. 4
Apr. 30.	Kalamazoo, Mich., Adv., Apr. 4.	Apr. 4
Apr. 30.	Norfolk, Va.	Apr. 4
May 1.	West Point, N. Y., Adv. Apr. 4.	Apr. 4
May 1.	Boston, Mass.	Apr. 4
May 4.	Catlettsburg, Ky., Adv. Apr. 4.	Apr. 4
May 4.	Memphis, Tenn.	Apr. 4
May 5.	Greensboro, N. C., Adv. Apr. 4.	Apr. 4
May 6.	Norwich, Conn.	Apr. 4
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 15.	Manila, P. I., Adv. Mar. 14 to Apr. 4.	Mar. 14
	BUILDINGS.	
Apr. 6.	School, Brooklyn, N. Y.	Mar. 28
Apr. 6.	Church, Stuart, Ia.	Apr. 4
Apr. 7.	Court house, Webster, S. D.	Mar. 21
Apr. 7.	Jail, Morristown, Tenn.	Feb. 28
Apr. 7.	School, Windber, Pa.	Apr. 4
Apr. 8.	Library, Des Moines, Ia.	Mar. 28
Apr. 8.	City Hall, Athens, Ga., Adv. Mar. 28.	Mar. 28
Apr. 8.	Hospital, Yankton, S. D.	Mar. 28
Apr. 9.	School, Reading, Pa.	Apr. 4
Apr. 9.	Pub. Bldg., Redfield, S. D.	Mar. 28
Apr. 9.	Bus. Bldg., St. Marys, O.	Mar. 28
Apr. 9.	School, Sheldon, Ga.	Mar. 28
Apr. 9.	Htg. System in Pub. Bldg., Xenia, O. Adv. Mar. 21, 28.	Mar. 21
Apr. 9.	Htg. Court house, Centerville, Ia.	Mar. 21
Apr. 9.	Church, Kewanee, Ill.	Apr. 4
Apr. 9.	Pub. Bldg., New York, N. Y.	Apr. 4
Apr. 9.	Pub. Bldgs., Greenfield, Ia.	Apr. 4
Apr. 10.	Bus. Bldg., York, Neb.	Apr. 4
Apr. 10.	Pub. Bldg., New Orleans, La.	Apr. 4
Apr. 13.	Schools, New York, N. Y.	Apr. 4
Apr. 13.	School, Nottingham, Ind.	Apr. 4
Apr. 13.	School, Alexandria, Ind.	Apr. 4
Apr. 14.	School, Mansfield, O.	Mar. 28
Apr. 14.	School, Decatur, Ill.	Apr. 4
Apr. 14.	Jail, Merced, Cal.	Apr. 4
Apr. 15.	School, New Bedford, Mass.	Mar. 28
Apr. 15.	Library, Olney, Ill.	Mar. 28
Apr. 15.	Court house, Corsicana, Tex.	Mar. 14
Apr. 15.	Church, Liberty, Ind.	Apr. 4
Apr. 15.	Church, Union, S. C.	Apr. 4
Apr. 16.	Court house, Monroeville, Ala.	Mar. 28
Apr. 16.	Pub. Bldg., Lisbon, O.	Mar. 28
Apr. 16.	Court house, Greenburg, Pa.	Apr. 4
Apr. 16.	Bus. Bldg., Dennison, O.	Apr. 4
Apr. 17.	Hospital, New York, N. Y.	Apr. 4
Apr. 18.	Church, etc., Holyoke, Mass.	Apr. 4
Apr. 19.	School, St. Clair, Pa.	Mar. 28
Apr. 20.	Library, Jacksonville, Fla.	Mar. 28
Apr. 20.	School, Cleveland, O.	Mar. 28
Apr. 20.	School, Reedsburg, Wis.	Mar. 28
Apr. 20.	School, Schenectady, N. Y.	Apr. 4
Apr. 21.	Pub. Bldgs., Great Bend, Kan.	Apr. 4
Apr. 22.	Pub. Bldgs., Texarkana, Ark.	Apr. 4
Apr. 23.	School, Mansfield, O.	Apr. 4
Apr. 23.	Hospital, Gallipolis, O.	Apr. 4
Apr. 25.	School, Sarnia, Ont.	Apr. 4
Apr. 27.	School, Olivia, Minn.	Apr. 4
May 1.	School, Hamilton, O.	Apr. 4
May 4.	Court house, Abbeville, Ga.	Mar. 21
May 8.	Htg. Court house, Shakopee, Minn.	Mar. 28
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21 to Apr. 4.	Mar. 21
———	Court house, Wray, Colo.	Mar. 21
	MISCELLANEOUS.	
Apr. 6.	Garb. Disp., Chester, Pa.	Apr. 4
Apr. 6.	Garb. Disp., Burlington, Ia.	Apr. 4
Apr. 7.	Supplies, New York, N. Y.	Mar. 28
Apr. 7.	St. Sprinkling, W. Springfield, Mass.	Apr. 4
Apr. 7.	Garb. Disp., Newburgh, N. Y.	Apr. 4
Apr. 7.	Ditch, Tekamah, Neb.	Apr. 4
Apr. 8.	El. Ry. franchise, Visalia, Cal.	Mar. 28
Apr. 9.	Hospital Equip., Johnson City, Tenn. Adv. Mar. 21 to Apr. 4.	Mar. 21
Apr. 9.	Park Work, New York, N. Y.	Apr. 4
Apr. 10.	El. Ry. franchise, Hanford, Cal.	Mar. 28
Apr. 13.	St. Ry. franchise, Los Angeles, Cal.	Mar. 21
Apr. 13.	El. Ry. franchise, Whittier, Cal.	Mar. 14
Apr. 14.	R. R. Work, Beckley, W. Va.	Mar. 21
Apr. 15.	St. Sprinkling, La Crosse, Wis.	Apr. 4
Apr. 17.	Harbor work, Quebec, Que.	Mar. 28
Apr. 20.	St. R. R. franchise, San Jose, Cal.	Mar. 28
Apr. 20.	Harbor improv., Falmouth, Jamaica.	Mar. 21
Apr. 30.	Dredging, Honolulu, H. I.	Mar. 28
May 1.	St. Cleaning, etc., Washington, D. C. Adv. Apr. 4.	Apr. 4
May 2, '04	R. R., Oodnadatta, So. Australia.	Feb. 21

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Civil Engineers in the Navy.

Civil engineers' positions in the United States Navy, for some reason, do not seem sufficiently attractive to young engineers to cause them to compete sharply for the vacancies in the department. At examinations recently held only six candidates presented themselves to the examiners in New York City, and one in Chicago. Of these one passed with the required mark of 75 per cent. or more. Two positions at $2,700 a year are now vacant. The perquisites, prospects of promotion, retired pay and other advantages of the service were set forth in The Engineering Record of January 31, and are believed to be such, under usual conditions, as to be satisfactory to men of suitable qualifications. The 57th Congress passed a bill authorizing the increase of the Civil Engineer Corps of the Navy to 40, including 28 civil engineers and 12 assistant civil engineers. Three assistants may be appointed this year and each succeeding year until the full number is appointed. Another examination is likely to be held soon to fill two vacancies in the grade of Civil Engineer, and obtain the three assistants authorized this year. Examinations will also be held, probably, in November or December of this year and annually thereafter.

The poor success of the Navy Department in attracting candidates to the examinations for civil engineers is probably largely due to the nature of the questions in the technical papers, of which an example was printed in The Engineering Record of February 16 and 23, 1901. For a man who has been out of school a few years, busily engaged in active work, an academic examination is somewhat formidable, and it is frequently the case that the men who could make the most creditable percentage on an examination paper have not developed the abilities and resourcefulness which are most valuable in the conduct of the design and construction of important works. However, it should be borne in mind that greater weight (80 per cent.) is given to the practical part of the examination than to the academic; and men of somewhat more than average quickness and intelligence—and such are the men desired in the corps—should be able with two or three months' notice to refresh their theoretical knowledge sufficiently to pass the examinations, the purpose of which is to insure the proper technical intellectual equipment of the men. It is highly desirable that the positions in the navy should be filled by well educated and able men. If the result of misapprehension regarding the examinations is to deter many of the most desirable men from trying for the places, it certainly is unfortunate. However, the difficulty of the examinations is, doubtless, overestimated, and may be said to be in the breadth of the field covered rather than in the nature of the questions upon any one topic, but the demands of the work of the department are quite as broad as the scope of the examinations.

Valuable Data on Mechanical Filtration.

The presentation of such a useful paper as that by Mr. Geo. W. Fuller on the filtration works of the East Jersey Water Company, at Little Falls, N. J., read before the American Society of Civil Engineers last week, is an incident meriting comment outside the Society's publications. Fifteen years ago the mechanical filter was an apparatus regarded with suspicion by most engineers. Slow sand filters were doing fair work abroad, and the investigations of the Massachusetts State Board of Health were beginning to demonstrate the true reasons for the successful action of sand as a filtering medium. It was known from experience in many of these purification works, that any attempt to increase the rate of filtration above a certain limit would result in a poor effluent. So when the advocates of the mechanical filter urged that their apparatus could accomplish as good work as the slow sand filter, on a very much smaller tract of land and at a greatly increased rate, most engineers were incredulous. Later, when the various patentees of such apparatus engaged in a commercial warfare, and each derided the claims of the others, the conservative engineer very naturally derided the claims of all of them. The fundamental principle of rapid filtration was gradually recognized to be a good one; the use of a coagulant certainly had possibilities of great benefit, and, indeed, had been already tried with some success on a small scale in a few foreign plants having slow sand filters. It was not until Mr. Charles Hermany began at Louisville his comprehensive investigation of the best system of filtering the Ohio River water that any systematic scientific study of the use of a coagulant and the merits of rapid filtration was undertaken on a scale of sufficient scope to be of much value. Before this time, a number of engineers had become sufficiently satisfied with the apparatus to use it without hesitation, but they were by no means a majority of the waterworks specialists. Mr. Hermany entrusted the detail of the investigation to Mr. Fuller, whose experience at the Lawrence Experiment Station must naturally have tended to make his views of mechanical filtration conservative. His reports on that investigation and on his subsequent studies at Cincinnati for Mr. Bouscaren established beyond any question the position of rapid or mechanical filtration as the equal of the older slow process, when properly conducted, and as its superior in the removal of color and turbidity.

Aside from these reports the literature of mechanical filtration has been confined practically to reports of Mr. Hazen on experiments at Lorain and Pittsburg, and papers by Messrs. Edmund Weston, R. S. Weston and Morris Knowles, with a few articles in periodicals on improvements in details of the mechanical plant. Mr. Fuller's American Society of Civil Engineers' paper is the first statement of an official character on the construction and operation of a large installation of mechanical filters embodying the latest improvements which the manufacturers have introduced. It is, therefore, a timely and useful contribution to the Society's transactions, while to the water-works engineer it will be a source of most valuable data. The Engineering Record has no intention of discussing these data at this time, but there are a few features of the paper to which it desires to draw attention.

The first is the fact that the owners of this costly plant spent their money very largely for an aesthetic reason to reduce the color of the raw water until it had a satisfactory appearance. The typhoid fever death rate of communities supplied with the unfiltered water had not been high, and it will be many years before the pollution of the supply is so great as that of the supplies now furnished by the municipal works of many cities. The construction of the Little Falls works must therefore be regarded as an excellent example of the shrewd business policy which endeavors to forestall every objection before it is raised. Although the addition of a suitable coagulant to reduce color as well as to enmesh suspended matter is possible with slow sand filtration, the mechanical filter has many advantages for its use. One of these is the compactness of the works, an advantage which Mr. Fuller states was the main reason for selecting this type of filters. Enough land at a low level was available for rapid filters which would receive the raw water and deliver the effluent by gravity, but slow sand filters of equal capacity could only be constructed, owing to the larger area they cover, at a much higher level, making pumping necessary.

The efficiency of the filters is also an interesting subject on which the paper affords ample information. During the first month of operation, when the operating staff was learning its duties, the color was reduced from 31 to only 11, but afterward the reduction was to 7 and 5. As it is impossible for a consumer to recognize color when the amount is 10 or less, this feature of operation is very satisfactory. The bacterial efficiency has been equally noteworthy. During the first month of operation the average number of bacteria per cubic centimeter in the filtered water was 190, but for the three following months it was between 90 and 50. During January of this year, while experiments with different quantities of coagulant were being made, the average count of bacteria rose to 110. These numbers are equivalent to a percentage reduction of 96.5 to 99.1, but that method of recording the bacterial efficiency is not so useful as the statement of the actual counts, although it is more frequently employed.

The necessity of a continuous scientific control of a mechanical filter plant for water of variable character has long been asserted by many engineers, and it is interesting to find in this paper a practical confirmation of such views. The raw water has such a low alkalinity during times of freshet that the sulphate of

alumina used as a coagulant is not decomposed by it to the requisite degree, and if the chemical character of the river water were not watched closely the process of filtration would thus fail when most needed. By analyzing the water from time to time each day during freshets, it is possible to determine the deficiency in alkalinity and add enough solution of soda ash to remedy it. This is only one of many advantages of skilled supervision in operating the works which will be found mentioned in the paper.

The procedure which was adopted by the East Jersey Water Company in respect to these works deserves a few words of commendation. The entire matter was placed under the charge of Mr. J. Waldo Smith, its chief engineer and superintendent. Preliminary studies of the subject were made by Mr. Fuller and his recommendation for mechanical filtration was adopted. Manufacturers were then requested to submit preliminary plans and estimates for a plant of the desired capacity. These were referred to Mr. Fuller, who selected that which appeared most suitable and supervised the preparation of the detailed plans by Mr. Charles L. Parmelee, chief engineer of the New York Continental Jewell Filtration Company. Mr. W. B. Fuller assisted in the designs of the concrete work and acted as resident engineer during construction. In this way every part of the design and construction was done by a specialist working in harmony with his associates yet relieved from responsibility for everything outside his immediate field. The heavy concrete work forming the substructure, built with cement furnished by the Water Company and from its own plans, was constructed without any guaranty being required as to stability and tightness, while the remainder of the concrete work was guaranteed by the contractor because he furnished the cement and was given the privilege of changing the plans somewhat. The manufacturers of the filter equipment guaranteed specified efficiencies for the machinery and the successful mechanical and physical performance of the work for which they were designed, but the Water Company assumed full responsibility for the behavior of the plant in treating water. The first year's operations are under Mr. Fuller's supervision. That the treatment is so satisfactory can be attributed in no small measure to this method of managing the undertaking from its inception.

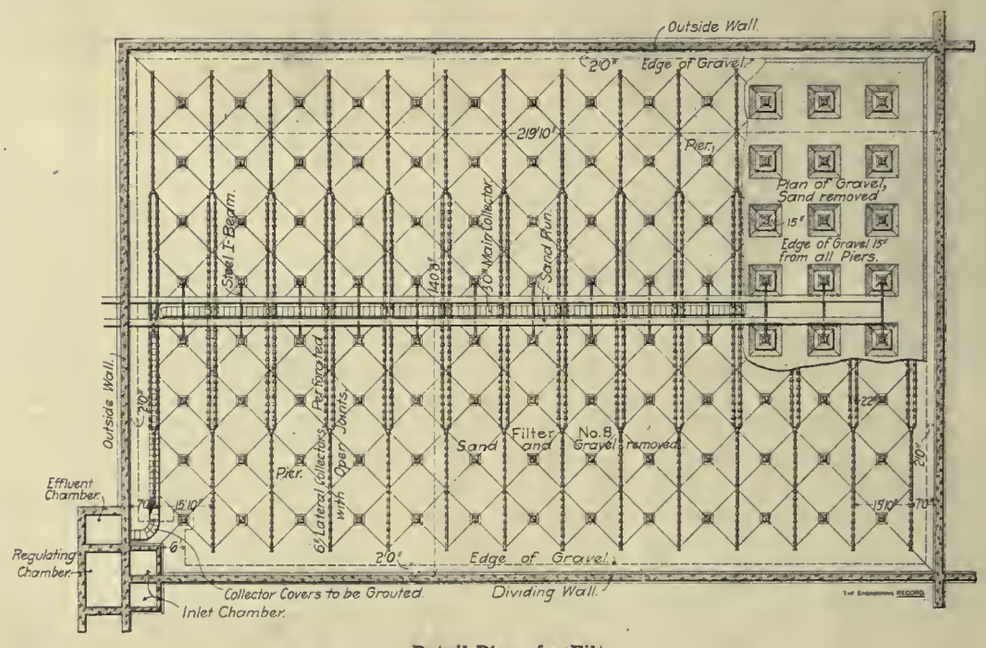
The Philadelphia Filtration System—III. Upper Roxborough Filters.

The general scheme for the Upper Roxborough filters, the earthwork and some of the masonry details were described and illustrated in The Engineering Record of March 28. The piping which, as in all large plants, would seem complicated on the drawings and hence is not shown, may be divided for ease of description into five systems, the raw water supply pipes and drains, the effluent pipes, the sand washer supply pipes and drains, the refilling pipes and the storm water drains. All the main pipes are parallel and are laid under the courts and the driveway beside Hagy Street. The raw water system is fed with settled water by the auxiliary pumping station through the 48-inch main, which divides at the Hagy Street entrance to the main court into two 48-inch branches. One branch extends under the main court, reducing to 36 inches in diameter after passing the branch to filters Nos. 5 and 6 and further reducing to 30 inches after passing filters Nos. 3 and 4; and finally divides into two 24-inch branches, one of which feeds filters Nos. 1 and 2.

The other 48-inch branch of the pump main extends under the driveway, and the court in front of filters Nos. 7 and 8 and is capped just beyond the branch supplying these filters so that it may be continued to feed future filters. This branch is controlled by a 36-inch valve with 48-inch to 36-inch reducers on each side, just beyond which is a capped 48x48-inch branch provided for a future additional pumping main. All branches to the inlet chambers are 24-inch pipes and each supplies two filters.

A system of pipes to convey the water from above the sand and sand beds back again to the low service pumping-station, and re-supply pipe to filters now in service, have been provided. The main pipe for this purpose is 24 inches in diameter, and extends at right angles to the axis of the system of filters from the south court to Port Royal Avenue, thence to Eva Street and thence to the 36-inch main which supplies water from the Upper Roxborough reservoir to the low service pumping machinery located in the addition to the Roxborough auxiliary pumping-station.

Opposite each controlling house is a circular brick manhole on the raw water drains, through which the 20-inch branch from the pair of filters connects with the main drain. Each filter is provided with an overflow communicating through a 16-inch terra-cotta pipe to the storm drain with a 4-foot diameter brick manhole at each connection. For filters Nos. 2 and 3 and for filters Nos. 4 and 5 the two overflows connect into one 16-inch pipe. There is an overflow in the filtered water basin also connecting, by a 30-inch terra-cotta pipe, to the storm drain.



Detail Plan of a Filter.

The effluent pipe system begins with the perforated 6-inch terra-cotta laterals discharging into the main collector in each filter, as shown in the detailed plan of one of the filters. Each main collector discharges into an effluent chamber, from which a 20-inch cast-iron pipe leads to the main effluent pipe. This pipe is 48 inches in diameter from filter No. 8 to the gate chamber at the northerly corner of the filtered water basin, from which, also, a 48-inch pipe extends across the court to a cast-iron main varying from 20 to 36 inches in diameter, which receives the branches of the controlling houses for filters Nos. 1 to 6. (The direction of Hagy Street is northwest and southeast.) The filtered water may be taken into the basin through these pipes or by-passed around it from a branch and valve near the west corner of the basin through a 48-inch pipe in Hagy Street to a connection in Port Royal Avenue with a 48-inch service main from the southerly corner of the basin. A 16-inch cast-iron pipe leading from the 48-inch pipe near the gate chamber supplies filtered water to the sand washer pumps. There is also a cast-iron effluent chamber drain having 16-inch connections with each effluent chamber and a 20-inch connection to the gate chamber of the filtered water basin. This drain, also, connects with the storm water drain in the 6-foot circular brick manhole in the main court near Hagy Street, where it is controlled by a 20-inch gate and a 30-inch check valve. All large valves outside the gate and regulator chambers are in circular brick manholes.

A terra-cotta sand washer drain varying from 10 inches to 18 inches in diameter is laid under the courts and driveway and has a 10-inch connection and manhole at each sand washer. Terra-cotta storm water drains varying from 16 inches to 24 inches in diameter extend under the courts and receive the surface water through suitably located inlets and 12-inch terra-cotta pipe connections. There is also a system of 4-inch agricultural tile drains on the roof of the filtered water basin to intercept all surface water before it shall have opportunity to percolate into the basin. One of these drains is laid over the center line of each space between the rows of piers supporting the roof. The drains are thus about 15 feet apart on centers. They connect into 10-inch and 12-inch terra-cotta collectors laid along three sides of the basin. This system of drains discharges into the storm water drain near the westerly corner of the basin. The storm water drains have two connections, and the sand washer drains one connection with a 24-inch temporary storm sewer laid in Hagy Street, which discharges into the Schuylkill River.

There is also a 16-inch cast-iron refill main with a 16-inch branch into each effluent chamber, through which the filters can be filled from below with filtered water. When cleaning the filters the water is drawn down to about 1 foot below the top of the sand, and after the scraping water is admitted through the refill pipes until there is a depth of about 1 foot over the sand, when raw water is admitted as before.

The evolution of the main collector in the Roxborough filter plants has been instructive. The first type was a concrete trough formed in the bottom of the middle bay of each filter, with a uniform cross-section from the rear end

of the filter to the effluent chamber, covered with flat slabs of concrete reinforced with 1½-inch mesh No. 12 expanded metal, made by the Eastern Expanded Metal Company. The slabs were laid flush with the surface of the floor, and those in the lines of the lateral drains have holes into which the short branch of the special terra-cotta tees of the laterals project, as shown. This style involved difficult work in forming the foundations and placing the puddle and concrete, and some cracks occurred in the angle at the floor.

In the second type, not shown, the floor for the whole width of the middle bay was depressed to an increasing depth from the extremity toward the effluent chamber and a terra-cotta main 30 inches in diameter laid therein. The connections with the laterals were made by special branches. The purpose of depressing the floor was to keep the main collector pipe at a proper depth below the surface of the sand and in right relation to the laterals, and the form adopted avoided the sharp angle in the floor which had proved a weakness in the first type. This type did not prove wholly satisfactory. The third type now being built at Belmont and Torresdale, requires no change in the shape of the filter floor. Instead, low concrete walls are built on top of the floor to form a channel, and at proper intervals short bell pipes are built in to receive the laterals. The channel is covered with flat arched concrete slabs, reinforced with expanded metal. The slabs are 18 inches wide, measured along the channel, and each is provided with two lifting rings. After the slabs are placed, the joints between them are covered with strips of burlap dipped in hot asphalt. Easy access is thus provided at all parts of the collector. The details of this type and its connections to the effluent chamber are clearly shown.

A feature of the collector system, not heretofore used, although suggested as long ago as 1865, by Mr. James P. Kirkwood, for the filters at St. Louis, Mo., is the perforation of the laterals, instead of providing for the admission of water by laying the pipes with ½-inch spaces at the joints. The perforated pipes are believed to cause a more uniformly distributed flow of water through the underdrains toward the collector and to prevent more surely the occurrence of concentrated currents tending to bore through the sand, with consequent imperfect filtration. The bells of the lateral pipes are cut away at one place so that the bottom of the pipe throughout its length may rest upon the floor, as is usual in filter construction.

The cast-iron pipes and special castings were furnished by R. D. Wood & Company, of Philadelphia, and the vitrified pipes by Blackmer & Post, of St. Louis. Eddy valves are used in the pipe lines, and the flanged valves in the controlling houses are of the Ludlow make. All the cast-iron pipe lines were made with the usual form of lead joints.

At the middle of the front of each filter is an entrance of gray Roman brick with granite trimmings, closed by heavy battened wooden doors opening upon the sand incline, by means of which materials can be taken into and out of the filter. The construction of these is clearly shown by the drawings and views. The superstructure of the controlling houses, the gate-house of the filtered water basin and the building containing the office, laboratory and pumping plant, are of the Eastern Hydraulic Pressed Brick Company's gray Roman bricks with light gray granite bases and steps, and terra-cotta trimmings and slate roofs, with red pressed brick for the interiors of walls. These buildings and the filters and filtered water basin are fitted with a two-wire system for incandescent electric lights.



REGULATING HOUSE AND ENTRANCE TO FILTER.

Each controller house serves two filters and is situated at the end of the dividing wall between them, which is a more economical, convenient and pleasing arrangement than having a house placed at the middle of the front of each filter in conjunction with the entrance, as in the Lower Roxborough plant. The regulating, inlet and effluent chambers, with their pipe connections, are clearly shown by the drawings. The superstructures do not extend over the inlet chambers, which are entered through manholes in the vaulting. The upper 18 inches of the walls of the inlet chambers are of bricks laid dry so that they can be removed as the depth of sand is decreased by the scrapings, thus keeping the tops of the walls nearly at the level of the surface of the sand. In each inlet chamber there is a balanced disc valve with a large copper float, controlling the admission of raw water to the filter, by means of which the constant depth is maintained on the sand. In planning the filters it was thought best to provide for a depth of sand of 4 feet, and a depth of water over the sand of 4 feet; but experience indicates that these depths can profitably be reduced to 3 feet each, and there would be a considerable resulting saving of masonry in the piers and walls.

In each effluent chamber there is a regulating valve of the design shown. It consists essentially of a circular weir connected to the top of a vertical pipe working through a stuffing-box in the top of a large cast-iron cylindrical chamber, from near the top of which the effluent discharge pipe leads. The weir and its pipe are supported from a large annular copper float in such a way that the distance of the lip of the weir below the surface of the water in the effluent chamber can be readily adjusted by means of a screw stand on the floor above, the float being prevented from turning by a small block fastened in the wall. In this way the head on the weir can be varied by the screw and then kept constant at any desired setting, by the float. Each screw stand is provided with a brass indicator dial and pointer. Thus the head on the filter is controlled, and consequently the rate of filtration, .104 foot corresponding to 500,000 gallons, and .58 foot to 6,000,000 gallons per acre per day. Experience has shown that some modifications can be made to advantage in the details of this regulator. The water in falling over the crest of the weir forms at first a solid column in the center of the pipe, but the air is gradually sucked in from beneath the crest and opens the column out into a tube of water. There is then a rush of air and the column resumes its natural shape. This action is in no way injurious to the operation of the filter, but if a disk or other valve which will interfere with the free passage of the air be interposed in the pipe line leading to the filtered water basin, some annoyance is apt to be caused.



WALLS, PIERS, COLLECTOR CHANNEL AND BEAMS FOR SAND INCLINE.

In the controller houses over each effluent chamber there is an indicating apparatus to show the water levels, consisting essentially of a stationary dial, a moving dial and a pointer,

the last two being actuated by gearing and two floats. The floats are in vertical 10-inch cast-iron pipes, one of which is connected with the raw water in the filter and the other with the effluent pipe just inside the wall of the effluent chamber, as shown. The connections are 1-inch brass pipes.

The courts have granolithic pavements equal to that for the best sidewalk work and the driveway is paved with vitrified brick on a 6-inch concrete base. The bricks were laid on edge with a 1-inch layer of sand and the joints were grouted.

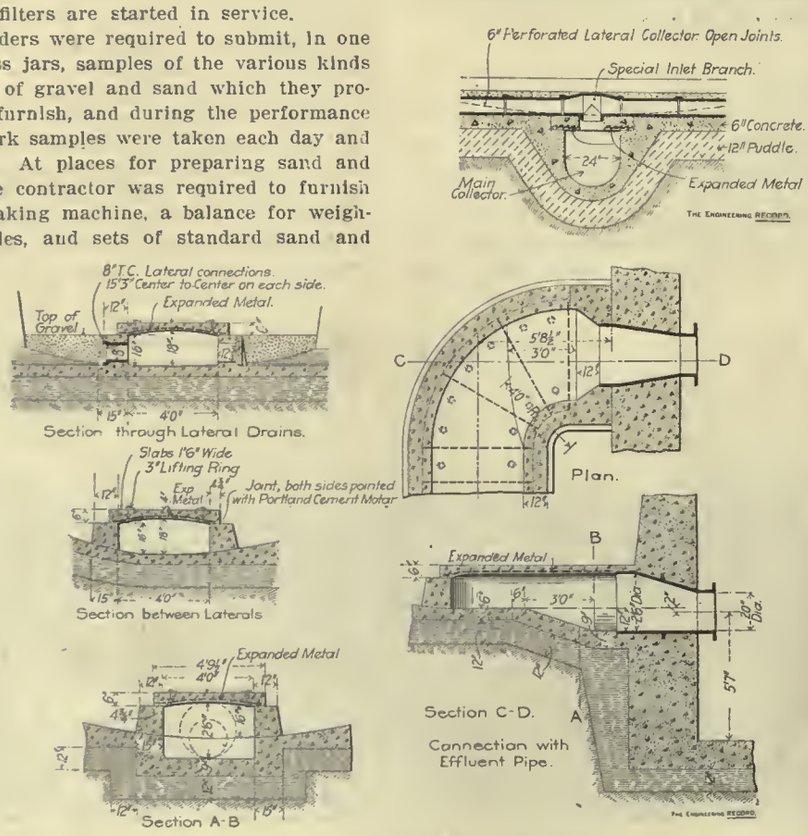
After the completion of the masonry the interior walls and floor of the filters were thoroughly washed before the placing of the underdrains and filtering material. Three methods were proposed for placing the filter sand and gravel, as indicated in the drawings. Plan A required the placing of the filter gravel 15 inches from all piers and at distances of about 2 feet from the walls; in plan B the gravel was to abut against the piers, and in plan C it was placed in horizontal layers abutting against piers and walls. All three methods were used in the Lower Roxborough filters, but as no one of the plans has shown during several months of service any distinct advantage over the others, plan A, which is slightly less expensive, will be used in future work. The contractor is held responsible for any defects in the placing of the collectors and the filtering material, due to his negligence, which may become apparent within six months from the time the filters are started in service.

The bidders were required to submit, in one quart glass jars, samples of the various kinds and sizes of gravel and sand which they proposed to furnish, and during the performance of the work samples were taken each day and analyzed. At places for preparing sand and gravel the contractor was required to furnish a sand-shaking machine, a balance for weighing samples, and sets of standard sand and gravel screens. In a set there are ten sand sieves 8 inches in diameter, 2¾ inches in total depth, containing brass wire cloth of 4, 10, 14, 20, 30, 40, 50, 60, 80 and 100 meshes per linear inch having respectively wire of the following gauges, 18, 23, 25, 28, 30, 33, 35, 36, 38 and 40. There are eight gravel sieves in a set, 12 inches in diameter and 4 inches in total depth, having brass wire screens of the following clear mesh: 3, 2½, 2, 1½ inches, 1, ¾, ½ and ¼ inch.

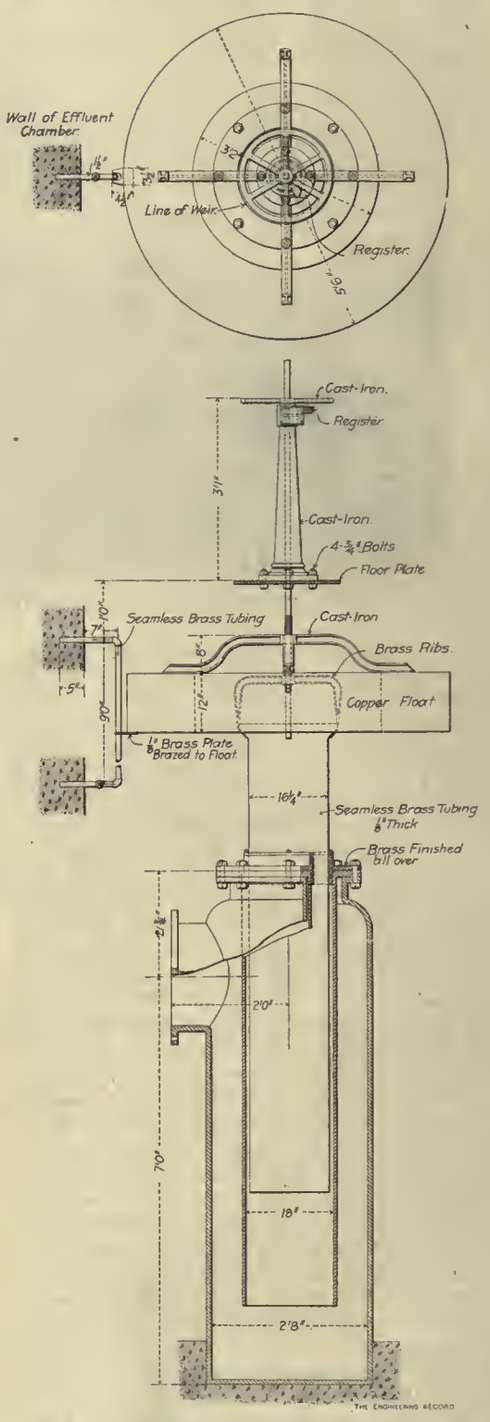
Five sizes of gravel are being used. Nos. 1 and 2 may be either rounded gravel screened from sandy deposits or broken trap or granite rock, but Nos. 3, 4 and 5 are rounded gravel only from sand deposits. The gravel was required to be clean, free from clay and similar ingredients, and to contain not more than 2 per cent. of lime and magnesia and other matter soluble in water or a weak solution of hydrochloric acid. The gravel was placed in the filters with a maximum thickness, at the deepest point, of 16 inches, arranged in five layers from the floor up as follows: No. 1, a 6-inch layer of gravel that would pass a 3-inch mesh and be retained on a 1¾-inch mesh; No. 2, a 4-inch layer that would pass a 1¾-inch mesh and be retained on a ⅝-inch mesh; No. 3, a 3-inch layer that would pass a ⅝-inch mesh and be retained on a ¼-inch mesh; No. 4, a 2-inch layer that would pass a ¼-inch mesh and be retained on a sieve having 14 meshes per inch, and No. 5, a 1-inch layer that would pass 14 meshes per inch and be retained on a sieve having 20 meshes per inch.

The first three sizes of gravel were obtained from Oyster Bay, Long Island, sizes 4 and 5 and part of the sand were screened from banks at Birmingham, N. J. The larger part of the sand, however, was taken from the Delaware River, at Bristol, Pa. Each layer was carefully placed and its top brought to a level surface before the succeeding layer was deposited upon it, the edge of each layer being kept at least 6 feet from the edge of the layer next below. At least 1 cubic foot of the largest pieces of No. 1 gravel was placed by hand around each joint of the lateral collectors. The sand was required to be of hard material which would not disintegrate and to contain less than 1 per cent. by weight of flat or laminated particles like mica. All sand used is as nearly as possible free from clay and organic impurities, being washed if necessary to remove such materials. The sand was specified to contain at least 95 per cent. of silica calculated as SiO_2, and not more than 1 per cent. of lime and magnesia together, calculated as carbonates. Other conditions being equal, the lighter colored sand was preferred. Sand was kept within the following limits as to size: Least effective size, 0.26 millimeter; greatest effective size, 0.35 millimeter; least uniformity coefficient, 1.50; greatest uniformity coefficient, 2.60. Sand containing particles larger in diameter than 5 millimeters or particles smaller in diameter than 0.165, millimeter was not accepted. Sand that would satisfy these requirements would readily pass by shaking a brass wire sieve of 4 meshes per linear inch (No. 18 wire, English gauge), but no appreciable portion would pass a sieve of 100 meshes per linear inch (No. 40 wire).

Usually the sand was deposited in layers about 16 inches deep, each layer being brought to a perfectly level surface before the succeeding layer was placed. Great precaution was exercised to prevent compacting the sand and to maintain a uniform density throughout all the layers, portions which accidentally became compacted being spaded over. To establish a convenient succession in the dates on which the different filters would require to be replenished with sand, the depth in the different beds



Details of Main Collectors.



Effluent Regulating Device.

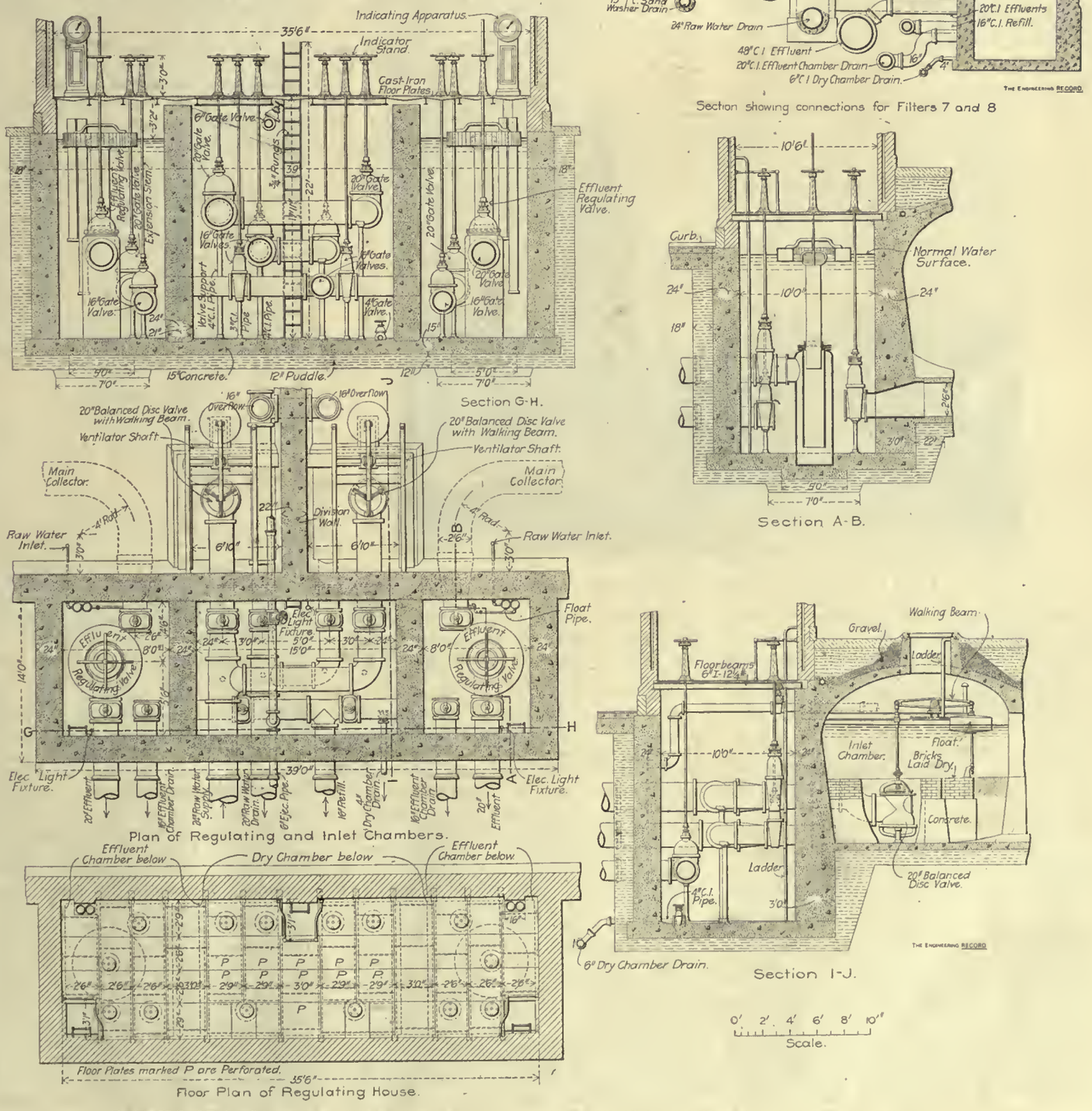
was varied from a minimum of 31 inches in one bed to the normal depth of 3 feet 8 inches in other beds. No frozen sand was allowed to be placed in the filters. After the sand had been deposited and graded in each filter it was settled with water for ten days. The usual amount of settlement was about 2 inches in a depth of 3 feet and was provided for by a preliminary excess depth. Measurements for payment were made after the sand had been settled.

The information used in the preparation of this article was kindly supplied by Mr. John W. Hill, chief engineer of the Bureau of Filtration. Mr. William C. Haddock is director of the Department of Public Works.

Anti-Smoke Ordinance for Chicago.

A so-called anti-smoke ordinance was passed by the Chicago City Council at its meeting on March 23. Under the terms of the ordinance, the offices of Smoke Inspector and Inspector of Steam Boilers are combined under one head, who is to be known as the Chief Inspector of Steam Boilers and Steam Plants. He is an appointee of the Mayor, for a term of two years. A board composed of the chief inspector as chairman, a supervising mechanical engineer and a chief smoke inspector, passes on all questions coming before the department, the vote of the majority of the three governing the action of the same in all important cases. The supervising mechanical engineer and the chief smoke inspector are appointed in accordance with the civil service act by the chief inspector.

The maximum penalty for a smoking chimney has been increased from $50 to $100. The emission of dense smoke, whether from the stack of a boat, locomotive or building within the city limits, is not permitted for more than three minutes in each hour, and in the case of the fires being cleaned, or new ones built, the limit is six minutes. An important feature of the ordinance is the provision that the plans and specifications for all plants, whether new or to be reconstructed, must be approved, before permits are issued. The Commissioner of Buildings, on being notified by the Board is expected to see that the work is carried out in conformity with the plans and specifications as approved. Owners are entitled to receive the advice, cooperation and assistance of the officers to make such further changes as will in their judgment prevent the nuisance. However, unless the appliances or the fuel used actually prevent the emission of smoke, any alterations made in either or both do not constitute a compliance with the ordinance. In the case of plants installed prior to the passage of the ordinance, a year is given in which to comply with its provisions, provided plans are at once prepared and the work prosecuted to the satisfaction of the board. A further provision of the ordinance specifies the notification of the board of all parties to whom sales are made by manufacturers and dealers.



DETAILS OF REGULATING CHAMBERS AND PIPE CONNECTIONS, UPPER ROXBOROUGH FILTERS.

Sewer System for Indiana Harbor, Indiana.

By Otto Gersbach.

The town of Indiana Harbor is situated on the shore of Lake Michigan, nineteen miles southeast of the city of Chicago. A year and a half ago the site of this town was flat, sandy and covered with large ponds. The town now contains 2,500 inhabitants, over 500 houses, 13 miles of graded streets, of which 1.7 miles are macadamized, and a sewer system comprising 6.2 miles of sewers, only recently completed. The town was laid out and is being improved by the Lake Michigan Land Company. The first question to be dealt with was that of drainage. Sewers to handle the surface water and drain the ponds in the business portion of the town were first put in. There are 4,740 feet of these sewers, ranging in size from 12 to 14 inches, emptying into the lake, and laid before street improvements were begun. There are 5.3 miles of sanitary sewers and a purification plant. These sewers range in size from 8 to 30 inches, are laid at grades between .40 and .08 per cent. and run to the purification plant located 1,750 feet from the lake. The maximum depth of sewer below street grade is 21 feet, and the average street surface is 8 feet above lake level.



EXCAVATING TRENCH FOR INDIANA HARBOR SEWER.

The material to be excavated consisted wholly of sand, and a novel method was used in keeping the trench dry. After excavating until ground water was reached, pipes were jetted down until their points were below sewer grade, at both sides of the trench. The water pumped from the trench was used for this purpose at a pressure of about 25 pounds per square inch. The usual distance between these pipes was 4 feet, which was increased to 8 feet where there was little water to handle. These pipes were pointed at the end, and perforated just above, and water was admitted through fine wire netting which excluded the sand. They were 2 inches in diameter and had an original length of 10 feet. Sections 2 and 4 feet long were used in making extensions so that the points would extend below sewer grade. These pipes were attached by hose to a main pipe 4 inches in diameter, with 20-foot sections. The connections were made after the smaller pipes had been jetted into place. The 4-inch pipe was connected to a 10x6x12-inch duplex pump supplied from a 20 horse-power vertical boiler, by which means the trench was kept dry while laying the sewer. After the trench was completed and the sewer laid, the 2-inch pipes were disconnected from the 4-inch pipe and pulled up; the 20-foot section of the main was unjointed, and all were carried ahead to be used again. This method was introduced by Mr. George B. Jackson, superintendent of sewer construction, and was found very efficient for this soil. Little or no sheeting was needed, except a row at the top of the trench to keep it free from sand that would otherwise be pushed down by men working above. Little trouble was found by the sand caving as long as it remained damp.

The purification plant consists of a pumping plant, a septic tank and filtration beds of fine gravel. The sewage first flows into a circular receiving well 16 feet in internal diameter and 19½ feet deep, located under the engine room. The concrete walls of the well are 16 inches thick, and the floor, also of concrete, is 18 inches thick, plastered inside with Portland cement mortar. Upon a wooden platform built into the walls of the well 8 feet above its floor, rest two centrifugal pumps, made by R. D. Wood & Company, for lifting the sewage into the septic tank. The pumps are always above the level of the sewage in the well. A gate valve in the 30-inch inlet can be closed should occasion demand. Each pump has a capacity of 1,000 gallons per minute at the 23-foot lift necessary to empty the sewage into the septic tank. Each pump is connected by a rope belt to a 16-horse-power gasoline engine, made by Fairbanks, Morse & Company. One pump is of ample capacity to handle the sewage, the other being held in reserve. The power house is brick, and is 33 feet long, 18 feet wide, and 15 feet high. The septic tank is 92.5 feet long, 24 feet wide, and 8 feet deep, has concrete walls 20 inches thick at the top with an inside batter of 1 in 8, and an 8-inch concrete floor, and is divided longitudinally into two compartments by a concrete wall 8½ feet high, 12 inches thick at the top, with a slight batter on each side. Four baffle boards in each compartment extend 3 feet below the flow line. The sewage enters each compartment through three 4-inch T branches connected to a 10-inch header leading from the pumps. By means of a gate valve the sewage can be carried directly to the outlet sewer without passing through the tank and beds.

From the septic tank the sewage flows over a weir into the syphon chamber or dosing tank, 24 feet long, and 7½ feet wide, having a depth of 3½ feet below the water line. This tank contains the 12-inch automatic syphons and a controlling device which discharges the sewage consecutively into the six filter beds. The controlling device is operated by rising and falling floats, and a rolling ball, and the syphons are operated by air valves. A similar device used at Lake Forest, Ill., was illustrated in The Engineering Record December 6, 1902. A 12-inch pipe connects each syphon to one of the six filter beds, each of which is 60 feet square, with a depth of 3 feet of fine gravel taken from a deposit at the works. On each bed there are two carriers of plank 10 by 12 inches in section with holes 2 inches square, spaced 3 feet apart along the bottom of each side, through which the liquid flows on to the sand. At the bottom of the beds there are three lines of 6-inch tile drains parallel to the carriers to collect the effluent. These drains connect to a 30-inch outlet emptying into the lake. At present there is a discharge on to a bed every 15 minutes, giving a period of rest of an hour and a half for each bed.

The complete system has now been in operation for some time. While the number of house connections to the sewer have been rapidly increasing, the amount of sewage handled has been reduced from 750 to 500 gallons per minute. This decrease is due to the decrease in the amount of ground water which enters the sewer through the manholes and joints of the pipe, the surface which was formerly very wet being now dry. The whole plant with the exception of the pumping is operated automatically, and requires no constant attention, a visit once a week or so to see that the syphons are working properly, being all that is necessary. The receiving well and septic tank are of sufficient capacity to handle the sewage of 5,000 people, but the filter beds will have to be extended from time to time as the population increases. The system was designed by Alvord and Shields, of Chicago. Mr. C. W. Hotchkiss is chief engineer for the Land Company.

Power from Refuse.

Refuse destruction works are in operation in 160 towns of Great Britain, and of that number 45 have decided, according to Mr. W. Francis Goodrich, of London, in a paper read before the Institution of Electrical Engineers, to combine the destructor with electric works. The combination plants already existing destroy 1,400 tons of refuse daily. In six towns 20 to 37.8 kilowatt hours are generated per ton of refuse. In Darwen the average evaporation per pound of refuse for one year was 1.25 pounds, based on 10,000 tons of refuse. The borough engineer of Darwen, Mr. R. W. Smith Saville, is authority for the statement that 2,940,000 gallons of water were evaporated with coal-fired boilers at a fuel cost of about $6,070 and that the destructor boilers gave a net evaporation of 2,520,000 gallons, which quantity would have involved a further expenditure of $5,100 for coal had the refuse destructor not been combined. In a test at Nelson, of 473½ hours' duration, 29 pounds of refuse were consumed per square foot of grate per hour (grate area 100 square feet), 1.85 pounds of water were evaporated from and at 212 degrees Fahr., per pound of refuse, 5.5 pounds of water, also equivalent evaporation, were evaporated per square foot of heating surface per hour, and the clinker amounted to 30.2 per cent. In two shorter tests 57 and 68.5 pounds were burned per hour per square foot of grate, with equivalent evaporation per pound of 1.5 and 1.96 pounds of water. The temperature of the combustion chamber varied from 1,959 to 2,227 degrees. A Lancashire boiler, 30x8 feet, with 986 square feet of heating surface, was used.

The Curtis Steam Turbine.

Extracts from a paper read before the American Philosophical Society, by Mr. W. L. R. Emmet.

The development which this paper describes is based upon the original theories and inventions of Mr. C. G. Curtis, of New York, whose ideas were first made the subject of patent application about 1895. Since that time these inventions have been the subject of experimental investigation at Schenectady under the direction of Mr. Curtis and of the General Electric Company's engineers, the object of these experiments being to establish data and laws which would form a basis for the correct design of commercial apparatus. The difficulties of such an investigation are very great. All new facts must be established by the test of different machines or parts which are difficult and expensive to produce. About two years ago the results of these experiments gave us data which showed great commercial possibilities, and since that time work has gone on on a large scale in the production of commercial machines. The contracts for these machines now aggregate 230,000 horse-power, in turbine-driven electric generating units, the largest size so far built being 7,500 horse-power. Thus a great industry has been brought into existence in a very short time, and since the work has all been done in one place and by a few persons very little information concerning it has reached the public. This paper is the first printed matter which has appeared on the subject. The reason for this immense demand and production without publicity and in so short a time, is that the improvements effected are radical in economy, simplicity and efficiency of action.

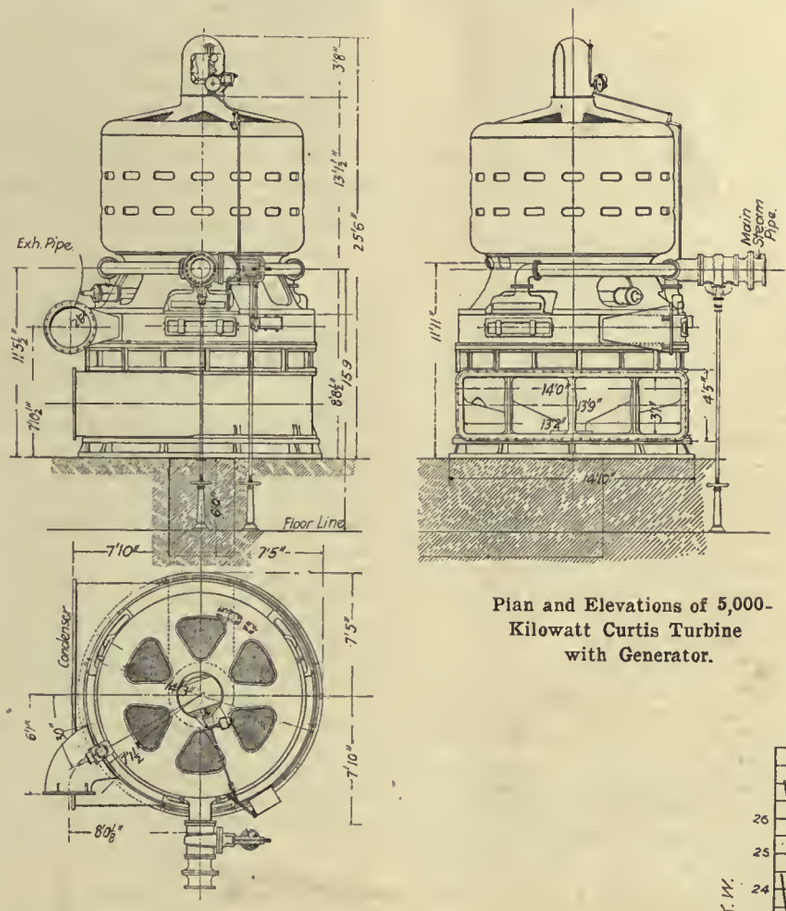
Every efficient steam engine must provide means by which a fair proportion of the expansive force of steam can be converted into useful work. In the engines of James Watt and his successors this result is accomplished in various degrees by the application of pressure from the steam to moving pistons. In steam turbines the expansive force imparts motion to the steam itself, and this motion is given up to a revolving part by impacts of the moving steam upon it.

The idea of the steam turbine is quite simple, and is similar to that of the water turbine or impulse wheel. The practical difficulty which has prevented the development of good steam turbines lies in the very high velocity which steam can impart to itself in expansion, and the difficulty in efficiently transferring this motion to wheels at speeds practicable for construction or practical use. Steam expanding from 150 pounds gauge pressure per square inch into the atmosphere, is capable of imparting to itself a speed of 2,950 feet per second, and if it is expanded from 150 pounds gauge pressure into a 28-inch vacuum it can attain a velocity of 4,010 feet per second. The spouting velocity of water discharged from a nozzle with 100 feet head is 80 feet per second. These figures illustrate the very radical difference of condition between water turbines and steam turbines. In both water and steam turbines the theoretical condition of maximum economy exists when the jet of fluid moves with a velocity equal to about twice that of the vane against which it acts. In water-wheels this relation is easily established under all conditions, while with steam the total power produces a velocity so high that the materials available for simple wheels and vanes are not capable of sustaining a proper speed relation to it under practicable conditions.

The general arrangement of a turbine generating unit of the Curtis type is shown by the drawings which accompany this paper. Its functions may be briefly described as follows, and are illustrated by the accompanying cut:

Velocity is imparted to the steam in an expanding nozzle so designed as to efficiently convert nearly all the expansive force, between the pressure limits used, into velocity in the steam itself. After leaving the nozzle, the steam passes successively through two or more lines of vanes on the moving element, which are placed alternately with reversed vanes on the stationary element. In passing successively through these moving and stationary elements, the velocity acquired in the nozzle is fractionally abstracted, and largely given up to the moving element. Thus the steam is first thrown against the first set of vanes of the moving element, and then rebounds alternately from moving to stationary vanes until it is brought nearly to rest. By this means, a high steam velocity is made to efficiently impart motion to a comparatively slowly moving element. The nozzle is generally made up of many sections adjacent to each other, so that the steam passes to the wheels in a broad belt when all nozzle sections are in flow.

This process of expansion in nozzle and subsequent abstraction of velocity by successive impacts with wheel vanes is generally repeated two or more times, the devices for each repetition being generally designated as a stage. There may be various numbers of stages and various numbers of lines of moving vanes in each stage. The number of stages and the number of lines of vanes in a stage are governed



Plan and Elevations of 5,000-Kilowatt Curtis Turbine with Generator.

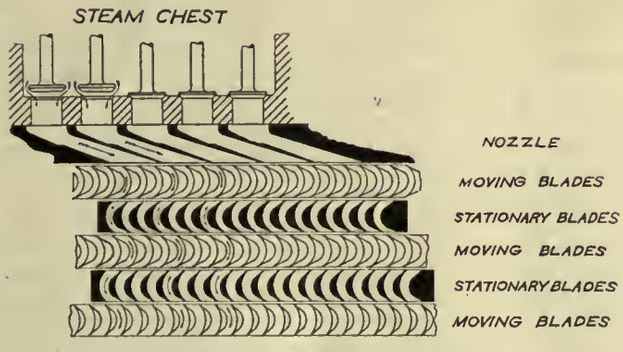
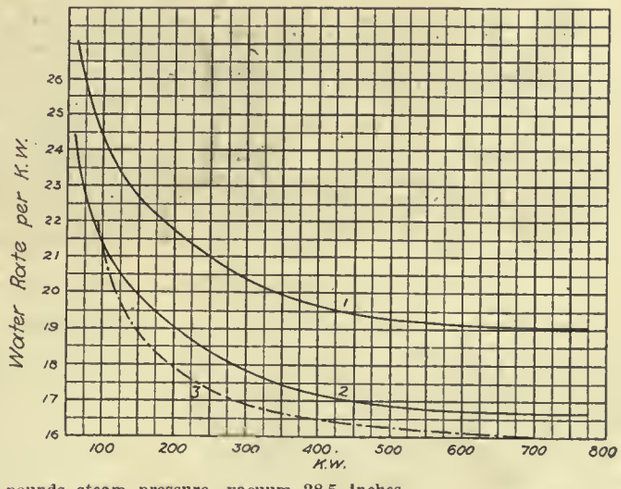


Diagram of Nozzles and Buckets.

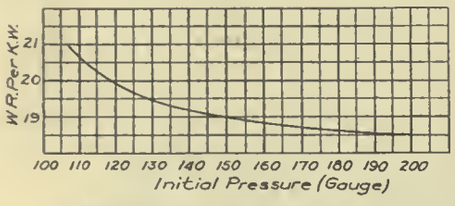


1—140 pounds steam pressure, vacuum 28.5 inches.
2—140 pounds steam pressure, vacuum 28.5 inches, superheat 150 degrees Fahr.
3—200 pounds steam pressure, vacuum 28.5 inches, superheat 150 degrees Fahr.

Comparative Curves of Water Consumption.

by the degree of expansion, the peripheral velocity which is desirable or practicable, and by various conditions of mechanical expediency. Generally speaking, lower pheripheral speeds entail more stages, more lines of vanes per stage, or both. Our general practice is to so divide up the steam expansion that all stages handle about equal parts of the total power of the steam. The losses and leakages of the earlier stages take the form of more heat or more steam for the later stages, and are thus in part regained. Much water of expansion, which might occasion loss by re-evaporation, is drained out of each stage into that which succeeds it.

The governing is effected by successive closing of nozzles and consequent narrowing of the active steam belt. The cut shows part of the nozzle open and part closed; the arrows showing space filled by live steam. In the process of governing, the nozzles of the later stages may or may not be opened and closed so as to maintain an adjustment proportional to that of the first stage, which is always the primary source of governing. Some improvement of light load economy may be effected by maintaining a relative adjustment of all nozzles; but in many cases the practical difference in economy is not great, and automatic adjustment of nozzle opening in later stages is dispensed with in the interest of simplicity. In some machines an approximate adjustment is maintained by valves in later stages, which open additional nozzles in response to increases of pressure behind them. These are used as much for limiting the

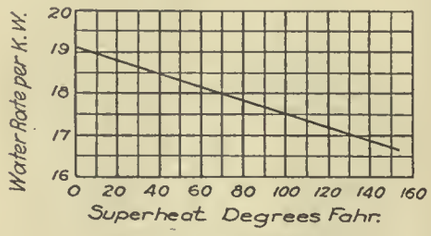


Effect of Varying the Pressure.

pressures in stage chambers as for maintaining the light load economy.

The economy of the Curtis turbine is shown by the accompanying curves, which are derived from actual tests of the first commercial machine of this type completed. This machine drives a dynamo of 600 kilowatts capacity. The curves give its performance at a speed of 1,500 revolutions per minute, which is a safe and practical speed for commercial operation, and which corresponds to a peripheral velocity of about 420 feet per second. The results, with superheat, given in these curves are not derived actually from tests of this turbine, but are plotted from data obtained on smaller turbines. They correspond to the results obtained on turbines of other types, and are undoubtedly reliable. Curves 1 and 2 show the steam consumption of this machine in pounds per kilowatt-hour output at various loads and under the conditions stated, curve 2 giving the steam consumption at various loads with 150 degrees superheat. Curve 3 shows the results which could be obtained from this turbine if it were operated with high pressure and a high degree of superheat, these conditions of operation being perfectly practical with the machine. It should be noted that these curves show a very high efficiency at light loads, as compared with results obtainable from steam engines, and that the efficiency does not fall off at overload as it must necessarily do with all engines which operate economically under normal full-load conditions. This light-load and overload economy is an important feature of the Curtis turbine, and arises from the fact that the functioning of its working parts is virtually the same under all conditions of load.

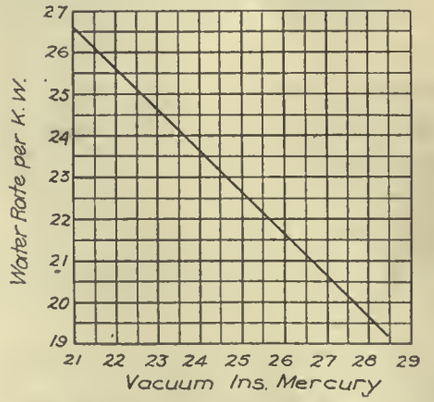
Curves 4, 5 and 6 show the effect upon steam consumption of changes in the steam pressure, the degrees of superheat and in the vacuum. It will be observed that the superheat and vacuum curves are straight lines so inclined as to indicate a great advantage by the use of all degrees of superheat and also an immense advantage in the use of very high vacuum. The Curtis turbine is adapted to use effectively the highest possible degrees of expansion, while in the steam engine it is practically impossible to provide for high degrees of expansion. As the



Effect of Superheating.

exhaust pressure approaches a perfect vacuum, the volume naturally increases at a rapid rate—the volume of steam with a 29-inch vacuum being double that with a 28-inch vacuum. To handle high degrees of expansion, it would, therefore, be necessary to make cylinders of steam engines very large, and this increase of size and weight of parts fixes a practical limit which cannot be passed without excessive cost and complication. In the turbine, the highest degrees of steam expansion are easily provided for, and consequently a much larger proportion of the total work in steam can be utilized by turbines than by steam engines.

The machine is also so constructed that leakage of air into the vacuum chamber is easily rendered impossible. With turbines of the type here described, no oil comes into contact with the steam, and consequently, condensed water can be taken from surface condensers and returned to boilers. The use of surface condensers under such conditions renders unnecessary the introduction of air either in feed or circulating water, and consequently makes possible a very high vacuum with small air-pumping apparatus.



Effect of Varying the Vacuum.

It is hoped that very soon after the reading of this paper a 5,000-kilowatt unit, which is now complete, will be put into operation in Chicago. This machine is expected to give considerably better steam economies than are shown by the accompanying curves, and will be superior particularly in the matter of light-load performance. The variation of efficiency in this machine from half load to 50 per cent. overload, will not exceed 3 per cent.

The external appearance and dimensions of this 5,000-kilowatt unit are shown by one of the drawings which accompany this paper. A comparison between this turbine and one of the units operating in the Manhattan Railway Company's power station, of the same capacity, shows that the respective weights of these complete units, exclusive of foundation, are in the ratio of 1 : 8, and the saving in foundations alone is a very important item. Other drawings which accompany this paper show a 500 kilowatt unit recently installed at Newport, and also a comparison drawn to the same scale between this 500-kilowatt unit and a cross compound engine unit of equal capacity designed to operate at 100 revolutions per minute. [The area occupied by the steam engine appears to be over 13 times that taken by the turbine.]

It has been conservatively estimated that engine units, like those in the Manhattan Company's station, can be replaced by turbines like that in Chicago, and that the cost of such replacement can be paid for by saving in operating expenses in three years.

Notes.

A Pneumatic System of Sewage Disposal on the Llernur principle at Stansted, England, is described as follows in a recent issue of "The Surveyor": Stansted is a scattered village in a hilly country, but the pneumatic system seems to have worked well since it came into operation a few months ago. The pumping station, containing a receiver, vacuum pump and gas engine, is in the lowest part of the village, the sewage being conveyed there by a network of 4-inch iron pipe about 1 mile long, with another mile of house connections. The receiver and pipes are kept in a constant state of partial vacuum, so that there is a steady flow; but the full vacuum (about one-fifth of an atmosphere) is applied for ten minutes every morning, which completely clears the house receptacles and sewer pipes, leaving them clean and dry. There is no need for special flushing, disinfecting the manholes, or ventilating shafts. The work of laying the sewers was carried out by Mr. E. T. Watts, surveyor to Stansted Rural District Council.

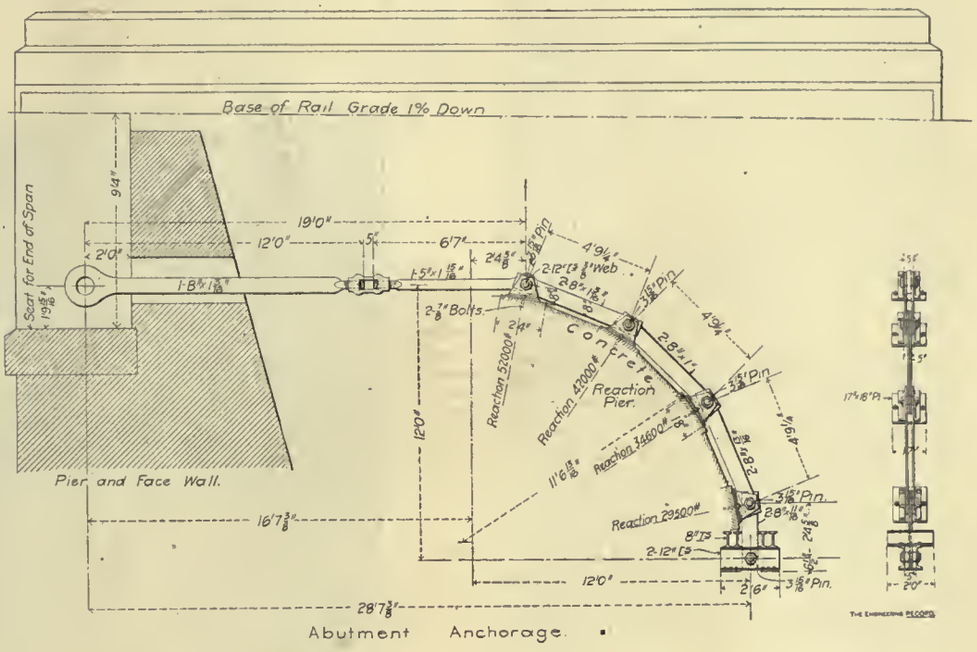
The Wood Block Pavements laid in Boston, Mass., are referred to substantially as follows in the 1901 report of Superintendent of Streets James Donovan. The blocks are of long-leaf Georgia or Florida yellow pine, and are laid on a 6-inch American cement concrete base. The joints are filled with paving pitch or Portland cement grout, and the entire paving is guaranteed for 10 years. This paving has been laid on a level stretch on Newbury Street, and on steeper grades on Harvard Bridge, Boylston and Tremont Streets. That on Tremont Street between Winter and Park Streets after being in service for about 18 months showed little evidence of wear. It has a smooth appearance, does not crawl or become wavy or billowy as does asphalt, and the entire paving seems impervious to moisture. Close joints (made by driving the blocks together after every sixth row laid) on grades over 3 per cent. prove more slippery than joints of from ¼ to ½ inch filled with Portland cement grout. The latter joint is laid on Boylston Street. Another recommendation for this paving, according to Mr. Donovan, is that excavations may be made and the surface easily repaired, and within a short time no trace of the patching will be noticeable. Some fault has been found from the fact that the blocks "bled," as the action of the sun in drawing the creo-resinate from them, is called, but the proportions of creosote and rosin have been changed in preparing new blocks, and no more trouble from this source is anticipated.

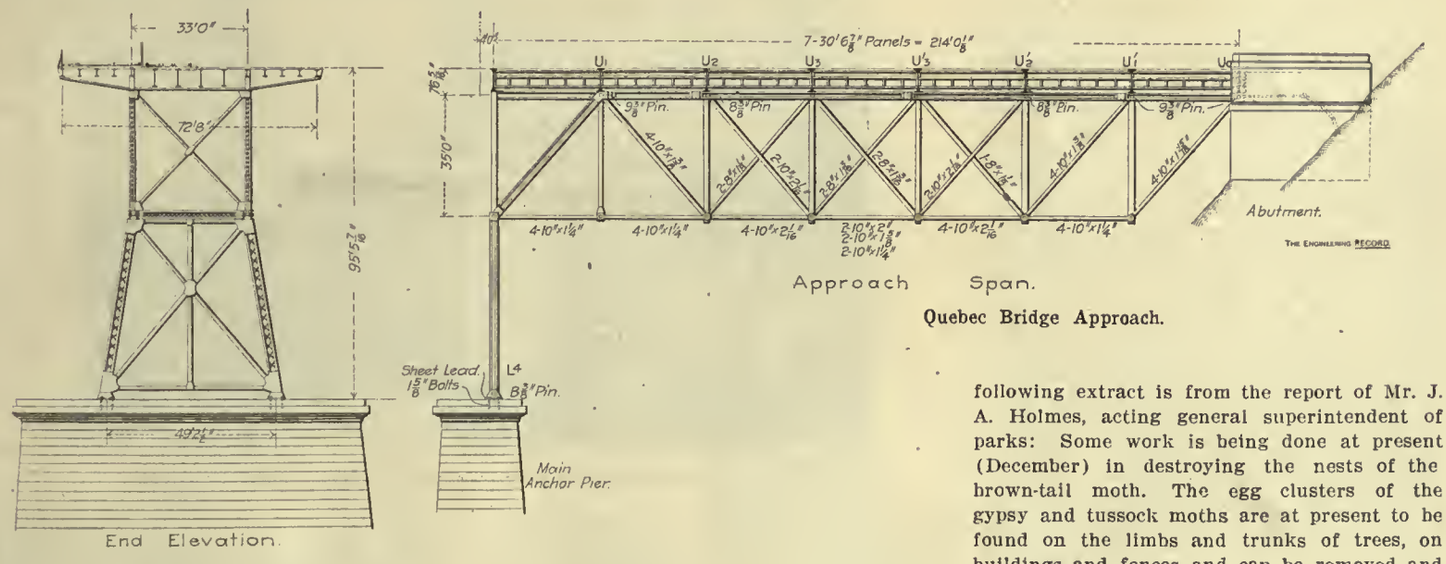
Anchor Approaches for the Quebec Cantilever.

Work on the substructure for the great 1,800-foot span cantilever bridge across the St. Lawrence River, near Quebec, has progressed during the last season, and the anchorage and main piers, which were described in The Engineering Record of July 27, 1901, have attained an advanced stage of construction. The superstructure for the main spans has not yet been put into the shops; but work has been commenced on the 214-foot approach span at the north end of the bridge. This span is an ordinary pin-connected deck span which is supported at the south on the north anchor pier and at the north end on an abutment pier terraced into the rocky hillside. The lower chord is over 50 feet above the coping of the anchor pier and is supported on a vertical steel rocker-bent independent of the main span. When the cantilever truss is completed, this bent will be entirely enclosed by its end vertical posts so that the anchor span will apparently be connected to the main trusses, but will in reality have no connection with them, except through the floor system.

By this arrangement the incongruity of appearance between the slender columns, which only support one end of a short span, and the massive end posts, which take the stresses from the great trusses, will be avoided and the latter only will be visible. Provision must be made, however, for the temperature movement over the anchor pier and this is accomplished by making this end of the approach span movable through the arc of a circle with the foot of the vertical bent as a center. Clearance is provided for the end of the span and the bent inside the end posts, and the fixed north end of the approach is seated on pedestals anchored in the usual manner to the abutment masonry.

The approach span is designed with four lines of deep stringers for the two railroad tracks and with ten lines of shallower stringers about 5 feet apart for the roadways on both sides of the railroad tracks. The bridge floor is about 74 feet wide over-all and is carried by plate girder floorbeams seated on the top chords and having cantilevers about 20 feet long at each end. The arrangement of the floorbeams and the transverse sway-bracing between trusses at intermediate cross sections corresponds to that shown in the end elevation of the bridge and rocker-bent at the south end, except that the connections for the lower horizontal struts and the bottoms of the X-braces





Quebec Bridge Approach.

To provide against any displacement at this point, this pedestal is anchored laterally into the masonry by an anchor chain deflected over knuckle bearings so as to form nearly a quadrant and engage reaction beams bedded in the concrete on the opposite side of the abutment. The first panel of this chain is composed of a single line of horizontal eye-bars which engages the end pin through the top chord and pedestal and has a sleeve nut adjustment of 5 inches. The remainder of the chain is composed of short lengths of double flat bars bored without forging for pin connections, as shown in the detail. An initial stress in the anchor chain is provided by connecting it to the span before the latter is swung clear of its falsework.

are somewhat varied to afford clearance for the heads of the lower chord eye-bars. The bottom lateral system consists of the lower transverse struts, and the system of single angles X-bracing them throughout. The top lateral system consists of X-bracing angles in every panel between the floorbeams inside the trusses and of additional X-bracing between the floorbeams outside the trusses in alternate panels.

Mr. E. A. Hoare is the chief engineer of the Quebec Bridge Company; Mr. Theodore Cooper is the consulting engineer; and the contract for the superstructure has been let to The Phœnix Bridge Company, Mr. John Sterling Deans, chief engineer.

Caring for Shade Trees.

The care of public shade trees in Cambridge, Mass., has occupied the attention of the Board of Park Commissioners during 1902, judging from the recommendations in their last annual report. It is stated that the year was an unfortunate one, in that the trees were visited with about every form of destructive insect known, including the brown-tail moth, the gypsy moth, tussock moth, and the elm-leaf beetle. Legislation was obtained authorizing the commissioners to enter private lands for the purpose of cleaning private trees, and this has been availed of to a considerable extent. The following extract is from the report of Mr. J. A. Holmes, acting general superintendent of parks: Some work is being done at present (December) in destroying the nests of the brown-tail moth. The egg clusters of the gypsy and tussock moths are at present to be found on the limbs and trunks of trees, on buildings and fences and can be removed and burned, or destroyed by painting with creosote oil, to which a little turpentine or tar has been added; this can be done most effectively during the winter months. The brown-tail moth is at present hibernating in the larval state in nests formed of dry leaves on the small twigs at the ends of the branches of nearly all our trees and shrubs, but more particularly on the pear trees. The most effectual method of destroying this insect is to remove and burn the nests. This should be done during the winter, while the nests are easily discernible. The most effective method of destroying the elm-leaf beetle is by spraying when in the larval state. This is also efficacious in destroying the very young brown-tail, gypsy and tussock caterpillars.

A 165-Foot Concrete Chimney.

By James D. Schuyler, M. Am. Soc. C. E.

One of the most notable pieces of construction in concrete recently completed is the high chimney built for the extensive new power station of the Pacific Electric Railway Company, at Los Angeles, Cal., in July and August, 1902. This company is building a great network of suburban electric roads, centering in Los Angeles, and although the power to operate the system will ultimately be supplied by a water power plant on Kern River, the new steam station is required in the interval of construction of the great water power plant. Plans for building this chimney of concrete were submitted by Mr. Carl Leonardt, and their adoption was urged on the ground of the general superiority of reinforced concrete over steel or brick in the matter of stability and strength. The plans were accompanied by a bid which demonstrated that it was also more economical than either brick or steel, and with this strong argument in favor of concrete the contract was awarded to Mr. Leonardt.

The chimney is 180 feet in height above its base, which is 15 feet 6 inches below the level of the ground; and its exterior diameter above the shoulder where it first becomes circular, is 15 feet 2 inches, the inner diameter being 11 feet. The shoulder is 51 feet above the base, and immediately above the two flues which enter the chimney from opposite sides. The accompanying cuts show clearly the construction of the stack, which consists of two concentric walls, separated by an air space of 11 to 16 inches, increasing in width toward the top. The outer shell, above the shoulder, is 9, 6 and 5 inches thick respectively up to the cap, in sections of about equal height, while the inner shell is 5, 4½ and 4 inches thick respectively from bottom to top, in corresponding sections.

The inner shell ends 4 feet below the cap and is free to elongate by heat independently of the outer shell. At intervals of 30 inches measured around the chimney, the air space is contracted for lengths of 6 inches to a width of 2¼ inches. At every 5 feet in height this is again reduced to ¾ inch by the introduction of a concrete brick in the wall. In this manner the oscillation of either shell independently of the other is checked, and the outer shell may sway in the wind ¾ inch without bringing pressure upon the inner shell. The chimney was built under the Ransome system, with cold-twisted steel bars, in each shell. The horizontal reinforcement consists of rings of ¼-inch bars, placed at intervals averaging 18 inches in the inner shell and 24 inches in the outer. Vertical ¾-inch bars were placed 1 foot apart in the lower third of the stack above the flues, 2 feet apart in the middle section, and 4 feet apart in the top section of the outer shell. In the inner shell, ¼-inch bars were used, spaced about 3 feet apart in the circumference of the work.

The upper 4 feet above the ornamental cap consists of a shell of concrete 2 inches thick, reinforced by expanded metal. The decorative cap 7 feet high consists of twenty-eight blocks, moulded on the ground and hoisted to position. As shown, these blocks are hollow and are formed by a shell of 2 inches of concrete, with stiffening cross-partitions, all reinforced by ¼-inch twisted steel rods. Each block weighs 1,250 pounds and the entire cap was hoisted and set in three days. The original design contemplated a straight shaft, 15 feet in diameter from the base up. Subsequent alterations in the plans of the boiler house changing the relative positions of boilers and chimney necessitated the provision of two flue openings, on opposite sides, instead of one. The extra opening would have materially reduced the sectional area of the chimney at this point, and it was deemed necessary to increase the diameter to 18 feet for a height of 45 feet above the base. This change in diameter and form made it necessary to build a special mould for that section, which was rendered more difficult by the square projections of the flue openings. During the time that this base section was being built the mould for the exterior of the circular part had to be pushed up ahead of the work, and supported on the scaffold by which the interior mould was raised, and from which all the work was done. This obviated the necessity of building the 15-foot mould around the scaffolding 45 feet up in the air.

Materials. The cement was California Portland, manufactured at Colton, 60 miles east of Los Angeles. The sand was clean, washed, silicious sand from the Los Angeles River bed. The broken stone used in the inner shell was a special quality of red sandstone from the Sespe district, noted for its hardness and heat resisting qualities, and in the outer shell Arroyo Seco crushed granite cobbles. The concrete was mixed in a Ransome drum mixer. The cement was tested carefully by the contractor, and test blocks of concrete of the proportions used in construction were made daily and tested at regular intervals. The proportions used on the inner shell were 1 : 2 : 4, and in the outer shell, 1 : 2 : 6.

The chimney contains approximately 20,000 cubic feet of concrete, requiring 850 barrels of cement. The steel embedded in the concrete consists of 10,000 pounds of twisted bars, and 4,000 pounds of old rails, which were placed 12 inches apart, in two layers in the base. The chimney weighs approximately 1,430 tons, and the distributed load on its base is less than two tons per square foot. The foundation is laid in a heavy stratum of river gravel.

The exterior of the chimney has not been trowelled, plastered, or washed over with cement, but is in the condition in which it was left when the moulds were removed; yet it is perfectly plumb, true and smooth.

Other Concrete Chimneys. In 1898 a chimney was built under the Ransome system at Constable Hook, N. J., for the Pacific Coast Borax Co., 150 feet in height, 7 feet inside diameter, with an inner and outer shell. During 1901, a similar chimney was built at Jersey City, for the Central Lard Company, 108 feet high above top of foundation, 8 feet inside diameter, 11 feet 4 inches diameter outside, and

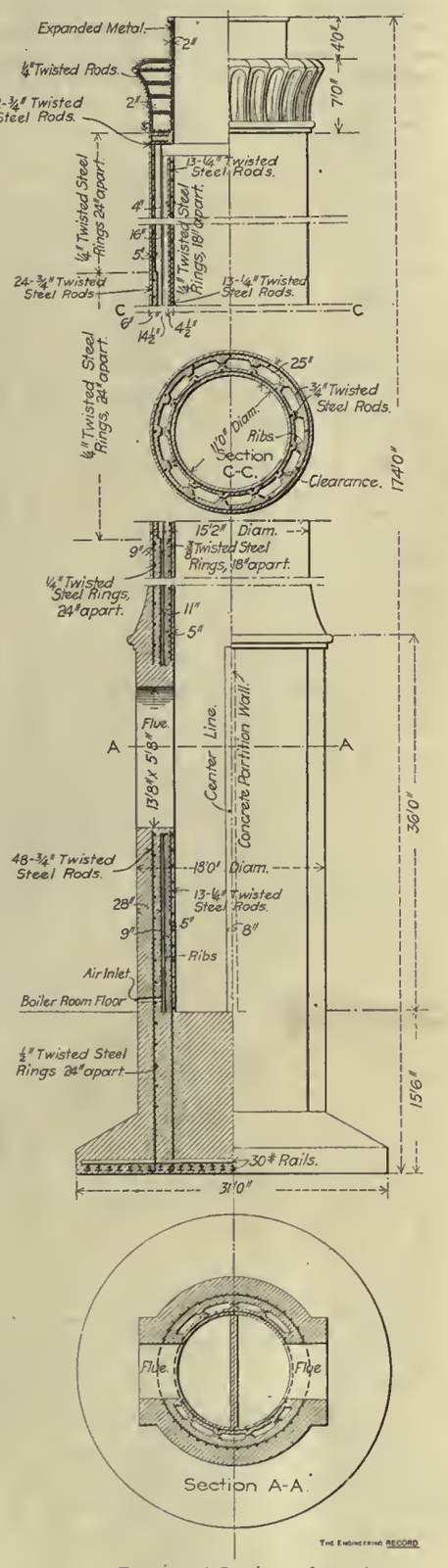


ERECTION OF CONCRETE-STEEL STACK IN SUSPENDED MOULDS.

containing 4,974 cubic feet of concrete and 8,020 pounds of steel rods. It is founded on piles. Two other chimneys of this type about 150 feet high and 7 feet in diameter, inside, were erected for the Singer Sewing Machine Company, at South Bend, Ind.

From the drawings and photographs accompanying the above description and from the preliminary data furnished by the Ransome Concrete Company, of New York, supplementary particulars of the design and construction methods and details have been prepared. The original specifications were especially complete in their requirements for the strength and quality of materials, and in outlining the method of construction. They provided that the neat cement should develop tensile strength of 500 pounds per square inch in 7 days and should satisfactorily endure the boiling test. The

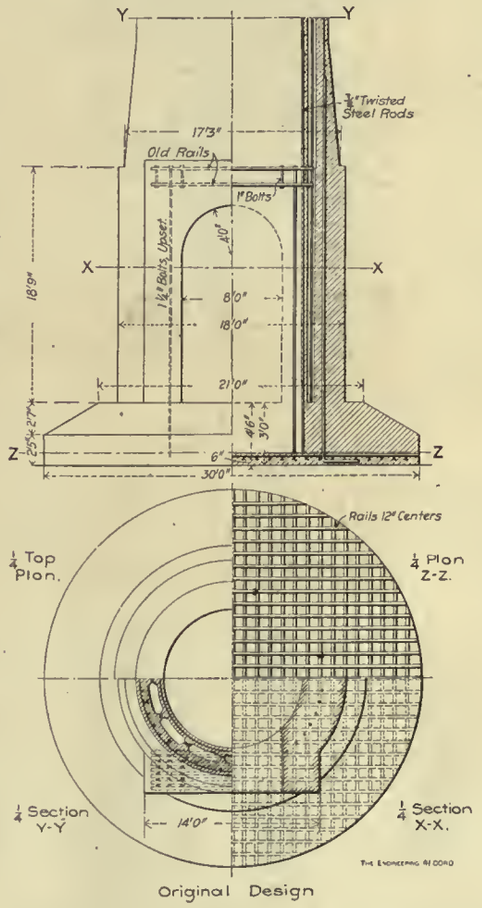
crushed stone or gravel was required to be 1 inch or less in size, and the reinforcement bars to be of not less than 60,000 pounds ultimate strength, and be able to bend cold 180 degrees around a bar of their own diameter, without fracture. The pitch of the twist was specified to be ten to twelve times per linear foot in ¼-inch bars, seven to eight times for ⅜-inch



Revised Design of Stack.

bars, five to six times for ½-inch bars, two and a half to three times for ¾-inch bars and one and one-quarter to one and one-half times for 1-inch bars. These were twisted cold in a belt-driven horizontal machine and their limit of elasticity was believed to be considerably raised by the process. The concrete was mixed wet enough to run slowly down a slope of 1 : 2 when dumped from a wheelbarrow. The circular reinforcement bars were bent to accurate curves and laid on the surface of the concrete as it was filled in the moulds with their ends lapping from 12 to 18 inches. The vertical reinforcement bars were in convenient lengths spliced together with sleeve nuts. Horizontal and vertical sections are given of the original design of the stack, so as to show the details of the reinforcement in the foundations and the anchorage of vertical rails with bent lower ends which were provided in the original design but were modified in the construction finally executed.

The system of falsework, scaffolds and moulds was a convenient and economical one, very ingeniously devised to avoid unnecessary weight and to secure accurate construction and safety for workmen. A falsework tower about 6½ feet square was built up on the center line of the chimney a little in advance of the construction of the concrete. It had four 4x6-inch corner posts with 2x10-inch horizontal braces 5 feet apart and 6x1-inch X-bracing in all panels. The verticals were halved at the splices and all joints were bolted. Across the upper horizontal pieces there were placed two pairs of transverse beams about 16 feet long which cantilevered 5 feet beyond the sides of the tower and supported the moulds. A 20-foot beam at right angles to these was set across them at the center to support the sides of the lower working platform, which was also to be suspended from the base timbers of the outer mould. The inner and outer moulds were each suspended from the cross beams by four approximately equidistant vertical rods having long threads at the



Original Design

upper ends which engaged screw wheels bearing on the beams and enabled them to be raised and lowered as required.

Hoisting was done by electricity through the center of the falsework tower, and horizontal planks were supported inside the chimney to provide working platforms for the men who deposited and rammed the concrete from the inside. A light working platform was bracketed out near the top of the outside mould, and it was at first intended to suspend a six-sided framed platform with enclosing walls below the outer mould, as shown in the drawings of the falsework, so as to permit grouting or dressing of the surface; but when it was decided not to finish the exterior surface by any special treatment, this construction became unnecessary and was replaced by a simple annular platform about 3 feet wide which was made with radial pieces resting on two lines of curved planks wedged out from the chimney and suspended by light rods or tackles from the outside mould and merely enclosed by a light handrail, as shown in the half-tone view. To prevent removing the cross beams and to facilitate the extension of the falsework tower as the work progressed, a telescopic section 24 feet long was built inside, and at each extension was first moved up to the required height, and the bearings of the cantilever beams were transferred to it. Another section of the main tower was then spliced on and received the moulds and platforms and so on. All of the suspended structure could be easily and uniformly raised by men simultaneously operating the screw wheels on the suspender rods. The scaffold could thus be disconnected, the head raised and the uprights extended in about two and one-half hours.

The moulds were made, as shown by the illustrations, with vertical wooden staves 12 feet long bevelled to an angle of 10 degrees on both edges so as to be in contact on the face next the concrete, on the inner side of the mould, and leave a V-shaped opening like a calking joint outside. The staves were hooped together with circular bands or collars 5 inches thick built up of ⅜-inch strips of Oregon fir 4 inches wide breaking joints and connected by special forged jaw bands bolted to them at the ends and engaging pairs of sleeve nuts by which they could be securely tightened, as indicated in the detail of the adjustment. The transverse timbers, shown in the drawing at the foot of the outside mould to support the lower platform, were omitted, and diagonal braces, not shown there, were nailed across the hoops, as indicated in the half-tone. The moulds were connected to the vertical suspension rods by clevises engaging riveted loop eyes at the upper ends of 1½x¼-inch vertical bars 12 feet long bolted to each hoop.

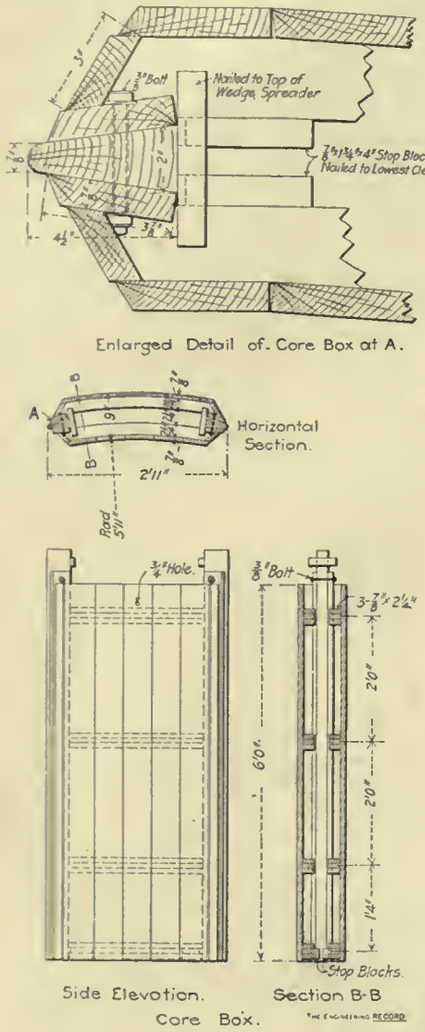
The spaces between the inner and outer shells were made with core boxes 6 feet high ingeniously constructed, as shown in the detail, so as to be easily adjusted or collapsed. Each box was made in separate halves with the opposite faces at the ends beveled to correspond with a center wedge shown in the large detail. It was held in place during the concreting by the ⅜-inch bolt engaging the side strips beyond the ends of the core box. To collapse the mould, the wedges were driven inwards and to widen it vertical strips were added between the wedge and the center member. Vertical wooden strips ½ inch thick were lightly nailed to the wedges of adjacent core boxes to form the joint between the webs of the inner and outer shells. Construction was carried on entirely from the interior of the chimney where all material was raised by an electric hoist. The chimney was built at the rate of 5 feet a day and the concrete was continuously deposited for each section and rammed in thin layers by six of the most experienced workmen selected from men trained in concrete work by the contractor.

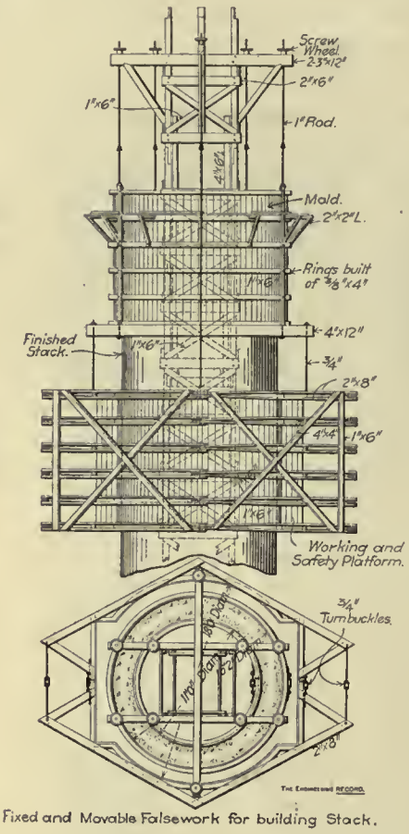
The concrete was hoisted in the afternoon and the daily section was completed about five o'clock. The next morning the adjustments in the hoops of the outside mould were loosened and the mould was raised and by nine o'clock was again clamped securely to the finished

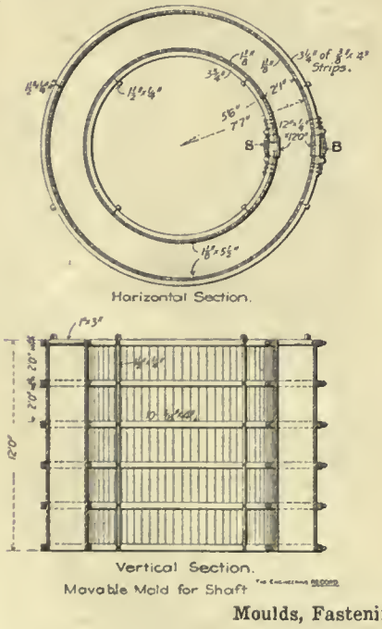
chimney so as to tightly engage 2 feet of the upper part of the concrete built fourteen hours previously. The inner mould and cores were raised 5 feet at the same time, but were kept below the level of the outside mould. The outside of the outer shell was sprayed by water under city pressure delivered through a perforated circular pipe attached to the bottom of the outer mould. On the inside of the chimney the air was cool and moist and such a provision was considered unnecessary there. The vertical reinforcement bars and outer shell were built into foundation concrete and the latter was carefully leveled to receive the inner and outer moulds, each being carefully set on the permanent center mark. The core boxes were accurately placed and their bottoms were temporarily closed by ½-inch boards to prevent concrete from working up into them. The vertical reinforcement rods were temporarily kept in place by wiring them to nails driven in the tops of the moulds. Provision was made for four of them to be made continuous through the height of the chimney, to project into the ground below the foundation and extend 5 feet above the top, with copper tips, so as to serve for lightning rods if desired.

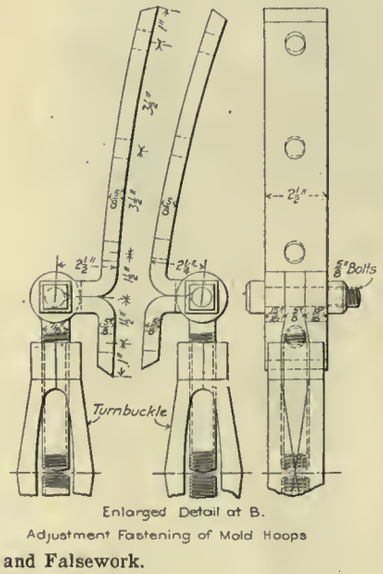
After the outside mould was raised for each day's work, the top was set with a carpenter's level and the inner surface was scraped clean after the turn buckles were thoroughly tightened. Then iron pins were put through the holes in the upper parts of the sides of the core boxes and they were collapsed and the wedge-shaped spreaders pulled up. When there was difficulty in moving these, it was overcome by putting a bolt through the hole in the top and prying it with pinch bars under each end. The sides of the boxes were then lifted out and put on the scaffold and they were reassembled with the spreaders and inserted in the tops of the openings, after which the inner circular mould was raised and carefully plumbed with the center mark on the foundation. When it was occasionally necessary to scrape the face of the inner mould, the order of raising was reversed and the core boxes were first raised, then the inner mould and then the outer mould. The moulds and core boxes were smeared with petroline as required to prevent the adhesion of the concrete.

The ornamental cap blocks were allowed to set one day before removal from their moulds, and three or more days before handling, and were not raised to position until they were at least two weeks old. They were carefully set on wooden fillers on the level concrete top of the chimney; dry mortar was rammed under them to make a firm bed; ½-inch rods were laid in chambers cored through them, and concrete was rammed around them to thoroughly connect and consolidate them.









Moulds, Fastenings and Falsework.

Some Chicago Statistics.

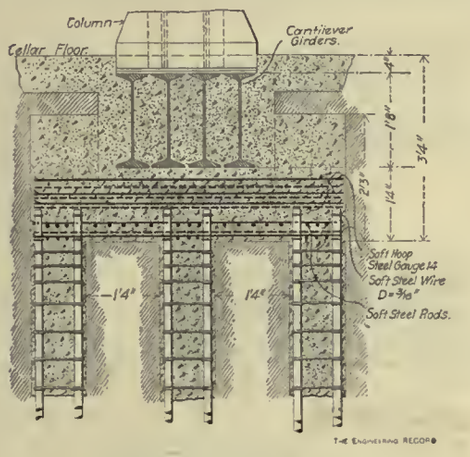
Number 4 of the second volume of "Statistics," published by the city of Chicago contains many interesting figures for the year 1902, a few of which are here given. Street cleaning aggregated 18,155 miles and cost $14.88 per mile or $1.67 per load of dirt removed, including the expense of removing weeds from 355 miles of streets and cleaning 229,113 catch-basin inlets. It cost an average of $0.97 per load to remove 21,268 loads of snow. The removal of 1,349,474 cubic yards of garbage cost on an average $0.40 per yard or $2.00 per load. To the cost of street cleaning and garbage removal, however, there must be added $39,897 for maintaining the dumps, situated in the most remote parts of the city, necessitating a haul of from 2 to 9 miles, averaging 5 miles, for each load. There are 4,173 miles of streets and alleys, of which 1,373 are paved.

During the year 350 miles of sewer were cleaned at an average cost of $85.43, and 12,054 catch-basins were cleaned at an average cost of $3.18. The daily average quantity of water pumped by the ten stations was 358,316,000 gallons. Over 30 miles of pipe were laid, making the total in use 1,919 miles. There are 19,645 hydrants, 15,437 valves and 7,075 meters in the system. There were 6,099 buildings erected with an aggregate frontage of 35.5 miles and an estimated total valuation of $48,243,000. The total cost of lighting streets was $936,179 for 11,600,000 candle-power (estimated), of all kinds of lights. The cost per arc light, municipal lighting plants, was: Operation, $50.64; replacement and betterment, $1.91; per cent. of office expense, $0.96; total, $53.51. The total number of lamp-hours was 18,104,000, and the average cost per lamp per hour, 1.3325 cents.

For Removing Ice from the Third Rail, a device has been invented for attachment to an electric car, which consists substantially of a polygonal wheel with angular or wedge-shaped faces in the tread, which cracks and breaks the ice or sleet on the rail in advance of the brush, so that it may be readily removed by the latter and permit satisfactory contact between the shoe and the rail. The axle of the wheel is vertically adjustable and governed by springs in a box carried on horizontal guide bars. When in service the wheel is intended to be set in contact with the rail and to revolve with the motion of the car. It has been patented by Mr. D. W. Brown, of New York.

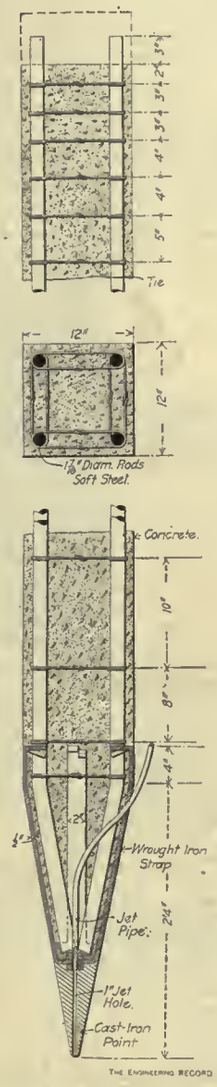
Concrete Pile Foundations of the Hallenbeck Building, New York.

In recent years concrete piers have largely replaced brick and stone masonry for engineering and architectural substructures. In many cases their use for supporting buildings on soft ground involves considerable additional expense and difficulty in making excavations for them which are likely to require costly pneumatic caissons or sheet piling or other kinds of sheathing and bracing, and may necessitate deep excavation, providing in any event for the extension of the pier to solid stratum, so that its load is carried by direct pressure on an unyielding footing. These requirements are often avoided by substituting for piers piles which may be driven without excavation, and have their carrying capacity greatly increased by the friction on their sides. The advantages in the use of piles instead of deep and difficult piers are in their economy, rapidity of construction and in the avoidance of danger of undermining adjacent structures and of freedom from trouble with ground water or quicksand. The connections between wooden piles and the superstructure are generally limited to different classes of timber, steel or concrete platforms which are principally adapted only to distributing the direct vertical pressure on the piles, and it is a desideratum that the piles should be constantly saturated with ground water, thus making it often necessary to cut them off and begin the masonry at an undesirably low level and perhaps requiring difficult excavation below the general level to accomplish this.



Pile Tops and Girder Seat.

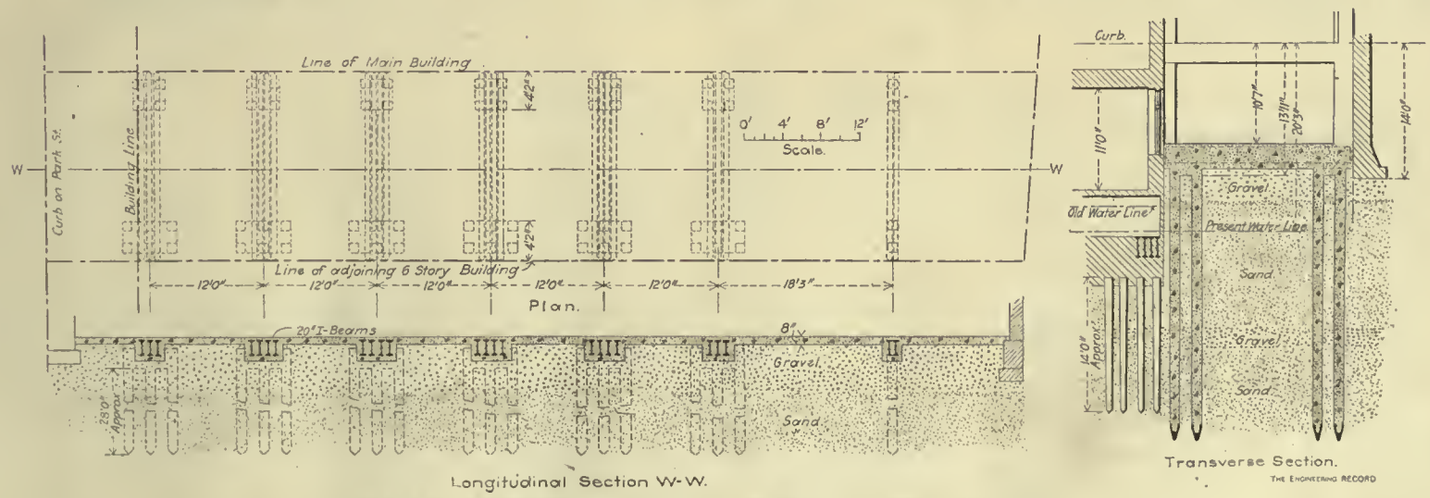
The successful use of concrete-steel piles promises to combine the advantages of wooden piles with some of those of masonry piers and to have the further merits of being entirely independent of ground water during and after construction so as to be equally satisfactory and durable in dry and in wet soils and to afford opportunity for simple and thorough connection with the superstructure. The principal difficulty in their use has been assumed to be in the driving of them, but it is believed that this has been provided for and they have been recently used in a number of cases, as described in The Engineering Record of December 13, 1902, where some computations are made for their strength, and in The Engineering Record of December 27, where an illustration is shown of special forms of concrete bearing and sheeting piles.



Concrete-Steel Pile.

The ten-story steel frame Hallenbeck Building at Park and Pearl Streets, New York City, has wall columns carried on I-beam grillages embedded in the concrete caps of clusters of wooden piles about 14 feet long driven to refusal and cut off about 40 feet below the curb and about 5 feet below the present ground water level. A 20x102-foot lot has been acquired, adjacent to this building, on which a ten-story steel cage addition to the old building is to be erected, extending it to the adjacent wall of a six-story building which has eccentric concrete foundations in sand and gravel at a depth of 14 feet below the curb and about 6 feet above the present ground water level. The ground water level has been lowered about 3 feet within the last two years, and it is thought that this may be due to the drainage of the ground by the rapid transit subway near by, and that the level may hereafter be still farther lowered so that if wooden piles were used for the new foundations it would be necessary to cut them off at a considerable distance below the present water line to insure their future saturation. Twelve test borings were made by the usual water jet process, one under each of the main columns of the new building and these being carried down to an average depth of about 28 feet below the present grade, or 40 feet below the curb, show fine gravel to a depth of about 5 feet, with 2½ feet of fine sand, 5 feet of coarse sand, 5 feet of sharp sand, 2½ feet of fine gravel and beyond that compacted sharp sand. On the side next to the six-story building the use of wooden piles would involve trenching a number of feet below the bottoms of the wall footings and it would therefore be necessary to underpin them and carry their foundations down deeper. The estimated expense for this, added to the cost of the wooden piles, is larger than the prices bid for driving concrete piles. The latter system has therefore been adopted and contracts have been awarded for a substructure composed entirely of reinforced concrete piles extending to a height of about 6 feet above the present ground water level, where they are to be made integral with the concrete grillages and concrete floor slab, and will not require any trenching, extra excavation and back filling or underpinning of the adjacent structure. The system has been carefully designed so as to avoid the use of patented features, and preliminary piles have been made and driving commenced to confirm the data necessary for the best construction and operations in the remainder of the work.

The arrangement of the foundations is shown in the general plan and sections and consists of clusters of piles in two longitudinal rows which support transverse cantilever I-beam girders carrying the wall columns beyond the



PLAN AND SECTIONS OF CONCRETE-STEEL PILE FOUNDATIONS.

centers of the piles. The piles are 28 feet long and 12 inches square made with 1 : 2 : 4 Portland cement concrete with ½-inch crushed trap rock rammed longitudinally in wooden moulds. The piles are calculated to sustain 80,000 pounds each, including a load of 36,000 pounds per square foot on the concrete as allowed by the New York building laws for concrete piers, and to receive an additional load of 44,000 pounds, which is assumed to be directly supported by the four 1 7/16-inch soft steel vertical reinforcement rods which are bedded in the concrete and are allowed by the Building Department to work in compression up to a load of 7,000 pounds per square inch. These rods are tied together on all sides by horizontal hooked wires 5 inches apart, and at the bottom they are bent to conform to the angle of the pyramidal pile point and are seated on a solid cast iron driving point which is locked to the pile by means of embedded wrought iron strips bent 90 degrees at the top.

It is proposed to build some of the piles with a central jet pipe as indicated in the accompanying detail, but which was not inserted in the piles already made. The concrete extends 2 inches above the tops of the rods, so as to form a seat for the follower or driving cap, but it is intended after the piles are driven to cut away 5 inches of it, as shown by the dotted lines, so as to leave the rods projecting to engage the grillage which will be built, as shown, in a solid mass 16 inches thick thoroughly reinforced by longitudinal and transverse rods and carefully surfaced to receive the ends of the cantilever girders.

Mr. H. C. Pittman is the architect, and Mr. F. A. Burdette, C. E., consulting engineer for the steel construction, designed the substructure, the contract for the latter having been awarded to Walter Reid & Company.

A Street Sprinkler designed to take its supply of water while in motion from a ditch at the side of the roadway has been used in Fresno, Cal., for two seasons, according to City Engineer I. Teilman, but has now been discarded.

Types and Details of Bridge Construction—I.

By Frank W. Skinner, C. E.

Introductory.

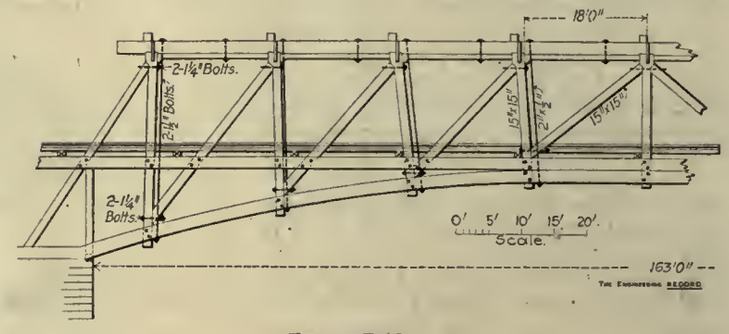
In this chapter and those which are to follow it is the writer's purpose to present descriptions and illustrations of types of bridge construction and give the essential data of notable or peculiar structures. General plans, sections or elevations are shown only where necessary to a clear description, and are accompanied by such details as are novel or characteristic, without regard to merit. Good and bad examples are shown, some that are curiosities, some which would be inexcusable in current practice and some which were permissible when designed, but have been superseded because of improved facilities of manufacture and advance in practice. As far as data have been available the selections have been simply to illustrate the developments and wide variations in actual construction and serve simply as records and for suggestions of characteristics to be copied, modified or avoided.

Where scale drawings were not available, sketches have been made to show arrangement and details regardless of exact dimensions. Many interesting and important examples are not included, but the descriptions illustrate, as far as the data was readily available, most of the typical and remarkable features of design, and some eccentricities, in American practice and a few in European which are notable, important, curious or of practical value, except those which are of such simplicity and standard use as to be universally familiar to persons interested in the subject. The majority of the descriptions have been condensed or amplified from the pages of The Engineering Record or from notes made by the writer in its service; some have been made from reports and society transactions, and some from foreign periodicals.

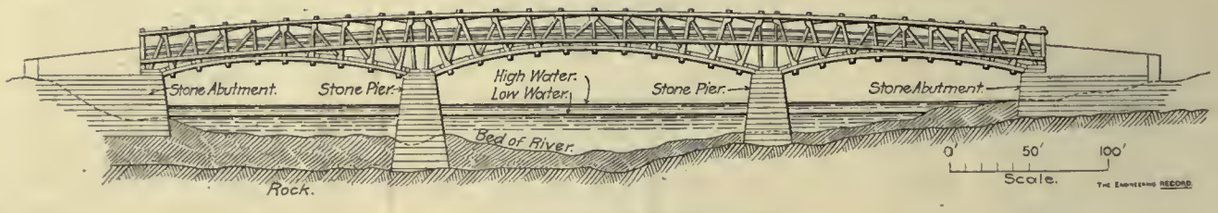
Although a few of the structures and details presented have not been previously described in technical journals, most of them have been; and so these articles are chiefly a classified collation of examples selected to show the development of design and to record it for convenient reference and the comparison of works actually built. No analyses or mathematics are given, but references are noted to available published data. Where no references are given the data has been secured from personal notes, official blueprints or from abstracts of reliable data in private libraries. In all drawings unnecessary detail has been eliminated and the greatest simplicity has been attempted; in some cases the scale and proportions have been modified to emphasize specific feat-



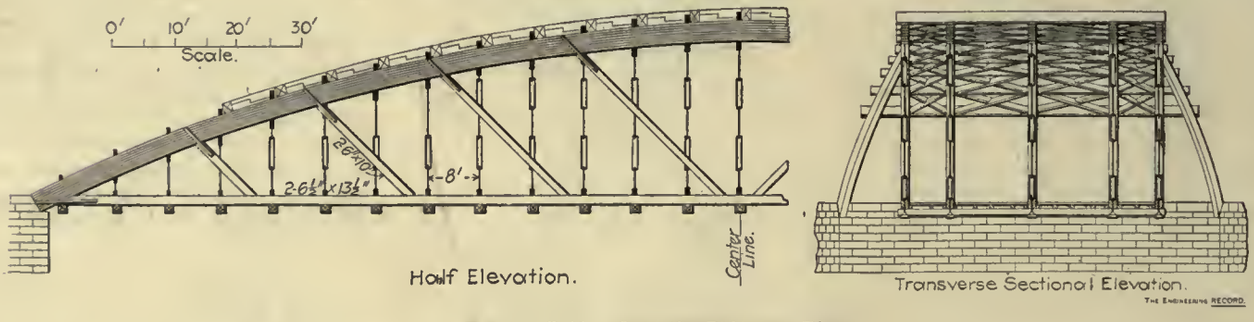
Colossus Bridge.



Easton Bridge.



Schuylkill Permanent Bridge.



Trenton Bridge Over the Delaware River.

Part I.—Arches.

Chapter I.—Wood and Iron Trusses.

The first examples of trussed arches were, of course, built of wood, and the earliest bridge of this type on record is one erected 104 A. D. across the Danube River by the Roman Emperor Trajan, and described in The Engineering Record, September 19, 1891, and February 20, 1892. Dion Cassius says that there were 170-foot timber arches supported on twenty stone piers 60 feet square and 150 feet high, dimensions which do not seem credible for that

date. The Engineering Record of February 20, 1892, mentions a 390-foot span built over the Limmat, in the middle of the eighth century and believed to have been a combination of timber arches and trusses. In 1809 the Bamberg bridge over the Regnitz was erected with an arch of 206 feet span and only 16½ feet rise. Its ribs were built up of several thicknesses of planks; a detail of construction common in Europe in the beginning of the nineteenth century.

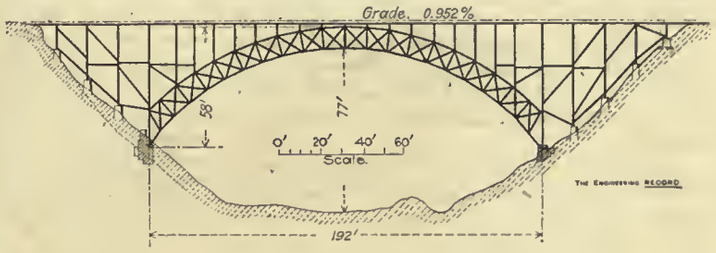
In a paper on American Railroad Bridges, published in the "Transactions" of the American Society Civil Engineers for July, 1899, Mr. Theodore Cooper, C. E., traces the history and development of long span bridges in this country and describes wooden arches at Easton, Waterford, Philadelphia, and Trenton. Three 163-foot spans were built across the Delaware River at Easton, Pa., in 1805 and remained in use for about 90 years. Each span had two trusses about 27 feet apart in the clear, 20 feet deep over all in the middle and 34 feet deep at the ends. The centers of the floorbeams were supported by an intermediate arch rib like the lower parts of the side trusses. The bottom chords were made of two 15x18-inch timbers bolted together through the ends of the vertical posts, which acted as keys. The two end panels were reinforced by pairs of 9x18-inch side pieces. The 15x18-inch top chord was reinforced by an 8x15-inch thrust piece bolted to the under side between the vertical posts. The tops of the inclined posts were secured by 1¼-inch bolts with keys instead of nuts. The floorbeams were single 12x13-inch timbers carried on pairs of 15x18-inch stringers bolted across the vertical posts, which were dapped over them and the bottom chord timbers. The trusses were connected by upper transverse struts with solid knee-braces, and were always protected by a double pitched roof. After nearly ninety years' service five-sixths of the original timber was still good and sound.

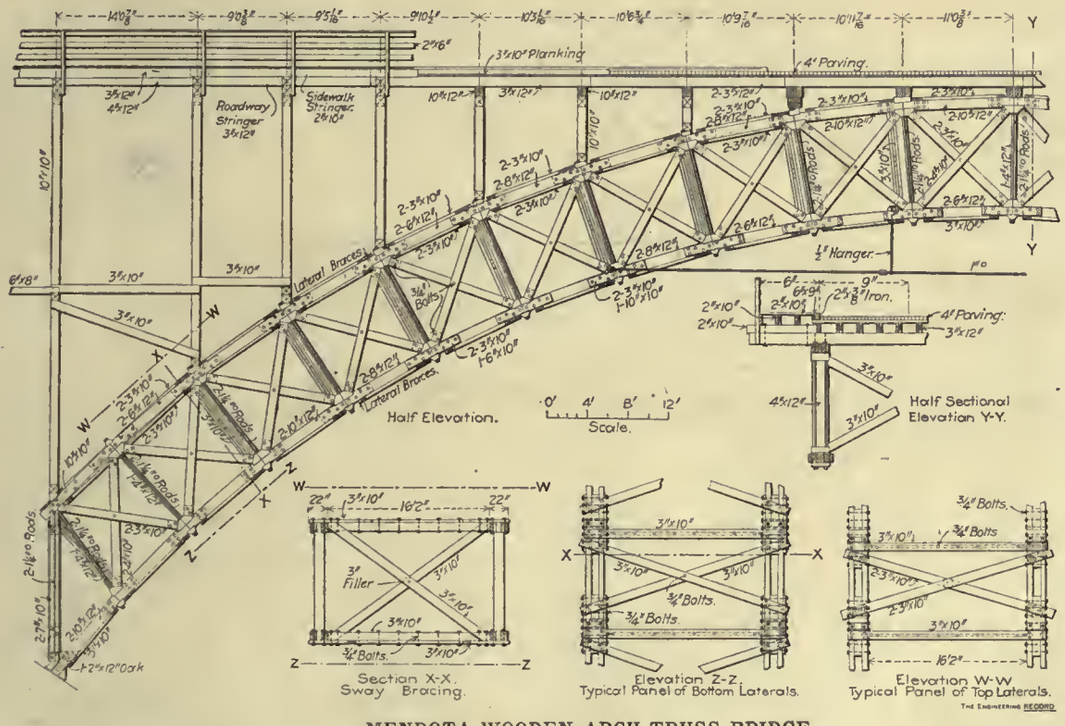
The Waterford bridge over the Hudson River was built in 1804, and was still in use and in good condition in 1890. It has four spans with clear lengths of 154, 161, 176 and 180 feet with three lines of simple rectangular trusses about 15 feet deep over all and 17 feet apart on centers. There were vertical posts about 12 feet apart and intersecting diagonals in every panel. Each truss was reinforced by an arch rib consisting of two 8x16-inch timbers bolted on opposite sides. They had 20 feet rise, were tangent to the top chords at mid-span, and were seated at the ends on skewback pieces bolted to the extended lower parts of the vertical end posts, which were carried down on the faces of the piers.

The Colossus bridge over the Schuylkill River, at Fairmount, Philadelphia, was built in 1812 and destroyed by fire in 1838. It had a span of about 340 feet and rise of about 20 feet. The trusses had top and bottom chords curved to different radii, and were about 20 feet deep in the middle and 30 feet at the ends. They were divided by radial posts into panels about 16 feet long, with wooden X-braces and iron diagonal main ties in each. The bottom chords were made of three tiers of timbers keyed together, the ends of the top chords were anchored by inclined tension rods to the abutment masonry, and both top and bottom chords were connected by transverse horizontal struts.

The Schuylkill Permanent Bridge at Philadelphia was finished in 1806, and had two spans of 150 feet and one of 195 feet clear. There were three lines of arch trusses about 20 feet apart with a rise of about 20 feet in the bottom chord and about 10 feet in the top chord from abutment to center of middle span. The trusses were about 20 feet deep in the middle and about 35 feet deep at the piers. The bottom chords had skewback seats on both sides of the piers, above which the top chords were continuous. The roadway was "through," parallel to the top chord and cambered in a continuous curve from abutment to abutment. The bridge was roofed and had transverse top chord struts and sway bracing under the floor at the piers.







MENDOTA WOODEN ARCH TRUSS BRIDGE.

The highway bridge over the Delaware River, at Trenton, had four-arch spans of 161, 186, 198 and 203 feet, clear. It was finished in 1806 and removed in 1875. There were in each span five arch ribs with bottom chords and counter brace diagonals. Each rib was 32 inches deep, built up of 4-inch planks laid flat and breaking joints. The ribs had rise of about 30 feet and were connected in the middle by X-bracing, which extended as near the ends as there was clearance for traffic. The floor was suspended from the ribs by iron verticals 16 feet apart for the outside and 8 feet apart for the inside ribs. The ends of the spans were braced laterally by semi-arch ribs 50 feet long splayed out each side to a width of about 50 feet on the abutments. In 1848 one line of trusses was reinforced and another line added to carry a railroad track.

Mr. Cooper also describes several other long span arch bridges built in early times. The Deer Island bridge across the Merrimac River had a 160-foot arch span built in 1792. The Piscataqua bridge, near Portsmouth, N. H., was built in 1794 and had a 244½-foot arch span with a rise of 27⅛ feet and three trusses 18¼ feet deep. It was 38 feet wide and the chords were made of two timbers each, selected from crooked pieces corresponding to the curve. The butt joints were staggered and the chord pieces were connected by dovetailed keys. A similar 236-foot span was built in 1796 across the Connecticut River, at Hanover, N. H., and fell of its own weight in 1804. White pine timbers 18 inches square and 60 feet long were used in its construction. A highway bridge over the Mendota ravine, near St. Paul, Minn., has a 192-foot arch span about 95 feet in extreme height. There are two hingeless Howe truss arch trusses about 15 feet deep and 18 feet apart on centers with about 48 feet

rise. The chords are spliced with wooden fish plates in vertical planes, and have cast iron angle blocks for the bearings of the web members. The lower chords are reinforced by horizontal adjustable tension rods connected to them about one-third the distance from the crown to the skewback. The floorbeams are carried on vertical spandrel posts from 9 to 11 feet apart, which are seated on the top chords at panel points and are X-braced transversely but not longitudinally.

The lower chords have square ends seated on cast iron skewback pedestals which receive the end vertical posts. The latter continue beyond the top chords to form spandrel posts and are bolted between the top chord timbers, which have no end bearings. Adjacent and parallel to nearly all the radial members of the trusses are sway brace frames composed of T-shaped horizontal top and bottom chord transverse struts and 3x10-inch intersecting diagonal planks bolted to the radial web pieces of the struts. On both sides of the top chords and on the under side of the bottom chord 3x10-inch lateral X-bracing is bolted between the transverse struts. Bevelled filler pieces are bolted on the top chords at panel points and on them are seated 10x10-inch transverse beams, which form sills for the spandrel post bents.

A highway bridge near Kanday, Ceylon, which was described in The Engineering Record of December 2, 1893, has a 205-foot span with a 20-foot roadway carried on four wooden arch ribs of about 20 feet rise. Each rib is composed of three double beams about 2 feet apart in the clear, in the same vertical plane. Each half of a double beam is composed of two 12-inch timbers from 14 to 18 inches deep keyed together, side by side. The three beams of each rib are keyed together with dovetailed pieces 8 feet apart and in the centers of the panels thus formed there are radial iron rods extending up to the level roadway platform with bearing nuts on the upper and lower sides of the ribs. The ribs are connected by transverse X-bracing in radial planes and the roadway is carried by pairs of radial posts on each side of each rib at panel points.

Short and moderate length spans have been built with arch trusses having cast iron compression members, but these are now obsolete and descriptions of them will be omitted. Steel and wrought iron structures will be considered in following chapters.

(To be continued.)

Theory and Calculation of the Two-Hinged Spandrel-Braced Arch.

By Alex. Rice McKim.

1. *Introduction.*—On account of economy of material and stiffness, the two-hinged arch is one of the most desirable forms of bridges; but many American engineers object to its use because of the difficulties in calculation; while slight and unavoidable errors in workmanship, material or construction cause the stresses to vary from those calculated. For instance, the Bonn arch over the Rhine consists of three two-hinged arches. The large middle span was erected first and allowed to stand during the winter months without the resisting thrusts from the side spans. Consequently the piers gave somewhat and, although the spread was slight, it was sufficient to effect the stresses in all the members. And, in the erection of the Niagara railway arch, when the ends were slackened off by the adjusting toggle, the upper chord should have come together first and then the lower chord; and, when released by the toggle, there should have been a compression of 350 tons in the center upper chord. But instead, the lower chord came together first and, when the toggle was released, there was a clearance of ½ inch in the upper chord. This clearance was filled out by further separating the upper chords, by means of an improvised device, and inserting wedges which were thicker than the original clearance of ½ inch. In this way a compression was forced into the upper chord; but in so doing the stresses in all the members were changed from those calculated. However, this is not serious as, on account of the unreliability of the calculated stresses, the engineer-in-chief had increased somewhat the areas of the middle lower chord.

The object of this article is to present a method by which the two-hinged arch can be constructed so that the stresses may be calculated with some degree of certainty of their being those of the finished structure. This is accomplished by so erecting the structure that the permanent loading, which forms a large proportion of the whole loading, may be considered as statically determinate. The article follows the lines of investigation developed by Mohr, Winkler and Mueller-Breslau. Also, the wind stresses have received more attention than is usual. The results show that it is a very important factor in proportioning the sizes of members and cannot be guessed at or rudely estimated. The form of arch treated is the one which will probably be most frequently used in the future; that is, the symmetrical two-hinged spandrel-braced arch with a horizontal upper chord divided into panels of equal length, and a curved lower chord which is spread from the center toward the supports for stiffness. See Fig. 1.

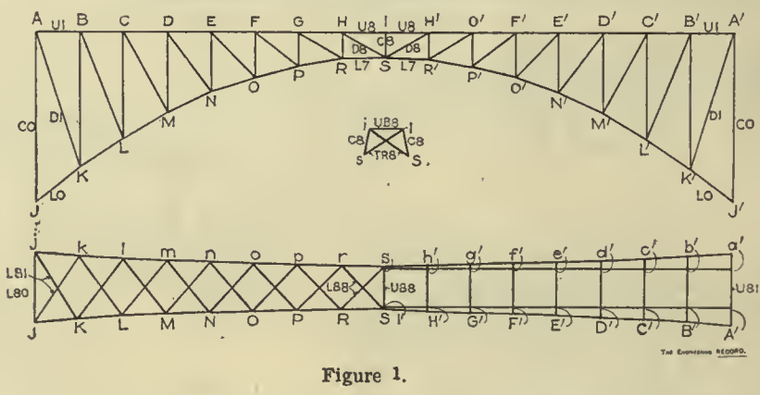


Figure 1.

Part I.—Theory.

2. *Statically Indeterminate.*—An arch differs from other structures in that loads produce inward horizontal reactions, as well as vertical reactions. As there can be no moment at a hinge, the points of application of the reactions are fixed by the two hinges, which are at the supports. With given loads and unknown reactions, there are therefore four unknown quantities as regards the outer forces—the two components of the reaction at each hinge. In order to determine these four unknown quantities, four equations of condition are necessary. The equilibrium of the arch gives three equations: namely, the sum of all the horizontal components of the loads and reactions must equal zero; the sum of all the vertical components of the loads and reactions must equal zero; and the sum of the moments of the loads and reactions about any point must equal zero. These three equations are not sufficient to determine the four unknown quantities, and the system is statistically indeterminate as regards the outer forces. The fourth equation of condition is found by obtaining an expression for the horizontal reactions, from the elasticity of the material of the structure.

3. *Horizontal Reactions for Vertical Forces.*—To obtain the horizontal reactions, the effect of a unit force at each panel point must be determined. This is done by the principle of virtual work. Consider the truss as without weight, fixed at the left support and free to move horizontally without friction at the right support. With a vertical unit load at any upper chord joint as E, see Fig. 1, let g represent the vertical deflection of that joint and j the outward horizontal displacement of the right or free support. And with outward horizontal forces of unity at the supports J and J' acting alone on the truss, let d represent the vertical deflection of any upper chord joint as E and s the outward horizontal displacement of the right support.

If the load at E be applied gradually, increasing from zero to one, it will perform the work $1 \cdot g \cdot 1 \div 2$. Now apply gradually the outward horizontal forces of unity at the supports, without removing the unit load at E, and the work performed by the outward forces will be $1 \cdot s \cdot 1 \div 2$ at the right support and $1 \cdot d$ at the joint E, as the load is further deflected. The work performed by both would be

$$1 \cdot g \cdot 1 \div 2 + 1 \cdot s \cdot 1 \div 2 + 1 \cdot d.$$

If, however, the forces of unity at the supports be applied first and then the load at the joint in a similar manner as before, the total work would be

$$1 \cdot s \cdot 1 \div 2 + 1 \cdot g \cdot 1 \div 2 + 1 \cdot j.$$

As the work performed in the two cases is the same, d must equal j. Or, horizontal forces of unity at the supports produce a vertical deflection at any joint which will be the same as the horizontal displacement of the free support caused by a vertical unit load applied at that joint. A vertical unit load placed at any joint E will cause a horizontal displacement of d at J'. And if a horizontal force R be applied at J', just sufficient to cause it to resume its former position, the displacement will be $s \cdot R$. As the two displacements are equal in amount $d = s \cdot R$, or,

$$R = d \div s \quad \ldots\ldots(1)$$

For any member, let Δ represent its change of length, and h the stress produced by inward horizontal forces of unity at the supports. The equation of equality between the virtual work of the outer and the inner forces for inward horizontal forces of unity at the supports will be $1 \cdot s = \Sigma h \cdot \Delta$. Then

$$R = d \div \Sigma h \cdot \Delta \quad \ldots\ldots(2)$$

Equations (1) and (2) represent the inward horizontal reactions caused by a unit load at any joint. Equation (1) is used for the graphical method of obtaining the values of R by means of the distortion diagram. This method should be used, however, only as a check, on account of the liability of error. The analytical method here described is more accurate, and the results as quickly obtained.

4. *Vertical Deflections.*—If the vertical deflections of the upper chord joints for horizontal forces of unity at the supports are laid off from an axis through the supports, each directly under its panel point, the broken line

connecting the extremities will be the influence curve for the outward displacement of the free support from a unit load. The influence curve will coincide with a closed equilibrium polygon of certain fixed vertical loads at the panel points. And, if the pole distance be taken as unity, the moment of these loads at any joint will be the vertical distance between the closing line and the equilibrium polygon at that joint and will equal the displacement of the free support with a unit load at the same joint.

Of these loads let that at any joiut, as E, be represented by F; and let the ordinate at this joint be d_n, while those of the joints to the left and right are respectively d_{n-1} and d_{n+1}; and let X represent the panel length. Then similar triangles in the equilibrium and force polygons give

$$F = [(d_n - d_{n-1}) - (d_{n+1} - d_n)] \div X \quad (3)$$

Next, take any section of the truss containing an upper and its corresponding lower chord member, as EDNO and OF. Suppose this section loaded at D and F by upward or minus forces $1 \div X$ and supported at E, which may be called the nth panel point. The virtual work of the outer forces will he

$$[(d_n - d_{n-1}) - (d_{n+1} - d_n)] \cdot 1 \div X$$

which is equal to F in (3).

If a stress diagram be drawn for this truss section, the following proportions are obtained from the similarity of the two figures:

$$U : 1 \div X = X : C$$
$$D : 1 \div X = X \cdot sec\ D : C$$
$$C : 1 \div X = X\ (tan\ D + tan\ L) : C$$
$$D_{+1} : 1 \div X = X \cdot sec\ D_{+1} : C$$
$$L : 1 \div X = X \cdot sec\ L : C$$

in which U represents the stress of the upper chord member DE, D of the diagonal DN, C of the column EN, D_{+1} of the diagonal EO, L of the lower chord NO, and C_{+1} of the column FO. The angles D, D_{+1} and L represent the angles which the members DN, EO, and NO make with the horizontal. From these proportions the stresses in the members can be expressed as

$$U = -1 \div C,\ D = sec\ D \div C,\ C = -(tan\ D + tan\ L) \div C,$$
$$D_{+1} = -sec\ D_{+1} \div C,\ L = sec\ L \div C, \text{ and}$$
$$C_{+1} = 1 \div X.$$

The virtual work of the inner forces will be the sum of the products of the change in length of each member and its stress, and must be equal to F. Or,

$$F = \frac{1}{C}\left[\Delta U + \Delta D \cdot \sec D + \Delta C(\tan D + \tan L) + \Delta D_{+1} \cdot \sec D_{+1} + \Delta L \cdot \sec L + \Delta C_{+1}\frac{C}{X}\right] \quad (4)$$

Let l, b, and z represent for any member respectively the length, the area of its cross-section, and the vertical distance of its center of moments from an axis through the supports; r the perpendicular distance of any member from its center of moments, M the moment of any piece about its center of moments with inward horizontal forces of unity at the supports, and E the modulus of elasticity. As the change in length Δ for any member with inward horizontal forces of unity at the supports equals $h\ l \div Eb$, and as $h = M \div r$, and $M = 1 \cdot z$, then $\Delta = z \cdot l \div r \cdot E \cdot b$. Equation (2) for the horizontal reactions from a unit load at any upper chord joint then becomes

$$R = \frac{\text{Moment of forces } F(4) \text{ at that panel point}}{\Sigma \frac{z^2 \cdot l}{r^2 \cdot E \cdot b}} \quad (5)$$

5. *Vertical Deflections, Approximate Formula.*—In obtaining the horizontal reaction R, the following assumptions can be made. The elasticity of the web members effect the deflection much less than that of the chord members and therefore the effect of the web members may be neglected. Also as the middle chord members have the greatest effect, the length of all chord members will be considered equal to the panel length X; and the area of all the upper and all the lower chord members each equal to its middle member a and A respectively. The reactions from the approximate formula based on these assumptions vary but little from those of the exact formula; and the flatter the arch the nearer are the results of the two. In the final calculation for arches of great depth, the exact lengths of the chord members can be used and, if great exactness is desired, the web members may also be considered. But in the preliminary, and generally in the final calculations, the above assumptions give the horizontal reactions sufficiently close for all practical purposes.

Let y represent z for any upper chord member and Y for the lower chord members. The stresses U and L can be represented by $1 \div C$. Formula (4) then becomes

$$F = \frac{1}{C}\left(\frac{h\,X}{E\,a} + \frac{h\,X}{E\,A}\right) = \frac{X}{E\,a}\left(\frac{y}{C^2} + \frac{Y}{C^2}\frac{a}{A}\right)$$

or dividing by $X \div E \cdot a$

$$F = \frac{y}{C^2} + \frac{Y}{C^2}\frac{a}{A} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

And the denominator of formula (5) becomes

$$\frac{X}{E \cdot a}\left(\Sigma\frac{y^2}{C^2} + \Sigma\frac{Y^2}{C^2}\frac{a}{A}\right)$$

Dividing both numerator and denominator of formula (5) by $X \div E \cdot a$, gives as the approximate formula for the horizontal reactions from a unit load at any upper chord joint

$$R = \frac{\text{Moment of forces } F(6) \text{ at that panel point}}{\Sigma\frac{y^2}{C^2} + \Sigma\frac{Y^2}{C^2}\frac{a}{A}} \quad (7)$$

It must be remembered that the center of the upper chord I is not a center of moments for any member and therefore there is no Y at this point. And as the center of the lower chord S is the center of moments for two members, its y must be doubled.

6. *Horizontal Reactions for Changes in Temperature.*—Let e represent the coefficient of expansion, t the number of degrees rise or fall in temperature, and m the number of equal panels into which the span is divided. Consider the truss as without weight, fixed at the left support and free to move horizontally without friction at the right support. For a change in temperature t the truss would change its span by the amount $e \cdot t \cdot m \cdot X$. If horizontal reactions H be applied just sufficient to cause the truss to resume its former position, the displacement will be $s \cdot H$. As the two displacements are the same

$$e \cdot t \cdot m \cdot X = s \cdot H \text{ or } H = \frac{e \cdot t \cdot m \cdot X}{s}$$

Applying the same reasoning as in sections 3, 4 and 5 gives as the exact formula for the horizontal reactions for changes in temperature

$$H = \frac{e \cdot t \cdot m \cdot X \cdot E}{\Sigma\frac{z^2}{r^2}\frac{l}{b}} \quad \ldots\ldots\ldots\ldots (8)$$

and as the approximate formula

$$H = \frac{e \cdot t \cdot m \cdot E \cdot a}{\Sigma\frac{y^2}{C^2} + \Sigma\frac{Y^2}{C^2}\frac{a}{A}} \quad \ldots\ldots\ldots\ldots (9)$$

7. *Reactions for Normal Horizontal Forces.*—Normal horizontal forces at the upper chord joints will be transferred to the lower chord by means of the top struts, the columns and the diagonal cross tie-rods between the columns. These together with the horizontal forces of the lower chord joints will be carried to the abutments by means of the lower chords and the lower chord bracing. Consider the forces to act in the direction Ss, see Fig. 1. A normal horizontal load P at any joint will produce the following reactions: horizontal reactions W at J and J' in the opposite direction from the load; horizontal reactions H parallel to J J', outward at J and J' and inward at j and j'; and vertical reactions V, downward at J and J' and upward at j and j'.

Two of these reactions can be found by statics. Let w represent the distance between corresponding joints of the lower chord (Jj) to (Ss). Then

$$W = \Sigma\frac{P}{2} \ldots (10) \text{ and } V = \Sigma\frac{P}{2}\frac{y}{w(Jj)} \ldots (11)$$

The horizontal reaction H is determined by the method of virtual work, the same as for vertical loads in sections 1 and 2.

Consider the trusses as without weight, fixed at the two left supports and free to move horizontally at the two right supports without friction, each truss in the line of its supports. Then, outward horizontal forces of unity at the supports of one truss and in the line connecting its supports, and similar inward forces at the supports of the other truss, will produce a normal horizontal deflection at any joint which will be the same as the sum of the displacements at the free supports parallel to the line of direction of the forces, caused by a normal horizontal unit load at that joint.

The approximate expression for the horizontal reactions for a unit normal horizontal load at any joint reduces to

$$R = \frac{\text{Moment of forces } F = \frac{1}{w} \text{ at that joint}}{M - 1} \quad (12)$$

Part II.—Application.

8. *Description.*—The span and depths of the trusses are fixed by the conditions of each case; but generally the end depth should be at least one-fifth of the span, and the center depth at least one-fortieth of the span. The upper chord is usually horizontal, except for the camber, which should be greater than for a truss with parallel chords; and the upper chords of the two trusses are parallel. The joints of the lower chords lie in a parabola passed through the bottoms of the center and end columns; and spread for stiffness by giving an outward batter of one-tenth to the columns. The general outline of such a bridge as is here treated is shown in Fig. 1. The horizontal projection, the vertical off-set and the actual length of each member should be calculated.

9. *Live Load Stresses.*—The live load assumed will depend upon the character and the location of the bridge. In an eight-column Table numbered I place in the first column the letters A to I, representing the panel points; and opposite in the other columns place for each panel the values of the following quantities: y, C, $y \div C^2$, $Y \div C^2$, $y^2 \div C^2$, $Y^2 \div C^2$ and R; where Y and y are the heights respectively of the upper and lower chord joints above the supports, C is the length of column and R the horizontal reaction for a unit load at the panel point. As there are two y's at the center panel point, the values for $y \div C^2$ and $y^2 \div C^2$ opposite I are doubled.

The horizontal reactions R for a unit load at each upper chord are calculated from formula (7). The moments of the forces F of formula (6) are most readily obtained by getting the shears and then the moments of the quantities $y \div C^2$ and $Y \div C^2$, divided by the panel length, by simple addition. In formula (6) assume a value for $a \div A$. For beginners, who have had no practical experience to guide them, this value may be taken as two-thirds in the preliminary calculations. Multiply each $Y \div C^2$ moment by the assumed value of $a \div A$ and add each product to the corresponding $y \div C^2$ moment. These sums give the total moments, at each joint B to I, and are the numerators of formula (7).

Multiply the sum of the values of $y^2 \div C^2$

from B to H inclusive in the sixth column of Table 1 by two, to include both sides, and the sum of the values of $Y^2 \div C^2$ in the seventh column by twice the assumed value of $a \div A$. Add these two products to the value of $y^2 \div C^2$ for I and the result will be the denominator of formula (7). Multiply each numerator by the panel length—if the moments neglected the panel length—and divide by the denominator. The quotients will be the required values R of the horizontal reaction for a unit load at each upper chord joint.

In a nine-column Table 2, place in the first column the figures 1 to 16, representing the number of members of each kind. Over the other columns place in order U, L, C, D, U, L, C and D, representing respectively the upper chord members, the lower chord members, the columns and the diagonals; the first four columns are for the perpendicular distance r of each member from its center of moments, and the last four columns are for the horizontal distance of each center of moments from the left hand support. By means of the quantities in Table 2 and the y's in Table 1, the stresses are calculated for an upward vertical force of unity at J and supported at A' and J'; and the stresses for inward horizontal forces of unity at the supports. The first are placed in Table 3 and the second in Table 4; both tables are arranged in a similar manner to the first five columns of Table 2.

From these tables are readily obtained separately the stresses under the above assumptions caused by the live loadings without the horizontal reactions; and also the horizontal reactions produced by these live loadings and the stresses the reactions produce in the members. The difference between the two stresses gives the resulting stress for any member. Both of these stresses should be placed in Tables 5 to 10, respectively, for the upper chord members, the lower chord members, the columns, the main diagonals, the upper chord bracing, and the lower chord bracing. There should be an extra column for dead load stresses in Tables 6, 7, 9 and 10; an extra column for temperature stresses in Tables 5, 6, 7 and 8; an extra column for wind stresses in Tables 7 and 9; and two extra columns for wind stresses in Tables 6 and 10. There is also a Table 11 with one column of wind stresses for the cross diagonal tie rods marked T R. The batter of the columns, besides influencing the stresses in the trusses, produce compression in the upper chord bracing and tension in the end lower chord tie rod—all of which must be taken into account.

10. *Dead Load Stresses.*—The dead load is carried by the columns and lower chord. To insure this the lower chord members should have added to the figured length of each the amount of its contraction under the dead load; and, if erected by means of false-work, the main diagonals, except those in the middle panels, are riveted up after the whole of the dead load is on the bridge, drilling the holes in the gusset-plate connections to match shop punched holes in the diagonals. If erected by the cantilever method, one middle upper chord member should be omitted until after the dead load is all on the bridge, drilling the holes in the gusset-plate connections to match shop punched holes in the chord member, which chord member should be made from field measurements.

The dead load stresses are all determined by statics and placed in Tables 6, 7, 9 and 10. The loads at the upper chord joints produce compression in the upper chord struts A a to I i of one-tenth, and corresponding tensions in the end lower chord tie J j. The lower chord loads produce compression in the double trianguiar lower chord bracing J k and j K to R s and r S, and tension in the end lower chord strut J j.

11. *Wind Stresses.*—These are variously specified, but the maximum is generally for a force of 30 pounds per square foot of exposed surface for both trusses and acting at the joints of both chords. The upper chord forces are transferred to the lower chord by means of the upper bracing, the columns of the rear truss and the diagonal cross tie rods T' R between the columns. The stresses obtained should be placed in Tables 6, 7, 9 and 10.

12. *Temperature Stresses.*—Assume a coefficient of expansion e of 0.0000065 per Fahr. degree of temperature, a variation in temperature t of 75 degrees, a modulus of elasticity E of 29,000,000 pounds per square inch, and, from the stresses already calculated, an area a for the middle upper chord member. Using the same denominator in formula (9) as found for formula (7) in paragraph 9, gives the greatest horizontal reaction due to changes in temperature. Multiplying the quantities in Table 3 by this reaction gives the maximum stresses that can be produced by a fall or rise in temperature, being tension in one case and compression in the other. These stresses should be placed in the column reserved for temperature stresses in Tables 5, 6, 7 and 8.

13. *Final Calculations.*—From the stresses given in Tables 5 and 6, calculate from the given allowable stresses the area of cross-section for the middle upper chord member a and the middle lower chord member A. If the calculated area of a varies much from the assumed value, or the ratio $a \div A$ much from that assumed value, the calculations based on these assumptions will have to be gone over again with new values based upon the calculated stresses.

14. *Secondary Systems.*—Generally the upper chords would have a secondary system of stiffening diagonal bracing, the sizes depending on the amount of stiffness derived from the floor system and the number and length of panels. Long columns usually have secondary systems of horizontal bracing combined with the diagonal cross tie rods between the columns, to economize material by reducing the length of columns.

Extension of Water Supply of Hartford, Conn.

Hartford has nearly outgrown its present source of water supply and in 1901 engaged Mr. Allen Hazen, of New York, to study and report means for extension and improvement. An abstract of this report, made in 1902 and recently published, is here presented. The present supply is drawn from a number of impounding reservoirs in small watersheds of a hilly district in West Hartford, and the capacity of this source in a dry year is estimated at 7,500,000 gallons per day, which is equivalent to a per capita consumption of 80 gallons. The recent introduction of meters has materially aided in reducing the consumption and keeping it near this reasonable figure.

Three sources were studied for supplementing the present supply, the Connecticut River a short distance above the city, the Farmington River at a point distant about 5 miles, and Salmon Brook, a tributary of the Farmington River. The waters of both rivers are polluted with sewage and manufacturing wastes, but the present supply and Salmon Brook are almost free from pollution, hence the river waters will require filtration while the brook water could be used without. Careful consideration of all these supplies from various points of view led to the recommendation of a slow sand filter and pumping plant on the bank of the Connecticut River about two miles above the center of the city. Low lift pumps will supply the filters, and filtered water will be pumped by high-service engines from the clear water basin through the distribution system, all the engines and boilers being located in one station. As the present supply will probably be nearly sufficient in ordinary seasons for several years, only a part of this plant need be built at the outset and this portion would be operated only at such times as the West Hartford supply should be overtaxed. The filters will be of vaulted masonry construction, although for some years open filters could be used because the Connecticut River water would not be needed during cold weather. It is thought, however, that covered filters are more satisfactory for such an intermittent service, and besides, when the demands of consumption require the continual operation of the filter plant, covered filters would be necessary.

The cost of construction of the Connecticut and Farmington River works were estimated to be about equal, but other considerations led to the preference for the Connecticut River supply. The Salmon Brook project involved the construction of either a large masonry or a large earth dam. The dimensions for the earth dam would be unusual, the proposed water level in the reservoir being 98 feet above the present water level, the super-elevation of the dam 15 feet, top width 30 feet and slopes 3 to 1 on each side. The downstream slope, however, would be broken into a series of steeper slopes and berms. Even with these dimensions the estimated cost of the earth dam was less than half that for the masonry dam on the same site.

Although the sewage pollution of the Connecticut River is large, it is much less than that of other rivers now used as sources of filtered water supplies. The urban populations on several of these watersheds are as follows: Connecticut River above Hartford, 25 per square mile; Schuylkill above Philadelphia, 98; Merrimac above Lawrence, 69, and the Hudson above Albany and above Poughkeepsie, 46. In the last three cases filters have been in use for some time and the hygienic quality of the water, so far as can be determined, is as wholesome as the best waters from natural sources.

Carborundum as an Abrasive is now widely used. Recently carborundum powder mixed with sodium silicate has been successfully applied as a refractory surfacing to furnace bricks. The bricks may be coated with a brush or by immersion. It is claimed that a layer about one-twelfth inch thick will protect the bricks from injury by temperatures met in any ordinary operations.

The Municipal Engineers of the City of New York have during the past few months taken the preliminary steps for organization as an engineering society, as related in The Engineering Record. At the meeting held on April 3, 1903, at the house of the American Society Mechanical Engineers, Mr. O. F. Nichols was elected temporary president and Mr. A. S. Tuttle was made temporary secretary, both to hold office until permanent officers should be elected. The constitution reported by the committee, Mr. N. P. Lewis, chairman, was adopted with a few minor amendments. A nominating committee of 15 members, in which each of the boroughs and eleven departments has representation, was elected and instructed to make its report to the temporary secretary within two weeks. The first regular meeting of the society will be held on April 22, at which time permanent officers will be elected and a paper of interest will be presented. Additional enrollments have increased the membership to nearly 400.

New Books Received.

Under this heading books received from publishers will be punctually announced. Reviews may be published in subsequent issues. Publishers are requested to send retail price with each book.

Railroad Construction. Theory and Practice. A text-book for the use of students in colleges and technical schools. Second edition, reset and enlarged. By Walter Loring Webb, C. E., Assoc. M. Am. Soc. C. E.; sometime Assistant Professor of Civil Engineering, University of Pennsylvania, etc. New York: John Wiley & Sons. 675 pages, illustrated. Morocco, price, $5.

Book Notes.

The Induction Motor. Its Theory and Design Set Forth by a Practical Method of Calculation. By Henry Boy de la Tour, Chief Electrician and Designer, Electrical Department of the Compagnie Fives-Lille, Givors, France. Translated from the French by C. O. Mailloux, M.A.I.E.E., M.I.E.E., past president of the New York Electrical Society. New York: McGraw Publishing Company. 200 pages, illustrated. Price, $2.50.

This book comprises nine chapters, and an introduction by the translator principally explanatory of the nomenclature used in the text. The first chapter, on the revolving field, is very clear and easily understood, and shows the method of deriving the constants which enter into the formulae for the maximum air gap density. The diagrams, however, lack clearness in that both the end connections of the windings are not shown. One end connection only is indicated, and while readers familiar with the subject may easily see whither the other ends lead, it is not so apparent to the uninitiated. Chapter II. on the electro-motive forces induced by the revolving field, Chapter III. on the electro-magnetic couple, and Chapter IV. on the magnetizing action of windings, are all clear and exhaustive. Chapter V. gives formulae for computing the resistance of short circuiting rings in cases where the squirrel-cage winding is used. The suggestions as to relative resistances of conductors and connecting rings, and the calculations relating thereto are new. Chapter VI. is a recapitulation of the preceding chapters and is good for reference. Chapter VII. on performance diagrams of induction motors and Chapter VIII. on practical applications are both complete and instructive, and Chapter IX. treats of the Heyland motor. The book has several points of merit, among which may be enumerated: The clear and original method of treatment, differing from most of the other methods heretofore published; the deduction of all formulae and constants used; the carrying through of every mathematical substitution or transformation so that all the work is easily followed, and the fact that the physical side of the subject is given some attention. Instead of numbering the equations and requiring the reader to refer back to them, as is customary in many technical works, the equations are here repeated wherever they are required.

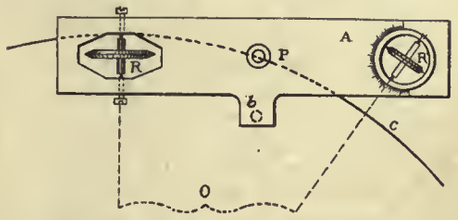
Dimensions of Direct-Current Dynamo-Electric Machines. By Carl Kinsley, instructor in Physics, The University of Chicago. Chicago: The University of Chicago. 14 pages, illustrated.

This publication is printed from Volume IX. of the first series of the Decennial Publications of the University of Chicago. It constitutes a systematic method of calculating the dimensions of direct-current dynamos, with an arrangement of equations for determining the important constants of any machine when the type desired is known. For illustration, the desirable proportions are studied of a 30-kilowatt 115-volt four-pole belted dynamo, to run at 950 revolutions per minute, with parallel drum-wound armature and compound-wound field.

Letters to the Editor.

Elastic Deformations.

Sir:—Concerning the methods employed by C. S. in the checking of elastic deformations of steel structures in your issue of March 28, I beg to state that I have used a similar method with great advantage and believe that its adaptability in the design of many structures besides arches is large. My latest application was to the design of the A-frame and back-stays for a large dipper dredge, where it immediately revealed the existence of much larger stresses than would have been detected by any but the most rigorous analysis. While perpendiculars drawn to the center lines of truss members are for all practical purposes sufficient, your readers may be interested in a little device for the drawing of the curves of large radius, which are theoretically involved in the above method. The device consists of a frame carrying a pencil and two rollers, the angle between the planes of which may be varied according to pleasure. The angle at which the rollers are placed will determine the radius of the curve according to well known rules. I happened to discover this instrument (a sketch of which is included), in "Die Integraphen," Die Integralkurve Und Ihre Anwendungen von Br. Abdank-Abakanowicz. Deutsch Bearbeitet von Emil Bitterli.



Yours very truly,

E. P. Goodrich,

Chief Engineer, Bush Terminal Company.

New York, April 4, 1903.

Design of Steel-Concrete Beams.

Sir:—In the complete design of steel-concrete beams, several important elements must be carefully considered. They are: (1) The amount of steel needed to take up the direct tensile stresses; (2) The steel and concrete required for direct compression; (3) The steel and concrete required to take up the maximum vertical reaction; (4) The steel and concrete required to take up the longitudinal shearing stress. Computations can be made for the design of all these elements. In what follows are given the formulae together with some explanatory remarks.

The tensile resistance of concrete will be ignored. Since the deformation of concrete and steel should be the same, the compressive resistance of the steel must be taken equal to the compressive resistance of the concrete multiplied by the ratio of the moduli of elasticity of steel and concrete. Consider a non-continuous beam loaded uniformly over its entire span and let p = pounds per linear foot, l = span in feet, D = effective depth in inches, or the distance from the extreme fibre of beam to the center of the steel rods on the tensile side, s = total direct tensile or compressive stress at any point x feet from the support. This is also equal to the total longitudinal shear between the point of support and x feet from the point of support, w = width of beam in inches, p_1 = allowable compressive stress in pounds per square inch for concrete, and f = allowable shearing stress in pounds per square inch for concrete.

The bending moment at x feet from the point of support is

$$M_x = \frac{p\,x}{2}(l - x) \qquad (1)$$

In Ransome's system the stress is taken to be very nearly equal to the bending moment divided by 5/6 of the effective depth. Therefore, the stress at x is

$$s_x = \frac{36}{5}\,p\,x\,\frac{l-x}{D} \qquad (2)$$

One-third of the effective depth is regarded for simplicity of computation to be in uniform compression. Therefore, we also have

$$s_x = \frac{D}{3}\,w\,p \qquad (3)$$

Eliminate Sx in equations (2) and (3) and there results

$$D^2 = \frac{108}{5}\,\frac{p\,x\,(l-x)}{w\,p_1} \qquad (4)$$

Put $x = \frac{l}{2}$

$$D^2 = \frac{27}{5}\cdot\frac{p\,l^2}{w\,p_1} \qquad (4)$$

From equation (4), we can obtain D, provided we either know w or assume a relation between w and D. With D obtained, s can be computed from equation (3). The steel is designed to take up all the stress given by s.

From equation (1) we obtain the intensity of longitudinal shearing stress (f) at x.

$$\frac{d\,s}{d\,x} = w\,f = \frac{36\,p}{5 \times 12\,D}(l - 2\,x)$$

or

$$f = \frac{3\,p}{5\,D\,w}(l - 2\,x) \qquad (5)$$

If f is made equal to the allowable shearing stress per square inch for concrete and if we solve for x, we obtain

$$x = \frac{1}{2}\left[l - \frac{5\,D\,w}{3\,p}\,f\right] \qquad (6)$$

This equation indicates that steel must be added between the support and x feet from the support to take up enough of the longitudinal shearing stress so that the concrete may not experience an intensity of shearing stress above the allowable.

With x obtained from equation (6), substitute it in equation (2) to obtain the total longitudinal shearing stress. Subtract from this the resistance which the concrete itself will offer to the longitudinal shearing stress; the difference must be taken care of by steel suitably placed. The necessary width of beam to avoid the use of steel to resist longitudinal shearing stress is obtained from equation (6) by putting x equal to zero.

$$w = \frac{3}{5}\cdot\frac{l\,p}{p_1 D} = \frac{1}{15\,p_1}\cdot p$$

Very truly yours,

Sam'l D. Bleich.

Cincinnati, O., March 20, 1903.

The Class in Geology and Mining of the Missouri School of Mines and Metallurgy will make a summer excursion this year, in charge of Director Ladd, to the Black Hills, Butte and Anaconda and the Yellowstone Park. Similar excursions will in the future be a required part of the work. The new catalogue announces that there will be made, during the spring and summer months, as a part of regular courses, excursions to the Joplin mining district for mine surveying; to the Gasconade River for field practice in lines of communication; to southeast Missouri for geological field work; and to Joplin, St. Louis, Herculaneum and the Flat River district for the study of mines and ore-dressing and metallurgical plants.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual Convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Watea Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

Amerıcan Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers.. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

Personal Notes.

Mr. Elmer E. Piper has been appointed city engineer of Hagerstown, Md.

Mr. Herbert A. Marden has been elected chief engineer for Portsmouth, N. H.

Mr. H. Sweet has been appointed superintendent of water-works, Ballston Spa, N. Y.

Mr. Peter E. Costello has been appointed director of the department of public works, Philadelphia.

Mr. Edward M. Bigelow has been appointed director of the department of public works, Pittsburg.

Messrs. Alden & Harlow, architects, have removed their offices to the Farmers' Bank Building, Pittsburg.

Mr. A. W. Newton has been appointed superintendent of construction at St. Louis of the Chicago & Alton Railway.

Mr. C. L. Gates, M. Am. Soc. C. E., has been engaged as consulting engineer for the Genesee avenue lift bridge, Saginaw, Mich.

Mr. Percy S. Davis, one of the directors of the Davis Calyx Drill Co., has returned from a prolonged business trip in Australia.

Mr. M. G. Holmes has been appointed superintendent of the Rochester, Minn., Water Company, succeeding Mr. R. H. Mills, resigned.

Mr. John A. Dodson has been appointed superintendent of construction on the Southern Railway, in charge of double tracking and new work.

Second Lieut. Mark Brooke, Corps of Engineers, U. S. A., has been ordered to report for duty to the senior officer of the Isthmian Canal Commission.

Capt. Chester Harding, Corps of Engineers, U. S. A., has been detailed to supervise the construction of the Municipal Building for the District of Columbia.

Mr. J. L. Ludlow, M. Am. Soc. C. E., has been elected by the Columbus, Ga., water works commissioners as the engineer in charge of construction of municipal water works.

Mr. J. Y. McClintock, M. Am. Soc. C. E., has resigned his position as commissioner of public works, Rochester, N. Y., and is succeeded by the deputy commissioner, Mr. Thomas J. Neville.

Mr. K. C. Weedin has been appointed resident engineer of the Middle, Eastern, and River Divisions of the New York Central & Hudson River Railroad, succeeding Mr. L. W. Tucker, resigned.

Mr. John T. Dickerson has resigned his position with the Chicago, Burlington & Quincy Railway, to accept a position in the bridge department of the Chicago, Rock Island & Pacific Railway.

Maj. William M. Black, Corps of Engineers, U. S. A., has been relieved of his duties at Washington Barracks by Maj. Edward Burr, and has reported to senior officer of the Isthmian Canal Commission.

Mr. Edward D. Rich, formerly connected with the engineering department of Syracuse, N. Y., and recently assistant city surveyor of Utica, has been appointed city engineer of Summit, N. J.

Prof. C. S. Slichter, of the University of Wisconsin, read a paper before the Western Society of Engineers in Chicago on April 2, entitled "The Measurement of Underflow Streams in Southern California."

Mr. Theodore A. Leisen, superintendent of public parks and park engineer of Wilmington, Del., has been selected by the board of water commissioners as consulting engineer for the new reservoir for that city.

Civil Engineer A. C. Cunningham, U. S. Navy, has been detached from the naval station at New Orleans to the Naval Academy; and Civil Engineer A. G. Menocal has been detached from the Naval Academy, awaiting orders.

The new Omaha Water Board, Ex-Governor J. E. Boyd, chairman, which was appointed by the governor under the recent act of the legislature providing for the acquisition of the Omaha Water-Works by the city, has appointed Mr. Arnold C. Koenig, Assoc. Mem. Am. Soc. C. E., water commissioner and secretary of the Board.

Capt. George P. Howell, Corps of Engineers, U. S. A., has been relieved from duty at St. Louis as secretary of the Mississippi River Commission and ordered to Charleston, S. C., to relieve Capt. James C. Sanford, in charge of river and harbor works in that vicinity, who will assume charge of similar work at Philadelphia, where Capt. Sanford relieves Lieut. Col. Charles W. Raymond.

Announcement has been made of the President's approval of the following promotions in the Corps of Engineers, U. S. A., only the new rank being given: Col. David P. Heap; Col William A. Jones; Lieut. Col. Ernest H. Ruffner; Lieut. Col. Clinton B. Sears; Maj. George A. Zinn; Maj. William C. Langfitt; Capt. William B. Ladue; Capt. William J. Barden; First Lieut. Ernest D. Peek; First Lieut. George R. Spalding.

The sub-committee, composed of Rear Admiral John G. Walker, U. S. N., Brigadier Gen. Peter C. Hains, Corps of Engineers, U. S. A., and Prof. William H. Burr, of Columbia University, appointed by the Isthmian Canal Commission to complete the preparations for the transfer of the canal property to the United States, sailed April 9 for Colon, and will remain on the Isthmus several months. Major William M. Black, Corps of Engineers, accompanies the committee.

Mr. William C. Andrews, for the past two years associate editor of the "Street Railway Journal," has accepted the position of eastern representative of E. P. Roberts & Co., consulting engineers, Cleveland. Mr. Andrews is a graduate of the School of Mines, Columbia University, receiving the degree of electrical engineer in 1895. Since 1900, when he became connected with the editorial department of the "Electrical World and Engineer," he has been engaged in technical journalism.

Col. Amos Stickney, Corps of Engineers, U. S. A., will relieve Brig.-Gen. Peter C. Hains, Corps of Engineers, of his duties on the Lighthouse Board; and Lieut.-Col. Charles J. Allen, Corps of Engineers, will relieve Gen. Hains of charge of the river and harbor improvements and fortifications at Baltimore. The Eastern Division of Fortifications and River and Harbor Works has been extended to include Philadelphia, Baltimore, and Washington, and has been placed in charge of Col. Stickney.

Obituary Notes.

Joseph B. F. Navarre, a civil engineer recently connected with the Third Lighthouse District, at Staten Island, N. Y., died at his home in Monroe, Me., March 29, aged 64.

William W. Card, second vice-president of the Westinghouse Air Brake Co., died April 4, at his home in Pittsburg, Pa., as the result of being struck by a trolley car. He was educated as a civil engineer and early in life became connected with railroad work in the middle west. He entered the service of the Westinghouse Company in 1872, and became secretary in 1879. He was 71 years old.

The Valparaiso, Ind., Water Works suit was recently decided by court in favor of the city. The works were built by a company under a 50-year franchise, reserving to the city right of purchase, 15 years after construction, on appraisal by "three disinterested hydraulic engineers." But the company rejected the city's advances looking toward a purchase, and so the case went to court. Messrs. J. W. Alvord and D. W. Mead, of Chicago, were the city's engineer experts, and Mr. H. B. Smith, Bay City, Mich., and Mr. A. L. Holmes, Grand Rapids, were employed by the company. The valuations presented were, respectively, $83,106 and $165,000, but the latter was severely criticised by the court. After adding $3,600 to the former estimate, for items not fully included, the valuation was fixed by the court at $86,706.

Bids for Wood Block Paving were recently opened in Brooklyn, N. Y., and as this is the first time that this material has been proposed for any extended amount of paving in New York City, it is thought that the figures may be of more than local interest. The total area of the several streets to be paved under this contract is 15,980 square yards. The lowest bidder was the United States Wood Preserving Company, at $3.77 per square yard, including the 5-inch concrete foundation. Although the price for this pavement seems high for use in residence streets at least, it is claimed that the advantages in the way of maintenance and repair fully offset the extra first cost. At the same time bids were opened for 41,830 square yards of granite block pavement, 35,880 square yards of Medina sandstone, and 10,470 square yards of asphalt block. The average prices per square yard of the lowest bids on these types of pavement were: Granite, $4.17; Medina sandstone, $4.39; asphalt block, $3.32. These prices include in all cases the concrete foundation.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
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OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 23, 24 and 26.

WATER.

Jasper, Ala.—J. M. Cranford, of Jasper, is stated to have secured a franchise for water works, to be constructed, at a cost of $25,000.

Suisun, Cal.—F. Wm. Gabriel, Town Clk., writes that it was voted Mar. 25 to issue $25,000 bonds for a 5-in. pipe line. Engineer, H. N. Tracy, 151 Sansome St., San Francisco.

Anaheim, Col.—The Dirs. of the Anaheim Union Water Co. are stated to have approved plans of the engineer for excavation of 3 cement-lined tunnels.

Antioch, Cal.—R. H. Wall, Town Clk., writes that it was voted Mar. 28 to issue bonds to the amount of $2,200 for water works and $8,000 to complete the sewerage system.

Fountain, Colo.—Engineer Reed is stated to have completed preliminary plans for 2 of the series of reservoirs to be constructed in Fountain valley by St. Louis capitalists.

Denver, Colo.—It is stated that the Water Co. will construct a new reservoir this year near South Platte station, ¾ of a mile long and about ¼ mile in width, with a capacity of 300,000,000 cu. ft. of water. It will be an adjunct to the 4 filter beds now about completed. It will cost $300,000. Mr. Cheesman, Pres.

Norwalk, Conn.—It is stated that bids are wanted by Chas. S. Glover, Mayor, until May 18 for $80,000 water works improvement bonds.

Bids will be received by the Water Comrs. until Apr. 22 for hauling and laying approximately 25,000 lin. ft. of 16-in. water main. Frederick Buckley, Secy.

Waterbury, Conn.—Bids will be received Apr. 14 by the Bd. of Pub. Wks. for constructing water conduits in 6 streets and catch basins on Washington St. R. A. Cairns, City Engr.

Southington, Conn.—The Secy. of the Southington Water Co. writes that it is proposed to lay 2½ miles of 6, 4 and 1¼-in. pipe, at a probable cost of $12,000, to be done by day labor.

Wilmington, Del.—The Water Dept. has contracted with the U. S. Sand Filtration Co., of Indianapolis, Ind., to furnish plans and specifications for the new reservoir and filter beds which are to be built at a cost of about $500,000.

Washington, D. C.—According to press reports contracts for the filtration plant have been awarded by the War Dept. as follows: Excavating and concrete work, Cowardin, Bradley Clay & Co., Richmond, Va., $989,694; pipe and drainage system, Brennan Constr. Co., Washington, $225,535; sand and gravel, L. E. Smoot, Washington, $487,855. For detail bids see issue of Engineering Record, April 4th.

Smithville, Ga.—It is stated that bids are wanted Apr. 15 for sinking an artesian well; size of piping to be not less than 4 in. C. A. Rhodes, Mayor.

Columbus, Ga.—The Water Works Comrs. have selected J. L. Ludlow, of Winston-Salem, N. C., to prepare plans and superintend the construction of the city water works.

Statesboro, Ga.—See "Power Plants, Gas and Electricity."

Twin Falls, Idaho.—Allen & Mathison, of Seattle, Wash., is stated to have secured a $50,000 contract for constructing a portion of the irrigation canal to be constructed in Snake River valley; the canal will be about 65 miles in length, and cost about $2,000,000.

Peoria, Ill.—It is stated that a well 1,700 ft. in depth and 8 inches in diameter will be sunk at the Insane Asylum.

Quincy, Ill.—The franchise of the present company expires Aug., 1903. The city has $200,000 cash on hand to purchase this plant, or part payment on same; if no satisfactory price can be reached the city will construct a new plant. If the old plant is acquired by city, considerable new pipe will be used. Address John A. Steinback, Mayor; F. L. Hancock, City Engr.

Evanston, Ill.—Bids are wanted Apr. 16 for constructing a system of 6-in. c. i. water mains and appurtenances in a portion of 4 streets. Jas. A. Patten, Pres. Bd. of Local Improv

Elgin, Ill.—The following bids are reported to have been received Mar. 29 for (*a*) shaft and tunnels complete at the artesian wells and (*b*) for the elevator: John H. Sutter & Co., Chicago, Ill., *a*, $42,300. A. E. Rutledge & Co., Rockford, Ill., *a*, $31,500; *b*, $1,800. Bracy, Howard & Co., Chicago, Ill., *a*, $24,445; *b*, $1,500. John J. O'Heron, Chicago, Ill., *a*, $25,965; *b*, $2,000.

Crete, Ill.—The Village Board is stated to have decided to employ Sturtevant & Todd, of Chicago, Ill., to prepare plans for a complete system of water works.

Anderson, Ind.—The Water Com. of Council is stated to have decided to install a filtration system with a capacity of 9,000,000 gals. of water a day; it will probably cost about $75,000.

Gardiner, Me.—Chas. O. Wadsworth, City Clk., writes that the Gardiner Water District has voted to buy the works already constructed. Freeman Patter, Chmn. Water Works Trus.

Bangor, Me.—See "Miscellaneous."

Belfast, Me.—The Mayor in his annual address referred to the need of a filtration plant at the water works. A. P. Mansfield, City Clk., writes that no decision has as yet been made on this question.

Dexter, Me.—A press report states that the Water Comn. has called for bids to be in Apr. 15 from 6 different firms dealing in iron pipe, the same to be used for the water works to be constructed here.

Brockton, Mass.—The city will commence construction of a pumping station in the near future. About 400-H.-P. will be provided for. It is proposed to lay this year about 6 miles of 24-in. force main in addition to the regular work. Chas. R. Felton, City Engr.

Newburyport, Mass.—The Camden Iron Co., of Camden, N. J., is stated to have secured the contract for 125 tons of 12-in. c. i. pipe, at $30.65 per ton, and castings at $55 per ton.

Houghton, Mich.—F. W. Cappelen, 501 Oneida Blk., Minneapolis, Minn., is reported to have been directed to prepare plans for improving the water system.

Niles, Mich.—The Bd. of Pub. Wks. is stated to have decided to install a water meter system.

Agricultural College, Mich.—Bids will be received until Apr. 14 by A. M. Brown, Secy. State Bd. of Agriculture, Agricultural College, for furnishing material and constructing a water works distributing system in this city, approximately 8,000 ft. of 4, 6 and 8-in. c. i. pipe, special castings, 24 hydrants, blow off valves, etc.

Montevideo, Minn.—Bids are wanted May 4 for $15,000 water works bonds. J. M. Severens, Village Recorder.

Kansas City, Mo.—Bids are wanted Apr. 15 for furnishing material for constructing a smoke-stack, including foundations, at the Turkey Creek Pumping Station, to be 175 ft. high and 8 ft. diameter; also on same date (readvertisement) for furnishing material for constructing a 36-in. c. i. pipe, 48 in. inside diameter by ½ in.; also a 36x⅜-in. steel riveted and caulked pipe line asphaltum coated and a 66-in. concrete and steel aqueduct similar to the Monier or Bonna system; approximate distance of each, 18,000 lin. ft. Bids are also wanted Apr. 20 (readvertisement) for furnishing and installing at Turkey Creek pumping station, 1 vertical triple expansion condensing crank and fly wheel pumping engine, 1 horizontal triple expansion condensing crank and fly wheel pumping engine, and 1 horizontal triple expansion condensing pumping engine having capacities of 12,000,000 and 15,000,000 gal. in 24 hours. Baxter Brown, Secy. Bd. Pub. Wks.

According to press reports the Missouri Pacific R. R. Co. (G. W. Inge, Div. Supt., Kansas City, Mo.) is going to make it possible for the city to supply Sheffield with water. The company proposes to lay over a mile of 16-in. main from the present connection at Helm's brewery to its lands at its own expense, about $30,000, the main to eventually become the property of the city.

Storrs, Mont.—See "Power Plants, Gas and Electricity."

Gloucester City, N. J.—This city is reported to be ready to expend $16,000 to remove iron from driven well water by filters; will probably add some wells to plant also. David Lane, City Clk.

Riverton, N. J.—The Water Co. will increase its water works, wells and distributing pipe. Howard Parry, Secy.

Atlantic City, N. J.—Kenneth Allen, Engr. & Supt. Water Dept., writes that the contract for a concrete weir at Absecon Reservoir (bids opened Apr. 3) has been awarded to C. J. Kelly, of Atlantic City, N. J., for $5,946.

Bids will be received by the Bd. of Water Comrs. for installing a plant for pumping 3,000,000 gal. per day from 12 artesian wells. Contract will be let for either an air lift plant and for laying vitrified clay discharge mains, or for a centrifugal pump plant, with impulse wheel or electric motor and laying a suction main. Louis Kuehnle, Chmn. Comrs.; Kenneth Allen, Engr. & Supt.

Rahway, N. J.—The Water Bd. is reported to be considering the question of installing a filter, at a probable cost of $30,000.

Yonkers, N. Y.—All bids received by the Water Comrs. on April 2 for raising the Grassy Sprain dam have been rejected.

Alexandria Bay, N. Y.—Frank A. Hinds is preparing plans for the proposed water works and sewerage system, estimated to cost $60,000.

Ithaca, N. Y.—The Legislature is stated to have passed a bill authorizing the city to issue $700,000 bonds to secure control of the city water system.

Santa Rosa, N. M.—The Ft. Sumner Irrigation Co. has been incorporated by Henry B. Jones and Edward H. Settle, of Santa Rosa, and Wm. R. McGill, of Ft. Sumner, to construct reservoirs and pipe lines on east side of Pecos River. The ditch will be 30 miles long and extend into Leonard Wood and Chaves Counties; capital, $100,000. Principal place of business, Santa Rosa.

Akron, O.—The Supt. of Water Wks. is reported to have been instructed to prepare an estimate of the probable cost of extending the mains in the n. w. and s. w. parts of city. About 2 miles of mains will be laid.

Toledo, O.—T. R. Cook, Supt. Water Wks., writes that the following bids for furnishing f. o. b. cars c. i. pipes were received on Apr. 3—*a*, 30 tons 4-in.; *b*, 800 tons 6 and 8-in.; *c*, 270 tons 20-in., price given per ton: American Car & Fdy. Co., Detroit, Mich., *a*, $30; *b*, $29.50; *c*, $29.30 (awarded contract). The Dimmick Pipe Co., Birmingham, Ala., *a*, *b* and *c*, $33. U. S. Cast Iron Pipe & Fdy. Co., Chicago, Ill., *a*, $31.40; *b*, $30.40; *c*, $29.40. Reading Foundry Co., Reading, Pa., *a* and *b*, $31.80; *c*, $31.40. Jas. B. Clow & Sons, Chicago, Ill., *a*, $32.90; *b* and *c*, $31.90. National Supply Co., Toledo, *a*, $31.90; *b*, $30.90; *c*, $29.90.

Frackville, Pa.—The water plant owned by the Haupt Water Co. has been purchased by Jos. J. Kehler, of Frackville, Pa. Improvements will be made during the summer.

Harrisburg, Pa.—City Engr. Cowden has purchased the upper half of the bridge island in the river opposite the city, to be used as a site for the filtration plant soon to be built.

Philadelphia, Pa.—The Trus. of the Univ. of Pennsylvania are stated to have decided to install a filter plant.

Ordinances have been passed by Select and Common Council providing for the laying of mains in numerous streets.

Scranton, Pa.—The Campbells Ledge Water Supply Co. is reported formed, with a capital of $1,000,000, to furnish Scranton with water from Susquehanna River. The company will construct a reservoir near the top of Campbells Ledge. J. F. Eichholzer and P. J. Conway, of Pittston, are among the incorporators.

Tarentum, Pa.—Bids will be received at the office of Chapin & Knowles, Frick Bldg., Apr. 20, for furnishing a 3,000,000 gal. pumping engine, to be constructed at Tarentum for the Tarentum Water Co.

Nazareth, Pa.—It is stated that the Nazareth Water Co. will issue bonds to the amount of $60,000. Among the improvements contemplated by the company is a reservoir to hold about 500,000 gals. of water and a 10-in. main in Main St.

Watertown, S. D.—The Council is reported to have ordered 17 blocks of water mains.

Nashville, Tenn.—The House has passed the bill authorizing the city to issue $200,000 bonds for the construction of a filtration plant.

Franklin, Tenn.—The Senate has passed the bill authorizing this city to issue $50,000 water works bonds.

Granger, Tex.—The Missouri, Kansas & Texas Ry. Co. (S. B. Fisher, Ch. Engr., St. Louis, Mo.) is stated to have decided to construct a reservoir here, to cost about $10,000.

Mt. Pleasant, Tex.—The contract for constructing the proposed water works is stated to have been awarded to the McQuatters Plumbing & Mach. Co., of Hillsboro. The system includes a power house, standpipe, reservoir, 2 miles of pipe, 12 fire hydrants, etc.

Mt. Pleasant, Utah.—J. M. Boyden, City Recorder, writes that it was voted Mar. 31 to issue $18,000 bonds for the construction of water works.

Proctor, Vt.—The citizens are stated to have voted Apr. 1 to improve and extend the water works, at a cost of $25,000.

Brattleboro, Vt.—This village on April 2 voted to instruct the bailiffs to lay a water main of not less than 8 inches in diameter from the main of the Chestnut Hill Reservoir Co. at Whetstone bridge to the factory of B. Souto & Co., for domestic and fire protective uses, and to borrow $7,000 to pay cost of same.

Lynchburg, Va.—According to local press reports, Jas. H. Fuertes, of New York, N. Y., in his report to Council Com. on Water, recommends that the city procure its new water supply from Pedlar River from a reservoir to be formed by the construction of a dam 60 ft. in height; that the pipe line follow if possible a new route to Lynchburg and be a composite one, consisting of approximately 19.4 miles of 36-in. wooden stave pipe; 1.1 miles of 30-in. riveted steel pipe, and 2.4 miles of 30-in. c. i. pipe; total estimated cost of work, $710,811.

Seattle, Wash.—The City Council is stated to have passed an ordinance appropriating $33,000 for a standpipe.

The lowest bid opened by the Bd. of Pub. Wks. Mar. 28 for laying water mains in 13th Ave. and other streets is stated to have been submitted by F. McLellan, for $41,868.

Tacoma, Wash.—Bids are wanted Apr. 27 for drilling and casing 2 wells, furnishing and erecting 2 air compressors, 2 75-H.-P. motors to operate same, with wiring and switchboards. R. W. Clark, Comr. of Pub. Wks.

Wheeling, W. Va.—Walter Worls, City Clk., writes that a large quantity of pipe will probably be laid this year.

Benwood, W. Va.—Bids will be received Apr. 17 by Engineers Chapin & Knowles, Frick Bldg., Pittsburg, Pa., for a concrete covered storage reservoir, 52 ft. in diameter and 33 ft. deep, to be constructed at Benwood, for the Benwood Water Co.

Ft. D. A. Russell, Wyo.—Bids will be received until May 8 by Capt. W. S. Scott, Constructing Q. M., Cheyenne, for furnishing material and extending the present water system at Ft. D. A. Russell, consisting of 9,100 ft. of 6-in. and 1,450 ft. of 4-in. c. i. pipe, including the necessary valves and fire hydrants.

Strathroy, Ont.—Bids will be received Apr. 30 by R. P. Smith, Chmn. Bd. Electric Light and Water Wks. Comrs. for pipe laying, pump house, iron pipes and specials. Willis Chipman, Ch. Engr., Toronto.

Toronto, Ont.—Bids will be received Apr. 15 by the Bd. of Control for laying and jointing water pipes for the year 1903. Thos. Urquhart (Mayor), Chmn.

SEWERAGE AND SEWAGE DISPOSAL.

Birmingham, Ala.—The Jefferson County Sanitary Comn. is stated to have authorized the president to annul contracts existing between Comn. and 3 local firms of contractors for sale of $300,000 bonds and for construction of Valley Creek trunk sewer. The Donelson Constr. Co., C. M. Burkhalter & Co. and Pennington Constr. Co. are the contractors. The Comn. is stated to have appointed a committee to look after the negotiating of these bonds, and as soon as said bonds are sold the Comn. will again advertise for bids for the construction of the sewer.

Ensley, Ala.—The citizens are stated to have voted Mar. 31 to issue $45,000 for sanitary sewers, $30,000 for storm water sewers and $10,000 for general street improvements.

San Francisco, Cal.—The lowest bid received by the Bd. of Pub. Wks. on Apr. 1 for constructing the 6th St. sewer is stated to have been submitted by Flinn & Treacy, 412 Pine St., for $50,254.

Los Angeles, Cal.—Harry F. Stafford, City Engr., writes that bids for sewer bonds will be received about June 1st. Bids for construction will not be received before July or August.

Antioch, Cal.—See "Water."

Oakland, Cal.—City Engr. Turner estimates the cost of a sewer along Cemetery Creek from 24th St. to Moss Ave., at $7,890, and from Moss Ave. to Pleasant Valley, $7,386.

Colorado Springs, Colo.—City Engr. E. W. Case is reported to be making surveys for sewers to be constructed this summer, at a probable cost of $15,000.

New Britain, Conn.—The following bids were opened by the Bd. of Sewer Comrs. Mar. 24 for the construction of 3 sections of New Britain Sewerage System. Section two (*a*) consists of a tunnel 1,048 feet long and approaches 680 ft. of 24-in. pipe complete. Section 3 (*b*) consists of about 13,000 ft. of 24-in. sewer and about 300 ft. of smaller sizes, together with manholes complete. Section 4 (*c*) consists of about 9,000 ft. of 24-in. sewer and about 400 ft. of small sizes with manholes complete: Hooker & Son, Rochester, N. Y., (awarded contract), *a*, $16,182; *b*, $11,040; *c*, $12,342. Abbott-Gamble Co., *a*, $38,446; *b*, $24,100; *c*, $25,896. Edw. Tracy, *a*, $26,264; *b*, $16,584; *c*, $16,693. M. J. McGawley and Jas. J. Coughlan, *a*, $37,854; *b*, $21,352; *c*, $23,958. P. McGovern, *a*, $43,112. Eglee Bunting Co., *a*, $35,664; *b*, $18,913; *c*, $22,715. Frank Pidgeon, *a*, $22,989; *b*, $26,437; *c*, $22,810. C. E. Trumbull Co., *a*, $39,737; *b*, $20,253. D. F. O'Connell, *a*, $45,297; *b*, $23,178; *c*, $25,706. C. B. and F. A. Cadwell, *b*, $14,932; *c*, $14,281. John F. Magee & Co., *c*, $20,425.

Chicago, Ill.—Bids will be received Apr. 15 by the Bd. of Local Improv. for constructing brick and vitrified tile pipe sewers with manholes and catch basins in portions of 47 streets. Andrew M. Lynch, Pres.

Peoria, Ill.—H. E. Beasley, City Engr., writes that the following bids for the Persimmon St. sewer were received Mar 30: Crescent Stone Co., Y. M. C. A. Bldg., Peoria, Ill., $19,998; Thompson & Case, Peoria, Ill., $23,650. This work includes 8,305 ft. of brick and pipe sewers from 12 in. to 3 ft. x 4 ft. 6 in. in diameter, 19 manholes, 38 catch basins, and 7 flush manholes. The trench is expected to average 14 ft. in depth, and will be excavated in gravel and sand. The detail of the Crescent Stone Co., which according to press reports secured the contract, is as follows: 12 in. to 3 ft. x 4 ft. 6 in.-pipe, $1.60 to $3.90 per ft.; manholes, $35, and storm water inlets, $25.

Evanston, Ill.—Bids are wanted Apr. 16 for constructing a system of vitrified tile pipe sewer with appurtenances in portions of 3 streets; also for laying a vitrified tile pipe sewer with appurtenances in portions of Florence Ave. Jas. Patten, Pres. Bd. of Local Improv.

Rockford, Ill.—Bids will be received until Apr. 23 by A. Hutchins, Pres. Bd. of Local Improv., for furnishing material and constructing sewers on parts of 4 avenues; approximate cost, $8,000. Edwin Main, City Engr.

Frankfort, Ind.—The Council has adopted a resolution instructing the Engr. to prepare plans for the construction of sanitary sewers on Main Ave. and Jackson St.

Anderson, Ind.—The American Straw Board Co. will build a system of settling basins and filtration beds to purify the trade refuse, at a cost of about $10,000.

Rockwell City, Ia.—B. E. Stonebroker, Co. Aud., writes that contract for a drainage ditch in Lake Creek Township (bids opened Mar. 24) has been awarded to Inter-State Drainage & Investment Co., of Britt, Ia., at 11.8 cts. per cu. yd.

Olathe, Kan.—Bids will be received May 5 (extension of date) by the City Council for furnishing material and constructing 4,980 ft. 8 to 24-in. pipe sewer and 8 manholes in lateral Dist. No. 2 of main sewer Dist. No. 1. C. F. Garwood, City Clk.

Baltimore, Md.—See "Paving and Roadmaking."

Hagerstown, Md.—In his annual message to Council Mayor Holzapfel recommends that the drainage system be extended to several parts of the city that are now flooded by heavy rains, and advocates that more streets and some of the alleys be paved with vitrified brick.

Brockton, Mass.—It is proposed to lay about 3 miles of pipe sewers by city labor. Chas. R. Felton, City Engr.

Worcester, Mass.—Contracts for furnishing supplies to the Worcester Sewer Dept. during the year are stated to have been awarded on Mar. 30 as follows; Iron castings, including 150 manhole covers and 125 catch basin covers, to the Sessions Foundry Co., of Bristol, Conn., at $9.30 ea. for manhole covers and $1.86 per 100 lbs. for catch basin covers, and Rosilndale cement, to Smith-Green Co., of Worcester, at $1.04 per bbl. and 89 cts. a bag.

Boston, Mass.—Chas. Logue, of Boston, has secured the contract for constructing the granite 2-story extension to main part of sewer division pumping station at Calf Pasture, for $44,975.

Lowell, Mass.—The Sewer Com. has voted to recommend to City Council that $50,000 be borrowed for the construction of new sewers and finishing of Court St. sewer.

South Hadley Falls, Mass.—The Selectmen are stated to have been authorized to look up the matter of a new sewer system and estimate of cost and report at a meeting to be held May 2.

Jackson, Mich.—A. B. Stevens, City Engr., writes that the citizens have voted to bond the city to construct trunk sewers and build purification plant and intercepting sewers; probable cost of work, $100,000.

Duluth, Minn.—Plans for sewers prepared for the West Duluth Dist. have been approved by City Council, and bids will soon be asked for the construction of the trunk sewer of this system, at an estimated cost of $20,000. W. B. Patton, City Engr.

St. Louis, Mo.—Bids are wanted Apr. 28 for the construction of sewers, in all about 17,724 lin. ft. brick sewers and 86,430 lin. ft. vitrified clay pipe sewers as follows: Blackstone public sewer, estimated cost, $120,000; Blackstone joint district sewer, $55,000; Blackstone district sewers, $132,000, and Rock Spring district sewers, $116,000. E. A. Hermann, Supt. of Sewers.

Independence, Mo.—It is proposed to construct sewers in Dist. No. 20, at a cost of $3,700. H. H. Pendleton, City Engr.

Ft. Missoula, Mont.—It is stated that bids will be received by G. E. Pond, Q. M., St. Paul, Minn., until May 4 for constructing sewer and water system at Ft. Missoula.

Claremont, N. H.—Francis F. Hasken, Town Clk., writes that a sewerage system will be constructed in the near future.

South Orange, N. J.—According to press reports the Bd. of Trus. will receive bids Apr. 20 for laying sewer pipes connecting houses with the local system, in accordance with plans of Alex. Potter, of New York, N. Y. The work will cost about $10,000.

Trenton, N. J.—Gov. Murphy has signed the bill providing for a trunk sewer to drain Passaic Valley Dist., at an estimated cost of $9,000,000.

New York, N. Y.—Bids will be received Apr. 21 by Jacob A. Cantor, Pres. Boro. Manhattan, for furnishing material for alteration and improvements to sewer in portions of East End Ave. and E. 87th St. Engineer's estimate, 875 lin. ft. brick sewer, 3 ft. 6 in. by 2 ft. 4 in. interior diameter.

Gloversville, N. Y.—The Senate is reported to have passed the bill providing for the disposal of the sewage of the city by the construction of intercepting and trunk sewers and purification works; probable cost of work, $250,000.

Oneida, N. Y.—The Bd. of Pub. Wks. is stated to have decided to construct sewers in So. Willow and Stone Sts. and Washington Ave.

Long Island City, N. Y.—Bids will be received Apr. 16 by Joseph Cassidy, Pres. Boro. Queens, for constructing storm sewers in portions of 4 streets. Engineer's estimate, 5,005 ft. 6, 12, 15, 18 and 24-in. vitrified salt glazed sewer pipe, 34 manholes, etc.

Alexandria Bay, N. Y.—See "Water."

Middletown, N. Y.—Bids will be received Apr. 13 by I. B. A. Taylor, City Clk., for furnishing to the city until Jan. 1, 1904, 8 to 18-in. salt glazed tile sewer pipe, 8x6-in., 10x6-in. Y's, 6-in. covers and sewer caps.

Schenectady, N. Y.—The following bills which have passed Senate and Assembly were approved by Council Mar. 25: Authorizing the city to issue bonds to the amount of $60,000 for repairs in upper Union St., and to increase the issue of bonds for the construction of sewers from $275,000 to $400,000.

Watertown, N. Y.—The Bd. of Pub. Wks. is stated to have decided to build a 12-in. sewer in Pleasant St. The City Engr. is reported to have been directed to prepare an estimate of cost of a trunk sewer to drain the Academy and Arlington St. section.

Skaneateles, N. Y.—E. C. Miller, Village Clk., writes that the question of constructing a sewerage system is being discussed but not decided as yet.

Columbus, O.—The Council has passed an ordinance to appropriate $11,000 for the recoustruction of the Peter's Run and other main trunk sewers.

Portland, Ore.—The Council Sewer Com. has recommended to Council the construction of sewers in 9 streets.

South Bethlehem, Pa.—Local press reports state that the following bids were received Mar. 3 for sewers in 5 streets—*a*, brick; *b*, concrete; *c*, concrete and steel: Geo. H. Hardner, *a*, $130,907; *b*, $101,791. Jas. Nagle & Sons, Allentown, *a*, $110,268; *b*, $109,870. Richardson & Gaston, *a*, $190,209; *b*, $151,574. Rathburn & Co., *a*, $143,019; *b*, $143,019; *c*, $160,227. David Peoples, *a*, $164,497; *b*, $146,209; *c*, $169,693. Harmer & Quinn, *a*, $203,291; *b*, $149,760; *c*, $156,894. Miles, Fehr & Co., of Easton, bid only on Elm St. sewer, $25,000.

Ardmore, Pa.—Bids will be received until May 4 by the Lower Merion Township Comn. for constructing a system of sewers in this Township. The work will consist of laying approximately 41 miles of terra cotta pipe sewers, 8 to 24-in. in diameter, Y branches, manholes, etc.; also for constructing 2 collecting basins and pumping stations for collecting sewage and pumping same to high level main sewer. Chester E. Albright, Engr., Land Title Bldg., Philadelphia, Pa. Applications for plans and specifications must be made to W. E. Barrett, Chmn. Com. on Health & Drainage, Ardmore, and a deposit of $5 to be made for said specifications, half of which will be returned.

Erie, Pa.—A correspondent writes that all bids received Apr. 2 for about 3,500 ft. of 30-in. main sewers were rejected, the bids being above the estimate.

Culpeper, Va.—R. Bootou, Chmn. Sewerage Com., writes that the following bids were opened on Apr. 7 for the construction of a sewerage system: John M. Colvin, Culpeper, $5,117 (awarded contract); R. L. Thomas, Charlottesville, Va., $6,641, and J. M. Bran, Baltimore, Md., $18,160.

Sheboygan, Wis.—R. Norumensen, of Sheboygan, has secured the contract for constructing a sewer in S. 14th St. for $7,163. C. U. Boley, City Engr.

Marshfield, Wis.—C. S. Vedder, Town Clk., writes that the following bids were received by the Bd. of Pub. Wks. Mar. 30 for constructing about 6 miles of storm sewers, septic tank, filter beds, etc.: Elkhart Constr. Co., Elkhart, Ind., $52,500; E. T. Webster, Dubuque, Ia., $48,612; F. W. Krause, Wausau, $47,510; Harding & Nelson, Racine, $45,000; C. T. Bartlett, Evanston, Ill., $44,444; Chris Johnson, Oshkosh, $44,985; Hackworthy Constr. Co., Appleton, $44,354; J. Rasmussen & Son, Oshkosh, $44,000; J. H. Green & Son, Appleton, $43,510; Frank Engel, Chicago, Ill., $42,871; Blake Bros., Madison, $42,850, and Municipal Eng. & Constr. Co., Chicago, Ill., $40,365.

Toronto, Ont.—See "Paving and Roadmaking."

Bids will be received Apr. 14 by the Bd. of Control for furnishing and delivering at the water works dock, and Frederick St. dock, sewer brick, cement, and Lake Boulder stone for 1 year. Thos. Urquhart (Mayor), Chmn.

BRIDGES.

Stamford, Conn.—Press reports state that the Eastern Bridge & Structural Co. has received a contract from the Stamford St. Ry. Co. for building a private steel bridge across the river at Stamford parallel with the present highway bridge.

Macon, Ga.—The Central of Ga. Ry. will construct a steel bridge for its tracks over Walnut St. H. M. Steele, Ch. Engr., Savannah, Ga.

Washington, D. C.—The following bids were opened by Lieut.-Col. Chas. J. Allen, Engr., U. S. A., Mar. 30 for reconstruction of Pier No. 5 of Aqueduct bridge across Potomac River at Georgetown: Penn Bridge Co., Beaver Falls, Pa., $54,956; Foundation Constr. Co., New York, N. Y., $57,007; McCullen & McDermott, New York, N. Y., $61,685.

Chicago, Ill.—Local press reports state that the Dearborn St. bridge may be replaced by a trunnion bascule bridge of the type used at Clybourn Pl.

Keithsburg, Ill.—Press reports state that the Iowa Central Ry. Co. is contemplating the building of a bridge across Mississippi River at Keithsburg, to replace present structure. Howard G. Kelley, Ch. Engr., Minneapolis, Minn.

Indianapolis, Ind.—The Indinnapolis & Northwestern Traction Co. has awarded contracts for 22 steel and concrete arches to the National Bridge Co. of Pittsburg, Pa.

It is stated that bids are wanted by the Co. Comrs. until May 1 for constructing a bridge across Birch Creek near Southport.

South Bend, Ind.—Bids will be received by John M. Brown, Co. Aud., Apr. 29, for a bridge over St. Joseph River at River Park. Length, 432 ft.; width, 16 ft. Two plans. Mangular wooden truss, with steel shell piers and pile bridge.

Indianapolis, Ind.—See "Railroads."

Springfield, Mass.—Mace Moulton is reported to have submitted to the Mayor rough plans for the proposed raising of the South End bridge.

Beaver City, Neb.—It is stated that bids will be received by the Co. Comrs. until Apr. 14 for constructing a 300-ft. bridge at Edison, a 360-ft. bridge at Cambridge; also for repairing a 90-ft. bridge at Holbrook. T. F. Newton, Co. Clk.

Atlantic City, N. J.—Bids will be received until May 12 (readvertisement) by the Bd. of Freeholders, at Memorial Hall, Atlantic City, for constructing 2 steel drawbridges on the new highway leading from Pleasantville to Atlantic City. Plans and specifications may be secured by mail, at a cost of $1, from J. C. Anderson, Clk. of Bd., Mays Landing, N. J. J. J. Albertson, Co. Engr.

Paterson, N. J.—The F. R. Long Co. is reported to have secured the contract for constructing a steel and concrete bridge, 55 ft. wide, at Spruce St. hill, for $8,910.

Plainfield, N. J.—An agreement has been reached between the Freeholders of Union and Somerset Counties, whereby an iron girder, buckle plate bridge is to be built at Geraud Ave. in Plainfield.

New York, N. Y.—Bids will be received Apr. 16 (readvertisement) by the Park Comrs. for furnishing material and constructing a concrete steel and stone bridge over the Bronx River, in the Botanical Garden, in Bronx Park. Wm. R. Willcox, Chmn.

New York, N. Y.—The following bids were opened Apr. 9 by G. Lindenthal, Comr. Bridges, for constructing masonry pedestals on the tower foundations of the Manhattan Bridge (No. 3) over East River: Johnson & Rodgers, 31 W. 125th St., $150,000; Thos. Dwyer, $168,618; Ryan & Parker, $182,000; Edw. J. Farrell, $190,450.

New York, N. Y.—See "Railroads."

West Union, O.—Bids are wanted Apr. 15 for furnishing material for constructing the substructure and superstructure of a bridge across Brush Creek. R. A. Stephenson, Co. Aud.

Columbus, O.—Bids will be received by the Co. Comrs. May 7 for constructing substructure, superstructure, approaches and paving the Hayden Run bridge in Norwich and Washington Township; also constructing substructure and superstructure of several other bridges. Bidders may submit plans with bid or may secure from the Co. Surveyor at $3 each plans for the substructure and superstructure of the Hayden Run bridge, and at $1 each plans for the substructure and superstructure of the other bridges. L. E. Jones, Co. Aud.

Toledo, O.—The Lake Shore & Michigan Southern R. R. Co. is reported to be considering the building of a viaduct for the E. Bway. crossing. E. A. Handy, Ch. Engr., Cleveland, O.

Coshocton, O.—Bids will be received Apr. 27 by the Co. Comrs. for furnishing material for constructing 1 pier and 2 abutments, and the superstructure for the Hadden bridge in Tiverton Township. C. A. Lamberson, Co. Aud.

Sharon, Pa.—The Penn Bridge Co. has, according to reports, submitted to the Co. Comrs. an estimate of the cost of constructing a steel bridge and viaduct, with asphalt driveways, from So. Main to Dock Sts., at $45,000.

Allentown, Pa.—An ordinance has been passed in the Councils appropriating $35,000 for the construction of a bridge at Allen St.

Erie, Pa.—B. E. Briggs, City Engr., writes that bids for a steel bridge in Buffalo Road were received on Apr. 2 as follows: The Van Dorn Iron Works, of Cleveland, put in 2 bids, $29,950 to be completed in 6 months, and $27,000 (awarded contract) to be completed in 8 months. R. B. Willis, of Erie, $29,484 (4 mos.), $28,010 (6 mos.). The Mt. Vernon Bridge Co., Mt. Vernon, O., $35,000 (6 mos.). $33,500 (9 mos.), and the following to be completed in 6 mos.: West Va. Bridge & Constr. Co., Wheeling, W. Va., $36,146; Bellefonte Bridge & Iron Co., Bellefonte, O., $37,000; A. D. Young, Corry, Pa., $33,149; New Jersey Bridge Co., Manasquan, N. J., $32,900; Penn Bridge Co., Beaver Falls, Pa., $31,980; Owego Bridge Co., Owego, N. Y., $34,783.

Philadelphia, Pa.—According to local press reports plans and specifications for the new double deck bridge over the Schuylkill River are nearly completed, and the Philadelphia Rapid Transit Co. will soon receive bids for building the piers.

Norfolk, Va.—It is reported that an ornamental iron bridge, with granolithic footway, is to be built in the Navy Yard, at a cost of $5,000.

Parkersburg, W. Va.—Plans have been submitted to the War Dept. for 7 bridges which the Wabash R. R. Co. intends to construct across Little Kanawha River.

Menasha, Wis.—The building of a bridge, at a cost of $18,000, between Menasha and W. Menasha, is reported to be under consideration.

Platteville, Wis.—The Chicago & Northwestern Ry. Co., it is reported, will build a 90-ft. steel bridge across the creek near the depot in this city.

Brandon, Man.—An agreement has been reached between the city officials and the Canadian Pacific R. R. Co., whereby a steel bridge 26 ft. wide is to be built across the R. R. tracks east of 9th St.

PAVING AND ROADMAKING.

Ensley, Ala.—See "Sewerage and Sewage Disposal."

New Haven, Conn.—The Paving Comn. has decided to pave with crushed stone, and construct Belgian block gutters, on a portion of Cedar St. at a probable cost of $6,000.

Tampa, Fla.—Bids are wanted Apr. 21 for furnishing material for approximately 4,500 superficial yds. vitrified brick paving and 2,600 lin. ft. granite curbing on portions of Fortune St. W. R. Fuller, Pres. Bd. Pub. Wks.

Chicago, Ill.—Bids will be received Apr. 15 by the Bd. of Local Improv. for grading, wooden and sandstone curbing, and paving portions of numerous streets with brick, asphalt, granite blocks; also 4, 6 and 8-in. blast furnace slag on 4-in. of crushed gravel. Andrew M. Lynch, Pres.

Belvidere, Ill.—City Engr. Morean has submitted to the Bd. Local Improv. the following estimate of the cost of paving State St.: 8,000 sq. yds. asphalt on concrete, $2.25 per yd.; 14,000 sq. yds. brick on concrete, $1.75 per yd.; 1,000 ft. cement curbing, 60 cts. per ft. Total cost, $43,100.

Evanston, Ill.—Bids are wanted Apr. 16 for constructing a granite top macadam pavement and appurtenances on portions of Dempster St., requiring 9,000 sq. yds. paving, 11,000 ft. of 24x4-in. Berea sandstone curb, etc., estimated to cost $17,000; 3-year guarantee required. Jas. Patten, Pres. Bd. Local Improv.

Freeport, Ill.—Bids will be received Apr. 14 by the Bd. of Local Improv. for grading, cement curbing and macadamizing portions of 8 streets. C. A. Huenkemeier, Chmn.

Washington, Ind.—Bids will be received Apr. 20 by the Co. Comrs. for constructing gravel roads in Steel Township.

South Bend, Ind.—Bids are wanted by the Bd. of Pub. Wks. Apr. 15 for 20,000 cu. yds. excav., 16,000 lin. ft. 6x10-in. cement curb, and 80,000 sq. ft. of cement walk. A. J. Hammond, City Engr.

Linton, Ind.—Bids will be received by John A. Greenwood, City Clk., Apr. 21 for 4 contracts aggregating approximately 34,000 sq. yds. vitrified brick street improvement, with concrete bed, hard line cement stone curbing, storm sewers and drain tiles.

Indianapolis, Ind.—Bids will be received Apr. 25 by Geo. T. Breunig, City Comptr., for $100,000 boulevard bonds.

Ft. Wayne, Ind.—City Engr. Randall is preparing plans and specifications for paving E. Washington St., W. Main St. and Fairfield Ave., in all about 3 miles, and requiring 59,622 sq. rods of paving.

Waterloo, Ia.—Bids will be received Apr. 13 by H. C. Schultz, City Clk., for paving about 4,500 sq. yds. of the roadway of West 4th St. with Trinidad Pitch Lake asphalt and about 1,500 lin. ft. Portland cement curbing.

Davenport, Ia.—Thies Herzog, Clk. Bd. Pub. Wks., writes that the following contracts have been awarded for improving portions of 13 streets, bids for which were received on Mar. 31: McCarthy Stone Co. received contracts for 6 streets aggregating $39,144; Davenport Constr. Co., 3 streets, for $15,087, and People's Constr. Co., 4 streets, at $13,990. The bids average as follows: Grading, 3.6 cts.; telford paving, $1.07; brick paving, $1.45, and curb, .57 cts. Contractors all of Davenport.

Sioux City, Ia.—City Attorney Weaver has prepared a resolution ordering 20,000 ft. of sidewalk in Greenville. The walks will be 5 ft. wide and will cost approximately $12,000.

Wichita, Kan.—Local press reports state that the Council has voted to accept the bid of the Barber Asphalt Paving Co. for paving on W. Douglas Ave., at $2.25 per sq. yd. There will be required about 12,400 cu. yds. excav., 6,150 lin. ft. curbing and 23,800 sq. yds. paving.

New Orleans, La.—The Council has approved plans and specifications submitted by the City Engr. for asphalt pavement on portions of Toulouse, Bourbon, Arabella and Calhoun Sts.

Portland, Me.—The village of York Harbor is reported to be considering a proposition to spend $15,000 in road improvements.

Baltimore, Md.—The 1st branch of City Council passed following ordinances for repaving with asph. blocks: McComas St., Hanover St. to Creek Alley (appropriation, $13,000); E. North Ave., Broadway to Washington St. ($25,700); streets around Union Sq., southwest Baltimore ($19,000); McCulloh St., Lafayette to North Aves. ($37,500).

At the same time $45,000 was appropriated for belgian blocks on Columbia Ave., Bush St. to Gwynn's Falls bridge.

On Apr. 3 the First Branch of the City Council passed ordinances to pave with macadam and asphalt block on portions of numerous streets.

Baltimore, Md.—Separate bids are wanted Apr. 15 for furnishing sidewalk and sewer brick, asphalt blocks, and creosoted heart Georgia pine blocks and planks. Thos. G. Hayes, Pres. Bd. of Awards. B. T. Fendall, City Engr.

Hagerstown, Md.—See "Sewerage and Sewage Disposal."

Worcester, Mass.—Bids are wanted Apr. 13 for furnishing approximately 35,000 lin. ft. of curbstone, 2,000 lin. ft. circular curbstone, 12,000 sq. yds. paving blocks, etc. Wright S. Prior, St. Comr.

Fall River, Mass.—The following bids for granite curbing are stated to have been accepted and contracts awarded: 15,000 ft. granite curbing to Archie F. Benoit, at 67½ cts., delivered on the street; 15,000 ft. to Timothy Benoit, at 67½ cts., delivered on the street. A total of 160,000 paving blocks were purchased as follows: 25,000 from Archie F. Benoit, at $58 per thousand, delivered on street; from Dudevoir & Lavoie, 25,000, at $62.50 per thousand, delivered on street; 25,000, at $65 per thousand, and 25,000 at $66 per thousand; and from William Beattie, 60,000, at $65 per thousand. Bids on artificial curbing were rejected.

Jackson, Mich.—About $5,000 will be expended in paving certain alleys with brick. A. B. Stevens, City Engr.

Charlevoix, Mich.—Engr. Geo. S. Pierson, of Kalamazoo, has been employed to prepare estimates for paving with either brick or Warren bituminous macadam on Bridge St.

Holland, Mich.—Bids are wanted Apr. 22 for paving 8th St. Wm. O. Van Eyke, City Clk.

Detroit, Mich.—Estimates for paving have been allowed as follows: Brick, $345,079; cedar, $60,292; block asphalt, $92,665, and sheet asphalt, $66,610.

Duluth, Minn.—The City Council has ordered the paving of a portion of Superior St., East. Bids will probably be asked on sandstone blocks, sheet asphalt, vitrified brick, and bituminous macadam pavements. W. B. Patton, City Engr.

St. Paul, Minn.—The Barber Asphalt Paving Co. is reported to have secured the contract to pave on a portion of Exchange St., at $1.90 per sq. yd.; total, $19,347.

Minneapolis, Minn.—Local press reports state that the Council Committee on Paving awarded contracts for this season's work as follows: Purington Paving Brick Co., No. 1 pressed brick, at 99 cts. per sq. yd., any amount; Arnold Granite Paving Co., 8,000 sq. yds. of granite paving blocks at $1.85 per sq. yd.; Kettle River Quarries Co., 60,000 sq. yds. Kettle River sandstone paving blocks at $1.58 per sq. yd.; George J. Backus, any amount of white cedar paving blocks at 60 cts. a sq. yd.; Republic Chemical and Creosoting Co., 40,000 sq. yds. creosoted wood paving blocks at $1.64 for pine blocks. The Kettle River Quarries Co. got contracts for sandstone curbing and the Arnold Granite Co. for granite curbing. The committee will readvertise for bids for artificial curbing and 10,000 sq. yds. of granite blocks. The contracts for crushed stone were equally divided between Wader & McLeod and the Langdon Stone Co., both agreeing to furnish stone at $1 per cu. yd. The contract for crushed granite to the Kettle River Co. at $2.75 per cu. yd.

Camcron, Mo.—M. T. Hayde, of Kansas City, Mo., is stated to have secured the contract for street paving in this city, at a cost of $12,000.

Independence, Mo.—H. H. Pendleton, City Engr., writes that a resolution has been passed by Council to grade and pave with broken stone College Ave., at an estimated cost of $12,300.

Derry, N. H.—It is stated that bids will be received by the Bd. of Selectmen until Apr. 20 for macadamizing, curbing, etc., of public highways. Edw. L. Jones, Selectman; Geo. H. Allen, Des. Engr., Manchester.

Jersey City, N. J.—The Cement Paving & Constr. Co., care of Vankeuren & Son, Prior St., has secured the contract for grading and improving, by laying about 51,000 sq. ft. cement walk in Lafayette Park, for which bids were received by Bd. St. & Water Comrs., Apr. 7, at 87 per cent. of the standard set by the Ch. Engr.

Newton, N. J.—Bids will be received May 4 by the Co. Bd. of Chosen Freeholders for macadamizing about 8,945 ft. of county road. A. H. Konkle, Co. Engr., Newton. Emmet H. Bell, Dir.

Ocean City, N. J.—Bids are wanted Apr. 13 for paving with broken stone, vitrified block gutters and granite or bluestone curbing the driveways on portions of 12 streets. Hiram Steelman, Chmn. St. Com.

Vailsburgh, N. J.—Bids will be received until Apr. 15 by the Mayor and Boro. Council for grading, laying and resetting curbs, and laying walks on So. Carolina St. requiring approximately 1,340 lin. ft. of new curb, laying 2,035 lin. ft. of old curb, and laying 13,500 sq. ft. of artificial stone sidewalks, 4 ft. wide. Eugene A. McMurray, Boro. Engr., 22 Clinton St., Newark.

New York, N. Y.—The Bd. of Aldermen has authorized the appropriation of $3,500,000 for street paving.

Canandaigua, N. Y.—Engr. John Hanrahan has submitted to the Bd. of Trus. the following estimates for paving Main St.: With Telford macadam from the lake to the head of the street, except between the railroad and Saltonstall St., and there with brick, $121,137; paving from the lake to Chapel St. with brick, $155,730; for paving with brick from the lake to Gorham street and from there north with Telford is $140,485.

Johnstown, N. Y.—Local press reports state that bids will be received until May 4 for paving on William St., requiring as follows: 9,522 sq. yds. of bituminous macadam, 1,854 sq. yds. of sandstone and macadam, 4,500 ft. of old curb reset, 100 ft. of new curb; total estimated cost, $25,183. Jas. W. Miller, City Engr.

Binghamton, N. Y.—It is stated that about $35,000 is to be spent this year in building new and repairing old sidewalks in this city.

Long Island City, N. Y.—Bids will be received Apr. 16 by Jos. Cassidy, Pres. Boro. Queens, for furnishing material for regulating, grading, curbing, flagging, repaving with asphalt block and paving with asphalt portions of 10 streets. Engineer's estimate, 42,000 sq. yds. asphalt pavement, including binder course, 8,500 sq. yds. old stone pavement to be relaid as foundation or in approaches, etc.; 24,200 lin. ft. new bluestone curbstone, furnished and set; 44,200 sq. ft. new bluestone flagstones, etc.

Brooklyn, N. Y.—Of the bids for granite block pavement opened Apr. 1 the following awards have been recommended by Engr. Geo. W. Tillson: Wm. Fitzgerald, $118,945; Sterling Constr. Co., $42,046; McDermott & Foxton, $13,437. For Medina sandstone pavement the following bids have been recommended for award: Jas. Quinn, $64,059; John O'Grady, $56,935; Dennis Norton, $36,483.

Watertown, N. Y.—Mayor Pappa has approved the resolution passed by the Bd. of Pub. Wks., adopting bituminous macadam pavement, for State St.

Syracuse, N. Y.—Local press reports state that the Asphaltina Construction Co. submitted the lowest bid for paving on Oswego St., as follows: Asphalt, with brick between street railway tracks, at $8,867, and if sandstone between the tracks, $9,410; on brick, at $9,672 and $10,667.

Watervliet, N. Y.—J. P. Thomas, City Engr., estimates the cost of paving 7th Ave. with bricks, 1,050 lin. ft., at $7,105. A concrete base to be used.

New Brighton, S. I., N. Y.—The following bids were opened Apr. 3 by Geo. Cromwell, Boro. Pres., for repaving with granite on concrete foundation Bay St. from Hannah St. to Union Pl., only main items being given—*a*, John E. Donovan; *b*, Michael Fitzgerald; *c*, Jos. Johnson Sons:

Bidders.	Granite, 9,800 sq. yds.	20" curb, 3,100 ft.	Bgrstone, 2,800 sq. ft.	Concr., 1,800 sq. yds.	Recvg. basins, 3.
a	$3.21	$1.00	$0.70	$5.00	$150.00
b	3.09	.95	.55	4.00	140.00
c	3.00	.95	.65	5.25	150.00

Richmond Turnpike—Tompkins Ave. to Brooks St.

	a	*b*	*c*
Granite, 5,800 sq. yds	$3.00	$3.23	$3.10
20-in. curb, 2,500 ft	1.00	.95	.95
Bridgestone, 2,600 sq. ft	.70	.60	.60
Concrete, 1,100 cu. yds	5.00	5.50	5.25

Bids were also opened Apr. 3 for asphalt block pavement on Bay St. from Thompson St. to Clifton R. R. crossing, as follows—*a*, Hastings Pavement Co.; *b*, Continental Asphalt Paving Co.:

	a	*b*
Asph. bl., 9,900 sq. yds	$1.75	$1.79
20-in. curb, 4,000 ft	1.05	1.10
Concrete, 1,300 cu. yds	6.32	6.50
Flagstone, 50 sq. ft	.25	.23
Receiving basins, 2	160.00	175.00

New York, N. Y.—The following bids were opened Apr. 7 by Aqueduct Comrs., 280 Bway., for constructing highways, bridge piers and abutments, culverts, fences, etc., around Croton Lake—*a*, McArthur Bros. Co., 128 Bway.; *b*, Bellew & Merritt Co., Tuckahoe, N. Y.; *c*, Chas. W. Smith, 110 E. 56th St.; *d*, Wm. J. Flanagan, 390 S. Bway., Yonkers, N. Y.:

	a	*b*	*c*	*d*
Bailing and draining	$2,000.00	$500.00	$500.00	$500.00
Clearing, 15 acres	75.00	200.00	40.00	20.00
Grubbing, 6 acres	65.00	250.00	60.00	50.00
Earth excavation, 455,000 cu. yds	.25	.23	.32	.28
Rock excavation, 16,000 cu. yds	1.32	.90	1.40	1.50
Long haul, 70,000 cu. yds	...	.0092	.0128	.0112
Riprap laid, 17,000 cu. yds	1.75	1.00	1.00	1.50
Stone ballast, 250 cu. yds	2.00	2.00	.50	1.50
15 in. tile laid, 1,100 ft	1.10	.80	.50	1.00
18-in. tile laid, 350 ft	1.30	1.00	.60	1.10
1:2:5 concrete, 500 cu. yds	5.50	5.90	5.00	5.00
1:2:3 concrete, 250 cu. yds	6.50	6.12	6.00	5.50
Brick masonry, 130 cu. yds	12.50	11.00	12.00	12.00
Dry rubble, 500 cu. yds	3.00	2.50	3.00	3.00
Rubble masonry, 16,000 cu. yds	5.85	5.00	4.40	3.50
Face work on rubble, 25,000 sq. ft	.30	.75	.40	.75
Masonry for culverts, 100 cu. yds	5.85	8.00	6.00	10.00
Dimension masonry, 1,800 cu. yds	28.50	40.00	20.00	35.00
6-cut face dressing, 11,000 sq. ft	.60	2.00	1.00	.50
Rough-point face, 40,000 sq. ft	.35	.80	.30	.40
Pier and abutment masonry, 3,000 cu. yds	40.00	35.00	15.00	12.00
Additional masonry, 500 cu. yds	2.25	2.20	1.50	2.00
Stone wall fencing, 245,000 ft	1.20	.73	.70	.60
Permanent timber, 5,000 ft	30.00	40.00	50.00	50.00
Piles driven, 250 ft	1.00	.50	2.00	.50
Rail fence, painted, 110,000 ft	.28	.22	.25	.25
Guard rail, painted, 20,000 ft	.24	.18	.20	.22
Totals	$803,210.00	$689,209.00	$584,801.00	$564,104.00

Dunkirk, N. Y.—The Cleveland Trinidad Paving Co., of Cleveland, is reported to have submitted the lowest bid for paving with shale brick on portions of Eagle and Deer Sts., at 30 cts. per cu. yd. for excavation, and $1.87 for pavement on concrete and $1.57 on ballast. The Barber Asphalt Paving Co., of Buffalo, was the lowest on asphalt at 35 cts. per cu. yd. for excavation and $1.74 per sq. yd. for pavement on concrete. Eagle St. will require 14,823 sq. yds. and Deer St. 11,875 sq. yds. of pavement.

Schenectady, N. Y.—See "Sewerage and Sewage Disposal."

Massillon, O.—Bids will be received Apr. 21 by the City Council for furnishing material for curbing and paving with brick portions of South Erie St.

Youngstown, O.—Bids are wanted Apr. 13 for $13,820 paving bonds. Wm. I. Davies, City Clk.

Cincinnati, O.—Bids are wnuted May 1 for improving portions of Fairfax Ave. by grading, curbing and paving with brick and constructing culverts, etc. Robt. Allison, Pres. Bd. Pub. Service.

Hamilton, O.—A resolution has been passed by the Co. Comrs. to repave the roadway of the High and Main St. bridge over the great Miami River with block asphalt.

Lisbon, O.—Bids will be received May 5 by the Village Council for furnishing material for improving portions of Park Ave. Lodge Riddle, Village Clk.

Lakewood, O.—It is stated that bids are wanted Apr. 23 for paving with brick on portions of Hall and W. Lake Aves. J. French, Village Clk.

Calcutta, O.—Bids will be received by Jerry I. Ansley, Township Clk., on Apr. 15 for $27,000 bonds to be used for paving from Liverpool Twp. line to village of Calcutta.

Salem, O.—The following bids were opened on Apr. 3 for paving with asphalt (*a*) Highland Ave., 2,650 sq. yds.; (*b*) Aetna St., 7,325 sq. yds.: Bwell & Baker, Salem, *a*, $7,577; *b*, $19,891. Geo. D. Smith & Bro., Salem, *a*, $6,863; *b*, $19,076. They bid $1.60 and $1.58 per sq. yd. respectively for the asphalt. B. M. French, City Engr.

POWER PLANTS, GAS AND ELECTRICITY.

Birmingham, Ala.—The Mayor and Bd. of Aldermen on Apr. 2 granted a franchise to T. H. Aldrich and T. H. Aldrich, Jr., Trus., for the Birmingham District Coal, Light & Power Co. The company expects to start work within 30 days on by-product coke ovens, using the gases to generate the power for electrical purposes, and the coke and other products will be sold on the market.

Santa Maria, Cal.—It is reported that Reuben Hart, owner of the water works, is about to petition the Bd. of Superv. for a franchise for an electric light plant.

Boulder, Colo.—The City Council has granted a franchise for 25 yrs. to John C. Conway, of Buffalo, N. Y., for the use of streets and alleys for a gas plant. Mr. Conway is to utilize the natural gas of the National Consolidated Oil Co.

Statesboro, Ga.—The citizens are stated to have voted on Mar. 27 to issue $37,000 bonds for an electric light plant and water works.

Cambridge, Ill.—C. E. Larson and E. G. Johnson are stated to have been appointed by Council to secure estimates for a gas plant.

Greencastle, Ind.—The Trus. of De Pauw Univ. have decided to construct an electric lighting plant on the college grounds.

Springfield, Ill.—A. L. Ide & Sons have petitioned the Council for a franchise for a hot water heating system and electric light plant.

Elkhart, Ind.—The City Council is stated to have granted the National Mfg. Co. a franchise for an electric plant. The company proposes constructing a plant at Bristol on the St. Joseph River. Walter Brown is reported interested.

Ft. Wayne, Ind.—The Council has granted a franchise for a heating system to Geo. W. Beers and others.

Mapleton, Ia.—G. G. Harris, Town Clk., writes that the citizens voted Mar. 30 to grant a franchise to W. H. Leathers and J. E. Scott, for a gas plant.

Shelby, Ia.—The town is reported to have voted to put in a municipal light plant.

Toledo, O.—G. W. Tonson, City Engr., writes that the following bids for paving with block or asphalt on Starr Ave. were received on Mar. 30:

	Grading, 3,000 cu. yds.	Curb, 7,200 lin. ft.	Radius curb, 220 ft.	Curbstone headlines, 750 ft.	Iron, 2,400 lbs.	Catch basins, 6.	Iron inlets, 13.	(Brick), 13,770 sq. yds. conc. found.	Sheet asph., 13,770 sq. yds.	Asph. blks., gravel found.
H. P. Stretcher	$0.30	$0.31	$0.55	$0.21	$0.04	$50.00	$21.00	$1.80	..	..
J. F. Lehany	.30	.35	.40	.40	.04	60.00	12.00	1.95	..	..
H. G. Jennison	.30	.36	.70	.45	.04	45.00	15.00	1.72	..	2.30
C. H. Burchinal	.30	.38	.76	.35	.06	50.00	18.00	..	..	2.14
Garrigan Bros.	.30	.35	.40	.35	.05	45.00	16.00	1.65	..	..
Barber Asph. Pav. Co.	.25	.50	..	.30	.03	35.00	20.00	..	2.03	..
O'Sullivan & Sheehan	.23	.36	.40	.35	.04	40.00	18.00	1.74	..	..

Bidders of Toledo, with the exception of Barber Asphalt Paving Co., of New York, N. Y. No award will be made until property holders decide material to be used.

Oil City, Pa.—Bids are wanted Apr. 13 for improving portions of Hoffman and Grove Aves.; also paving Main St. S. W. Barnhart, Compt.

Ardmore, Pa.—Lower Merion Township Comn. is reported to be contemplating the expenditure of $45,000 in road improvements.

Pittston, Pa.—About 2 miles of paving will be laid this summer.

Lansdale, Pa.—Press reports state that the Supervisors of Worcester Township will issue bonds to the amount of $15,000 for the purpose of road improvement.

Philadelphia, Pa.—D. J. McNichol has secured the contract for grading, filling, etc., Torresdale Boule., bids opened Mar. 25. The Council recently appropriated $250,000 for this work. The paving of the Boule. will probably not be taken up for another year. Dir. of Pub. Wks. Haddock, according to local press reports, has awarded the contract for raising the grade and widening Market St. at 23d St. to C. P. Weaver for $69,000. The work will be done in connection with the building of the subway by the Philadelphia Rapid Transit Co.

Meadville, Pa.—A. C. Pardee, City Clk., writes that contracts for 5,825 sq. yds. of brick paving on 2 streets, bids opened Mar. 25, have been awarded as follows: To Thos. De Guigan, for Water St., at $1.80 per yd. for metropolitan block, and to Fred. Robinson, for Chestnut St., at $1.86 per yd. for block brick. Bidders both of Meadville.

Chattanooga, Tenn.—It is stated that the building of a boulevard in Chickamauga Park, a distance of one and a half miles, is under consideration.

Galveston, Tex.—Local press reports state that the following bids were received for furnishing paving brick: On 1,500,000 more or less vitrified brick, Texas & Pacific Coal Co. bid $10.25 f. o. b. cars Thurber, or $17.35 delivered. Stuart Wheeler bid $8.65 f. o. b. Thurber or $18.70 delivered. For the common brick for foundations for the paving, Texas & Pacific Co. bid $5.40 f. o. b. Thurber, or $10.75 delivered.

Dallas, Tex.—An election held Mar. 31 on the issuance of $500,000 in county road bonds is reported to have carried.

Green Bay, Wis.—The Council has, according to reports, decided to spend $65,000 in paving.

Stratford, Ont.—Bids are wanted Apr. 16 for constructing 2¾ miles of broken stone roadway. Angus Smith, City Engr.

Toronto, Ont.—Bids will be received Apr. 14 by Thos. Urquhart (Mayor), Chmn. Bd. of Control, for constructing concrete sidewalks on portions of numerous streets and macadam road on portions of George St.; also for constructing tile pipe sewer in portions of Ritchie Ave.

Fort Dodge, Ia.—It is stated that the Light & Power Co. will enlarge the electric light plant, extend the street railway system, and rebuild its gas plant.

Reinbeck, Ia.—W. P. Walsh is stated to have secured a franchise to install a complete electric light plant. He will also pump the city water.

Wall Lake, Ia.—The citizens are stated to have voted to have a heating and lighting plant erected by the town. Gasoline gas will be used and a $4,500 plant will soon be installed.

Radcliffe, Ia.—The citizens are reported to have voted to grant a franchise to the Radcliffe Heating & Lighting Co.

Dubuque, Ia.—It is stated that the Chicago, Milwaukee & St. Paul R. R. Co. will install a power plant at the shops, to cost about $25,000. The plant will be of 750-H.-P. and will supply heat and steam power for all machinery in various buildings at shops. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Alta, Ia.—The Town Clk. writes that it was voted Mar. 30 to grant a franchise for a hot water heating plant to the town of Alta.

Baltimore, Md.—John Waters, 23 E. Centre St., is stated to have secured the contract to erect an electric power substation for the United Electric Light & Power Co., at McClellan Alley and Little Sharp St.; the building and equipment will cost about $100,000. The contract for steam piping for the power plant of the United Rys. & Electric Co. on Pratt St. has been awarded to the Crook-Horner Co. for about $50,000. The contract embraces all work in connection with new boilers and engines, and also connections for the condensing machinery.

Malden, Mass.—The Malden Electric Co. is to enlarge its plant so as to secure 14,000 ft. of floor space. The new building is to be built around the present structure. The company will also build a wharf at which all its coal will be received. The improvements will cost about $100,000.

Marine City, Mich.—A franchise is stated to have been granted to Harry M. Lau and Jas. D. Butterfield, of Detroit, to establish a gas plant.

Sault Ste. Marie, Mich.—Wallace-Jaastad-Drewsen, Temple Court Bldg., New York, N. Y., will design a new hydraulic power station for the Edison Sault Electric Co.

Caledonia, Minn.—Jerry Kenny, Village Recorder, writes the citizens have voted to issue $8,000 bonds for the construction of an electric light plant.

Mankato, Minn.—The Council has rescinded all previous actions as to water works, rejected all bids received on Mar. 23 for a building and returned unopened the bids for the lighting plant. J. R. Thompson, City Engr.

Nicollet, Minn.—C. R. Weller, Recorder, writes it is proposed to construct an electric light plant, to cost $3,000. Engineer, H. A. Hildebrandt, St. Peter.

Faribault, Minn.—The Faribault Gas & Electric Co. has been incorporated; capital, $250,000. Incorporators: B. W. Cowperthwaite, John Hang and Ellis F. Preston.

Winona, Minn.—C. J. Grove has petitioned the City Council for a franchise for an electric light plant.

Columbus, Miss.—The Stockholders of the Columbus Light & Power Co. are stated to have decided to construct a new electric plant, to cost about $30,000.

Storrs, Mont.—H. T. Hopka, Cashier Washoe Copper Co., writes that this company proposes to construct an electric light plant and water works under supervision of P. M. Gallaher, of Storrs.

Brooklyn, N. Y.—Bids will be received Apr. 16 by Gustav Lindenthal, Comr. of Bridges, N. Y. City, for furnishing and installing 1 100-H.-P. steam engine (electric light plant) and 1 50-Kw. direct current generator at the Brooklyn bridge power house, Main St.

North Lawrence, N. Y.—L. L. Dewey is reported to have purchased the Townsend water power at North Lawrence, and expects to put in electric lights at that place and Lawrenceville.

Waterloo, N. Y.—Capitalists from Corning, Elmira, and Albany are reported to have organized a company, with $1,000,000 capital, to build a plant at Waterloo to manufacture gas and coke and supply Geneva, Waterloo, Seneca Falls, and Aurora. A pipe line will be run across Cayuga Lake.

Binghamton, N. Y.—Bids will be received on Apr. 20 by A. W. T. Back, Clk. Bd. Superv., for the construction of a county heating and lighting plant on the Court House Sq. Architect, I. G. Perry, of Binghamton.

New York, N. Y.—The Consolidated Gas Co. is stated to have made final arrangements for centralizing the gas manufacturing plants now scattered throughout Manhattan. The proposed location of new works is at Lawrence Point, on Long Island shore of Hell Gate, and comprises about 300 acres. It is proposed to erect a plant with a capacity of 200,000,000 cu. ft. a day, to be installed in units of 20,000,000 ea.

Columbus, O.—Bids will be received Apr. 14 by John A. Connor, Clk. Bd. of Pub. Wks., for erecting a barn and storehouse located upon the grounds of the municipal electric light plant; bids will also be received Apr. 24 for furnishing poles, wire and pole line sundries for the municipal light plant.

Youngstown, O.—It is stated that the Youngstown Consolidated Gas & Electric Co. will install a 1,000-Kw. generator in the addition being erected to the plant in North Ave.

Portland, Ore.—G. C. Moser is stated to have petitioned for a franchise for a steam and hot water heating plant.

Dallas, Ore.—The Dallas Electric Light & Power Co. is reported incorporated; capital, $20,000. Incorporators: M. D. Ellis and T. A. Wagner.

Avondale, Pa.—The Avondale Borough Electric Co. has been incorporated; capital, $10,000. Directors: Edw. H. Wert, C. Raymond Fritcher and Herbert F. Harris, of Harrisburg.

Westgrove, Pa.—The West Grove Borough Electric Co., of West Grove, has been incorporated; capital, $10,000. Directors: Edw. H. Wert, C. Raymond Fritcher, and Herbert F. Harris, of Harrisburg.

Mt. Holly Springs, Pa.—The Mt. Holly Springs Light, Heat & Power Co. has been incorporated; capital, $5,000. Directors; Patricio Russ, Harrisburg; C. Faller, of Carlisle, and others.

Westerly, R. I.—The Senate is stated to have passed the bill authorizing the town to issue $150,000 bonds for the construction of an electric light plant.

Rapid City, S. D.—Frank M. Lockhart and W. H. Chambers have secured a franchise from City Council to build and equip an electric light plant.

Marble Falls, Tex.—W. H. Badger, Secy. Marble Falls Water & Power Co., writes that the company contemplates further development of water power.

Cleburne, Tex.—The City Council has granted a franchise to the Cleburne Light, Power & Htg. Co. to construct and operate a gas plant for a period of 50 years.

Vernal, Utah.—See "Electric Railways."

Brattleboro, Vt.—The Connecticut River Power Co. will build a $50,000 dam across the Connecticut at Brattleboro. It will probably be 20 ft. high, and generate from 4,000 to 5,000-H.-P.

St. Marys, W. Va.—See "Electric Railways."

La Crosse, Wis.—It is stated that the Central Electric Co. will increase its capital from $50,000 to $100,000, to meet several improvements which have been planned by the company.

La Crosse, Wis.—It is stated that the Central Electric Co. will increase its capital from $50,000 to $100,000 and install another boiler and a complete set of generating machinery.

Sheboygan, Wis.—Jacob Cloos, of Milwaukee, the electrical engineer engaged by Mayor P. A. Dennett to ascertain the cost of a municipal lighting plant, has completed the plans and specifications. It is reported that he estimates that a lighting plant with a capacity of 200 arc lights of 2,000 c. p. will cost about $35,500.

Toronto, Ont.—Bids will be received Apr. 18 by the Raven Lake Portland Cement Co., 16 King St. West, Toronto, for constructing an electrical transmission line between Raven Lake and Elliott's Falls.

Tweed, Ont.—P. T. Bowlby, Reeve, writes that the town proposes to take over and reconstruct electric light plant of company which was burned; water power proposed; probable cost of work about $7,000.

Ft. William, Ont.—The Council is stated to have contracted with the Anglo-American Power Co., of Chicago, Ill., to develop the water power on the Kaministiquia. The agreement is that at least 5,000-H.-P. is to be developed in 2½ years.

ELECTRIC RAILWAYS.

Washington, D. C.—It is stated that the Chesapeake Beach Ry. is to be converted into an electric railway. S. T. Smith, Gen. Mgr., Washington.

Atlanta, Ga.—The Atlanta & Marietta Electric Ry. Co. has received a charter to build an electric railway from Atlanta to Marietta. Incorporators: B. D. Gray, Warren Montgomery, of New York, N. Y., and others.

Paxton, Ill.—The Supervs. of Vermillion County have granted a franchise to the Paxton, Danville & Wilmington Electric Ry. Co. to run a line northwest from Danville by either of two routes—to Pontiac, then through Blue Grass to Rankin.

Vincennes, Ind.—The Council has granted a franchise to the Western Indiana Traction Co., which proposes to build an electric railway from Vincennes to Sullivan.

Indianapolis, Ind.—The Indianapolis, Greencastle & Western Traction Co. has been incorporated, with a capital of $50,000. Incorporators: Frank M. Fauvre, M. B. Wilson, and others, of Indianapolis.

The Indianapolis, Green Castle & Western Traction Co. has organized, with Frank M. Fauvre as Pres. The company has obtained nearly all the rights of way and franchises necessary for its road from Indianapolis to Terre Haute, via Danville, Green Castle and Brazil.

The Toledo & Chicago Interurban Ry. Co. has been organized, with a capital of $500,000, to construct and operate an electric railway across the State of Ind., beginning at the eastern boundary in Dekalb County and crossing the counties of Dekalb, Noble, Steuben, Allen, Elkhart and Kosciusko. Incorporators: F. E. Seagrave, F. B. Perkins, and others.

Wabash, Ind.—The City Council has granted franchises to the Northern Indiana Traction Co., which is to be built from Marion to Wabash, and to the Wabash & Rochester Ry. Co., which has been voted $115,000 in subsidies, and which is to be constructed during the year.

South Bend, Ind.—The Indiana Western Ry. Co. has been incorporated, with a capital of $1,000,000, to build an electric railway to connect South Bend, New Carlisle, Laporte and Michigan City. Directors: D. D. Bates, H. F. Wurzer, John M. Brown, and others, of South Bend.

Lagrange, Ind.—The St. Joseph Valley Traction Co. has been incorporated, with a capital stock of $200,000, to build an electric railway through Steuben, Lagrange, Elkhart and St. Joseph Counties. Directors: Rollin Ellison, M. V. Bieger, and others.

Angola, Ind.—The Ohio & Indiana Ry. Co. has been incorporated to build an electric railway 15 miles in length, from the State line in Steuben County; capital, $50,000. Incorporators: Chas. J. Pilliard, Alphonso C. Wood, and others, of Angola.

Columbus, Ind.—The Bartholomew Co. Comrs. have granted a franchise to J. S. Crump, B. B. Jones, and others, to build an electric railway from Columbus to the intersection of the Big Sandy and the county line, the road to continue to West Baden.

Ft. Dodge, Ia.—See "Power Plants, Gas and Electricity."

Worcester, Mass.—The Hartford & Worcester St. Ry. Co. has organized, with Fred C. Hinds, of Boston, as Pres., and Thos. C. Perkins, of Hartford, Conn., as Vice-Pres.; capital, $300,000. It is proposed to build through the Massachusetts towns, Leicester, Charlton, Sturbridge, Brimfield, Wales and Holland on the route from Worcester to Hartford.

Saginaw, Mich.—A company is being organized by D. M. Farson, 115 Devon St., Chicago, Ill., and G. N. Pannell, Secy. Trowbridge & Niver Co., Boston, Mass., to build an electric railway from Saginaw to Flint, a distance of about 30 miles.

Muskegon, Mich.—The West Michigan Interurban R. R. Co. has been organized to construct an electric railway connecting with the Grand Rapids St. Ry. at Mill Creek, just north of Grand Rapids. It will extend through Sparta, Kent City, Casnovia to Muskegon and from there through Whitehall, Montague, Shelby and Hart. G. S. Johnson, E. M. Deane, F. A. Nims are among the incorporators.

Adrian, Mich.—The Toledo & Michigan Electric Ry. Co. has been incorporated to build an electric railway from Adrian to Coldwater, a distance of about 56 miles; capital, $450,000. Directors: Wm. P. Heston and Saml. C. Heston, of Toledo, O.; Chas. H. Lards, of Adrian, and others.

Duluth, Minn.—The City Council has granted A. C. Volk & Co. the right to build a 6-mile street railway from 71st Ave. west in West Duluth to New Duluth.

Johnstown, N. Y.—Surveys are being made westward from Johnstown for a projected electric railway to Little Falls. J. M. Farley, of White Plains, is said to be interested.

Canandaigua, N. Y.—The Rochester & Eastern Ry., now building between Rochester and Canandaigua, has been granted a franchise in Canandaigua.

Marietta, O.—The Marietta, Woodsfield & Barnesville Electric Ry. Co. has been organized with R. Merydith, Pres., to build an electric railway from Marietta to Woodsfield and Barnesville.

Springfield, O.—The American Rys. Co., controlling the Springfield Ry. Co., is to expend $35,000 for erection of an addition to power house and construction of a new storage battery, $25,000 in improving Spring Grove Park, and $30,000 for track renewals. Teverne & Son, of Dayton, will build the storage-battery station.

Columbus, O.—The Urbana, Mechanicsburg & Columbus Ry. Co. will erect its power house, car houses and repair shops near this city. The company will also establish two parks, one at Matthews Grove, north of Columbus, the other at or near Mechanicsburg. W. A. Glan, Ch. Engr., Columbus.

Dayton, O.—It is stated that the Dayton, Lebanon & Cincinnati R. R. (A. E. Appleyard, Pres., Boston, Mass.) is to be equipped with electricity, and will form part of the through line from Columbus to Cincinnati.

Butler, Pa.—The Butler Passenger Ry. Company is reported to have decided to spend $100,000 in extending its lines and improving the service.

Glassport, Pa.—The Pittsburg Rys. Co. has secured a franchise in Glassport to extend its lines through that place to the borough limits. F. Uhlenhaut, Ch. Engr., Pittsburg.

Scranton, Pa.—The Scranton, Factoryville & Tunkhannock Ry. Co. has organized, with J. Selden Swisher as Pres. Capital, $500,000. The company proposes to construct an electric railway with branches to Lake Winola and Lake Carey, the main line to pass through Clark's Green, Waverly, Dalton and Factoryville, thence to Tunkhannock.

Pittsburg, Pa.—The Corporations Com. of Council has approved the ordinance granting the Morningside St. Ry. Co. the right to construct a line to connect with the terminus of the Butler St. line of the Pittsburg Railways Co. and North Negley Ave., by way of Highland Park.

Narragansett Pier, R. I.—The Sea View R. R. Company has in contemplation improvements calling for the expenditure of $100,000. Wm. Henry, Ch. Engr., Narragansett Pier.

Valley Falls, R. I.—The Valley Falls & Franklin St. Ry. Company is seeking incorporation. The company proposes to build an electric railway from Valley Falls to Franklin; capital, $300,000. Andrew J. Currier, John F. Clark, and Wm. H. Bolster are among the incorporators.

Pawtucket, R. I.—The City Council has granted the Pawtucket St. Ry. Co. a franchise on Smithfield Ave.

Tiverton, R. I.—The Tiverton & Seaconnet Beach Ry. Co. is seeking incorporation. It proposes building an electric railway in Tiverton and Little Compton. Wm. H. Briggs and Abel B. Simmons are interested.

Belton, Tex.—The Belton & Temple Electric Ry. Co. is stated to have secured franchises for its proposed road between Belton and Temple. J. M. Carter, of Dallas, is reported interested.

Vernal, Utah.—The Council has granted a franchise to Wm. Ochs to install and operate an electric light plant and railway system.

St. Marys, W. Va.—The Williamstown & Moundsville Ry. Co. is stated to have secured a franchise to build its line through the county. The company will also furnish light and power.

Kenosha, Wis.—The Kenosha Electric Ry. is to be extended into Pleasant Prairie as far as Grand View Park. A private right of way has been secured.

Sheboygan, Wis.—The Sheboygan-Elkhart Lake Ry. & Electric Co. has awarded to the J. H. Clark Construction Co., of Chicago, Ill., the contract for building and equipping its line between Sheboygan and Elkhart Lake via Plymouth, with a branch from Parish Corners to Waldo.

RAILROADS.

Melbourne, Fla.—The Central Florida & Indian River R. R. Co. has been incorporated, with a capital of $2,000,000, to construct a railroad from Melbourne to Orlando. E. O. Painter, of Jacksonville, is one of the incorporators.

Salina, Kan.—The Nebraska, Kansas & Gulf R. R. Co. is reported incorporated, to construct a railroad to extend through Republic, Cloud, Ottawa, Saline, McPherson, Marion, Sedgwick and Cowley Counties in Kan.; through Ind. Ter. to a point at or near Ft. Smith, Ark., connecting with the Kansas City Southern Ry. John Lambert, Joliet, Ill., and Saml. W. Jordan, Kansas City, Mo., are among the incorporators.

Harlan, Ky.—It is stated that the Middlesboro Mineral Springs R. R. Co. has completed a survey for a line from Harlan to Middlesboro, Ky.

Litchfield, Ill.—The Litchfield & St. Louis Ry. Co. has been incorporated, with a capital of $10,000. The railroad is a part of the Cleveland, Cincinnati, Chicago & St. Louis R. R., and is to be constructed from a point east of Litchfield to a point south of Litchfield. Incorporators: David Davis, Eli Miller, and others, all of Litchfield.

Marion, Ill.—The Coal Belt Ry. Co. has been incorporated to construct a steam road to connect with the Coal Belt Electric Ry., which starts from Marion and traverses 30 miles through coal fields of Ill.; capital, $50,000. Directors: Francis S. Peabody, Arthur W. Underwood, and others. Principal offices to be at Marion.

Indianapolis, Ind.—A press report states that a contract has been signed between the Indiana Harbor Syndicate and the trunk lines running through Hammond from Chicago by which a canal will be built at once from Indiana Harbor, 3½ miles south to Calumet River, to be 21 ft. deep, 300 ft. wide, and cost about $700,000. The railroads will construct swing bridges. The syndicate is composed of C. W. Hotchkiss, F. R. Babcock, Fred. S. Winston, all of Chicago, Ill. The syndicate has incorporated here the East Chicago Belt Line to parallel the canal at a distance of 3,000 ft., and has incorporated the Indiana Harbor R. R. Co. to connect the harbor with the coal fields of Indiana in the vicinity of Terre Haute.

Alamogordo, N. M.—The Vernon, Roswell & El Paso Ry. Co. is about to file a charter. It proposes building an extension of the Blackwell, Enid & Southwestern branch of the Frisco west to a connection with the Rock Island's El Paso line at or near Alamagordo, N. M., passing through Roswell, N. M. The distance is over 300 miles.

New York, N. Y.—According to press reports, plans for the expenditure of about $20,000,000 on the lines of the New York Central & Hudson River R. R. have been prepared. Including double tracking, sidings and extensions of single track branches, 297 miles of new track will be laid. Nearly 500 miles of line are to be reballasted and surfaced anew. The automatic block signal system will be extended over 434 miles. About 469 new steel bridges, with an aggregate length of 125,000 ft., single track, are included in the improvement plans, to cost over $5,000,000; 52 new passenger stations and 35 new freight houses are also contemplated. Herring Fernstrom, Ch. Engr., New York.

Cincinnati, O.—Bids will be received Apr. 20 by G. W. Kittredge, Ch. Engr. C., C., C. & St. L. Ry. Co., for grading 18 miles of double track roadway for the C., C., C. & St. L. Ry. Co. between Lawrenceburg Junction and Sunmans, Ind., material to be moved from excavation and placed in embankments, is approximately 2,000,000 cu. yds.

Alliance, O.—The contract for double tracking the Cleveland & Pittsburg division of the Pennsylvania system, between Alliance and Ravenna, 19 miles, is stated to have been awarded to McArthur Bros. & Co., of Chicago, Ill., for about $300,000. They have also secured the $2,500,000 contract for building part of the Zanesville, Marietta & Parkersburg branch of the Wabash.

Curwensville, Pa.—The Curwensville & Bower R. R. Co. has been incorporated to build 16 miles of road in Clearfield County; capital, $60,000. Congressman Olmstead, of Harrisburg, Pres.

Bradford, Pa.—It is stated that the Baltimore & Ohio R. R. Co. is about to construct a new line to run, by way of the Pittsburg & Western to Bradford; from that point a line will be built to Elmira, N. Y., to connect with a road now projected from Binghamton to Elmira. M. Graham, Ch. Engr., Baltimore, Md.

Creekside, Pa.—Clements, Kane & Shoemaker, of Philadelphia, Pa., are stated to have secured the contract for the extension of the Buffalo, Rochester & Pittsburg R. R. from Creekside to the Elders Ridge coal fields, near Saltsburg. The road will be 17 miles in length.

Philadelphia, Pa.—Local press reports state that bids will be received on Apr. 14 by the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr.) for the construction of masonry, and grading necessary for a double track road from Glen Loch to Thorndale, a distance of about 10 miles.

Nashville, Tenn.—It is stated that $200,000 will be expended by the Tennessee Central R. R. Co. for improving its line. Wm. N. McDonald, Ch. Engr., Nashville.

Port Lavaca, Tex.—The Rice Belt Ry. Co. is reported to have been formed, with a capital of $1,000,000. The road is to extend from Galveston to Brownsville by the nearest practicable route to the Gulf. Headquarters of company to be at Port Lavaca.

Clifton Forge, Va.—The Chesapeake & Ohio Ry. Co. is stated to have decided to enlarge Allegheny tunnel, west of Covington, so as to build a double track through it. It will be 4,703 ft. in length. E. W. Grice, Div. Supt., Clifton Forge.

Huntington, W. Va.—The Stony River R. R. Co., of Huntington, has been incorporated, to build a railroad from the junction of the North branch of Potomac River with Stony River to the junction of Helmet River and Stony River; capital, $100,000. Incorporators: M. H. Leonard and Harry M. Kurtz, of Philadelphia, Pa., and Clifford L. Pullen, of Beverly, N. J.

Mannington, W. Va.—The Baltimore & Ohio R. R. Co. is reported to be considering the construction of a short line railroad, from Mannington to Smithfield, a distance of about 16 miles. M. Graham, Ch. Engr., Baltimore, Md.

Grand Rapids, Wis.—The Gunflint & Lake Superior R. R. Co. has been incorporated, to construct a railroad from a point on or near the Canadian boundary line in Cook County, in a southerly direction to Lake Superior. It is also empowered to construct telephone and telegraph lines; capital, $50,000. D. J. Arpin, Grand Rapids, Wis.; Herman Finger, Port Arthur, Ont., and Wm. Scott, Grand Rapids, are the incorporators.

Winnipeg, Man.—The Manitoba Legislature is reported to have guaranteed $10,000 a mile for 338 miles of extension of the Canadian Northern Ry. E. A. James, Gen. Supt., Winnipeg.

Quebec, Que.—The Quebec Legislature has passed the bill incorporating the Montreal North Western Ry. Co. and the Quebec & Western Ry. Co.

PUELIC BUILDINGS.

New Haven, Conn.—Bids will be received Apr. 15 at the office of the City Compt. for erecting, including heating, plumbing, gas fitting, etc., a public bath house on St. John St. Brown & Von Beren, Archts., 865 Chapel St.

Washington, D. C.—The contract for the erection of the edifice to be erected by the Foundry M. E. Church is stated to have been awarded to S. J. Prescott & Co., 507 12th St., N. W., for $110,723.

Albany, Ga.—Bids are wanted May 4 for erecting a courthouse. T. F. Lockwood, Archt.

Attica, Ind.—Bids will be received Apr. 24 by the Co. Comrs. for erecting a brick, stone and metal asylum about 32x62 ft. Geo. A. Law, Chmn.

Greencastle, Ind.—Competitive plans will be received Apr. 20 for a $130,000 court house. Peter F. Stoner, Aud.

Denison, Ia.—Press reports state that the Library Bd. will receive estimates until Apr. 24 for erecting a Carnegie library.

Russellville, Ky.—Robt. P. Manly, of Atlanta, Ga., is stated to have received the contract (bids opened Apr. 1) for erecting Logan Co. Court House, for $38,000.

Alexandria, La.—The Bd. of Control of the Colored Insane Asylum is stated to have let the contract (bids received Mar. 31) for the erection of the asylum to Chas. N. Gautier & Co., of Baton Rouge, for $72,380.

Thigiers, La.—Bids will be received Apr. 20 by E. B. Cushing, Engr. M. L. & T. R. R. & S. S. Co. and L. W. R. R. Co., for erecting a brick round house.

Baltimore, Md.—The contract for the erection of the engine house at McCulloh and Gold Sts. is stated to have been awarded to Milton C. Davis, 620 3d Ave. N., for $25,734.

Boston, Mass.—The lowest bid received on Mar. 28 for installing a ventilating and heating system in new group of buildings at Austin St. Insane Hospital, was that of A. A. Sanborn, 18 Post Office Sq., for $44,399.

Detroit, Mich.—An item of $125,000 for remodeling the city hall has been approved by the Aldermen.

Minneapolis, Minn.—The Senate is stated to have passed a bill authorizing the issue of $400,000 bonds for the completion of the court house and city hall.

St. Louis, Mo.—Bids will be received Apr. 29 by the Bldg. Com. of the Illinois Comn. to the Louisiana Purchase Exposition for erecting the Illinois State Building, including plumbing, electric light wiring, sewerage, masonry, structural and ornamental iron and steel work, etc. Watson & Hazleton, Archts., 805 Plymouth Bldg., Chicago; C. N. Travous, Chmn. Lincoln Trust Bldg.

Bids will be received Apr. 15 by the Missouri Comn., Administration Bldg., World's Fair Site, for erecting the Missouri State Bldg. Isaac S. Taylor, Archt., Columbia Bldg., 8th and Locust Sts. F. J. Moss, Chmn.

St. Louis, Mo.—Caldwell & Drake, of Columbus, Ind., are stated to have received the contract for erecting the Horticulture building, on the grounds of the La. Purchase Exposition, for $228,872.

Missoula, Mont.—Plans will be received Apr. 18 by the Carnegie Pub. Library Bldg. Comn. for the Carnegie library. Henry C. Stiff, Secy.

Oneonta, N. Y.—The Assembly is stated to have passed a bill providing for an appropriation of $50,000 for an armory to be erected here.

Binghamton, N. Y.—The plans of S. O. & H. A. Lacey, Phelps Bank Bldg., and I. G. Perry, 3 Chenango St. are stated to have been accepted for the Carnegie Library to be erected here, at a cost of $60,000.

Syracuse, N. Y.—It is stated that the plans prepared by Taber & Draper, Onondaga Co. Sav. Bank Bldg., were accepted for the $30,000 hospital to be erected here. Contracts will be let at once. Dr. A. B. Kinne, Secy.

Long Island City, N. Y.—Bids will be received Apr. 17 by Thos. Sturgis, Fire Comr., for furnishing material for erecting a building for Hook and Ladder Co. No. 66; also for erecting a building for Engine Co. No. 124.

New York, N. Y.—The Senate is reported to have passed the bill for the erection of a public bath at 38th St. and 1st Ave.

The Mayor is stated to have approved the following measures: Authorizing the Comptroller to issue $3,500,000 of corporate stock for schools; $125,000 for the completion of the Harlem Hospital, and $75,000 to pay the expenses of preparing plans and specifications for the construction of the new Bellevue Hospital; approving the issue of $250,000 for the construction of new buildings and additions to buildings under the jurisdiction of the Dept. of Public Charities; authorizing the issue of $90,000 for the construction of an interior public bath in the Boro. of Brooklyn, and $50,000 of corporate stock for making alterations in the Borough Hall, Brooklyn, as will furnish suitable accommodations for the use of the Appellate Div. of the Supreme Court of the Second Dept.

Kings Park, L. I., N. Y.—T. E. McGarr, of Albany, Secy. State Lunacy Comn., writes that the contract for installing an air compressor at L. I. State Hospital, Kings Park (bids opened Mar. 18), has been awarded to the Ralph B. Carter Co., 26 Cortlandt St., New York, for $4,290.

Watertown, N. Y.—An isolated ward building, 106 x32 ft., 1½ stories high of brick, will be erected at the City Hospital. D. D. Kieff, Archt., 24 Flower Bldg.

Akron, O.—Bids will be received Apr. 27 by the Bd. of City Comrs. for erecting a market house; separate bid for plumbing and gas fitting. Chas. H. Isbell, Clk. of Bd.

Springfield, O.—The Bd. of Trus. of High Street M. E. Church is stated to have awarded the contract for the erection of the edifice to Wolf & Harrison, of Indianapolis, Ind.; probable cost, $31,000.

Bids will be received May 1 by the Bd. of Pub. Affairs, for furnishing material for erecting a building to be used as a city prison, patrol house and work house. Robt. C. Gotwald, Archt.; R. N. Lantz, City Clk.

Toledo, O.—Bids will be received May 1 by the Bd. of Trus. of the Toledo State Hospital for remodeling the main dining and serving room (for females) and a new annex dining room for female employes of said institution. David L. Stine, Archt.; H. A. Tobey, Secy.

Cleveland, O.—Bids are wanted Apr. 28 for erecting a library on Woodland Ave. W. R. Watterson, Archt., 1203 New England Bldg.

Youngstown, O.—Bids will be received Apr. 25 by the Bd. of City Comrs. for furnishing material for erecting the fire station on Madison Ave. and Elm St. E. R. Thompson, Archt.; C. E. Cross, Clk.

Cleveland, O.—Andrew Carnegie is stated to have offered the Public Library Bd. of this city $250,000 for erecting 7 branch libraries.

Mansfield, O.—Andrew Carnegie is stated to have offered this city $35,000 for a Carnegie Library.

Wilkesbarre, Pa.—Bids are wanted Apr. 18 for erecting steel cells, steel doors and steel frames for an addition to the Luzerne Co. prison. McCormick & French, Archts., Laning Bldg.; Geo. R. McLean, Co. Compt.

Philadelphia, Pa.—The following bids are reported to have been opened on Apr. 2 by the Dirs. of Charities & Correction for an administration building to be erected in the 41st Ward, for the new Municipal Buildings for the poor and insane: John H. Jordan, $103,789; Wm. J. Smith, $97,793; John W. Henderson & Co., $112,713; Doyle & Doak, $98,268.

Harrisburg, Pa.—The Woodbury-Woodbury Co., John S. Holden, Pres., Bennington, Vt., is stated to have received the contract for supplying the granite to be used in the erection of the capitol, for $4,000,000.

Corsicana, Tex.—Architect, J. E. Flanders, of Dallas, writes that on account of irregularity in election for issue of bonds, no action was taken on bids received Apr. 1 for erecting a 3-story brick and granite court house, to cost about $130,000. Must be done over. Will come up later. Everything postponed until then.

Moundsville, W. Va.—It is stated that bids are wanted Apr. 14 for stone and cement extension, 127x48 ft. to North Hall of the W. Va. Penitentiary. Cost estimated, including equipment, $85,000. C. E. Haddon, Warden.

Winnipeg, Man.—Jas. Chisholm, of this city, is stated to be preparing plans for an edifice for the Congregation of Zion Church, to be erected at Pacific Ave. and Ellen St.; probable cost, $40,000.

Windsor, N. S.—Bids will be received Apr. 14 by J. C. Geldert, Town Clk., for erecting a hospital.

Athens, Ont.—It is stated that bids are wanted Apr. 15 for erecting a town hall. B. Loverin, Village Clk.

North Bay, Ont.—It is stated that bids are wanted Apr. 20 for erecting a Presbyterian church at North Bay. Address J. Francis Brown, Archt., Toronto.

Ottawa, Ont.—The Library Bd. will soon ask for bids for the erection of the Carnegie Library. Alderman Enwright, Chmn. Bldg. Com.

BUSINESS BUILDINGS AND DWELLINGS.

Washington, D. C.—The Potomac Hotel Co. is reported incorporated, with a capital of $1,000,000, to erect a hotel at 7th and H Sts. at a cost of $1,400,000. Incorporators: Laskin M. Martin, of Chicago, Ill., and Horace W. Westcott, of Washington, and others.

Macon, Ga.—Walter Turpin will erect a 4-story hotel on Mulberry St., to cost about $20,000.

Atlanta, Ga.—H. Leslie Walker is stated to be preparing plans for a brick, 100x250-ft. apartment house to be erected on Peachtree St., by the Vendome Building Co., 1221 Empire Bldg.; estimated cost, $300,000.

Chicago, Ill.—The building at 75 Monroe St. is reported destroyed by fire Apr. 4.

Des Moines, Ia.—It is stated that plans are being prepared for a brick building to be erected at 7th and Mulberry Sts.; probable cost, $75,000. H. S. Butler is reported interested.

Louisville, Ky.—It is stated that the Selbach Realty & Constr. Co. is preparing to erect a $300,000 hotel. Dodd & Cobb, Archts., 600 Equitable Bldg.

Baton Rouge, La.—Bids are wanted Apr. 15 for erecting a 5-story hotel. W. L. Stevens, Archt., New Orleans. Address F. I. Raymond.

Baltimore, Md.—The John A. Sheridan Co. is stated to have been awarded the contract to build the Conway Warehouse at Conway and Hanover Sts. The building will be 6-story, 138x165-ft. structure, and cost with machinery $225,000.

Ellicott & Emmart are stated to be preparing plans for a residence for Isidor Rayner to be erected at 1125 N. Calvert St.; probable cost, $40,000.

Sault Ste. Marie, Mich.—The contract for the erection of the 5-story building by R. N. Adams is stated to have been awarded to M. N. Hunt, of this city, for $50,761.

Red Wing, Minn.—Lowell A. Lamoreaux, of Minneapolis, is stated to have been selected to prepare plans for a 62x120-ft. stone and brick opera house, to be erected by the T. B. Sheldon estate; probable cost, $40,000.

St. Louis, Mo.—It is stated that Nelson-Chesman & Co. will erect a building at No. 1127 Pine St., to cost $250,000. Kennedy & Mathias, Archts.

St. Louis, Mo.—See "Miscellaneous."

Kansas City, Mo.—Matthew O'Connell, New Ridge Bldg., has prepared plans for an apartment house and brick dwelling for L. N. Leslie, to be erected at 1101 Jefferson St., to cost $66,000.

Penacook, N. H.—W. C. Spicer will erect a 3-story brick block in Penacook, to cost about $15,000.

Wildwood, N. J.—Willis G. Hale, 1524 Chestnut St., Philadelphia, Pa., is stated to have prepared plans for a 5-story, 187x167-ft. hotel to be erected at 22d St. and Pennsylvania Ave.

Orange, N. J.—The Bd. of Dir. of the Mutual Trust Co. is stated to have accepted the plans of H. P. Kirby and Geo. B. Post & Son, of New York, N. Y., for the office building to be erected here at a cost of $25,000.

Albuquerque, N. M.—Bids will be received Apr. 17 by the Bldg. Com. for erecting the superstructure of the Elks Opera House (except heating and plumbing). D. J. Rankin, Chmn.

Buffalo, N. Y.—Adam Meldrum & Anderson Co. will erect a $50,000 store building on Pearl St.

Edwin H. Webster will erect a $20,000 residence at 785 W. Ferry St.

New York, N. Y.—See "Railroads."

Schenectady, N. Y.—It is stated that St. George's and New Hope Lodges will erect a Masonic Temple here, to cost about $120,000.

Watertown, N. Y.—Roth & Sante will erect an 8-story store and office building on Court St.

A 7-story hotel will be erected on the site of the Otis House, destroyed by fire Mar. 6.

Binghamton, N. Y.—S. O. & H. A. Lacey, Phelps Bank Bldg., are stated to be preparing plans for an apartment house to be erected at 31 Front St. for S. B. Davidge; probable cost, $20,000.

Columbus, O.—F. L. Packard, New Hayden Bldg., is reported to be preparing plans for a business block to be erected at Gay and 4th Sts. for J. S. Morton. Estimated cost, $25,000.

Philadelphia, Pa.—Floyd Adams is reported to have been selected to prepare plans for the 5-story warehouse to be erected at Willow and Orianna Sts. for the Retail Grocers' Assoc.; estimated cost, $1,000,000.

Houston, Tex.—S. Westheimer is reported to have decided to erect a brick office building on Franklin Ave.; probable cost, $30,000.

Burlington, Vt.—The Burlington Light & Power Co. is reported to have had plans prepared for a 3-story brick, 40x100-ft. building to be erected at S. Winooski Ave. and College St. Chas. E. White, Archt., American Gas Co.

Newcastle, N. B.—Bids are wanted May 1 for erecting a 2-story brick and stone building, 97x47 ft. H. B. McDonald, Archt. Address John Menzies, Newcastle.

Toronto, Ont.—Mason, Reed-Hill and W. S. Painter are stated to have been commissioned by the Toronto Opera House Co. to prepare the plans for an opera house, to replace the one recently destroyed by fire; estimated cost, $100,000.

SCHOOLS.

New Haven, Conn.—Local press reports state that the Bd. of Educ. will receive bids Apr. 17 for alterations in the High School.

Chicago, Ill.—Bids will be received Apr. 24 by the Com. of Bldgs. and Grounds of Bd. Educ. for erecting the McKinley High School, W. Adams St., including ventilating, steam heating, heat regulation, plumbing, gasfitting, sewerage, electrical work, masonry, structural iron, etc. W. B. Mundie, Archt. of Bd.; T. J. Waters, Ch. Engr.

Rushville, Ind.—It is stated that plans are being prepared for a high school to be erected here, to cost $35,000. Architect, Philip Jeckel, of Anderson.

Cedar Rapids, Ia.—Prof. A. N. Palmer is stated to have had plans prepared for a 4-story building to be erected at 1st Ave. and 5th St. for the Cedar Rapids Business College; estimated cost, $130,000.

Ames, Ia.—Proudfoot & Bird, Archts., Crocker Bldg., Des Moines, write that C. E. Atkinson, of Webster City, has secured the contract for erecting the pavilion, addition to Agricultural Hall greenhouse and feeding shed at Iowa State College for $53,500 (bids opened Mar. 26). New bids are to be received for the 4-story stone central building.

Rome, Ia.—Bids are wanted May 2 for erecting a school in Independent Dist. J. E. Wallers, Secy. Bd. Educ.

Alexandria, La.—Bids will be received Apr. 15 for erecting a $50,000 school.

Baltimore, Md.—An ordinance is stated to have been passed appropriating $30,000 for an addition to School No. 96 at Ramsay and Smallwood Sts.

Beverly Farms, Mass.—Bids will be received Apr. 15 by the Joint Special Com., Beverly, for furnishing material and erecting a school. Theo. A. Holmes, Chmn.

Marblehead, Mass.—The citizens are stated to have voted to issue $40,000 bonds for school.

Peabody, Mass.—It is stated that bids will be received until Apr. 15 for erecting a brick high school. A. E. Wells, Chmn. Com.

Le Sueur, Minn.—It is stated that bids will be received until May 1 for erecting a school. Chas. C. Kolars, Clk. Bd. Educ.

Trenton, N. J.—The Senate is stated to have passed the bill providing for an appropriation of $145,000 for the enlargement of the Trenton Normal School.

Camden, N. J.—Local press reports state that bids will be received by the Bldg. Com. of the Bd. of Educ. until Apr. 21 for erecting School No. 15.

Brooklyn, N. Y.—Bids will be received Apr. 20 by C. B. J. Snyder, Supt. of School Bldgs., for installing electric light wiring and fixtures in school No. 19.

New York, N. Y.—Bids will be received Apr. 20 by C. B. J. Snyder, Supt. of School Bldgs., for installing ventilating and heating apparatus in school No. 6, Boro. Bronx; also for sanitary work and alterations in school No. 92 and for installing, ventilating and heating apparatus, electric light wiring fixtures and electric bell system in school No. 190, Boro. Manhattan.

Bids will be received Apr. 20 by C. B. J. Snyder, Supt. of School Bldgs., for erecting an addition to and alterations in the truant school on E. 21st St.

Long Island City, N. Y.—Bids will be received Apr. 20 (readvertisement) by C. B. J. Snyder, Supt. of School Bldgs., for erecting school No. 84, Boro Queens.

Bids will be received Apr. 20 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for the completion of School No. 5 in accordance with the original plans and specifications of contract awarded to John Langley, which has been declared abandoned.

Newburgh, N. Y.—The Bd. of Educ. is stated to have awarded the contract for ventilating and heating South St. School to the International Heater Co., for $8,525.

New York, N. Y.—See "Public Buildings."

Brooklyn, N. Y.—The following bids were opened by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, Apr. 6, for general construction of Public School 47, Boro. of Brooklyn—*a*, to be completed Feb. 1, 1904; *b*, to be completed Apr. 15, 1904: Thos. Cockerill & Son, *a* and *b*, $174,000; Chas. H. Peckworth, *a*, $175,445; *b*, $139,445. F. J. Kelly's Sons, *a*, $166,382; *b*, $164,382. W. & T. Lamb, *b*, $162,465. Myron C. Rush, *a*, $199,400; *b*, $194,400. Richard E. Henlingham, *a*, $163,400; *b*, $160,900 (awarded contract). Edwin H. Thatcher, *a* and *b*, $167,000.

Mayville, N. D.—W. C. Albrant, Archt., Fargo, N. D., writes that the opening of bids for erecting a 3-story brick and stone addition to Normal School has been deferred to Apr. 17.

Bowling Green, O.—Bids will be received Apr. 18 by the Bd. Educ. for furnishing material and erecting a brick school. Frank W. Dunn, Clk.

Lawton, Okla. Ter.—T. J. O'Keefe, of Oklahoma City, is stated to have secured the contract for erecting the high school, at a cost of $31,250.

Pittsburg, Pa.—Bids will be received Apr. 15 by the Bd. Educ. for $100,000 school bonds. Address Dr. S. A. Sturm, Secy., Larimer Ave. and Mayflower St.

Columbia, S. C.—Bids are wanted Apr. 14 for installing a system of sewers and sanitary plumbing in new buildings at the South Carolina College; also alterations in old buildings required for the installation of plumbing. Chas. C. Wilson, Archt., 1422 Main St.

Descronto, Ont.—Bids will be received Apr. 30 by W. J. Malley, Secy. Pub. School Bd., for erecting a school.

STREET CLEANING AND GARBAGE DISPOSAL.

South Bend, Ind.—The Bd. of Pub. Wks. (W. A. McInerney, Pres.) will ask Council for an appropriation for the construction of a crematory at once. Dr. H. T. Montgomery is Chmn. Fin. Com.

Indianapolis, Ind.—Local press reports state that bids will be received by the Bd. of Pub. Wks. April 15 (readvertisement), for street sprinkling.

Chicopee, Mass.—The Bd. of Health is stated to have awarded to Geo. McQueen, of Chicopee Falls, the contract for collecting garbage for the year ensuing May 1.

Brooklyn, N. Y.—Bids will be received Apr. 17 by John McG. Woodbury, Comr. of St. Cleaning, N. Y. City, for completing an abandoned contract in Brooklyn for the collection and removal of garbage and kindred refuse for the period of 1 year, beginning Sept. 1, 1902.

Avalon, Pa.—E. E. Custard, Boro. Clk., writes that the contract for the disposal of garbage (bids opened Apr. 2) has been awarded to Allegheny Garbage Co., of Allegheny, at $3,100 for 1 year.

Monessen, Pa.—The Boro. Council is stated to have appropriated $75,000 for a garbage plant.

Sharon, Pa.—John Matta and Dr. Berryhill are stated to have petitioned the South Sharon Council for a franchise to operate a garbage plant in that borough.

GOVERNMENT WORK.

Hot Springs, Ark.—Bids are wanted Apr. 16 for remodeling, enlarging, etc., of the free bath house in the Hot Springs Reservation at Hot Springs. E. A. Hitchcock, Secy. Dept. of the Interior, Washington, D. C.

Grand Junction, Colo.—Bids will be received Apr. 29 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material and constructing a brick office building; also a frame or brick laundry building, including plumbing, acetylene gas piping, at the Grand Junction Indian School. Theo. G. Lemmon, Supt. Grand Junction.

Washington, D. C.—Bids are wanted Apr. 16 for high pressure steam boilers, economizer, and induced draft apparatus for the National Bureau of Standards. Jas. Knox Taylor, Supervy. Archt.

Pensacola, Fla.—Bids will be received Apr. 14 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Pensacola, a quantity of supplies consisting of iron, steel, pipe, pipe fittings, valves, etc. A. S. Kenny, Paymaster Gen., U. S. Navy, Washington.

Leavenworth, Kan.—Bids will be received Apr. 17 at the office of the Treas., Western branch, N. H. D. V. S., National Military Home, for furnishing material for constructing headquarters building, 1 combination barracks and 1 chaplain's quarters. Maj. W. W. Martin, Treas.

New Orleans, La.—Bids will be received May 12 at Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing a complete equipment for construction and repair shops at Naval Station, New Orleans. A. S. Kenny, Paymaster-Gen., U. S. N., Washington, D. C.

Portland, Me.—The Bodwell Granite Co., of Rockland, Me., is stated to have secured the contract for furnishing the granite to be used in the construction of the light and fog signal tower to be erected on Ram Island Ledge at the entrance to Portland Harbor, Me., for $33,679.

Boston, Mass.—Bids will be received Apr. 14 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Boston, a quantity of supplies consisting of cement, sand, broken stone, furnaces, etc.; also heating plant.

Grand Rapids, Mich.—The following bids for (*a*) repair of South Pier at Portage Lake, Mich., and (*b*) extension and repair of piers at Frankfort, Mich., were received by Capt. Chas. Keller, Corps Engrs., U. S. A., Apr. 1: F. J. Bennett & Co., Muskegon, *a*, $14,608; *b*, $21,056. Nelson J. Gaylord, Ludington, *a*, $14,823. Burk, Smith & Nelson, Muskegon, *a*, $15,596; *b*, $21,459. Robt. Love, Muskegon, *a*, $16,875; *b*, $24,531. Robt. Millen & Co., Muskegon, *b*, $21,831.

Ft. Brady, Mich.—Bids are wanted May 4 for constructing 2 double brick barrack buildings at this post. W. H. Miller, Ch. Q. M., U. S. A.

Duluth, Minn.—A press report states that all bids received on Mar. 9 for concrete pier work, Superior Entry, Wis., has been rejected. The amount to be expended is $250,000, and the lowest bid received amounted to $321,420. Accordiog to the press report, Capt. D. D. Gaillard, Corps Engrs., U. S. A., has been instructed to do the work by hired labor, purchasing the necessary material after due advertisement.

Minneapolis, Minn.—The following bids were opened at Treas. Dept., Washington, D. C., on Apr. 6 for enlarging (including heating apparatus, plumbing, electric conduits and wiring) of the U. S. Post Office at Minneapolis: P. M. Hennessey, St. Paul, $237,997; Angus McLeod Co., Minneapolis, $236,872; H. N. Leighton Co., Minneapolis, $224,735.

Tongue River Agency, Mont.—Bids are wanted Apr. 30 for furnishing and delivering material for constructing a combination dormitory, school and mess, employees' quarters, laundry, warehouse, gas house and piping; also water and sewer system on the Bushy Ranch at Tongue River Agency. Address W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

New Brunswick, N. J.—Bids will be received Apr. 25 at the Treas. Dept., Washington, D. C., for furnishing and installing combination gas and electric light fixtures in the U. S. Post Office, New Brunswick.

Jamestown, N. Y.—Edw. Joy, of Syracuse, is stated to have secured the contract for electric wiring and constructing conduit system in Post Office, for $16,200.

Philadelphia, Pa.—The following bids are reported to have been opened on Apr. 2 by Lieut.-Col. C. W. Raymond, Corps Engrs., U. S. A., for the removal of Schooner Ledge, in Delaware River, opposite Thurlow—*a*, for removing and depositing ledge rock or bowlders, about 9,500 cu. yds.; *b*, for removing and depositing 163,000 cu. yds. of overlying material; *c*, totals, price given per cu. yd.: Submarine Contracting Co., of New York, N. Y., *a*, $19.85; *b*, 50 cts.; *c*, $270,075. The R. J. Packard Co., New York, N. Y., *a*, $65; *b*, 65 cts.; *c*, $723,450. The P. Sanford Ross, Inc., of Jersey City, N. J., *a*, $30; *b*, 92 cts.; *c*, $434,960.

Charleston, S. C.—The following bids were opened at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., on Apr. 4, for constructing a brick and steel building for machine, boiler, and blacksmith shops, navy yard, Charleston, S. C., appropriation, $342,000: Clark Constr. Co., Chicago, Ill., $297,751; Penn Bridge Co., Beaver Falls, Pa., $318,700: Snare & Triest Co., New York, N. Y., $319,800: Connors Bros., Lowell, Mass., $323,000; L. P. Hazen & Co., Cincinnati, O., $398,720.

Rapid City, S. D.—Bids will be received May 1 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material and constructing brick employees' quarters, including plumbing and acetylene gas piping; also an addition to brick dormitory, including plumbing and gasoline gas piping at the Indian School, Rapid City. Sam B. Davis, Supt. Indian School, Rapid City.

Galveston, Tex.—Only one bid is stated to have been received on Mar. 25 by Col. C. S. Riche, U. S. Engr., for the removal of part of old jetty at Aransas Pass. This was from Moore & Seiber, of Texas City, for $46,000; and Col. Riche recommended same for award.

The contract for the jetty work at Galveston has been finally awarded to J. M. O'Rourke & Co., of Galveston, and that for the mouth of the Brazos to Moore & Siebert, of Texas City.

Ft. Wright, Wash.—Capt. W. C. Wren, 17th Infantry, Q. M. in charge of Construction, writes that the contract for constructing, including steam heating, gasfitting and plumbing, 1 double set officers' quarters, 1 Q. M. and 1 ordnance storehouse, has been awarded to Alfred W. Burrell, Oakland, Cal., for $54,406.

Port Wing, Wis.—Hugo & Tims, of Duluth, Minn., are stated to have secured the contract for work at Port Wing, which consists of some dredging and the construction of the east pier for harbor protection, for the amount available, which is $22,200.

Haines, Alaska.—The contract for constructing the 24 buildings for the army post at Haines Mission, Alaska, is stated to have been awarded to Bonnell, Cornell & Estes, of Tacoma, Wash., for $314,511.

Juneau, Alaska.—Press reports state that bids will be received Apr. 20 by Jas. M. Shoup, U. S. Marshal at Juneau, for erecting a jail and court house; appropriation available, $55,000.

NEW INDUSTRIAL PLANTS.

The Bryigon Steel Casting Co., Reading, Pa., is preparing to build a new plant in New Castle, Del. The main building will be over 600 ft. long and 60 ft. wide, and additional power plant of about 300-H.-P. capacity will be installed. The present plant will be operated to its full capacity until the new one is completed, when the machinery in the present plant will be removed to the new plant.

The Pacific Coast Co., Seattle, Wash., will install in its power plant for the new coal bunkers, mentioned last week, four 75-H.-P., one 30-H.-P., two 20-H.-P. and one 10-H.-P. motor. The generating plant will include one 300-Kw. or two 150-Kw. generators and a 500-H.-P. boiler plant. James Anderson, Ch. Engr.

The McGee Mfg. Co., Greenville, S. C., will begin work at once on a 2-story, 211x60-ft. cotton mill and will require a 100 to 125-H.-P. compound engine.

The Roseland, La., Veneer & Package Co., Ltd., is in the market for woodworking machinery.

The Reese Water-proof Mfg. Co., 610 Examiner Bldg., San Francisco, Cal., will erect a new plant, to include a 50x100 and a 26x48-ft. building. A power plant of 20-H.-P. will probably be installed.

The Pittsburgh, Pa., Reduction Co. expects to begin work at once on a new mill at Massena Springs, N. Y., the main building to be 500x160 ft. Some of the contracts have been let.

A. Booth & Co., Chicago, contemplate the erection of a fish offal reduction plant at Green Bay, Wis.

The Stacey Mfg. Co., 233-239 Mill St., Cincinnati, O., will erect a new plant at Elmwood Place, O., to include a 130x500-ft. machine shop, 90x200-ft. foundry, 30x90-ft. pattern shop and a pattern vault 30 ft. square, of brick and iron. Harry Hake, Archt.

The Piedmont, W. Va., Mercantile & Development Co. has been incorporated and will at once erect a plant having a capacity of 40,000 to 50,000 fire brick, paving brick and special shale brick daily, and will open coal mines. The company is in the market for brick-making and coal-mining machinery. C. B. Karn, Gen. Mgr.

Contracts have been let for some of the buildings of the new car shops of the C. & E. I. R. R. at Danville, Ill., at a cost of $160,000. At present a power plant and machine and blacksmith shops will be erected, which, it is expected, will be completed this fall. Other buildings are planned for erection next year.

The American Sault Paper Co., Sault Ste. Marie, Mich., has retained Joseph H. Wallace, New York, to design a hydraulic power plant of 15,000 H.-P., ground wood and sulphite pulp mills and a four-machine paper mill. A large amount of structural steel and a 2,500-H.-P. boiler plant will be required.

The Ray Automatic Machine Co., Cleveland, O., has purchased property along the line of the Big Four Ry. at Berea, O., and will build a plant for the manufacture of nut and bolt-making machinery. Plans and specifications are being prepared by the Osborn Engineering Co., Cleveland, O.

Construction has been started on a 4-story brick building of standard mill construction for the Ontario Baking Co., Buffalo, N. Y. Niagara Falls power will be used and there will be three reel ovens 18x23x27 ft. high.

Plans have been drawn and contracts are pending for a 500x51-ft. shear and cold workshop for the Buffalo Bolt Company's plant at Gratwick, N. Y.

The National Automatic Needle Co., Springfield, Mass., has broken ground for a new plant. The power plant will include a boiler plant of about 150-H.-P. capacity in two units, a 100 brake H.-P. engine and a 300-light dynamo.

MISCELLANEOUS.

San Francisco, Cal.—The Governor has signed the bill authorizing this city to issue $2,000,000 bonds for improvement of sea wall.

Sacramento, Cal.—The Governor has signed the bill appropriating $200,000 for river improvement.

Oakland, Cal.—City Engr. Turner is stated to have submitted to Council Mar. 30 plans for improving West Oakland Park, at a cost of $40,000.

Denver, Colo.—A. L. Fellows, of Denver, Engr. U. S. G. S., writes that the proposed Gunnison tunnel will cost $2,500,000. F. H. Newell is Ch. Engr.

Indianapolis, Ind.—See "Railroads."

Bangor, Me.—The West Branch Driving & Reservoir Dam Co. is reported incorporated. This corporation proposes to expend about $200,000 in improving Penobscot's west branch for driving logs and for manufacturing purposes, by the removal of obstructions, erection of dams and other works and creation of basins or reservoirs for storage of water. Directors: Garrett Schenck, of New York, N. Y.; Edw. Stetson, of Bangor; Eugene Hale, Jr., of Elisworth, and others.

St. Louis, Mo.—It is stated that the St. Louis Dock, Ry. & Warehouse Co. contemplates constructing a system of docks, warehouses, supply depots and cold storage plants, to be connected by a system of railways, to extend along the river front from Washington Ave. on the north to Plum St. on the south, a distance of 13 blocks; probable cost of work said to be $10,000,000.

Syracuse, N. Y.—It is stated that plans and specifications for improvement of Harbor Brook under arrangement to spend $18,000 in deepening and straightening the channel of stream, and $6,000 for a bridge across brook in W. Fayette St. will be ready so that work may begin in May. F. J. Schnauber, City Engr.

Buffalo, N. Y.—Col. F. G. Ward, Comr. of Pub. Wks., is stated to have received official notification from the War Dept. at Washington, D. C., that his plans for straightening Buffalo River and abating South Buffalo floods had been approved.

Albany, N. Y.—Gov. Odell on Apr. 7 signed the Barge Canal Improvement bill.

New York, N. Y.—Bids will be received Apr. 17 by McDougall Hawkes, Comr. of Docks, for furnishing material for preparing and building a riprap embankment on the easterly side of Riker's Island.

Bids will be received Apr. 14 by McDougall Hawkes, Comr. of Docks, for furnishing material for constructing a pier, with appurtenances, at Cedar St., N. R., to be known as pier No. 11.

Bids will be received Apr. 14 by McDougall Hawkes, Comr. of Docks, for furnishing material for constructing a pier, with appurtenances, at Cedar St., North River, to be known as pier No. 11, N. R.; bids will also be received Apr. 21 for furnishing material for dredging in the East and Harlem Rivers.

New Rochelle, N. Y.—Bids will be received Apr. 14 by the Common Council for $94,000 local improvement bonds. Chas. Kammermeyer, City Clk.

Brooklyn, N. Y.—Bids will be received Apr. 24 by McDougall Hawkes, Comr. of Docks, N. Y. City, for furnishing material for preparing and constructing a pier, with appurtenances, between 51st and 52d Sts., Boro. Brooklyn.

Columbus, O.—See "Electric Railways."

Springfield, O.—See "Electric Railways."

Memphis, Tenn.—The Senate has passed the bill to allow this city to issue $200,000 bonds to build levees, establish pumping stations, etc., to protect the city against backwaters.

Hartford, Vt.—Bids will be received until May 1 by the Ottaquechee Woollen Co., at Hartford, for constructing a log dam across Ottaquechee River at No. Hartland, Vt. Length of dam, 240 ft.; height, 13 ft. R. E. Stevens, Treas.

Falmouth, Jamaica.—Bids will be received until May 20 (extension of date) by the Gov. of Jamaica for improving the harbor of Falmouth, including excavation and removing of rock. Address Dir. of Pub. Wks., Kingston, Jamaica, W. I.

BUSINESS NOTES.

The Crandall Packing Co., Palmyra, N. Y., has found it necessary to have larger offices in New York, which will be at 123 Liberty St. S. M. Hildreth is local manager.

The Buffalo Forge Co. has established a new branch office at 1409 Majestic Bldg., Detroit, Mich., which will be in charge of H. M. Brightman.

The Engineering Agency, Monadnock Block, Chicago, received applications in one day last week for 67 high-grade technical men; one company asking for 25 blast furnace draftsmen at $125 to $150 a month, and another company for 30 structural draftsmen at $125 a month. The agency has vacancies on its books for over 200 competent men, including instructors in shop work for technical colleges, teacher for manual training school, assistant editor for technical journal, chemists, engineers of all kinds, shop superintendents, and draftsmen.

The Stanley Electric Mfg. Co., Pittsfield, Mass., has sold to the Indianapolis, Columbus & Southern Ry. Co. the following apparatus: Forty-eight type No. 402 railway motors, one 500-Kw. revolving field generator, one 300-Kw. rotary converter, three 110-Kw. and three 150-Kw. transformers and the necessary switchboard apparatus. The new officers of the company, elected at the recent meeting of the Board of Directors, are as follows: Pres., W. Murray Crane, Pittsfield; 1st Vice-Pres., Dr. F. A. C. Perrine, Pittsfield; 2d Vice-Pres., M. D. Barr, New York; 3d Vice-Pres., S. N. Hammill, New York; Treas., W. W. Gamwell, Pittsfield; Asst. Treas., R. S. Murray, Pittsfield; Secy., W. S. Westover, New York; Asst. Secy., A. G. Davis, New York.

The Ball Engine Co., Erie, Pa., reports receiving the following orders: Engine for electric plant for Central Connellsville Coke Co., New Salem, Pa.; Excelsior Springs, Mo., Electric Light Co., two 135-H.-P. tandem compound engines to be direct connected to General Electric generators.

The Salt Lake Electric Supply Co., Utah agents for the Nernst Lamp Co., of Pittsburgh, has recently secured the lighting contract for the large department store of the Keith-O'Brien Dry Goods Co., Salt Lake City.

J. B. d'Homergue, manager of the Keystone hair insulator department of the H. W. Johns-Manville Co., sailed on March 30 for England, where he will investigate the trade for asbestos and sound-deadening materials in that country. Upon his return, about May, he will be permanently located in New York.

The electrical and mechanical engineering business of the late A. M. Patitz has been acquired by the Newton Engineering Co., Hathaway Bldg., Milwaukee, Wis., which has extended its business of structural and civil engineering to include hydraulic and electric power plants, and water works.

The Columbus Steel Rolling Shutter Co., Columbus, O., has the following orders now in its shops for delivery this month: Flaherty & Co., warehouse, Dayton, O.; Lane & Bodley Co., core ovens, Cincinnati, O.; Hocking Valley Ry., freight sheds, Fultonham, O.; Fredrick Jaeger, warehouse, Columbus, O.; Webster Tomlinson, Archt., warehouse for E. A. Cook, Chicago; Nashville, Chattanooga & St. L. Ry., interlocking tower station, Nashville; C. P. Finley, Mfgrs.' Agt., warehouse Mutual Realty Co., St. Louis, aggregating 58 openings.

The Lombard Water Wheel Governor Co., of Boston, reports that the demand is good for its water-wheel governors. Recently closed orders include the following: Cascade Electric Co., of Berlin; Redlands, Cal., Elec. Light & Power Co.; Brattleboro, Vt., Gas Light Co.; Ware Shonis Mfg. Co., Laurens, S. C. (including 4 hydraulically balanced relief valves); Masonville, R. I., Woollen Co.; Athens, Ga., Elec. Ry. Co.; Ludlow, Mass., Mfg. Associates; Sebasticook, Me., Power Co.; Niagara Falls, N. Y., Power Co.; Lynchburg, Va., Water Power Co. (with 4 electric speed controllers); Public Works Co., Bangor Me. (with electric speed controllers); Zanesville, O., Electric Lt. & Pr. Co. (with electric speed controllers); Canadian Elec. Lt. Co., Levis, Que.; Victor M. Braschi & Bro., City of Mexico; Sacramento Electric, Gas & Ry. Co. (with electric speed controller); Valley Counties Power Co., of California (with electric speed controllers); also some governors ordered through dealers for destinations unknown.

The American Tinplate Co. has just sent its 25th order for oil filters to the Burt Mfg. Co., Akron, O., making 30 filters now in use in its works.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Apr. 14.	Waterbury, Conn.	Apr. 11
Apr. 14.	Agricultural College, Mich.	Apr. 11
Apr. 14.	Tower, Marshall, Tex.	Mar. 28
Apr. 15.	Pipe, etc., Kansas City, Mo.	Apr. 11
Apr. 15.	Dexter, Me.	Apr. 11
Apr. 15.	Smithville, Ga.	Apr. 11
Apr. 15.	Toronto, Ont.	Apr. 11
Apr. 15.	Enfield, N. H.	Mar. 28
Apr. 15.	Wilmington, O.	Mar. 28
Apr. 16.	Evanston, Ill.	Apr. 11
Apr. 16.	Cleveland, O., Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 17.	Reservoir, Benwood, W. Va.	Apr. 11
Apr. 20.	Engine, Tarentum, Pa.	Apr. 11
Apr. 20.	Engines, Kansas City, Mo.	Apr. 11
Apr. 20.	Oakland City, Ind.	Mar. 21
Apr. 22.	Norwalk, Conn.	Apr. 11
Apr. 24.	Cleveland, O.	Apr. 4
Apr. 24.	Minneapolis, Minn.	Apr. 4
Apr. 27.	Tacoma, Wash.	Apr. 11
Apr. 27.	Willipeg, Man., Adv. Mar. 28, Apr. 4.	Mar. 27
Apr. 27.	Cleveland, O.	Apr. 4
Apr. 30.	Strathroy, Ont.	Apr. 11
May 1.	Chinook, Mont.	Feb. 7
May 2.	Ft. D. A. Russell, Wyo.	Apr. 4
May 5.	Atlantic City, N. J.	Apr. 11
May 7.	Newark, N. J.	Apr. 4
May 8.	Cheyenne, Wyo.	Apr. 11
May 12.	Toronto, Ont.	Mar. 21
Aug. 1.	Allegheny, Pa.	Apr. 4
———	Quincy, Mass.	Mar. 28
———	Lonaconing, Md.	Mar. 28
	SEWERAGE AND SEWAGE DISPOSAL.	
Apr. 13.	Middletown, N. Y.	Apr. 11
Apr. 14.	Toronto, Ont.	Apr. 11
Apr. 14.	Columbus, O., Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 15.	Chicago, Ill.	Apr. 11
Apr. 15.	Baltimore, Md.	Apr. 11
Apr. 15.	Amsterdam, N. Y., Adv. Apr. 4.	Apr. 4
Apr. 15.	Glenville, O.	Mar. 28
Apr. 16.	Long Island City, N. Y.	Apr. 11
Apr. 16.	Evanston, Ill.	Apr. 11
Apr. 20.	South Orange, N. J.	Apr. 11
Apr. 21.	New York, N. Y.	Apr. 11
Apr. 21.	Trenton, N. J.	Apr. 4
Apr. 22.	Cincinnati, O.	Apr. 4
Apr. 23.	Cleveland, O.	Apr. 4
Apr. 23.	Rockford, Ill.	Apr. 11
Apr. 28.	St. Louis, Mo.	Apr. 11
Apr. 28.	Cape May, N. J.	Mar. 28
May 1.	Ft. D. A. Russell, Wyo.	Apr. 4
May 2.	Crookston, Minn.	Apr. 4
May 4.	Ft. Missoula, Mont.	Apr. 11
May 4.	Ardmore, Pa., Adv. Apr. 11.	Apr. 11
May 5.	Olathe, Kan.	Apr. 11
May 12.	Beaumont, Tex., Adv. Apr. 11.	Apr. 11
May 15.	Tonah, Wis.	Apr. 4
Apr. —	Crookston, Minn.	Feb. 21
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
———	Port Huron, Mich.	Mar. 14
	BRIDGES.	
Apr. 14.	Beaver City, Neb.	Apr. 11
Apr. 14.	Columbus, O.	Mar. 14
Apr. 14.	Boston, Mass., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 15.	West Union, O.	Apr. 11
Apr. 15.	Flintstone, Md.	Apr. 4
Apr. 16.	New York, N. Y.	Apr. 11
Apr. 16.	Saginaw, Mich.	Apr. 4
Apr. 16.	Scottsdale, Pa.	Mar. 28
Apr. 16.	Indianapolis, Ind.	Apr. 4
Apr. 17.	Covington, Ind.	Apr. 4
Apr. 18.	Cleveland, O.	Apr. 4
Apr. 20.	Janesville, O.	Mar. 28
Apr. 21.	Bloomington, Neb.	Apr. 4
Apr. 22.	Spencer, Ind.	Apr. 4
Apr. 25.	Dayton, O.	Apr. 4
Apr. 27.	Coshocton, O.	Apr. 11
Apr. 29.	South Bend, Ind.	Apr. 11
May 1.	Indianapolis, Ind.	Apr. 11
May 4.	Quincy, Cal.	Mar. 28
May 5.	Atlantic City, N. J.	Apr. 11
May 7.	Columbus, O.	Apr. 11
May 18.	Fredericton, N. B.	Apr. 4
	PAVING AND ROADMAKING.	
Apr. 13.	Ocean City, N. J.	Apr. 11
Apr. 13.	Waterloo, Ia.	Apr. 11
Apr. 13.	Worcester, Mass.	Apr. 11
Apr. 13.	Oil City, Pa.	Apr. 11
Apr. 14.	Freeport, Ill.	Apr. 11
Apr. 14.	Toronto, Ont.	Apr. 11
Apr. 14.	Trenton, N. J.	Mar. 28
Apr. 14.	St. Louis, Mo.	Apr. 4
Apr. 14.	Massillon, O.	Mar. 28
Apr. 14.	Terre Haute, Ind.	Apr. 4
Apr. 14.	New York, N. Y.	Apr. 4
Apr. 14.	St. Louis, Mo.	Apr. 4
Apr. 14.	Marion, Ind.	Apr. 4
Apr. 15.	Chicago, Ill.	Apr. 11
Apr. 15.	Baltimore, Md.	Apr. 11
Apr. 15.	South Bend, Ind.	Apr. 11
Apr. 15.	Vallsburg, N. J.	Apr. 11
Apr. 15.	Glenville, O.	Apr. 4
Apr. 15.	Des Moines, Ia.	Mar. 28
Apr. 15.	Traverse City, Mich. Adv. Mar. 14 to 28.	Mar. 14
Apr. 16.	Long Island City, N. Y.	Apr. 11
Apr. 16.	Evanston, Ill.	Apr. 11
Apr. 16.	Stratford, Ont.	Apr. 11
Apr. 16.	Williamsport, Pa., Adv. Mar. 28, Apr. 4.	Mar. 28
Apr. 16.	Stratford, Ont.	Apr. 4
Apr. 16.	Findlay, O.	Mar. 21
Apr. 17.	Kalamazoo, Mich.	Apr. 4
Apr. 18.	Salem, O.	Mar. 28
Apr. 18.	Evansville, Ind.	Mar. 14
Apr. 18.	Salem, O.	Apr. 4
Apr. 20.	Washington, Ind.	Apr. 11
Apr. 20.	Derry, N. H.	Apr. 11
Apr. 20.	Cincinnati, O.	Mar. 28
Apr. 20.	New Albany, Ind.	Mar. 28
Apr. 20.	Louisville, Ky.	Apr. 4
Apr. 21.	Linton, Ind.	Apr. 11
Apr. 21.	Massillon, O.	Apr. 11
Apr. 21.	Tampa, Fla.	Apr. 11
Apr. 21.	Nevada, Mo.	Mar. 28
Apr. 21.	Cincinnati, O.	Mar. 28
Apr. 21.	Shawnee, Okla. Ter. Adv. Mar. 21 to Apr. 11.	Mar. 21
Apr. 22.	Holland, Mich.	Apr. 11
Apr. 23.	Lakewood, O.	Apr. 11
Apr. 26.	Vallejo, Cal.	Apr. 4
Apr. 27.	Lafayette, Ind.	Mar. 28
Apr. 28.	Cape May, N. J.	Mar. 28
May 1.	Cincinnati, O.	Apr. 11
May 4.	Newton, N. J.	Apr. 11
May 4.	Johnstown, N. Y.	Apr. 11
May 5.	Lisbon, O.	Apr. 11
May 5.	Marion, Ind.	Apr. 4
May 14.	Norfolk, Va., Adv. Apr. 11.	Apr. 11
———	Muncie, Ind., Adv. Mar. 21.	Mar. 21
	POWER, GAS AND ELECTRICITY.	
Apr. 14.	Columbus, O.	Apr. 11
Apr. 15.	Wilmington, O.	Mar. 28
Apr. 15.	Liverpool, N. S.	Mar. 28
Apr. 16.	Brooklyn, N. Y.	Apr. 11
Apr. 20.	Binghamton, N. Y.	Apr. 11
Apr. 20.	Great Falls, Mont.	Apr. 4
Apr. 24.	Columbus, O.	Apr. 11
May 11.	Toronto, Ont., Adv. Apr. 4, 11.	Apr. 4
May 12.	Copenhagen, Denmark	Apr. 4
Jun. —	North Yamkill, Ore.	Apr. 4
	GOVERNMENT WORK.	
Apr. 13.	Ft. McKinley, Me. Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 14.	Boston, Mass.	Apr. 11
Apr. 14.	Pensacola, Fla.	Apr. 11
Apr. 14.	Portland, Me., Adv. Mar. 21 to Apr. 11.	Mar. 21
Apr. 14.	Washington, D. C. Adv. Mar. 14 to Apr. 4.	Mar. 14
Apr. 15.	New York, N. Y. Adv. Mar. 21 to Apr. 11.	Mar. 21
Apr. 15.	Ft. Greble, R. I. Adv. Mar. 21 to Apr. 11.	Mar. 21
Apr. 15.	Norfolk, Va., Adv. Mar. 21, Apr. 4.	Mar. 21
Apr. 15.	Pineridge, S. D.	Mar. 21
Apr. 16.	Washington, D. C.	Apr. 11
Apr. 16.	Hot Springs, Ark.	Apr. 11
Apr. 16.	Ft. Washington, Md.	Mar. 28
Apr. 16.	Ft. Hunt, Va.	Mar. 28
Apr. 16.	Cherokee, N. C.	Apr. 4
Apr. 17.	Leavenworth, Kan.	Apr. 11
Apr. 17.	Philadelphia, Pa.	Mar. 28
Apr. 17.	St. Augustine, Fla. Adv. Feb. 21, Mar. 7, 21 to Apr. 11.	Feb. 21
Apr. 18.	Ft. Hancock, N. J.	Mar. 28
Apr. 18.	Charleston, S. C.	Apr. 4
Apr. 20.	Juneau, Alaska	Apr. 11
Apr. 20.	Boston, Mass.	Mar. 28
Apr. 20.	Ft. Ringgold, Tex. Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 20.	Ft. Barrancas, Fla.	Mar. 28
Apr. 20.	New York, N. Y. Adv. Mar. 21 to Apr. 11.	Mar. 21
Apr. 20.	Ft. McKinley, Me., Adv. Apr. 4, 11.	Apr. 4
Apr. 21.	Springfield, S. D.	Apr. 4
Apr. 21.	Ft. Dade, Fla., Adv. Apr. 4, 11.	Apr. 4
Apr. 22.	New York, N. Y. Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 22.	Nashville, Tenn. Adv. Mar. 21, 28, Apr. 11.	Mar. 21
Apr. 22.	Ft. Fremont, S. C.	Apr. 4
Apr. 23.	Ft. D. A. Russell, Wyo.	Mar. 28
Apr. 23.	New York, N. Y. Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 23.	New London, Conn. Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 23.	Ft. Lawton, Wash.	Apr. 4
Apr. 24.	Marquette, Mich. Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 24.	Port Townsend, Wash., Adv. Apr. 4, 11.	Apr. 4
Apr. 24.	San Francisco, Cal.	Apr. 4
Apr. 25.	New Brunswick, N. J.	Apr. 11
Apr. 25.	Ft. Gaines, Ala., Adv. Mar. 28.	Mar. 28
Apr. 25.	Boston, Mass.	Mar. 28
Apr. 27.	Richmond, Ky.	Apr. 4
Apr. 28.	Denver, Colo., Adv. Mar. 28 to Apr. 11.	Mar. 28
Apr. 29.	Grand Junction, Colo.	Apr. 11
Apr. 30.	Tongue River Agency, Mont.	Apr. 11
Apr. 30.	Portland, Ore.	Mar. 28
Apr. 30.	Washington Barracks, D. C. Adv. Apr. 4, 11.	Apr. 4
Apr. 30.	Kalamazoo, Mich., Adv., Apr. 4.	Apr. 4
Apr. 30.	Norfolk, Va., Adv. Apr. 11.	Apr. 4
May 1.	Rapid City, S. D.	Apr. 11
May 1.	West Point, N. Y., Adv. Apr. 4, 11.	Apr. 4
May 1.	Boston, Mass.	Apr. 4
May 4.	Ft. Brady, Mich.	Apr. 11
May 4.	Catlettsburg, Ky., Adv. Apr. 4, 11.	Apr. 4
May 4.	Memphis, Tenn.	Apr. 4
May 5.	Greensboro, N. C., Adv. Apr. 4, 11.	Apr. 4
May 6.	Grand Rapids, Mich., Adv. Apr. 11.	Apr. 11
May 6.	Norwich, Conn.	Apr. 4
May 12.	New Orleans, La.	Apr. 11
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 15.	Manila, P. I., Adv. Mar. 14 to Apr. 11.	Mar. 14
	BUILDINGS.	
Apr. 14.	School, Columbia, S. C.	Apr. 11
Apr. 14.	Hospital, Windsor, N. S.	Apr. 11
Apr. 14.	Pub. Bldg., Moundsville, W. Va.	Apr. 11
Apr. 14.	School, Mansfield, O.	Mar. 28
Apr. 14.	School, Decatur, Ill.	Apr. 4
Apr. 14.	Jail, Merced, Cal.	Apr. 4
Apr. 15.	Pub. Bldg., St. Louis, Mo.	Apr. 11
Apr. 15.	School, Alexandria, La.	Apr. 11
Apr. 15.	School, Peabody, Mass.	Apr. 11
Apr. 15.	Town hall, Athens, Ont.	Apr. 11
Apr. 15.	Hotel, Baton Rouge, La.	Apr. 11
Apr. 15.	Bath house, New Haven, Conn.	Apr. 11
Apr. 15.	School, Beverly Farms, Mass.	Apr. 11
Apr. 15.	School, New Bedford, Mass.	Mar. 28
Apr. 15.	Library, Olney, Ill.	Mar. 28
Apr. 15.	Court house, Coraicana, Tex.	Mar. 14
Apr. 15.	Church, Liberty, Ind.	Apr. 4
Apr. 15.	Church, Union, S. C.	Apr. 4
Apr. 16.	Court house, Monroeville, Ala.	Mar. 28
Apr. 16.	Pub. Bldg., Lisbon, O.	Mar. 28
Apr. 16.	Court house, Greenburg, Pa.	Apr. 4
Apr. 16.	Bus. Bldg., Dennison, O.	Apr. 4
Apr. 17.	School, Mayville, N. D.	Apr. 11
Apr. 17.	Engine houses, Long Island City, N. Y.	Apr. 11
Apr. 17.	Opera house, Albuquerque, N. M.	Apr. 11
Apr. 17.	School, New Haven, Conn.	Apr. 11
Apr. 17.	Hospital, New York, N. Y.	Apr. 4
Apr. 18.	Steel cells, etc., Wilkesbarre, Pa.	Apr. 11
Apr. 18.	School, Bowling Green, O.	Apr. 11
Apr. 18.	Library plans, Missoula, Mont.	Apr. 11
Apr. 18.	Church, etc., Holyoke, Mass.	Apr. 4
Apr. 19.	School, St. Clair, Pa.	Mar. 28
Apr. 20.	Court house plans, Greencastle, Ind.	Apr. 11
Apr. 20.	School, Brooklyn, N. Y.	Apr. 11
Apr. 20.	School, Long Island City, N. Y.	Apr. 11
Apr. 20.	Schools, New York, N. Y.	Apr. 11
Apr. 20.	Round house, Algiers, La.	Apr. 11
Apr. 20.	Church, North Bay, Ont.	Apr. 11
Apr. 20.	Library, Jacksonville, Fla.	Mar. 28
Apr. 20.	School, Cleveland, O.	Mar. 28
Apr. 20.	School, Reedsburg, Wis.	Mar. 28
Apr. 20.	School, Schenectady, N. Y.	Apr. 4
Apr. 21.	School, Camden, N. J.	Apr. 11
Apr. 21.	Pub. Bldgs., Great Bend, Kan.	Apr. 4
Apr. 22.	Pub. Bldgs., Texarkana, Ark.	Apr. 4
Apr. 23.	School, Mansfield, O.	Apr. 4
Apr. 23.	Hospital, Gallipolis, O.	Apr. 4
Apr. 24.	School, Chicago, Ill.	Apr. 11
Apr. 24.	Asylum, Attica, Ind.	Apr. 11
Apr. 24.	Library, Denison, Ia.	Apr. 11
Apr. 25.	Fire station, Youngstown, O.	Apr. 11
Apr. 25.	School, Sarnia, Ont.	Apr. 4
Apr. 27.	Pub. Bldg., Akron, O.	Apr. 11
Apr. 27.	School, Olivia, Minn.	Apr. 4
Apr. 28.	Library, Cleveland, O.	Apr. 11
Apr. 29.	Pub. Bldg., St. Louis, Mo.	Apr. 11
Apr. 30.	School, Deseronto, Ont.	Apr. 11
May 1.	Hospital, Toledo, O.	Apr. 11
May 1.	Pub. Bldg., Springfield, O.	Apr. 11
May 1.	Bus. Bldg., Newcastle, N. B.	Apr. 11
May 1.	School, Le Sueur, Minn.	Apr. 11
May 1.	School, Hamilton, O.	Apr. 4
May 2.	School, Rome, Ia.	Apr. 11
May 4.	Court house, Albany, Ga.	Apr. 11
May 4.	Court house, Abbeville, Ga.	Mar. 21
May 8.	Hltg. Court house, Shakopee, Minn.	Mar. 28
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21 to Apr. 4.	Mar. 21
———	Court house, Wray, Colo.	Mar. 21
	MISCELLANEOUS.	
Apr. 14.	R. R. Work, Philadelphia, Pa.	Apr. 11
Apr. 14.	Pier, New York, N. Y.	Apr. 11
Apr. 14.	R. R. Work, Beckley, W. Va.	Mar. 21
Apr. 15.	St. Sprinkling, Indianapolis, Ind.	Apr. 11
Apr. 15.	St. Sprinkling, La Crosse, Wis.	Apr. 4
Apr. 17.	Riprap, New York, N. Y.	Apr. 11
Apr. 17.	Garb. Disp., Brooklyn, N. Y.	Apr. 11
Apr. 17.	Harbor work, Quebec, Que.	Mar. 28
Apr. 18.	El. Ry., Toronto, Ont.	Apr. 11
Apr. 20.	Ity. Work, Cincinnati, O.	Apr. 11
Apr. 20.	St. R. R. franchise, San Jose, Cal.	Mar. 28
Apr. 21.	Dredging, New York, N. Y.	Apr. 11
Apr. 24.	Pier, Brooklyn, N. Y.	Apr. 11
Apr. 30.	Dredging, Honolulu, H. I.	Mar. 28
May 1.	Dam, Hartford, Vt.	Apr. 11
May 1.	St. Cleaning, etc., Washington, D. C. Adv. Apr. 4, 11.	Apr. 4
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21
May 20.	Dredging, Falmouth, Jamaica	Apr. 11

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A Review of Bridge Construction.

It is sometimes interesting, and instructive as well, to follow developments by the historical presentation of an art; and reviews sometimes suggest new views, which in turn lead to further advances in development. In the preceding issue, under the general title, "Types and Details of Bridge Construction," was commenced the publication of a series of articles which are intended to practically summarize the descriptions of bridge design which have appeared in The Engineering Record for the past fifteen years. The series will substantially cover the field of modern American steel bridge construction, which is more highly perfected than that of any other country. The succeeding chapters will also contain some special examples of foreign construction and some descriptions of important American bridges never before described in American periodicals. The details which have previously been published are here treated with a special view to bringing out only their important features, and are for this purpose generally redrawn and have their characteristics emphasized.

The series will present a full treatment of arch trusses, spandrel-braced arches and plate-girder arches, from short to longest spans; plate girders, and the floor systems of different classes of railroad and highway bridges. Along these lines it will provide a valuable record of standard practice and special details of design which will be of value for demonstration and reference, and will afford examples of features to be adopted, modified or avoided, as the case may be. The articles are believed to cover a field never before systematically or at all completely covered, and should be of considerable value to all structural engineers.

The Steam Turbine.

That the steam turbine has assuredly arrived as a potent factor in the selection of machinery in the modern steam power plant has received further proof, if, indeed, that was needed, in the announcement a fortnight ago by an engineer of the General Electric Company that 230,000 horse-power of Curtis turbines had already been contracted for. That several power stations designed to receive these turbines should be in process of construction before the general engineering community is in possession of anything but meager details of the machine in question shows, if nothing else, the confidence that has been inspired as to the availability and practicability of the steam turbine as a prime mover. The satisfactory performance of the turbines built a few years ago, which bear the distinction of being first productions that are economical both in steam consumption and in maintenance charges, together with the fact that many engineers have lately devoted themselves to the development of the turbine have largely been responsible for the present status of the steam turbine industry.

Like the advent of its best known contemporaneous turbines, the de Laval and the Westinghouse-Parsons turbines, the Curtis turbine has brought to the steam engineering field some remarkable possibilities. Like them, from the commercial aspect, great economies can be claimed for it in the relation of floor space to horse-power, in the relation of quantity and, consequently, cost of foundation material to horse-power, in the relation of head-room and, consequently, cubic contents of the engine room to horse-power, and in the relation of the cost of power house building to horse-power. For example in a certain modern power station equipped with eight 5,000-horse-power direct-connected electric generating units more than forty turbines could apparently be installed, allowing the same clear floor space between units. This rough calculation would indicate that the same number and capacity of turbo-electric units would occupy less than one-fifth the floor area taken up with the steam engine units, now in operation, and allowing the same clear head-room over the machines, would require a building a little more than one-half as high. This means that the cubic contents of a turbine plant would not be much more than one-tenth of those required for an engine plant of the same capacity. It must be remembered that these figures are based on the large plant in question and without consideration of any details.

From the more scientific point of view, the new turbine seems, among other things, to have yielded to the efforts of the designer to secure a speed, which for steam turbines is low, and promises remarkable steam economies and the adoption of a very high vacuum. While high speed is, of course, a desired requirement so far as the size and cost of the electric machine is concerned, there is a conservative speed which is regulated by the strength of materials making up the unit. It will hardly be necessary, however, to discuss the considerations of the speed of a turbine, or its valuable property of regular angular velocity, so advantageous in the parallel operation of alternating-current machinery, or the easily acquired flywheel effect of its rotating members, so needed in meeting sudden changes of load. The 500-kilowatt Curtis turbine is credited with a speed of 1,800 revolutions per minute, and the 5,000-kilowatt turbine, with 500 revolutions.

As to its steam economies there is likewise the indication that it, too, is a machine capable of operating in a highly economical manner at light as well as at full load. One of the curves shown in the paper, abstracted in the preceding issue, gives the water consumption of a 600-kilowatt machine running at 1,500 revolutions per minute, corresponding, it may be mentioned, to a peripheral speed of 420 feet per second. The steam pressure is 140 pounds and the vacuum is given as 28.5 inches, a notable degree of vacuum when it is recalled that steam at that pressure occupies about 1.85 times the bulk that steam does at 27 inches of vacuum. At 700 kilowatts load, the water rate as taken from the curve is equivalent to 14.21 pounds per electrical horse-power per hour; at 600 kilowatts, 14.28 pounds; at 300 kilowatts, 15.19; and at 150 kilowatts, 16.9, a difference in economy between one-quarter and full load of only about 18 per cent. For superheating, economies are indicated of 1 per cent. gain in the steam consumption corresponding to every 11.7 degrees of superheat; and in increasing the vacuum, 1 inch appears equal to effecting a gain of 3.7 per cent. in the steam consumption. The expectation appears to be that with 200 pounds steam pressure, 28.5 inches of vacuum and 150 degrees superheat, an electrical horse-power-hour will be developed by about 12 pounds of steam. To compare this performance with the steam engine unit, the water rate as usually referred to the indicated horse-power will have to be reduced in accordance with the combined efficiency of the engine and electric machine.

A Development in Engineering Practice.

Things do not merely happen; there are reasons for what comes to pass. Useful experience can be read in the history of successful undertakings, and biography is often very interesting and instructive. Architecture has had a body of educated professional men for a great many years, and there have been several generations of civil engineers trained in the schools; yet only twenty-five years ago there was hardly to be found in America a man who could be designated a mechanical engineer, in the present acceptance of that term. There were many skilful and resourceful mechanics, some men versed in the sciences and a few civil engineers whose practice led them into the fields now recognized as the peculiar province of the mechanical engineer. By the later seventies the polytechnic institutes had graduated several classes of men trained in the fundamental principles of dynamical engineering, and the results were evident. Mechanical engineering differs in several essentials from civil engineering and architecture, and so there have been certain phenomena in its development not observed in the kindred professions.

In general, mechanical arts are much more precise in their daily work than the arts which bring into physical existence the conceptions of the civil engineer and the architect. In the former, there is a peculiar exactness of detail underlying the integrity of the whole, while many works of the latter depend more upon the correct relation of grosser elements. Tools and machines of great precision are essential to the one; but more or less crude construction operations are sufficient for the execution of many of the equally ingenious and even more impressive works of the latter. To a greater degree in mechanical engineering than in other branches is intimate connection with the art, through experience or close contact, highly necessary to success; and the practice of the pro-

fession is closely linked to the business of manufacturing. Hence it naturally came about that many of the men who early entered mechanical engineering became constructors as well as designers; some as contractors, while many others became identified with manufacturing industries. Their pecuniary rewards were usually greater than those of the men who essayed to keep professional practice divorced from commercial work. For example, some men found it more profitable to sell engines than to give advice and furnish designs, and being alert and having an engineering education they discovered that many things in power plants were not as they should be. In order that an engine might give satisfactory performance it was necessary for the other parts of the plant to be well designed and built, and so for the sake of selling engines more successfully it became profitable to make suggestions about other parts of the plant; and as this service cost the seller something and was valuable to the purchaser, it became possible to make the profit margin on the engine sale broad enough to cover the, unrecognized, engineering service.

For years it had been thought that the proper and only men to install engines were the mechanics from the engine building works; and any handy man could do piping. But in time it was discovered that men from the technical schools or with equivalent training, who knew engines but had not necessarily built their parts, men with a broader knowledge of the requirements of the plant as a whole, men with some executive ability and power to get things done, and who besides possessed those qualities and attainments that made them acceptable and helpful to the buyers of power equipments could install power plants more successfully than the journeyman mechanic. Thus, almost unconsciously, under the guise of selling engines, corps of trained engineers were gotten together and given an experience which particularly fitted them not only to install engines and accessories, but to give sound advice about the design and equipment of the entire plant. From this it was an easy step to selling the other accessories, and finally to the engineering production of entire properties from the inception of the design to the completed construction. Gradually the engineering element became more prominent and distinct, and the wisdom of carefully preparing plans, making close estimates and writing reasonable and thorough specifications, all based on actual constructive experience, became more evident.

It came to be recognized in time that an organization which was prepared not merely to design and advise, but also to execute, and which contained men who had done or personally directed the doing of the various kinds of work required to create a large plant was particularly well fitted to be trusted with, and held responsible for, all the operations of a large undertaking. And so when several years ago a large railroad terminal was to be built and equipped in one of the principal eastern cities, such an engineering concern was asked to say whether it would undertake the entire responsibility for the design and construction of the mechanical equipment. After concentrating its composite experience and ability upon the problem, the concern presented complete plans and specifications and definite advice for the varieties of mechanical work required, from switch and signaling and track equipment through some fifteen or more features to baggage hoists and lights. The plans were adopted and the work performed. The results, as well as the methods adopted, compelled the attention, not of engineers alone, but also of the managers of other properties requiring engineering talent; and at the same time it revealed to the concern which had seized the opportunity the strength which it had accumulated, but had hitherto only partially realized.

Throughout this development the importance of high grade engineering as a necessary preliminary to successful and economical construction has become constantly more apparent. As a means to attaining the most expeditious and economical construction, methods have gradually developed by which more time and study are expended upon the preparation of complete, fully elaborated and accurate plans than heretofore customary, at greater expense, to attain ultimate economy. All this is impersonally rehearsed believing that sufficient time has now passed to warrant some lessons by generalization upon facts of record. Similar pathways are being traveled by others and some will, doubtless, in time lead to success. One danger is that many looking upon the notable successes and desiring to quickly reap the rewards forget, and seek to eliminate, the years of preparation required to build up the capacity for such work in so substantial a way that it will be competent and inspire confidence.

While this development of organization, capable not only of designing but also of doing, has taken place first and to a very advanced degree in the mechanical branch of the profession, because of the nature of the work, similar tendencies are discernible in the civil engineering field; and it is highly probable that in certain classes of architecture, also, a like course will be run in time. In mill engineering a nearly parallel development has already occurred. There are a number of advantages in this method of handling engineering work. Various economies are possible. Responsibility is concentrated and business relations are simplified. Much friction is avoided and personal misunderstandings, differences of opinion and jealousies are largely eliminated. Advantage is had of accumulated experience and data. The various parts of the work, although directed by expert specialists, are harmonized by central control; and the men, from previous association, at least for the major part, are mutually acquainted, and collaborate intelligently with a degree of sympathy made possible only by intimate association and by kindly appreciation by each of the qualifications of the others. In this way alone can proper harmony of the different elements of the plant be secured. The assembling of materials and men for the economical, rapid and orderly construction of great works demands special talents and facilities, and can be better secured by an organization directly connected with the business end of the operations, having men who devote their time to this feature, than by an individual acting in a strictly professional capacity. Furthermore the presence of such engineering concerns makes constantly and instantly available existing departments fully organized and well trained for the performance of special work required at times by the managers of great properties, thus avoiding the necessity for the assembling, organizing and training of special corps of engineers when new works or extensive improvements are projected, with the risk of consequent delays, mistakes and losses.

While, as an outcome of this development, large fields are being occupied by engineering concerns, there are other large fields which these organizations can hardly invade successfully and which will always remain peculiarly the province of the private practitioner. These fields, however, are already so well known, and are occupied by so many men of high attainments that it is unnecessary to point them out.

From selling and installing small engines to designing and constructing entire industrial works, electric railway properties and the mechanical equipment for the great approach tunnels and terminal facilities of a trunk line entering the National metropolis has not been one short leap, but the outcome of a quarter of a century of experience and development, following step by step the tendencies and requirements of the industrial progress of the times. The views here presented are not vague nor theoretical. They are founded upon the observations that many have recently made of certain practical successes in an engineering line which, by being on the right track, have constantly progressed, serving purposes that needed serving and perhaps even outstripping the intent with which they originated. A philosopher once said "The results of things follow not so much from their state as their tendency," and attention is here directed to a present tendency which has reached such proportions as to become a recognized feature of mechanical engineering.

Official Report on Preservation of Structural Steel in a Tall New York Building.

A brief statement of the condition of the structural steel in the Pabst Building, New York, as exposed by its demolition, was published in The Engineering Record of January 31. During its demolition the building was under constant examination by the engineers of the Department of Buildings, and records were made of the conditions of all parts of the steel framework, and numerous photographs were taken of different members in various stories. Since the publication of the article these data have been made the subject of a report by Mr. Jas. P. Whiskeman, Assoc. M. Am. Soc. C. E., to Mr. Perez M. Stewart, superintendent of buildings, which through his courtesy is reproduced, slightly condensed. The facts established by the report confirm the statements in The Engineering Record as to the excellent condition of the steel work in the upper stories, and the appearance of slight quantities of rust, chiefly at connections, in the vicinity of the elevator shaft and where the columns were enclosed



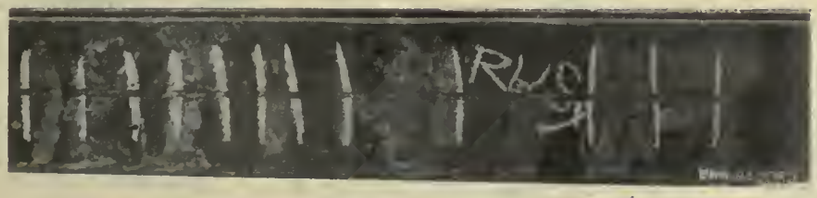
Clean Steel in Seventh and Eighth Stories.

with brick instead of being flushed with mortar. The report describes the substructure work, which was exposed at a later date, and states that the corrosion, although not excessive, was more extensive in the basement than in the upper stories. The building was 108 feet high, 25 feet wide and 54 feet long. The first story front walls were of iron, the second story walls were of limestone and the upper stories were of brick, all supported at each floor by the Z-bar columns.

The fireproof floor arches were of the Roebling system A, type 1, with suspended ceiling. The interior partitions were made of expanded metal, channels and a patent plaster. The outside walls were furred on the inside with hollow brick. The interior columns were encased in hollow terra cotta blocks. The building had a basement and sub-basement, both of which ran out to the curb line on three sides. The basement floor and sidewalk beams and girders were supported by cast iron columns. All columns were supported by cast iron bases resting directly on the rock, with the exception of the north wall columns where the bases were supported on grillage beams which in turn rested on the solid rock. According to the specifications, the steel work before leaving the shop was to be thoroughly cleaned of scale, rust and dirt, and be given one good coat of pure boiled linseed oil worked into all joints and open spaces. All pins, pin-holes and machined surfaces were to be coated with pure white lead and tallow. In riveted work, the surfaces coming in contact were to be painted before being riveted together. Pieces not accessible for painting after erection were to receive two coats of paint. After erection, all excepting the structural work was to have one good coat of paint mixed with pure linseed oil. Grillage beams were to be covered with a coat of liquid asphalt before setting in place. All other structural work was to receive one coat of "Nobrac" before leaving the shops, and after erection an additional coat of the same paint.

The work was begun in October, 1898, and was finished in about one year, constructed in accordance with plans submitted to the department by Henry F. Kilburn, architect. The steel work was erected during the months of December, January, February and March, 1898 and 1899, and was delayed on several occasions on account of snow storms and the severe winter weather. The masons pushed the erectors quite hard part of the time, and this may account for some of the steel not receiving a thorough second coat of paint. About the middle of December, 1902, removal of the structural steel was commenced, and it practically took eight men and one foreman two months. The expanded metal and channels in the partitions were badly rusted throughout the building. They may have been slightly corroded before being put in, and the patent plaster seemed to accelerate this rusting. In the basement floor the ceiling rods had rusted away and the arch centering was more or less rusted on the exposed sides, but not more than would probably develop during the process of drying out. In the basement floor, however, over the refrigerators in the sub-basement vault and in the southeast corner of the vault, the rods holding the ceiling had completely rusted out, the ceiling of the sub-basement was ready to fall almost by its own weight, and the wire cloth was completely gone; but the strength of the concrete floor arches at these points was not affected by the rusting of the temporary centering, and they remained strong and durable. The boiler stack, of 5/16 and ¼-inch sheet steel covered with asbestos, held by galvanized wire mesh imbedded in it was completely covered with rust. It was probably painted with a mineral paint, which the heat had reduced to dust.

After a most careful inspection of the structural steel work, it can safely be said that despite the unfavorable conditions under which the structure was erected, the following examples of corrosion are rather the exception than the rule. The interior beams, girders and columns above the first floor were as a rule free from corrosion, although little patches of rust could be found, more especially along the outer edges of the flanges of the beams, which were probably not properly painted, or here and there along the webs of the beams where the paint was probably scraped off in ramming the concrete, and where rusting set in during the drying out of the concrete. But this slight rusting was certainly a negligible quantity. At some points, where beams were connected to columns or girders, the outline of the connecting angle could be seen in rust. Practically the only point where corrosion was developed in any appreciable quantity was on the inner side of the webs of the channels forming the elevator framing, where they were unprotected by concrete. The illustration shows a channel of the elevator framing where the web was corroded above the chalk line; also that rust had developed on the column where a girder had been connected to it.



Alternate Rust and Clean Steel on Second Story Column.



West Wall Second Story Girder, Rusted over Unpainted Shop Mark.



Channel of Elevator Framing, Rusted below Chalk Line.

As might be expected, the wall girders and columns were most affected, especially those in the north wall. In the fourth, fifth and sixth stories, there was more corrosion than either above or below. This might be due to improper painting in these stories. Corrosion had set in along the outside edges of the flanges of the north wall girders of the fourth floor, which were encased in brickwork with the edges of the flanges within 2 or 3 inches of the outside of the wall. The bent girders around the corners were all more or less slightly corroded, which might be attributed to the fact that the paint was scratched off by the excessive amount of ramming required for the corners. The wall columns showed more corrosion than the wall girders. One from the second story had about four inches of brickwork beyond its extreme outer edge and was protected by 4 inches of hollow brick on the inside. The view of it shows, by chalk lines, alternate layers of rust and clean steel. Where the cement came in contact with the steel it was clean, but the brick did not prevent corrosion. Behind the connections of wall girders to columns or beams to wall girders there was always more or less corrosion; also on the girder seats, illustrating an almost general fact that rust developed where two steel surfaces came in contact.

The only place where corrosion developed in measurable quantity was behind the splice plates of the column connections in the fifth story. Practically the whole of the inside of one splice plate was badly rusted to a thickness of about .02 to .025 inch. Some few column splices in other stories indicated slight rusting. The rusting behind the splice plates of the fifth story columns was due, no doubt, to some local cause, as insufficient painting, or scraping the paint off in bringing the two columns together. The heads of field rivets usually showed rust.

The webs of second story riveted west wall girders, and the edges of their flanges, were badly rusted on the inside. The most logical explanation for this is that probably the rusted points on the web contained the shop marks and were never painted. This is frequently the case, and these spots usually rust in lying around before erection. A 6-inch third-floor beam was badly rusted on an unpainted place. The columns in the first story were in good preservation. The beams in the first floor were good, excepting at the edge of the sidewalk, where they were slightly corroded; the same is true of the columns. One of the basement girders was badly corroded at a beam connection; another was more or less corroded where it rested on a damp wall—a good place for corrosion, and a third between the vault and the main building was badly rusted on the webs and flanges, but where the beam connection had been the steel was clean. The ice-box stood directly over this girder.

The cast iron columns in the basement and sub-basement vaults were in excellent preservation, although the girders adjacent to them were rusted. These columns were covered with ordinary lime mortar held to the column by galvanized wire mesh. The cast iron column bases filled in between the ribs with brick and cement mortar, were not rusted, excepting on the top where they came in contact with the column. The grillage beams in the north wall were in a fair state of preservation. In one

set, the upper half of the beams were slightly rusted. The cast iron in the Firty-second Street portico was well preserved, showing slight rusting at the connections on the interior of columns and where the paint was rubbed off. All the unpainted work in this building—hangers, expanded metal, tie rods and floor rods, lintels, etc.—was more or less rusted.

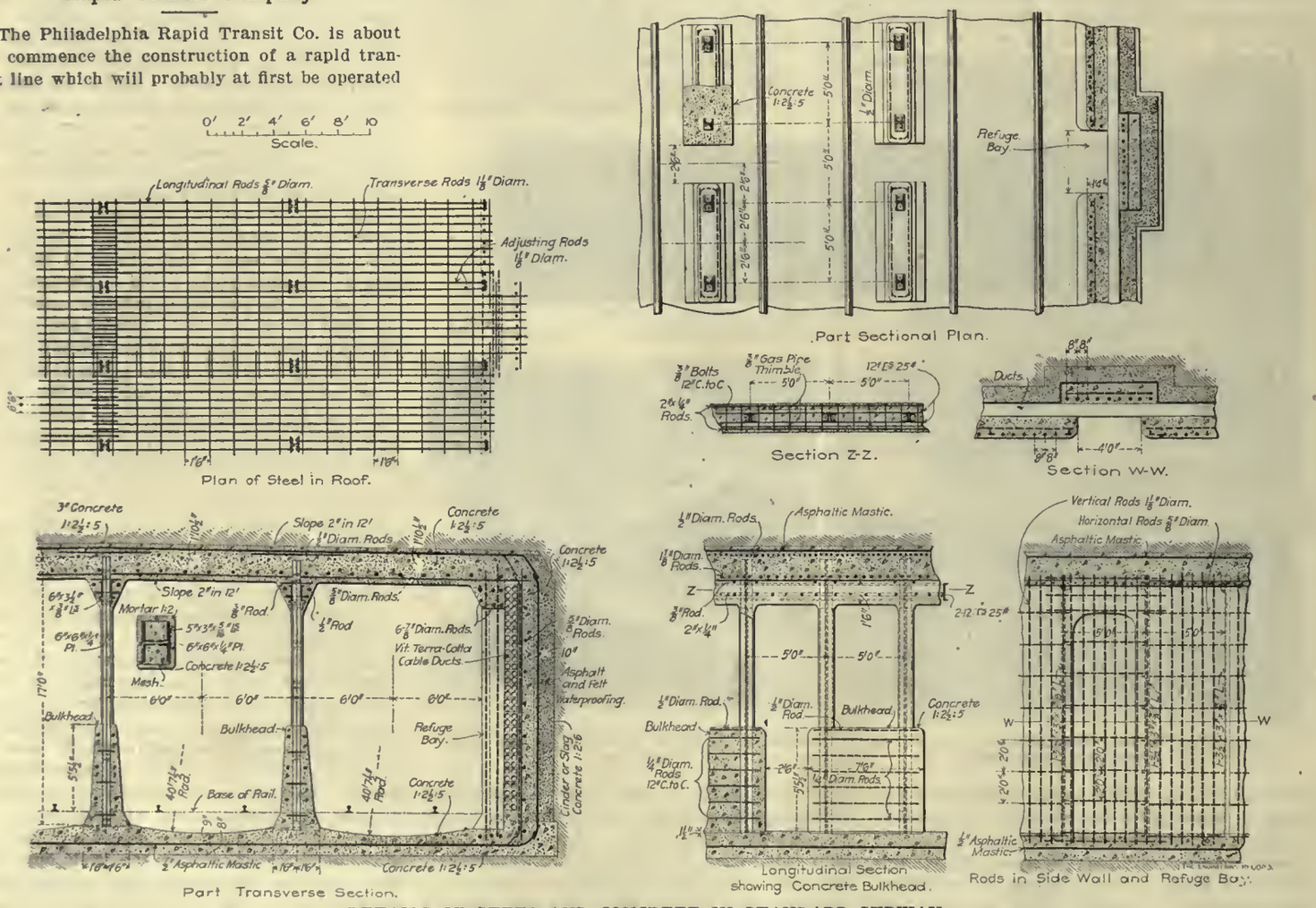
The fact that the grillage beams showed so little rust and that other parts of the building were well preserved indicate that steel can be protected against oxidation under almost all conditions by the proper application of paint or the thorough embedding of the members in concrete. The facts seem to indicate, however, that something more than paint is necessary to protect columns and beams in damp walls below the first story. The other facts brought out are that cast iron withstands rust better than steel; that in the upper stories of buildings the points of connections are very susceptible to rust; that paint is a protection against rust in the upper stories of buildings, and that cinder concrete is a very efficient protection against oxidation.

Subway Structures of the Philadelphia Rapid Transit Company.

The Philadelphia Rapid Transit Co. is about to commence the construction of a rapid transit line which will probably at first be operated from City Hall to Sixty-third and Market Streets, a distance of about five miles, within the next two years. The first construction will consist of an elevated steel viaduct for a portion of the way and of a concrete-steel subway from Front Street to Twenty-third on Market Street. The four-track portion of the line extends from Fifteenth to Twenty-second Street and is designated as section No. 3. Active construction will be immediately commenced. Besides the subway proper, which is essentially a four-track concrete lined tunnel built in open trench, the work will include an underground station, chambers, ducts and mechanical apparatus for drainage and ventilation systems, fire pipe line service, electric ducts, the maintenance of traffic and of existing adjacent structures and the reconstruction of sewers and drains. The total quantities involved include approximately 250,000 yards of excavation, 45,000 yards of concrete and 1,500 tons of steel, and the estimated cost is about $500 per linear foot.

The standard subway construction has an outside width of about 55 feet and a height of 19 feet, with concrete walls about 3 feet thick, concrete roof about 2 feet thick and concrete floor about 17 inches in minimum thickness. The roof slab is a continuous mass of concrete reinforced by longitudinal and transverse horizontal steel rods, respectively ⅝ and 1⅛ inches in diameter and 18 inches and 6 inches apart. It is supported on the side walls and on three longitudinal rows of riveted steel columns having an I-shaped cross section made with four 5x3x5/16-inch angles. These columns have bottom flange angles seated on the concrete floor, and project half way through the roof slab, which is specially reinforced above them by sets of horizontal ½-inch longitudinal rods 6 feet long and 4 inches apart, distributing the column reactions in the concrete. Just below the under side of the roof slab the columns are connected by continuous longitudinal girders each composed of a pair of 12-inch channels field-riveted to their bracket sheives, as shown in the detail. These channels are tied together by horizontal bolts 12 inches apart which project about 6 inches beyond the channel webs on each side to engage a 2x¼-inch round edged flat steel bar and are screwed up against pipe separators. These girders are filled with concrete and concrete is moulded around them to form solid reinforced beams integral with the roof slab.

Bents are 5 feet apart and the columns are connected transversely by pairs of 1⅛-inch horizontal adjustment rods, which have nuts bearing on the insides of the column flanges at the top. The lower ends of the columns are enclosed in solid concrete bulkhead walls 6½ feet long and 3½ feet high above the rail base, alternating with openings 3½ feet long. These bulkheads are reinforced by horizontal longitudinal and transverse rods and are constructed separately from the floor into which they are rabbeted. The side walls are reinforced with 1⅛-inch vertical rods 8 inches apart and ⅝-inch horizontal rods 2 feet apart. In the plane of each bent the vertical rods are replaced by 3x3½-inch angles, and at intervals of 25 feet the wall is recessed to form a refuge niche 4 feet wide and 16 inches deep. The concrete floor has no reinforcement rods and the upper side between columns is concave, practically making inverts with a radius of about 40 feet. The dimensions and arrangement are clearly shown in the general sections and elevations.



DETAILS OF STEEL AND CONCRETE IN STANDARD SUBWAY.

The angles made by the longitudinal beams and the side walls with the roof are filleted, and a connection is made between the concrete in the edges of the roof slab and that in the top of the walls, where there is a reinforcement consisting of a continuous strip of steel wire mesh about 5 feet wide curved to a radius of about 2 feet and bedded in the concrete inside the waterproofing, thus bonding the vertical and horizontal portions together with about 0.09 square inch of steel per lineal foot. In earth excavation the bottom of the trench is

compacted by ramming and rolling and in rock it is concreted to a depth of at least 4 inches, and the surface of the concrete is brushed with grout before waterproofing.

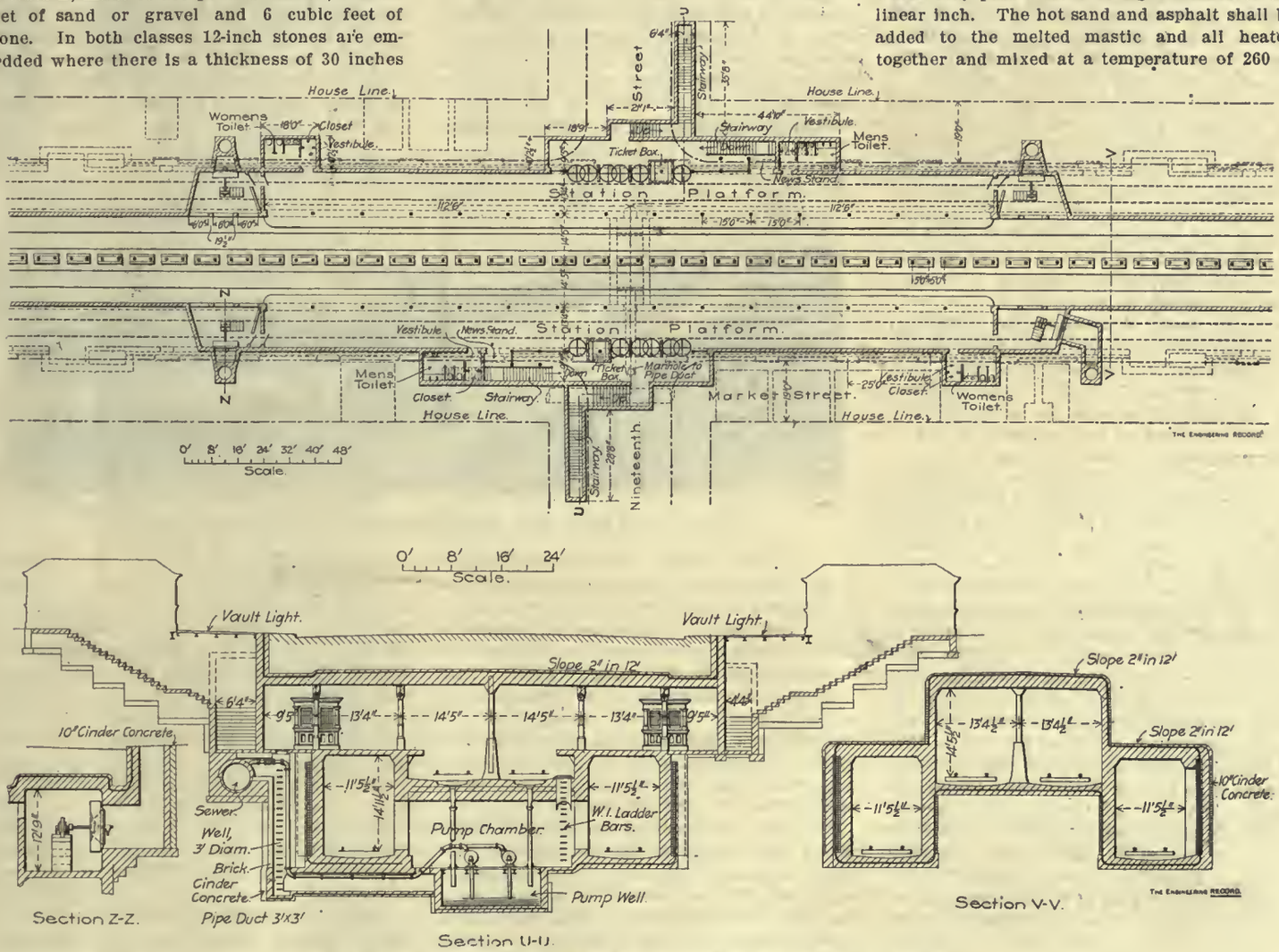
Portland cement concrete in proportions of 1 : 2½ : 5 is used generally throughout the work, except for the outside of the side walls which is made with 1 : 2 : 6 cinder or slag concrete. Portland cement is subject to thorough inspection and testing for fineness, soundness and tensile strength in accordance with the rules recommended by the committee of the American Society of Civil Engineers for uniform tests. In wet foundations grout is made of one part cement and two parts sand, elsewhere it is one part cement and three parts sand. Mortar is made 1 : 3 and is required to develop a tensile strength of 125 pounds per square inch after seven days and 175 pounds after twenty-eight days. The broken stone is crushed to 1 inch and passed over a screen of ¼-inch mesh. Most of the concrete used is of class A made with 100 pounds of cement, 2½ cubic feet of sand or gravel and 5 cubic feet of stone. Where it is used chiefly for filling it is of class B, made of 100 pounds cement, 3 cubic feet of sand or gravel and 6 cubic feet of stone. In both classes 12-inch stones are embedded where there is a thickness of 30 inches or more. Cinder concrete is made of 100 pounds cement, 2 feet of sand or gravel and 6 feet of hard coal cinders broken in 1 inch pieces. Slag concrete is made with 100 pounds of cement, 2 feet of sand or gravel and 6 feet of clean furnace slag broken to 1 inch. The concrete is to be rammed in wooden moulds with smooth faces covered, if necessary, with soap or oil; but after the moulds have been removed the surface of the concrete is to be cleaned and wet and vertically brushed with a thin wash of one part Portland cement and one part sand, repeated if necessary. Iron and steel is required to conform with standard specifications for structural work.

Special pains are taken to insure the continuity of the different sections of concrete and to compact it thoroughly around the shores, braces, etc., supporting the street bridges and conduits, which are left permanently embedded in it. Provision is made for future side walls and bulkheads by inserting beveled forms or blocks in the concrete to make recessed seats to form a bond between them. In the construction of the side walls the sheet pile wales and braces are removed as fast as the concrete is laid, and the vertical ends and upper edges of all wall sections are rabbeted with beveled blocks so as to form bonds locking it with succeeding sections and with the roof. After the columns are set, they are wrapped with steel mesh inside of which the space is filled with 1 : 2½ : 5 Portland cement concrete made with ½-inch stone. Above the bulkhead the steel mesh is plastered with 1:2 cement mortar about 1 inch thick.

Great care is required in the waterproofing which is designed to entirely enclose the subway. The lower layer of the concrete floor and of the concrete roof, together with all their approximately horizontal surfaces are brushed with a 1 : 1 Portland cement grout on which is placed a ½-inch layer of asphalt mastic. The vertical surfaces of the slag concrete outer portions of the sidewalls are painted with Bermudez asphalt dissolved in naptha, and while this is still hot, sheets of tough imperishable felt dipped in asphalt and weighing 0.15 pounds per square foot are ironed on so as to adhere without bubbles. The exposed surface of felt is again painted with hot asphalt, another layer ironed on and so on up to four or six layers. All joints are lapped and broken and the lower edges of the horizontal sheet are lapped outside of the upper edges. This waterproofing is protected by another thickness of concrete or by a tier of ducts in the side walls.

It is required that the refined Bermudez or Alcatraz asphalt shall contain 95 per cent. of natural bitumen soluble in rectified carbon bisulphide or in chloroform and two-thirds of the total bitumen shall be soluble in petroleum naphtha of 70 degrees Baumé specific gravity. The asphalt shall not lose more than 4 per cent. of its weight when maintained for ten hours at a temperature of 300 degrees Fahrenheit. The mastic waterproofing shall be made from Syssel, Limmer, Sicilian or Neuchatel asphalt rock manufactured with Bermudez or Alcatraz asphalt as a flux and made into blocks which shall be melted in the immediate vicinity of the work in the proportion of 70 parts of weight to 10 parts by weight of refined Bermudez or Alcatraz asphalt and 20 parts by weight of sharp sand which may pass a sieve of eight meshes to the linear inch. The hot sand and asphalt shall be added to the melted mastic and all heated together and mixed at a temperature of 260 to 280 degrees Fahrenheit, carried to the work in wooden pails or barrels and spread with wooden spatulas. To prevent danger of explosion the contractors are prohibited from covering with planks or roofing any gas pipes not surrounded by earth, except in very short sections where ample ventilation is provided.

The Nineteenth Street station is wholly under ground and is about 280 feet long and 76 feet wide, exclusive of stairways, and has a total depth of about 44 feet from the bottom of the pump well to the surface of the street. It has



PLAN AND CROSS SECTIONS OF NINETEENTH STREET STATION.

a platform, ticket office, toilet rooms and stairways on each side of the street, the entrance being through small houses built on the sidewalks of the intersecting street, and the general arrangement, as shown in the drawings. The surface cars are not intended to stop at this station and their grades are therefore depressed so that their tracks are run below the station platforms, giving access to the elevated trains on the two center tracks. At the center of the station a pump well and pump chamber are constructed below the center tracks and two 4-inch centrifugal pumps operated by electricity will be installed there to discharge the water which may collect from the tracks and by seepage, through a check valve into the street sewer. At each end of each platform there is, at the level of the upper track, a ventilation chamber in which there will be installed an electric fan to exhaust the air from the subway and discharge it into the street through a shaft. At intervals of 200 feet 6-inch valve connections are made on one side of the subway with the street water main and to each of them are connected two 200-foot lines of rubber fire hose on reels in the refuge alcoves. The principal obstacles to construction will be seven 36-inch and one 24-inch intersecting brick sewers, a 6-inch intersecting water main and two crossings of the Telephone Company's conduits.

Bids for construction were opened March 16, and the main contract was awarded to the E. D. Smith Construction Company, Philadelphia. Extras, although not anticipated in the specifications, are very carefully provided for by a list of unit prices with assumed quantities of work and materials which it is noted are not contemplated, but serve as a basis for bids. These quantities include totals of 1,600 cubic yards of concrete, 80,000 pounds of steel rods, 3,000 cubic yards of underpinning, 500 linear feet of terracotta pipe, etc. It is expected that this section will be completed by October, 1904. Mr. W. S. Twining, C. E., is the chief engineer, and Mr. Chas. M. Mills, C. E., is the principal assistant engineer of the company, to whom acknowledgment is made for these data.

In addition to the elevated franchise on Market Street from Delaware Avenue to Sixty-third Street, the Philadelphia Rapid Transit Company also owns an underground or subway franchise covering the same route. It has been decided, however, to build the portion from Twenty-third Street to Sixty-third Street under the elevated franchise, and the portion from Front Street to Twenty-third Street under the subway franchise. In the subway portion it is intended not only to take the elevated trains, but also to lay two tracks for the use of the surface cars. The surface cars will diverge from the line on Market Street on the west of the Schuylkill River, crossing it on the new bridge, using the outside tracks in the four-track portion of the subway, and looping around the City Hall. The elevated trains will occupy the inside tracks, and will continue through the two-track portion of the subway from City Hall to the Delaware River.

It is not intended that the surface cars shall make any stop at the present time at the Nineteenth Street station since it is believed that as these cars run only to City Hall, passengers will not go into the subway for that short distance, but will take the surface line on Market Street instead.

Ground was broken April 6 at Twenty-third and Market Streets for the construction of the new sewers which will be built preliminary to the building of the subway. The locations of the stations on the line have not been definitely settled, excepting as follows: Delaware Avenue and Market Street; City Hall—a double station, one part being on the north side of City Hall and the other part on the south side; Nineteenth Street; Thirty-second Street; Fifty-second Street, and Sixty-third Street. The locations of the shops, yards, etc., have not yet been definitely determined. The power for the lines will be supplied partly from the power house at Thirty-third and Market Streets and partly from a new power house which will be built on the company's property on Delaware Avenue above Poplar Street.

Damming the Niagara River at Buffalo.

By J. H. Massie.

The preliminary report, provided for by the Rivers and Harbors act of the year 1902, which required an examination of "Black Rock Harbor with a view to obtaining a suitable channel for deep draught vessels around the shoals and rapids at the head of Niagara River" was recently completed and forwarded to Washington by the United States engineer resident at Buffalo, Maj. Thomas W. Symons. This report strongly favored the building of the proposed ship canal, and its effect has been the ordering of the necessary surveys, plans and estimates of cost for carrying the project into effect. It is expected that these surveys, plans and estimates will be completed before next fall, as all advantage possible will be taken of the work done by the Deep Water commission in the same locality a few years ago. A bill will then be prepared providing for the money necessary to do the work, roughly estimated at $3,000,000 to $4,000,000, and this, it is expected, will be incorporated in the Rivers and Harbors act of 1904. The building of this canal is a necessary preliminary to a project that even in the fields of engineering, is interestingly novel. This is the proposed damming of the Niagara River, and raising of the levels of Lakes Erie, Huron and Michigan. Extracts from a statement concerning this project made by the Deep Water Ways Commission were printed in The Engineering Record January 6, 1900.



Erie Canal, Black Rock Harbor Channel and Niagara River, Buffalo.

For many years one of the popular myths among lake navigators was the supposed falling of the level of Lake Erie. It is an ancient excuse that has been offered by perhaps every boat captain in the history of Great Lakes navigation whose craft was scraped by running through the channel in the rapids at the head of Niagara River. Within the last fifteen years, however, the lowering of Lake Erie has become a serious fact, alike menacing to the navigators of the entrance to Niagara River and to all harbors situated along the lake shores. The level of Lake Erie adopted by the lake survey is the mean of the lake from 1860 to 1875, and is 572.86 feet above mean tide in New York Harbor. The lake fluctuates greatly in depth. it was the highest known in 1838, when it was 575.20 feet above tide level at New York. It was lowest in 1895, when it was only 570.95 feet above tide. Its yearly or seasonal change averages about 2 feet from highest to lowest, being highest in the early part of the summer, and lowest in the fall, when navigation is at its height. The accompanying chart, taken from the official log, shows also a cyclic change in the lake level. High periods are noted at 1860-4, 1870-1, 1876-7, 1881-8, and low periods at 1864-9, 1871-3, 1888-90 and 1891 to the present time, the latter being the longest period of low water known, as well as the lowest water. Federal engineers have concluded that the lake has been lowered permanently and will never return by natural causes to its former elevation.

The causes which may be assigned for this permanent lowering are: (1.) Deforestation of the lake region, and consequent quicker run-off of rainfall. (2.) The tendency of (1) to lessen the rainfall over the lake region. (3.) Cultivation, and improvement of the run-off capacity in streets, drains, sewers, etc.; drainage of small lakes and reclamation of swamps. (4.) Expedition of discharge of the lake by the Welland Canal, which in its present size was completed in 1888 and which is to be still further enlarged. (4.) The channel excavated by the United States Government through the Horseshoe Reef at the head of Niagara River. This work was completed in 1895; it included the excavating of 30,500 cubic yards of rock and gravel; the top of the reef wherever necessary was blasted off from 2 to 5 feet for a width of 4,000 feet, giving a resultant channel 18 feet deep. (6.) Diversion through the Chicago drainage canal, opened in 1899-1900, of water naturally tributary to Lake Erie. Besides the yearly and cyclic changes and permanent changes of level of Lake Erie, the level is temporarily affected, particularly at the eastern and western ends of the lake, by the wind. In Buffalo, under the influence of a strong west or southwest wind the lake rises often 3 feet, and sometimes as much as 5 feet and more. This rise is always followed by a fall to a very low level. The extreme is about 5 feet above and 3 feet below mean lake level, 8 feet in all. These wind-produced fluctuations are always superadded to the normal condition of the water at the time.

That in the judgment of the Lake Survey officials the lake has become permanently lowered is demonstrated by the fact that a proposition has been made, and will be carried out, to adopt a new datum plane for charts, since it is realized that depths shown on the present charts have become misleading. For Lake Erie it is proposed to lower the datum plane from 572.86 to 570 feet, nearly 3 feet. This lowering of the level of Lake Erie has not been without consequent evils, and the strongest argument for the proposed dam is the rapidly increasing losses to shipping that have been its direct result. Mr. E. A. Hitchcock, of Buffalo, a recognized insurance statistician on marine risks, is authority for the following statements:

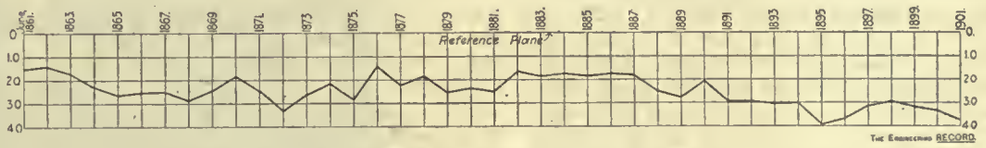
"In the period preceding the opening of the Welland Canal there were only four companies of consequence doing marine underwriting. These companies, as well as the minor ones which engaged in the business found the taking of marine risks highly profitable. Since that time little money has been made in marine insurance on the Great Lakes, and in some seasons the losses have been large. The profits of the year 1887-88, and before the opening of the Welland Canal, were unusually large. In the years immediately following there were heavy losses, culminating in 1892, which was so filled with disaster that many of the minor companies were forced out of business. A repetition of heavy losses came in 1895-96, with the opening up of the Niagara channel and the further lowering of the lakes; and since that time profits in lake insurance have been precarious, and few companies have made money in this line. The average profits of four large companies for the last fifteen years have been less than three



Location of Proposed Dam and Ship Canal, Buffalo.

per cent." During the season just past boats were constantly grounding in the Detroit River, Toledo Harbor, at Cleveland and Buffalo, and being scraped in the entrance channel of the Niagara River. Few dry docks on the lakes have not been busy all season to their full capacity. The evil is such, and the chances of its natural abatement so small, that either the building of the proposed dam, or the redredging and recharting of all the lake harbors and channels, will probably become a necessity in the not distant future.

The first named remedy involves both of the engineering undertakings already mentioned, one of which is the building of a ship canal around the rapids at Lake Erie's outlet, and the second of which is the actual damming of the Niagara River. The object of the proposed works will be to maintain the level of the lake at or near some fixed stage, the discharge being so controlled that it will be approximately equal to the supply of water to the lake less the evaporation from its surface. Various locations have been proposed for the dam, but, as is indicated in the accompanying map, it will in all probability be constructed at the foot of the lake just below Buffalo Harbor. It will be of rubble stone work, with long upper angle and steel anchors. To secure the control desired a series of submerged, fixed weirs, in combination with a series of sluices, will be constructed, having an aggregate of about 2,000 yards. The sluices, 13 in number, will have an aggregate length of 1,040 feet, or about 80 feet each. The weirs will be constructed of concrete blocks and the piers separating the sluice openings will be of first-class masonry. While the exact height of water to be above the weir is undetermined, it will be sufficient to cause a considerable fall. Computations made by the Government officials indicate that in order to maintain the level of the lake at a fixed stage it will be necessary to construct a weir over which a discharge of about 178,000 cubic feet per second can be maintained at times when the water below the dam is 4 feet lower than the regulated surface of the lake, and a set of sluices through which, in connection with the flow over the fixed weir, 271,000 feet per second will be discharged when the sluices are all open. The approximate depth of water over the proposed weir has been calculated by the use of co-efficients recently determined at the hydraulic laboratory at Cornell University, as applicable to the Francis formula for the design of weir proposed: $Q = C L h^{3/2}$ in which C is a constant, 3.54; L, the length of



Annual Mean Variation, in Feet, of Level of Lake Erie, at Cleveland.

weir, 2,900; and Q the discharge in cubic feet per second, 175,000; giving h a value of about 6.6 feet.

The effect of the dam on Lake Erie will be to give it an approximately constant level 3 feet above the present low water mark, which will be 0.5 foot below the present high water mark and 574.5 feet above tide water. The waters of Lakes Huron and Michigan have been lowered 1 foot during the last fifteen years, and the indirect effect on these lakes of the rise of Lake Erie resulting from the dam will be, it is expected, about one third, thus restoring their former level. Lake St. Clair and the Detroit River will be raised about 2 feet. The distribution of flow in Niagara River will be modified only about five per cent., and the levels of Lake Ontario and the St. Lawrence River will therefore not be materially affected. An objection to the proposed dam, and practically the only one, but which is of considerable importance, is the amount of consequential damages that would undoubtedly be claimed. A great deal of property on the lake shore, especially at the western end, has been improved, and with wind and season effects added to the contemplated raised level much of this property would be subject to injury. The practicability of the dam, therefore, is resolved into the question of whether or not the consequential damages would amount to more than the benefit derived. This is a question to which an answer will not be possible until the project has been carried to a more advanced stage, and the Federal Government has secured an approximation of the total of the claims.

The Misuse of Public Sidewalk Areas and Vaults.

By Reginald Pelham Bolton, M. Am. Soc. C. E., M. Am. Soc. M. E.

The City of New York has from the earliest days of street regulation permitted encroachment by property owners upon its street lines, for private convenience. These encroachments are limited as far as surface obstructions are concerned, to a width of 4 feet on streets or 5 feet on avenues, from the building line, and may be occupied by stoops, steps, areas, porches, elevator shafts, and other necessary or desirable means of access into the building. The concession is universally made use of in these ways, but has been further expanded into the utilization of the space for the erection of protuberances of the building itself, such as bay-windows, overhanging cornices, vent shafts, bulkheads, and even chimney stacks. In addition the use of the space is universal for the exhibition of goods, for the storage of boxes, for shoe-stands and similar conveniences. So far has this proceeded that many abutting property owners have for years rented out the space for such purposes, thus deriving an income from the possession of a convenience which evidently belongs to the city at large.

The use thus made of the public space has been and continues to be in the large majority of cases selfish and in very many cases is entirely unnecessary. Where an opening is needed for light or air to a basement, the space has been frequently so treated as to remove it entirely from public use, when it might answer just as usefully the desired purposes by other provisions, which would render the space available for traffic. Thus there are miles of such space, in which the grating over the areas in front of stores has been set up from sidewalk level. In other cases stoops at irregular intervals cut off the tide of traffic. Elsewhere railings have been placed around the space to no other apparent purpose than to keep the public off their own ground. Frequent use is made of descending flights of open steps, dangerous to the public, to carry on lucrative trades in spaces which should be and could be reached through the same descent within the property line. An examination at any busy hour of Cortlandt Street, leading from important ferries and elevated railway stations into a crowded business section, will convince any reader of the unnecessary and selfish character of many of these obstructions.

It is high time they were done away with. They have been so long enjoyed that their withdrawal would be entirely justifiable, and the cost of replacement of the public area and of reconstruction of stoops and steps, within the buildings would be very small compensation for their long-continued enjoyment at the public expense. Where such additions to the buildings as chimneys, vents and bulkheads have been made they should be ruthlessly ordered off. Such overcrowded streets as Dey, Liberty and Cortlandt could be vastly improved for traffic by these means.

Another part of the public property in streets frequently misused is the space under the sidewalks from the stoop line to the curb, which is permitted to be excavated and utilized by the abutting property-owner on payment to the city

of a maximum fee of two dollars per square foot of such area so occupied. This privilege is fortunately withdrawable if for any public purpose the space is required, but such a reservation does not by any means represent a due conservation of the public interest. This space is manifestly best suited to the placing of the network of tubes, sewers, and pipes which are needed to afford the various conveniences of city life. These are now and have been laid under the roadway, where they are far less accessible, and where their repair becomes vastly more expensive than would have been the case if placed, at first, where they should have been, under the sidewalks.

The future needs of the city will require, no doubt, that this use shall be made of the sidewalk spaces in the streets required for subways. This has been the case in Forty-second Street, to the discomfiture of the quasi-owners of such vaults, whose lamentations have been profound, they having, as is commonly the case, utilized this, the cheapest portion of their property, for the installation of machinery, boilers and kitchens, thereby enabling a rental to be obtained for equivalent spaces inside their private property lines. The extent of this practice is scarcely as well known as it might be. For space for which the city has received the munificent sum of two dollars per square foot, which price is the maximum for the best parts of the city, a property on Broadway may be increased to the extent of such space as will bring in an annual rental exceeding the sum so paid to the city, by a hundred per cent.

In one hotel on a corner in Fifth Avenue, the entire sidewalk on the avenue and the side street is excavated to a depth of two stories. On the basement level the space is utilized as part of a large café, and part of the kitchens, offices and machinery are in spaces below. It may safely be computed that this space represents an equivalent value in rentals of at least $12,000 a year, for which the public receives nothing. It is also safe to say that at the time this convenience was thus given away, the owners would have been very willing to pay ten times the trivial sum the city received. Such cases could be multiplied, not only by dozens but by hundreds. Surely some system of relating the charge for the privilege to the value of the property could be initiated and maintained. The constant use of these spaces for steam boilers is an indefensible menace to the public. Thousands of such possible sources of danger are so installed, and the injury thus inflicted is aggravated by the insult of open gratings, up which the heated offensive vapors of steam and oil are flouted in the faces of the helpless public, whose enjoyment of their property is thus turned to their discomfort.

Another misuse of the public sidewalks is the insertion in them of the opening which vents the house-trap in the modern systems of sanitation. This is not only most undesirable, but is entirely unnecessary in such a position and would much more effectively and properly answer its purpose if the pipe were extended back to the house line and carried up, as is done in many good installations to a point above the roof. Situated as these sidewalk vents are, they are a menace to the public if they operate, and a menace to the occupants of the house if, as is the case in four out of five, they are choked with mud and debris. They should never have been permitted, and should be entirely condemned and ordered to be changed, in the interests of the general sanitation.

Topographic Maps of Pittsburg and vicinity are being prepared by the United States Geological Survey. There are to be six sheets.

The Projected Lake Champlain and St. Lawrence Ship Canal.

By E. G. M. Cape, M. Can. Soc. C. E.

At the present time when the question of transporting the vast quantities of freight from the Lake Superior country to the sea, is engaging the attention of the politicians and public of America, it will be interesting to consider the canal which, it is stated, is shortly to be built from Montreal to St. Johns on the Richelieu River. The Lake Champlain and St. Lawrence Ship Canal Company has obtained a charter from the Dominion Government, which gives it the rights to build this canal and to utilize all the water power and other privileges that may be developed. Before describing the proposed canal let us consider the facilities which are at present afforded for handling the great amount of freight which comes down each summer through the Great Lakes. Last year some 47,000,000 tons of freight were carried through the canals at Sault Ste. Marie. This freight was mostly east-bound and consisted largely of lumber, iron and copper ore and wheat. Most of the ore was bound for Cleveland or other points on the lakes, but a large proportion of the lumber, and nearly all the wheat was for through transportation to the New England States or to Europe.

The bulk of the through freight is at present handled by the Erie Canal. The great steamers of 5,000 tons burden, come down through the lakes, and are discharged at Buffalo. Their freight is loaded into small boats of 240 tons or so burden, and taken through the Erie Canal to the Atlantic seaboard. The only alternative all water route offered at present for through freight, is via the Welland Canal, Lake Ontario and the St. Lawrence. By this route the distance between Liverpool and Chicago, Milwaukee, Duluth and Fort William, is 450 miles shorter than that by way of Buffalo and the Erie Canal. Besides being shorter, this route has the advantage of allowing boats up to 2,500 tons burden to go direct from the lakes to Liverpool. The St. Lawrence Canals have a minimum depth of 14 feet, lock width of 46 feet, and lock length of 270 feet. It is interesting to note in this connection, that the United States Steel Corporation is building a fleet of ten steamers for exporting their products by way of Montreal, and that the Illinois Transit Company is to establish a direct steamship line for passengers and freight from Chicago to Montreal and Liverpool.

It is an acknowledged fact that Buffalo and the Erie Canal are doing more than their natural share in the transportation of through freight from the lakes to the Atlantic. The St. Lawrence route, by virtue of its geographical position and its natural facilities, should be doing much more than it is at present. The question is, how is this route to get its proper share of the traffic. A canal from Georgian Bay to Montreal on the St. Lawrence is now projected. This will shorten the distance between the lakes and Liverpool by 400 miles, thus giving this route an advantage of some 850 miles over that by way of the Erie Canal. Besides this advantage, it must be remembered, that freight will be carried through, without transhipping, in boats of 2,500 tons burden.

Now let us regard the projected canal from Montreal to St. Johns on the Richelieu River. This canal will be 18½ miles long between these points. It will have a minimum depth of 14 feet and a lock width of 45 feet. The country between these two points offers a very suitable location for a canal. The difference in elevation between Montreal and St. Johns is 72 feet. This difference of level will be overcome by two locks of 28 feet lift, and one lock of 11 feet lift, and these locks are to have a minimum length of 270 feet, so that ships of 2,500 tons burden can be accommodated. The slope from St. Johns to Montreal is a very gradual one through an almost flat country. The heaviest cut throughout the length of the canal is only 30 feet, and the heaviest fill 35 feet. From St. Johns an old canal is to be utilized for a distance of 4 miles. This section will simply be widened and deepened. The channel through the Richelieu and across Lake Champlain will require very little deepening in order to make it suitable for boats of 14 feet draft.

It is expected that in the coming session a bill will be submitted to Congress for the widening and deepening of the canals from the Hudson up to Lake Champlain. When this system of canals is finished, if undertaken, there will be a much cheaper way of bringing freight from the Lakes to New York than exists at present. Also there will be at Burlington, a valuable distributing point for that part of the freight which is destined for the New England States. Thus it seems that for both through freight and for freight to be distributed in the eastern part of our country, the Lake Champlain route will offer much better facilities than those at present afforded by the Erie Canal.

An English Reinforced Concrete Highway Bridge.

A reinforced concrete highway bridge over Foredyke Stream, England, has a span of 40 feet and a width of 62 feet 8 inches. The bridge has two concrete abutments with wingwalls, and a slightly skewed horizontal platform, which is a monolithic concrete slab covered with sand filling and paving. The slab has a uniform thickness of 6 inches and is supported on eight main longitudinal girders from 8 to 9⅓ feet apart on centers, which take bearing on stone templates set in the abutments. The girders are 16 inches wide and 3 feet deep below the under surface of the floor slab, with which they are integral. Each one has eight horizontal bars 1¾ inches in diameter embedded in the lower part, and eight bars 1¼ inches in diameter in the upper part. Four of the bottom chord bars are inclined upwards at the ends to the tops of the girders. Parallel to the abutments the floor slabs are stiffened with transverse girders 8 inches wide and 10 inches deep with four reinforcement rods in each. The slab itself is reinforced throughout with small rods about 6 inches apart near the upper and lower surfaces. The two 10-foot sidewalks are paved with flagstones and the 40-foot roadway is paved with wooden blocks. The lower edges of the longitudinal and transverse girders are chamfered, and the upper edges are filleted with the floor slab. The concrete was made with 600 pounds of Portland cement to ½ cubic yard of sand and 1 cubic yard of gravel between ⅛ and ¾ inch size. The bridge was designed to carry four 25-ton wagons with axles 8 feet apart, and contains 23 tons of iron and 116 cubic yards of concrete. It was described in a recent issue of London "Engineering."

The Krupp Company, of Germany, is to spend $5,000,000 on extensive additions to its plants.

The Daily Consumption of Water in Reading, Mass., during 1902 averaged 29.2 gallons per inhabitant, or 33.3 gallons per consumer, according to the annual report of Superintendent L. M. Bancroft. The cost of supplying the water, based on total maintenance plus interest on bonds, was $305.16 per million gallons. The supply is pumped from a filter gallery and passed through mechanical filters.

Types and Details of Bridge Construction.

By Frank W. Skinner, C. E.

Chapter II.—Spandrel-Braced Arches.

The Cedar Avenue bridge, Druid Hill Park, Baltimore, Md., has a 150-foot span with three spandrel-braced arch trusses 12 feet apart on centers. They have 10-inch crown and skewback hinge pins, a rise of 38 feet on centers, depth of 3¼ feet at the crown and 39½ feet at the ends, the crown pins being set above the centers of the ends of the semi-trusses. The trusses are braced together by floorbeams resting across the horizontal top chords, by top and bottom lateral struts and diagonals in the planes of both chords, and by diagonal rods in the transverse vertical planes of the vertical posts. There are no intermediate horizontal transverse struts except between the end posts, and each panel between trusses is X-braced so as to make virtually triple intersection systems of top and bottom laterals.

The truss panels are uniformly 9 feet long and the vertical and diagonal members have I-shaped cross sections made with two pairs of angles latticed and field-riveted at the ends between tie plates which project beyond the flanges of the chords to make jaws and receive the angles for the field-riveted connections of the transverse struts. These are in vertical planes at the top chord and in radial planes at the bottom chord. For three panels each side of the center the top and bottom chords are united by wide side plates to make a single box section with regular vertical and diagonal members riveted on the outside of it. All chord splices are riveted and the 2¼-inch pins at the six lower chord panel points at each end serve only to receive pairs of single wing plates for the lower lateral rods. The lower chords are made with pairs of channels with horizontal webs, the end panel having solid cover plates in vertical planes, and the next four panels on each side having latticed sides.



Druid Hill Park Bridge, Cedar Avenue, Baltimore.

The skewback pins engage half holes in the ends of the chords and in the webs of the cast-iron pedestals, which have seats normal to the pressure cut in more than a foot from the vertical faces of the bed stones. At the crown the ends of the semi-trusses have a center vertical web and are reinforced by converging diagonals which concentrate the pressure on the hinge, the latter being locked by pairs of jaw plates with full holes. The main bearings are half holes and there is 1 inch clearance between the vertical ends of the trusses. The hinge pins have 3-inch holes through the axes and those at the skewbacks have no nuts, but are locked in place by collars turned out of the solid at each end. The crown pin has one solid collar and one loose collar secured by four set screws. The lower chord panels are not chords of circular arcs, but are bent to true curves, with radii of about 93 feet for the three end panels, and about 87 feet for the remaining 11 panels. The end sections of the top chord are shallow inverted troughs, made with two angles and a top cover plate with wide vertical connection plates riveted to the angles.

The bottom lateral rods are discontinued where the top and bottom chords unite and the stress in the center panels is carried by the top laterals only. These are loop ended square rods engaged between pairs of angle clips as are the sway rods. The lower lateral rods have split loop ends which engage the wing plates on the chord pins and pass through clearance notches in the ends of the strut webs. The very shallow floorbeams are plate girders only 12 inches deep, which at each end cantilever 7½ feet beyond the truss centers. The roadway, 20 feet wide in the clear, has a floor of crossed diagonal planks. The 2-inch upper layer is laid close, and the 1½-inch lower layer has 2-inch spaces. They are spiked to 3x12-inch longitudinal joists 12 inches apart seated on transverse filler strips crowned 2½ inches in the center. The curb timbers are faced with 3x3½-inch angles, and the sidewalk floor is laid with 2-inch transverse planks.

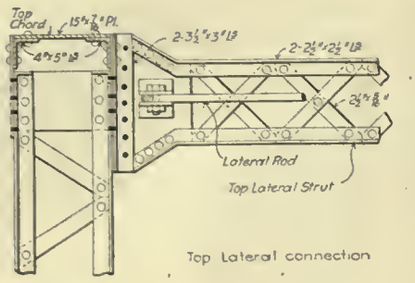
The highway bridge across the Noce ravine at St. Giustina, Tyrol, described in The Engineering Record of March 15, 1890, is remarkable for its great height of about 453 feet, nearly or quite unprecedented for such a structure. It is 222 feet long between abutments by 19½ feet wide, and has two-hinged trussed arch ribs of 40 feet rise and 197 feet span. The arch ribs are in vertical planes, and are connected by lateral bracing in the planes of the lower chords, by sway bracing in the transverse planes of the vertical members and by the floor system. The floor system has light latticed transverse beams about 13 feet long, and 3-foot sidewalk cantilevers. The skewback hinges are convex steel blocks bearing in cast iron pedestals and shoes. All other connections are riveted and all truss members are made of four angles each, the top and bottom chords being latticed. The stringers are anchored at one end of the span, and at the other end are provided with a truly remarkable temperature adjustment. Each stringer has a reinforced web pin connection to two horizontal eyebars, the opposite ends of which engage a sliding nut on a large screw. At the other end of the screw there is a duplicate connection to the upper eyebar of an anchorage chain. In the middle of the screw there is a ratchet lever by which it can be turned to increase or diminish the distance between the eyebars. As the temperature varies this apparatus is operated by hand to maintain the uniformity of the connection with the anchorage and "prevent oscillations." The bridge weighs 95 tons and was erected by the cantilever method, materials being handled by a cableway across the ravine.

The Mirabeau bridge, Paris, France, described in the "Genie Civil," of May 9, 1896, carries Convention Street across the Seine, with a clear center height of 26 feet above the water, and is a deck structure with a 39½-foot roadway and two 13-foot sidewalks. It has a channel span of 326 feet and two side spans of 131½ feet, all center lengths. The middle span is a three-hinge spandrel-braced arch, with seven riveted trusses, which are continued over the piers to form cantilevers balancing the skewback thrusts and pin-connected at their extremities to the tops of short vertical rocker bents. They are connected together by the deck floor system, by transverse struts and lateral X-bracing between the bottom chords, and by transverse X-bracing between the vertical posts. The principal member of each truss is the arch rib bottom chord the intrados of which is a very flat parabola with a horizontal axis. The middle of the intrados for 134 feet is the arc of a circle of 630 feet radius, and the ends of it are tangents.

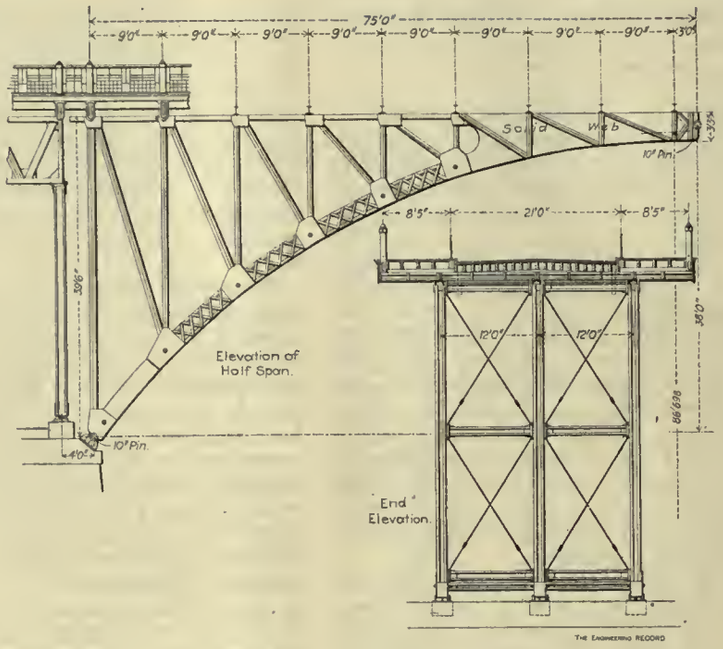
The chord has a peculiar cross section with two webs decreasing in depth from about 78 inches at the skewbacks to about 27½ inches at the crown, where it unites with the top chord to form a closed rectangular section. The webs have a constant thickness of 7/16 inch except where they are reinforced to ⅜ inch over the piers. The cover plates have a total thickness of 3 inches at the skewbacks and 7/16 inch at the crown, for the main span; and 2⅜ inches at the skewbacks, and 7/16 inches at the crown, for the side spans. All the flange plates are 35x7/16 inches. The horizontal top chords are each made in separate halves, each having an approximately T-shaped cross section, as shown in the detail. The cross sections of the chords are uniform except for the combined thicknesses of the top flange plates, which vary from 3 inches over the piers to 7/16 inch at the crown and at the extremities of the cantilevers.

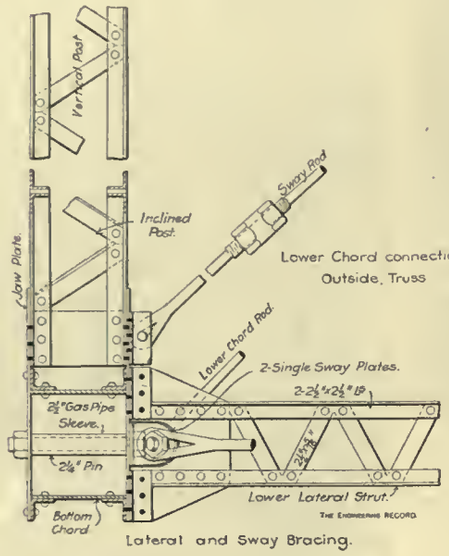
The vertical and diagonal posts have the same I-shaped cross section with a uniform depth and a variable width of from 12 to 23 inches for the former, and from 5¾ to 7½ inches for the latter. The outline of intrados of the bottom chord is continued to the vertex of the parabola in the upper surface of the pier masonry, but the lower flanges are tangent to the curve about 13 feet from the center of the pier, and abut against the horizontal transverse rib of the cast-steel hinge piece. This piece has two oblique arms engaging the under side of the flanges to which they are bolted. The ends of the flanges are planed and abut against keys driven between them and the bearing faces of the rib, which are about 15 inches wide and provide horizontal bearing surfaces for the ends of the inclined center posts. The lower part of the hinge casting has a segment of a transverse cylindrical surface 12 inches in diameter, which is seated in a concave steel casting keyed into a cast-iron bed plate, recessed into the granite pier cap.

The crown hinge consists of a cast-steel transverse bar, flat on one side and convex on the other, which is seated in a semi-cylindrical socket 4½ inches in diameter. The ends of



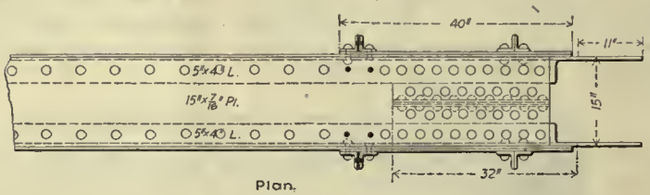
Top Lateral connection



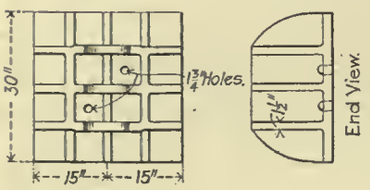


Lower Chord connection, Outside Truss

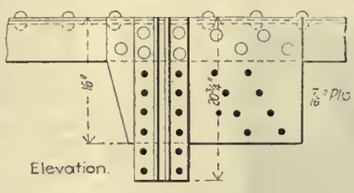
Lateral and Sway Bracing.



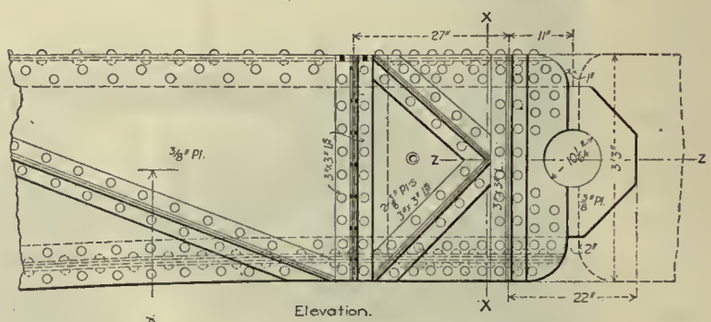
Plan.



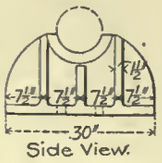
Plan.



Elevation.



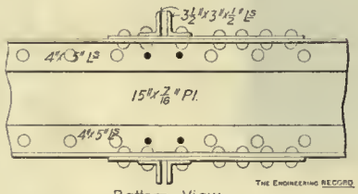
Elevation.



Side View.

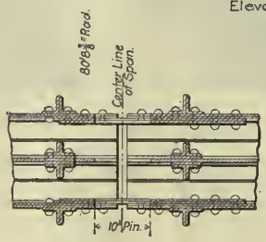
Skewback Pedestal.

The Engineering Record.

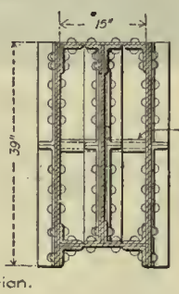


Bottom View.
Top Chord Section.

The Engineering Record



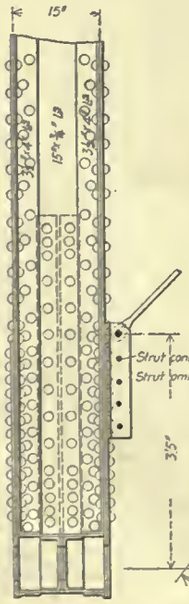
Section Z-Z.



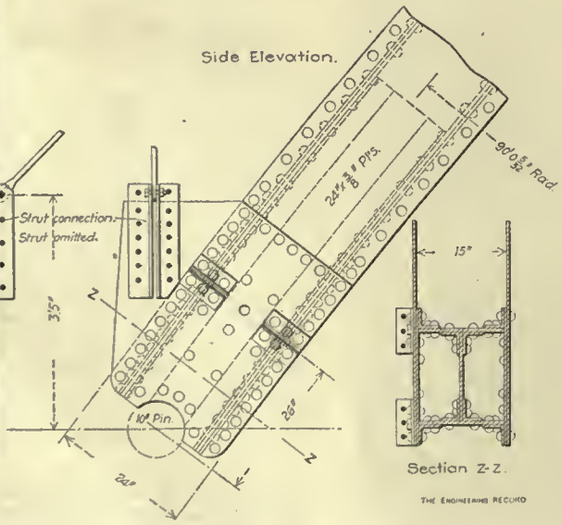
Section X-X.

The Engineering Record.

Crown Hinge connection.



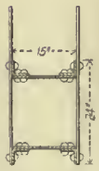
End Elevation.



Section Z-Z.

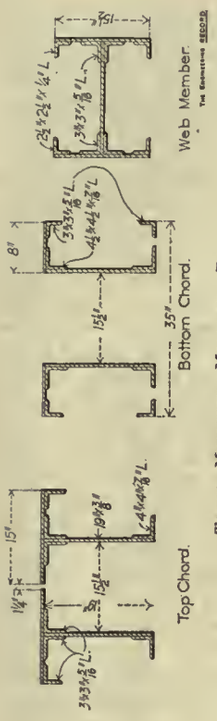
The Engineering Record

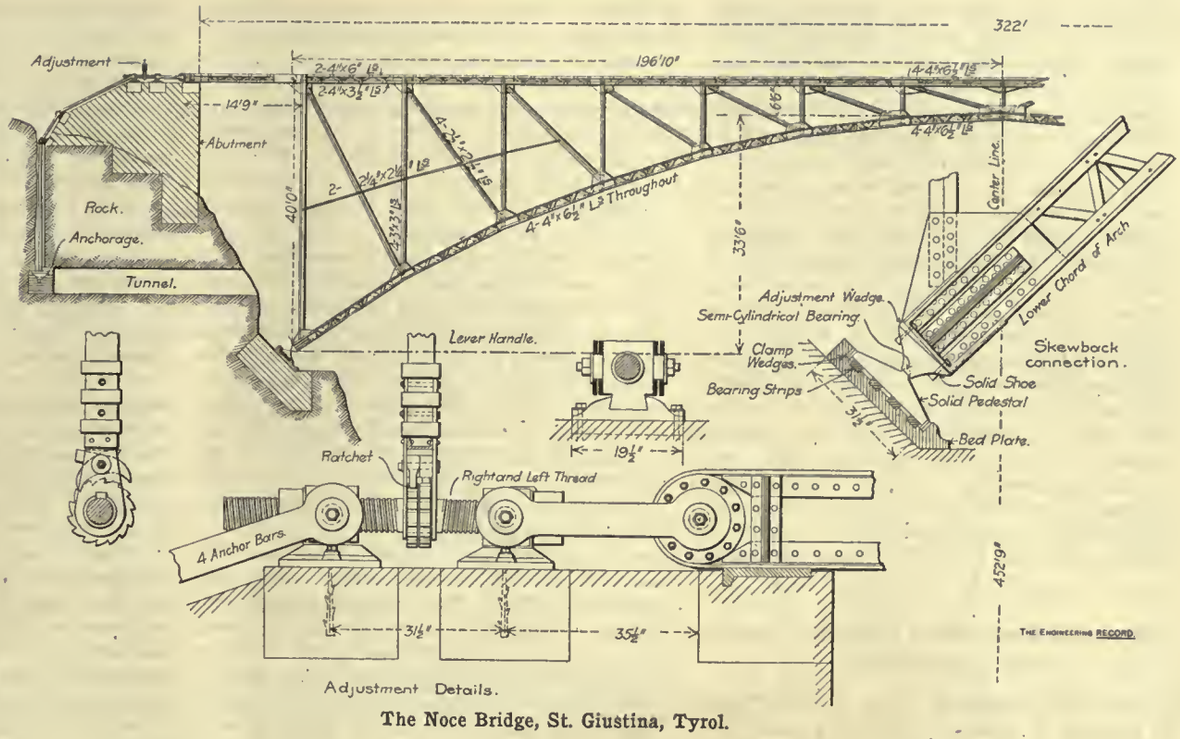
Skewback connection.



Section A-B

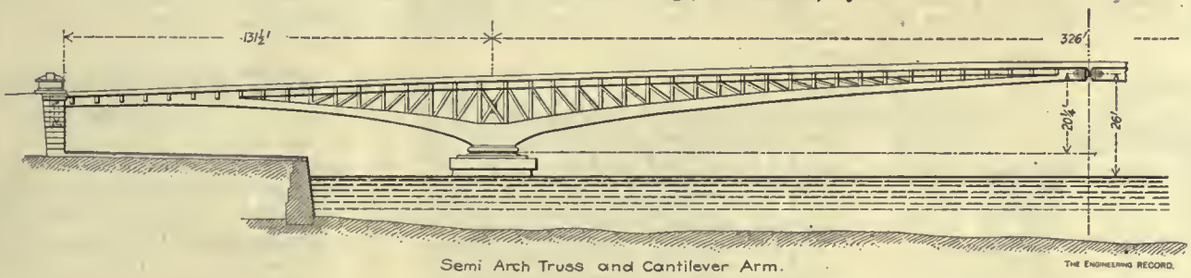
DRUID HILL PARK BRIDGE, CEDAR AVENUE, BALTIMORE.



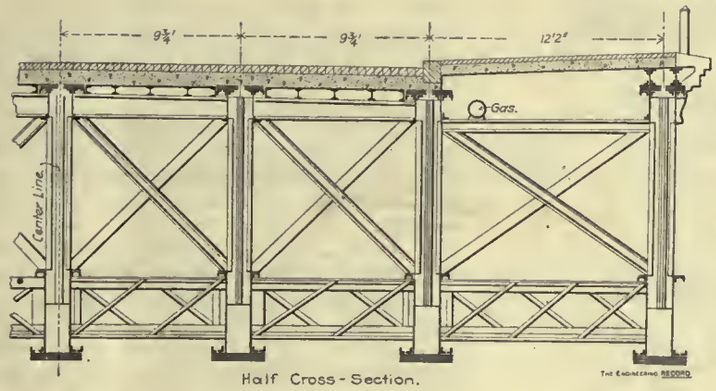


Adjustment Details.

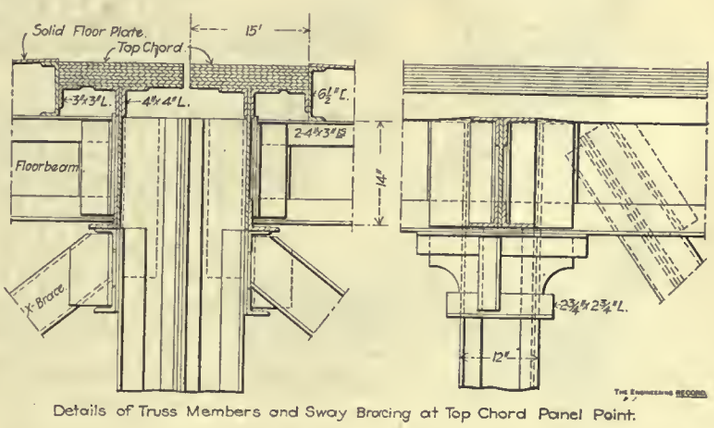
The Noce Bridge, St. Giustina, Tyrol.



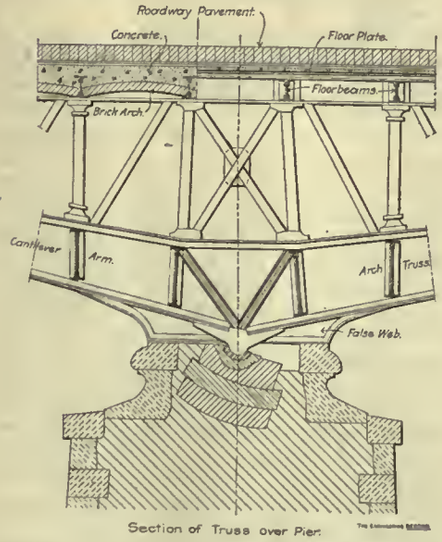
Semi Arch Truss and Cantilever Arm.



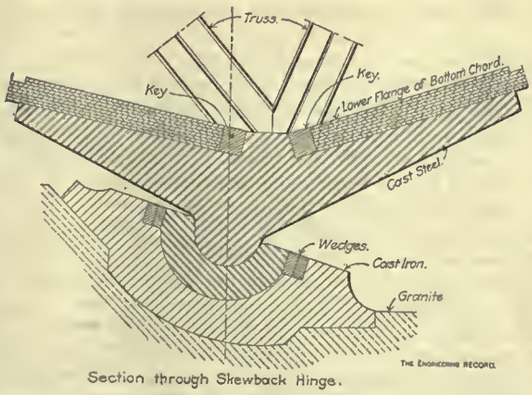
Half Cross-Section.



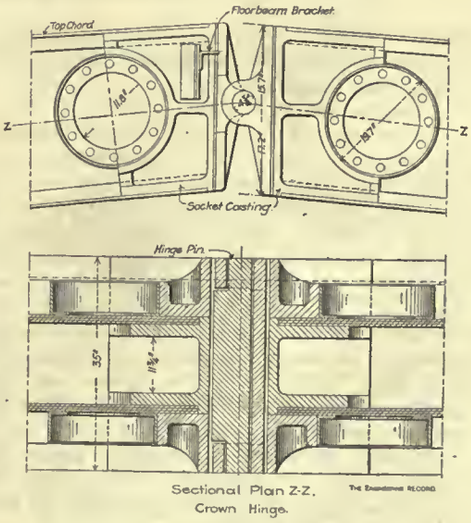
Details of Truss Members and Sway Bracing at Top Chord Panel Point.



Section of Truss over Pier.



Section through Skewback Hinge.



Sectional Plan Z-Z.
Crown Hinge.

HALF ELEVATION, SECTION AND SPECIAL DETAILS OF THE MIRABEAU BRIDGE, PARIS, FRANCE.

the convex piece are turned round and engage holes in the jaws of two cast-steel bearing pieces, bolted to the ends of the semi-arch trusses. The seats on the trusses are vertical transverse flanges each made of three steel castings bolted to the webs and flanges of the arch rib, and having additional bearing on a circular angle iron riveted to the outside of each web around a 12-inch bored hole. The outside trusses are decorated with ornamental cast-iron work; the skewback hinges are concealed by large figures in bas relief which crown the pier tops, and a large sculptured escutcheon masks each crown hinge. The superstructure weighs about 6,037,000 pounds, was assembled on pile falsework and erected by traveling gantries which spanned the full width of the bridge. They had two overhead trusses, transverse to the bridge axis, supporting carriages on which trolleys with hand windlasses moved longitudinally and commanded the whole structure to handle its members and the hydraulic riveting machines.

(To be continued.)

Improved Methods for Difficult Subaqueous Tunneling—IV.

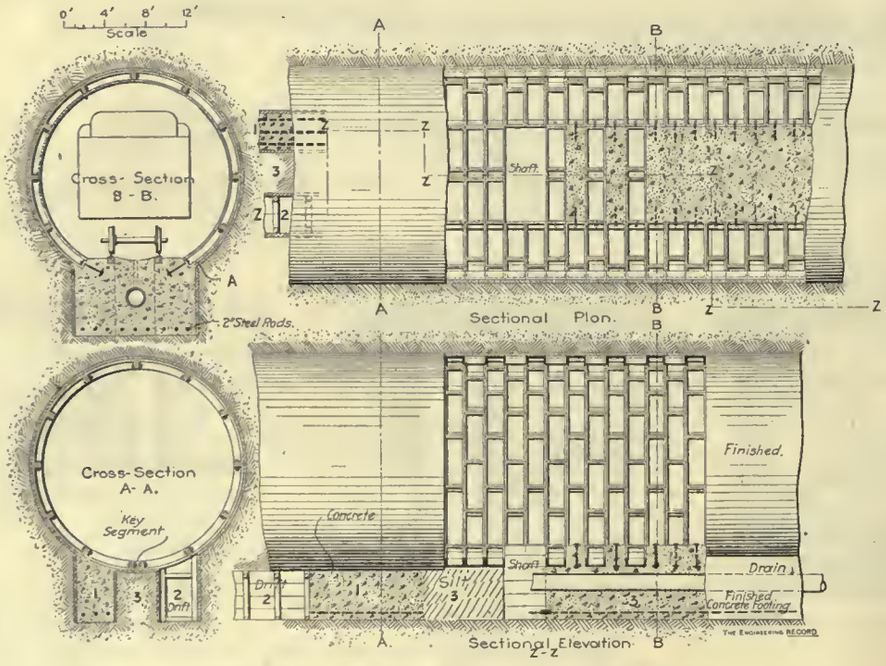
The method designed by Mr. Jesse W. Reno is intended to strengthen railroad tunnels with a sectional iron or steel shell built by ordinary shield methods in very soft material, and is specifically proposed for application to the Pennsylvania Railroad Company's tunnels under the Hudson and East Rivers, New York, where it is assumed that the material tunneled through will be silt, extending from a maximum water depth of 60 feet to bed rock at a depth of 150 feet and not sufficiently compact to provide a good foundation for a tunnel with 100-ton motors running 45 miles an hour. It is believed that under such conditions the segmental shell will not have a sufficient rigidity or moment of flexure to sustain the traffic without injury or development of leaks. It is therefore proposed to reinforce it by a massive concrete footing thoroughly secured to the shell and serving both as an anchorage for it and as a continuous reinforced longitudinal girder to distribute the live loads over such an area of the soft ground that the unit pressures will not exceed its bearing capacity.

After the segmental shell is completed, it is proposed to build the substructure in successive longitudinal sections as indicated in the illustrations. About 100 feet in the rear of the shield, floor segments will be removed and a shaft dug about 6 feet deep from which a 4x6-foot drift marked 1 will be driven forward 50 feet on one side of the center line. This will be filled with concrete in which are embedded continuous twisted steel rods in 50-foot sections joined with screw couplings. After the concreting is completed, drift 2, symmetrical with drift 1, on the opposite side of the center line will be similarly excavated and concreted and after its completion the material between them will be removed and section 3 will be concreted in the same manner, so as to complete a concrete base 12 feet wide supporting the tunnel shell. A drain will be formed in the concrete of section 3. The object of constructing the foundation by three operations is to minimize the possibility of settlement of the tunnel while this work is in progress.

After the concrete has set sufficiently, key segments will be removed from alternative panels of the invert, and the adjacent segments in those rings will be removed and concrete filled in on top of the footing to the required height shown in the cross-section of the finished tunnel and bolts bedded in it for connection with the flanges of the lowest remaining segments. Afterwards the rest of the invert segments will be similarly replaced by concrete and the reinforcement will be completed.

It is estimated that the weight per linear foot of single-track tunnel will be 3.75 tons for the cast iron lining, 3.96 for the concrete filling, 6.30 for the concrete and steel foundation and 3.33 for the maximum live load from a 100-ton motor, making a total of 17.34 tons per linear foot for the finished tunnel and train. The total weight of the earth displaced is assumed to be 27.6 tons per linear foot, so that the weight of the tunnel and motor is only 63 per cent. of the original earth weight. The concrete base is assumed to distribute without flexure the weight of a 100-ton locomotive over an area 12 feet wide and 50 feet long, this producing a live load pressure of 333 pounds per square foot.

An alternative method of construction by the use of transverse, instead of longitudinal, drifts has been planned. With it a pair of invert segments are removed and sheet piles are driven radially in longitudinal planes across the flanges of the adjacent segments in these rings. Thin steel sheeting 6 inches wide will then be driven in transverse vertical planes along the flanges of the invert segments of the adjacent rings, thus enclosing a space in which a flaring transverse trench 4 feet long and 6 feet deep will be excavated. Longitudinal horizontal twisted steel rods will then be inserted through holes in the transverse steel sheeting and the excavation will be filled with concrete. This process will be repeated in alternative sections of the tunnel invert, and after the concrete has set in them the intermediate panels of invert segments will be removed and the earth between the transverse masses of concrete will be removed, the transverse sheeting between them withdrawn and the excavations filled with concrete bonded to that previously laid by the horizontal steel bars already mentioned, thus forming a continuous reinforced foundation with a flaring base 16 feet wide which will diminish the unit pressures from live load to 240 pounds per square foot. In both methods a considerable economy is claimed for the saving effected by the omissions of the invert segments of the tunnel shell, aggregating one-sixth of the total shell. Furthermore it is claimed that the massive concrete foundation would largely neutralize injurious shocks or vibrations and prevent them from acting upon the tunnel lining to any considerable degree.



The Reno System of Reinforcing Tunnel Shells.

Water Waste Investigations in New York City.

The water waste investigation which is being carried on in New York City with the aid of the Cole-Flad pitometer, as described in The Engineering Record of January 31, has been made the subject of a further report, in which the results from eight districts are presented. In Table I. the details for districts 3, 5, 6, 7, and 9 are given, and the diagram shows the results obtained in district No. 8. Table II. gives a summary of the salient features of the whole investigation so far.

District No. 3 is bounded by Grand Street, East River, Market and Division streets, and is a typical East Side tenement section. Owing to the condition of the mains and valves, it was impossible to make the tests on the No. 4 district, which is bounded by Canal Street, Broadway, Chambers Street and West Broadway, representing the dry-goods district. No. 5 contains a large number of moderate priced apartment houses. It is bounded by 142nd Street on the north, Southern Boulevard on the east and south, and Alexander and Willis avenues on the west.

No. 6 district contains a large number of high priced apartment houses and private residences, and is bounded by Ninety-sixth and Eighty-sixth streets, Broadway and Riverside Drive. No. 7 is an irregular district approximately bounded on the north and west by the Southern Boulevard, on the east by the East River, and on the south by the East and Harlem Rivers. This district contains a gas works, a number of large factories and the yards of the New York, New Haven & Hartford Railroad. The barges and transports of this company take their water at this point. The resident population in this district is very small. District No. 8, including all of Manhattan south of Fulton Street, is a representative office building section, containing many "skyscrapers." No. 9 is similar to the No. 6 district, lying on the upper west side, and bounded by Eighty-sixth Street, Broadway, Seventy-second Street and the Riverside Drive.

The results obtained in district No. 8 are especially interesting. All but five of the mains

in this district were shut off, and the flow through each is shown on the diagram. The average per capita consumption was found to be 860 gallons per day on the basis of the resident population, or 83 gallons for the total population. The upper irregular line of the diagram gives the hourly variation in the total consumption as measured by the pitometers. It is interesting to note that Sunday, when practically only the resident population of 11,000 is in the district, the rate was about 6,400,000 gallons per day, with a difference of only 400,000 gallons between the day and the night rates. It is probable that a large part of the 6,000,000 gallons is used in keeping up steam for the office buildings.

This investigation is by no means completed, but as far as it has gone it has been thorough, and enough data have been collected to furnish the basis for some definite recommendations. In addition to measuring the flow into each district by the pitometers, every effort has been made to find out what becomes of the supply. For example, men have been sent through the sewers at night to locate all spurs from which there is a continuous flow. The cause of this flow and its approximate amount can be learned later by the day inspectors. The latter have been provided with tin cups of definite volume, into which the leakage from fixtures in buildings is allowed to flow, the time required to fill the cup being noted. This gives an approximate estimate of the fixture leakage.

Several evasions of the city ordinances have been discovered, and it is thought that there may be many cases where buildings are recorded on the department books as fully metered and yet connections have been made outside the meter. In connection with the proposed extended use of meters, recommended by both Commissioner R. G. Monroe and Chief Engineer Hill, it should be stated that it is planned to install meters to record the flow from all reservoirs and pumping stations in the city, and also to meter the water supplied to fountains, public buildings, etc. A bill is before the State Legislature providing for the buying and installing of meters in private buildings by the city, at the discretion of the commissioner. This bill provides that meters may be installed whenever the commissioner has reason to believe waste is going on, and if the waste shown by such a meter during four months' use amounts to 50 per cent. of what would be used according to the frontage rate, allowing 100 cubic feet for each 10 cents of the rate, then the meter is to be retained in the building. Chief Engineer Hill's report on the waste investigation follows, in slightly condensed form.

From Table No. 2 it is interesting to note, first, that there is no apparent connection between the metered consumption and the total per capita consumption. As an example, in district No. 1, 43 per cent. of the water consumed is metered, while the gross per capita consumption of the total population is 121 gallons per day. In No. 2 district only 20 per cent. is metered, whereas the gross per capita consumption is only 37 gallons per day; and in the No. 9 district the metered consumption is but 11 per cent., while the gross per capita consumption, based on total population, is 154 gallons per day. This indicates that the class of the population and the characteristics of the local industries, together with the per cent. of non-resident population, have to be considered in interpreting the results. In No. 1 district, where the non-resident population amounts to about 50 per cent. of the whole, the percentage of metered supply is the largest, whereas in the other two districts named the non-resident population need not be considered. In addition to the above districts, I would call your attention to section No. 5, where the metered consumption is only 5 per cent. of the total, and, at the same time, reduce the waste due to plumbing leakage. A rough estimate, based on the plumbing leakage reported in the territory examined to date, shows that the total plumbing leakage in the Boroughs of Manhattan and The Bronx will probably amount to 32,000,000 gallons per day. This is not definite or conclusive; a more thorough house to house inspection would probably develop a larger waste. At the metered rate, this leakage represents, approximately, $1,570,000 per annum. An appropriation equivalent to the annual loss thus sustained would meter a large proportion of the city. The effect of the meters would be to reduce the waste, and the city could probably, under these conditions, afford to sell water for less than at the present time.

We have not been able to go into a final and determinate examination of the leakage in mains, except in district No. 1, where no leakage was found. We have, however, examined the sewers, conduits and other underground structures, and have been unable

and the gross per capita consu
54 gallons per day.

The total revenue for Manha
is 6.73 cents per thousand gallo
in New York City is 13.3 cents
approximately twice the actual
would indicate that a reduction
would tend to popularize the in

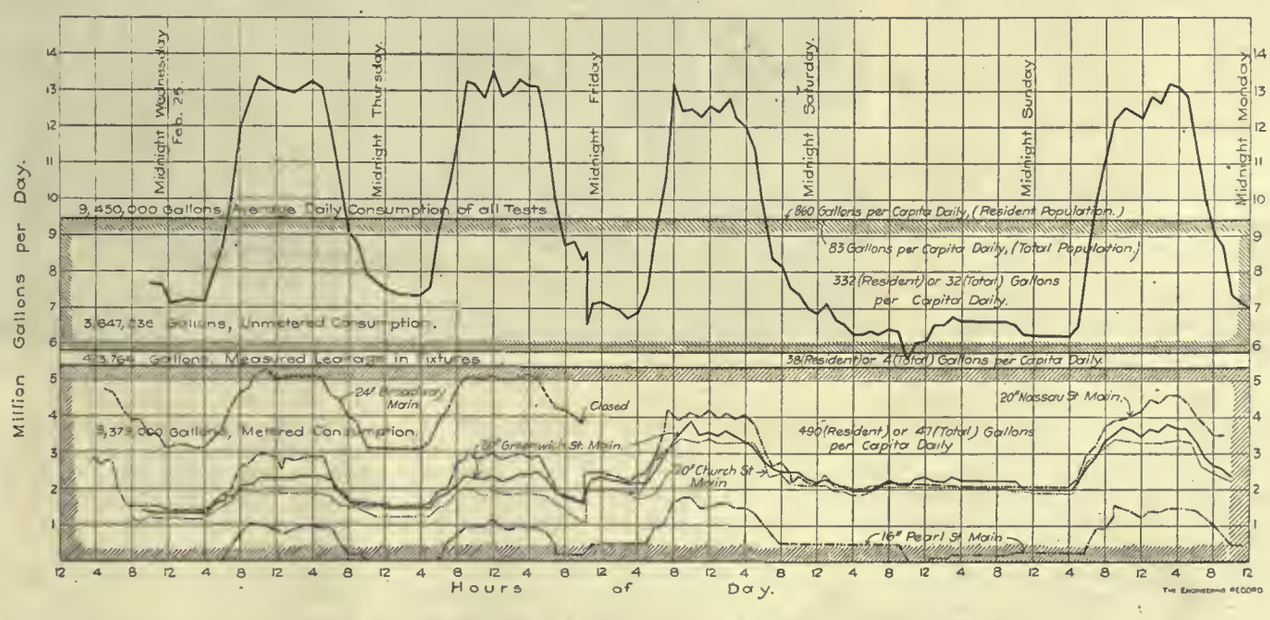
TABLE I.—RESULTS OF WATER WASTE INVESTIGATION WITH COLE-FLAD PI

District.	No. 3.	No. 5.	No. 6.	No. 7.	No. 9
Date of test.	Jan. 10-14.	Jan. 27-30.	Jan. 28-Feb. 1.	Feb. 3-7.	Mar. 5-9.
(5) Estimated population on frontage rates	66,834	30,000	4,940	3,076	6,930
(6) Population metered—resident	23,166	2,220	5,224	0	1,942
(7) Total pop. metered, res. and non-res., est.	...	2,450	5,224	3,000	1,942
Statistics of Consumption:					
Number of houses unmetered	1,593	1,362	434	251	748
(11) Number of houses metered	493	94	35	44	39
(12) Average daily gallons metered	940,000	86,000	160,500	551,900	156,300
(13) Gals. supplied population paying frontage rates.	4,460,000	1,664,000	599,500	1,048,100	1,209,700
(15) Total plumbing leakage reported	672,000	329,479	87,200	148,200	119,500
(16) Net consumption and leakage in mains	4,727,500	1,400,521	672,800	1,451,800	1,246,500
(21) Net per cap. cons.—resid. pop.	52.5	43.5	66.2	473.	140.5
(22) Net per cap. cons.—total pop.	...	43.2	66.2	239.	140.5
(23) Metered per cap. cons.—resid. pop. (12)÷(6)	40.6	39.1	30.7	0	80.6
(24) Metered per cap. cons.—total pop. (12)÷(7)	...	35.2	30.7	183.9	80.6
(25) Ratio min. night cons. to av. for 24 hrs.	.85	.81	.658	.814	.696
Leakage Inspection, House to House:					
(26) Number of buildings inspected	2,078	1,375	446	284	751
(27) Number with leaky fixtures	1,115	742	199	172	299
(28) Number of fixtures reported leaking	2,714	1,973	421	452	707
(29) Number of ball-cocks reported leaking	1,481	1,277	274	338	519
(31) Flow into sewers	Large	Large	Small	Large	Moderate
Financial Statistics (City meter rate = $.133 per 1,000 gals.):					
(32) Yearly revenue from frontage rates	$52,685	$38,843	$11,500	$3,858	$18,295
(33) Yearly revenue from meter rates	45,800	4,180	7,800	12,380	7,600
(35) Yearly revenue per cap.—resident population	$1.09	$1.33	$1.90	$5.29	$2.92
(36) Yearly revenue per cap.—total population	...	1.325	1.90	2.68	2.92
Night Rate of Supply:					
(39) Minimum night rate, gals. per 24 hrs.	4,600,000	1,400,000	500,000	1,300,000	950,000
(40) Number large meters read at night	33	0	12	14	13
(41) Total night rate of large meters read	540,000	0	93,150	411,000	71,900
(42) Estimated total night rate for all meters	800,000	69,700	105,800	448,000	108,900
(44) Night rate of net unmetered cons. per cap.	46.8	33.3	62.2	229	104

NOTE.—For population statistics, total supply, gross per capita consumption, and areas of districts, see Table II.

TABLE II.—SUMMARY OF WATER-WASTE INSPECTION.

No. of Dist.	Area, acres.	Total daily supply.	Per cent. metered.	Per cent. fixture leakage.	Resident population.	Total population.	Gross per cap. cons. Resid.	Gross per cap. cons. Total.	Total revenue, 1,000 gals.
1	127	1,470,000	43	3	8,396	12,156	175	121	$.0720
2	70	1,440,000	20	26	38,906	38,906	37	37	.0988
3	168	5,400,000	17	12	90,000	90,000	60	60	.0498
5	174	1,750,000	5	19	32,200	32,450	54.3	54	.0674
6	58	760,000	21	11	10,164	10,164	74.8	74.8	.0697
7	260	1,600,000	35	9	3,076	6,076	521	263	.0278
8	230	9,450,000	56	5	11,000	114,000	860	83	.0768
9	75	1,366,000	11	9	8,872	8,872	154	154	.0520
Total	1,162	23,236,000	35	9	202,614	312,624	115	74.6	.0673



RESULTS OF WATER WASTE INVESTIGATION IN DISTRICT No. 8.

to locate any sewer leaks. Owing to the condition of the service connections, which have not been supplied with check valves, and the age of the valves in the lower sections of the city where the largest leaks would be apt to occur, this investigation is impossible without the outlay of a large amount of money in repairs and changes.

The ratio of the minimum night consumption to the average for twenty-four hours, in the districts so far surveyed, runs from 50 to 90 per cent., which appears abnormally high. In district No. 1 a very careful survey showed a large number of tanks which were filled during the night hours, and which, owing to the low pressure in this area, did not overflow. This inspection, in conjunction with the sewer inspection, which showed little or no leakage through the spurs to the sewers, would indicate that the filling of the tanks accounts for the high ratio. There are a large number of tanks throughout Manhattan which are filled at night, and which will in part account for this high ratio. Out of about 1,500 tanks examined, 56 per cent. were without ball cocks, which clearly indicates that there is considerable waste due to the overflow from the tanks after they are filled.

The Cincinnati, Georgetown and Portsmouth Railroad.

By E. M. Stevens, General Superintendent.

The Cincinnati, Georgetown and Portsmouth Railroad Company was organized in 1872 to build a railroad from Cincinnati to Portsmouth, O. The road was completed first to Bethel, as a narrow-gauge railroad, but was afterward extended to Georgetown, O. On October 1, 1901, the road was purchased by Mr. A. W. Comstock, of Detroit, Mich., and Messrs. W. R. Todd & Company, of Cincinnati, and plans were immediately made for changing from narrow gauge to standard gauge and for equipping the road with electricity instead of steam. During the past year several extensions have been added and its lines now comprise 50 miles of road. All of this except five miles were laid until lately to a 3-foot gauge with 40-pound iron and 60-pound steel rails. At present, 70-pound steel rails are laid over about one-half of the road and 60-pound steel rails over the other half. New standard ties throughout the entire length of the road have been put in, and washed gravel of an excellent quality is being used to ballast the road, so that when finished the roadbed will be of the highest order.

The road traverses high table land and owing to the difficulty in reaching this table land through heavy cuts and deep fills, there were, up to the time the change was contemplated, 37 wood and steel trestles on this road. Nearly all of these wooden structures have been filled up with earth and the balance have been strengthened so as to permit heavy standard locomotives, passenger and freight cars to pass over them. Nearly 400,000 cubic yards of material have been used in making these fills. The right of way is owned in fee simple, the major part of it being 60 feet wide with ample sidings and facilities for freight business in all of the towns through which the road passes. In addition to this right of way the company owns valuable terminals in the city of Cincinnati, where it has a connection with the Pennsylvania Railroad, which receives and discharges all freight. The road has also terminal facilities in the new Cincinnati water works, Amelia, Batavia, Bethel and Georgetown. A right of way has been secured and the survey completed to extend this line from Georgetown to West Union, O., a distance of 23 miles in an easterly direction. The right of way is private and the maximum grade encountered in this extension will not be in excess of 1 per cent. The average grade of the main line at the present time is less than 1 per cent., so that the operating expenses of this road necessarily will be small as compared with the ordinary traction roads. It is expected that an average speed of about 40 miles an hour will be maintained with the utmost safety to operation.

At Olive Branch, where the power house is located, there has been constructed a lake which covers 10 or 12 acres. The company owns about 50 acres of ground here and this will be laid out and made a pleasure park. From a report by Mr. James Bryan, electrical engineer, the following description of the plant is obtained. The building, including boiler and engine rooms, measures 151 feet 10 inches by 95 feet 10 inches. The engine room is 45 feet 6 inches wide and the boiler room measures from center to center of walls 48 feet 6 inches. The building is of brick with steel roof trusses, slate roofing on 2-inch tongued and grooved sheeting. The boiler-house is arranged for four batteries of boilers of 500 horse-power each, two 250 horse-power boilers in each battery. The boilers are Cahall water-tube boilers with a smoke stack for each battery of boilers. There are at present installed three batteries with a total horse-power of 1,500. The foundation for an additional battery is constructed ready for its installation, if required, at some future date. In the boiler room are two Worthington boiler feed-pumps, each of sufficient capacity for feeding 2,000 horse-power of boilers. There is also one 2,000 horse-power Stilwell-Bierce & Smith-Vaile open-type heater. Coal storage is arranged alongside of the boiler room so that cars can be run on a trestle track and the coal dumped into the bin.

There are foundations for three cross-compound engines together with foundations for exciter engine, rotary converters and switchboard. There is a space at one end of the engine room, measuring 14x45 feet, partitioned off by brick wall, for a transformer room. In the opposite end of engine room is a pump pit, measuring 22x45 feet and the floor of the pit is some 14 feet below the level of engine-room floor. There are at present installed two cross-compound condensing Hamilton Corliss engines. The dimensions of these engines are: High pressure, 24 inches diameter, low-pressure cylinders 44 inches diameter, stroke 42 inches, and they are designed to operate at a speed of 90 revolutions per minute. Connected to these engines are two direct connected Westinghouse 600-kilowatt, 3,000 alternations, 360-volt, three-phase, alternating current generators. There is also in the power house one Harrisburg exciter engine, directly connected to a 50 kilowatt Westinghouse generator; also one Westinghouse motor driven exciter set, consisting of a 75 horse-power, 360-volt, three-phase motor, directly connected to a 50-kilowatt, 110-volt generator. There are also in the power house two 250-kilowatt, 25 cycle, 360-volt alternating current, 600 volt direct current rotary converters; together with marble switchboard having switchboard panels for the control of long distance transmission circuits. There are in transformer room six 200-kilowatt, 360-15,000 volt step-up transformers, together with circuit breakers, lightning arresters for long distance transmission.

The condensing apparatus consists of one central condenser of sufficient capacity for the operation of the three units for which the station is equipped. The water supply was obtained by building a dam across a natural ravine, through which flowed a small stream. The area of the lake thus formed will average about 300x3,000 feet, with an average depth of 16 feet, the lake giving an ample and permanent supply of pure water.



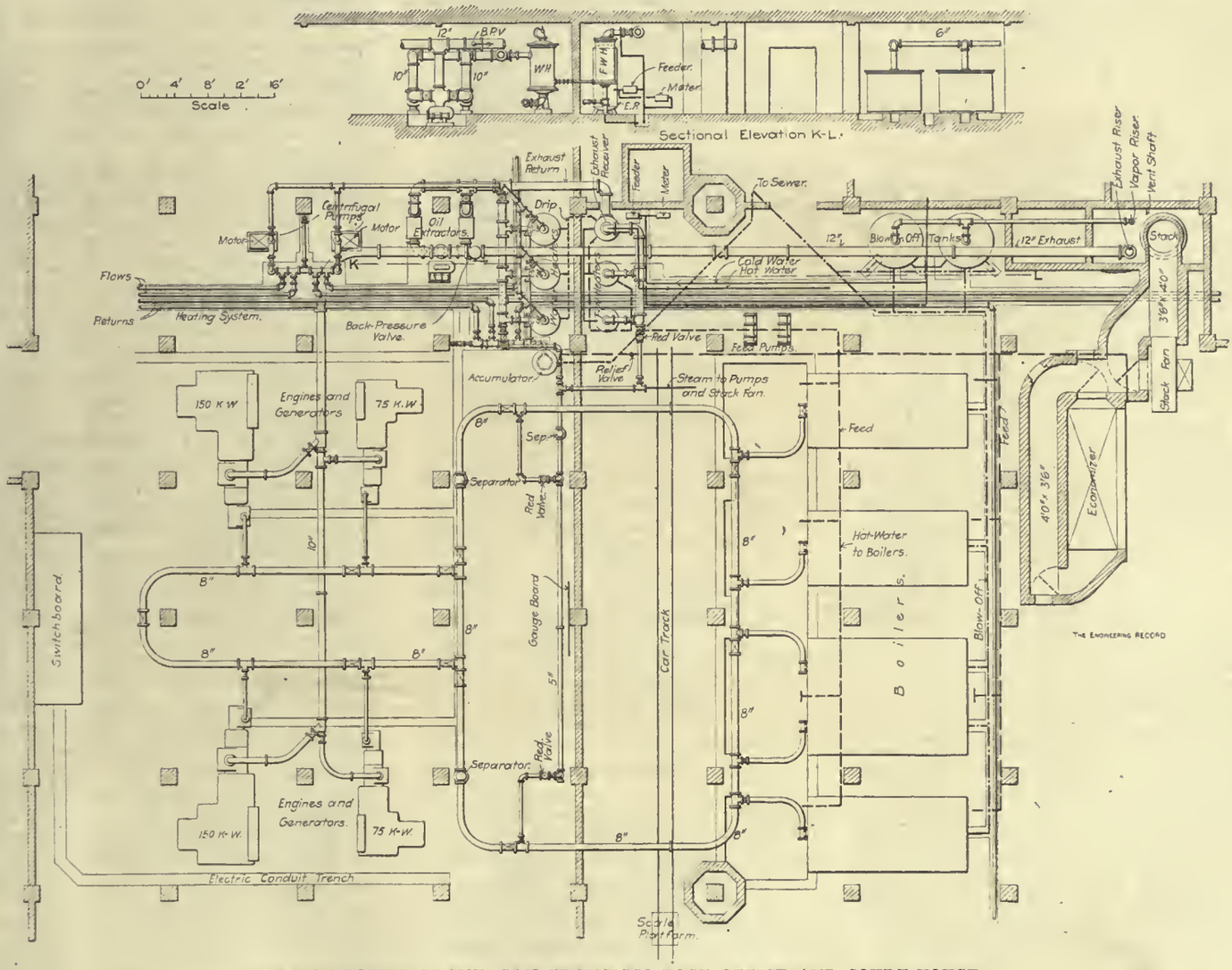
VIEW OF THE ENGINE-GENERATING UNITS.

In addition to the converting apparatus in the main power house there are three sub-stations, located at Mt. Washington, at Bethel and at Sunshine, these sub-stations being located so as to feed current to the line a distance of five miles each way. They are also designed to answer as freight and passenger stations.

The Cost of Sweeping and Cleaning asphalt, asphalt block, and brick pavements in Rochester, N. Y., during 1901 averaged $465.27 per mile, or $28.09 per thousand square yards. The average width of street is 28 feet. The cost of cleaning asphalt streets by day labor is stated by City Engineer Edwin A. Fisher in his report for 1901 to have been $37.10 per thousand square yards for the whole season. These streets were cleaned an average of 99 times during the season. Brick pavements were cleaned an average of 60 times during the season, at a cost of $26.91 per thousand square yards. Medina block stone pavements cost an average of $52.71 per thousand square yards and were cleaned 101 times during the season. The average cost of sprinkling these streets was $350 per mile, or 2.21 cents per square yard.

Power Plant for the New Government Building at San Francisco.

It is said that one of the most complete and nearly perfect buildings owned by the Government is the one now nearing completion in San Francisco, Cal., to serve the combined purposes of a post office and a court house. It contains three stories, an attic and a basement, covers an area of 330 by 210 feet, and will be completed at an approximate cost of $2,500,000. The basement and first floor fill the entire enclosed rectangle, while above there is a court in the rear which allows a large skylighted space for the main post office room on the first floor. Light, heat and power for the building are furnished from a plant located in the basement, which includes five boilers with a total of 650 boiler-horse-power and four engine-generator units with an aggregate normal capacity of 450 kilowatts. The direct current, generated at a pressure of 220 volts, besides supplying a total of nearly 4,000 incandescent lamps, furnishes power to one freight and four passenger elevators, ten motors driving fans for the mechanical ventilation, and two driving centrifugal pumps for the forced circulation of the hot water used by the indirect radiators in connection with the ventilation, and the direct radiators placed where the heat afforded by the fresh air supply is insufficient.



PLAN OF POWER PLANT, SAN FRANCISCO POST OFFICE AND COURT HOUSE.

The accompanying detail of that part of the basement containing the engine and boiler rooms, shows the advantageous placing of the two rooms side by side and the simple piping system consequently possible. The boilers, of the Heine Safety Boiler Company's water-tube type, generating steam at 130 pounds pressure, are arranged in a row facing the engine room, there being three of 150 horse-power set separately and two of 100 horse-power set together. Each has a 4-inch lever safety valve, a 4-inch pop safety valve and a steam separator secured inside of the steam drum on the outlet pipe, and is equipped with a Hawley down-draft smoke consuming furnace having an upper water-tube grate and a lower grate of the ordinary pattern, guaranteed to consume 90 per cent. of the smoke and to be capable of increasing the capacities of the boilers 25 per cent. The coal storage space at the rear of the building, is 138 feet long, 29 feet wide and 11 feet high, and is traversed lengthwise by two parallel tracks connecting by turn-tables near one end to a track at right angles extending through the boiler room. This latter track crosses a platform scale where the coal is weighed in the cars as it is brought to the front of the boilers. The ash pits under the furnaces and the firing pits in front of the boilers are paved with vitrified brick laid on edge in an 8-inch bed of concrete. The ashes are removed in the cars and conveyed to an ash storage space near the coal storage, from which they are raised to the ground level in an ash lift.

The boilers are connected, by means of smoke breechings of ¼-inch boiler iron stiffened with 2x2-inch angle iron, to a smoke header located as shown on the plan. The header is walled with ordinary brick with an interior lining of fire brick on all sides and an outside facing of enameled brick, and has cast-iron doors at each end to allow for cleaning. A fuel economizer flanks the header and may be put into operation or by-passed by means of the dampers indicated. A similar damper permits the gases to be passed directly to the stack by natural draft or through an induced draft fan as shown. The economizer is of Green Fuel Economizer Company's make, contains 28 sections of eight tubes each, the tubes being 4 inches in diameter, and 4½ feet high, giving a total of 1,000 square feet of heating surface. The top and bottom headers are connected longitudinally by branch pipes and these in turn are connected with the feed system. The side away from the smoke header is made of metal protected by a non-conducting covering and is removable to facilitate repairing. The draft fan, furnished by the American Blower Company, has a 6-foot wheel overhung so as to avoid a bearing on the inlet side, and enclosed by a full steel plate housing assembled in sections so as to be easily removable. It is designed to deliver 12,000 cubic feet of gas per minute at a temperature of 300 degrees and to create a draft in the smoke duct of not less than 1 inch of water when driven at 285 revolutions per minute. The fan is driven by a direct-connected center crank engine having its cylinder below the shaft, and is fitted with a governor which regulates the speed in accordance with the pressure in the steam main.

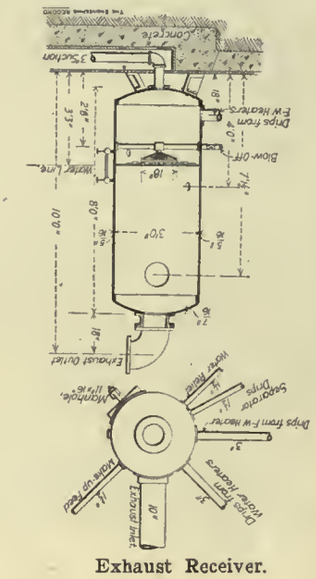
The connections of the individual boilers with the smoke breeching are provided with hand-operated dampers having locking devices, while the main smoke duct near the base of the stack has one which is operated by a Johnson Electric Service Company's automatic regulator. The smoke duct is 48 inches in diameter and 95 feet 9 inches high and is carried up through the

center of a ventilating shaft. It is made of tank steel, the lower 40 feet being ⅜ inch thick and the remainder ¼ inch thick, and is put together in 5-foot sections, each section being held in position by a retaining collar riveted to the next one beneath. The base rests on a cast iron plate 6 feet square, just above which there is a clean-out door, and is supported at every floor by 2½x½-inch bands bolted around it and secured to the frame work of the building. The boilers before being accepted are required to show the following performance in an 18-hour test: An average evaporation of not less than 43⅛ pounds of water in one hour, for each rated horse-power of the boiler, into dry steam from and at 212 degrees, at a rate of 11 pounds of water for each pound of combustible. The foregoing allows for the 25 per cent. increase of the boiler capacity through the use of the smoke consuming furnaces. The conditions imposed were that the boilers should run under a pressure of 125 pounds per square inch, with a draft in the breeching between boiler and smoke header not exceeding ½-inch water-gauge and should furnish steam containing not more than 2 per cent. moisture.

The high pressure steam piping, the sizes, general layout and disposition of valves of which are clearly shown on the plan, is principally remarkable for its double loop form which makes it impossible for anything short of a multiplicity of disasters to disable the entire equipment. The engines of the electric generating plant receive their steam through either or both of two zig-zag 8-inch separators in the main. The condensed steam in the separators is removed by two Western Kieley steam traps, each with a rated capacity for draining 15,000 feet of 1-inch pipe. The medium pressure steam main, carrying about 70 pounds pressure, is supplied through either or both of the reducing valves, from the high pressure main, and contains a 5-inch separator relieved of its condensation by a trap capable of draining 6,000 feet of 1-inch pipe. The medium pressure steam supplies the boiler feed pumps, the drip pump, the draft fan engine and when required may be further reduced to be used for the heating system. The pumps and fan engine are arranged so that their steam may also be taken directly from the high pressure main.

The four engines, of the Allfree Engine Company's horizontal tandem compound, non-condensing type, are direct-connected to Commercial Electric Company's direct-current, compound-wound, multipolar generators, and are capable of driving them at 20 per cent. overload. Two of the engines run at 260 revolutions per minute and are attached to 150 kilowatt dynamos, while the other two run at 300 revolutions per minute and drive 75 kilowatt dynamos. The larger engines were required to have a guaranteed average consumption of not over 22½ pounds of steam per indicated horse-power per hour and the smaller ones of not over 24. The generators develop a pressure of 230 volts under no load and 237 volts at full load; the larger ones give 630 amperes at full load and the smaller ones 315, and both were required to have a full load efficiency of 90 per cent. The exhausts are collected in a 12-inch main running overhead to the base of an exhaust riser, which is carried up to the roof parallel to, and in the same vent shaft with, the smoke stack. Very little of the exhaust steam is wasted through the riser, however, most of it being utilized for heating the feed water for the boilers, the hot water of the plumbing system and the water used in the heating apparatus, and is taken for these purposes from the under side of the exhaust main in the engine room through a short vertical 12-inch branch. Beyond this 12-inch stand-pipe a back pressure valve is inserted in the main to force as much of the exhaust steam as may be required into the water heaters. The exhaust steam from the feed pumps and the draft fan engine is wasted, being passed into the exhaust main beyond the back pressure valve. The drips of the engine cylinders and all foul drips are drained by gravity into the bottom of the stand pipe and are passed on with the exhaust steam through either or both of two 10-inch oil extractors. These are of special design and consist of cast-iron casings containing five screens of No. 20 galvanized wire of No. 8 mesh suspended in frames of No. 6 wire and through which the steam passes successively. Draw-off pipes are arranged to drain the oil to a suitable receptacle. The greasy water eliminated from the exhaust steam by the extractors is removed by a 3x2x3-inch duplex drip pump with attached receiver and automatic governor, and is passed to blow off tanks. A by-pass around the pump allows the drainage to go directly to the blow-off tanks or to the sewer, when a slightly increased back pressure on the engines can be temporarily tolerated. The exhaust steam from the drip pump is connected to the 12-inch exhaust stand-pipe.

The connections of the exhaust system beyond the oil extractors may best be followed by referring to the plan, where it will be seen that the 10-inch main divides; one branch leading to



Exhaust Receiver.

three hot water heaters and the other to two feed water heaters. Each branch ends in a 4x8-inch reducing valve connecting with the medium pressure steam system, through which any insufficiency of exhaust steam is automatically compensated for. The feed heater branch contains an exhaust receiver in which are collected all of the clean drips such as those from the high pressure mains and steam separators, and the water of condensation from the three water heaters and the two feed heaters. All of this condensed steam is returned to the boilers through a 3-inch line leading from the bottom of the receiver to the suction ends of two boiler feed pumps. Any deficiency in the amount required for the boilers is made up in the exhaust receiver by an automatic water feeder connected with the cold water supply, which maintains a constant water level in the receiver. The water feeder has a capacity of 40 gallons per minute at a water pressure of about 40 pounds per square inch. To keep a check on the amount of fresh water fed to the boilers a Pittsburg Meter Company's water meter is connected in the piping near the water feeder, both being equipped with by-passes so that they may be removed without interfering with the operation of the plant. The fresh feed taken from the city service may first be passed through coils in the blow-off tanks, which latter receive the boiler blow-off and all greasy water, where the double advantage is gained of cooling the sump water while preheating the feed.

The three water heaters for the heating apparatus consist of shells of ⅜-inch flange steel, 3 feet in diameter and 5½ feet high, with ¾-inch cast-steel heads, and each contains 91 2-inch tubes of charcoal iron 4 feet 10 inches long, giving a total heating surface of 238 square feet. The steam is introduced into the space surrounding the tubes and the water is passed through the tubes. Each heater is provided with an automatic air valve for the steam space, and an automatic relief valve for the water space, the wastes from the latter connecting with those from the feed-water system in the boiler room.

The two feed-water heaters are of the closed type, the steam being condensed within them and returned to the exhaust receiver where with the other water of condensation it goes to make up the feed to the boilers. The pumps draw their supply from the receiver, as has been stated, and pass the water for further heating to the feed heaters and finally into the feed main line to the boilers. The feed heaters are of the National pattern, each having a capacity of 400 horse-power, based on a rating of ⅓ square foot of pipe surface to 1 horse-power. Automatic air valves relieve the steam spaces, and the hot water outlets have safety valves between the stop valves. The outlets of both feed heaters are connected to the feed system of the boilers and also to a header from which branches are taken for the supply of hot water to the plumbing fixtures. The circulating, or return pipes of the hot water fixtures connect to the direct cold water supply header of the feed water heaters.

The exhaust receiver, shown in an accompanying detail, is 36 inches in diameter and 8 feet high over all, and is constructed of 5/16-inch steel with heads 7/16 inch thick. The condensed steam from the hot water heaters is introduced to the receiver above the water line and that from the feed heaters below the water line. A surface blow-off with flaring mouth is provided which wastes to the blow-off tanks or to the sewer. The exhaust steam is introduced at the side and withdrawn from the top.

In case of necessity the boiler feed may be taken directly from the city service, or it may be taken through the meter without passing through the heaters. The two feed pumps are Worthington 6x4x6-inch duplex pattern and have brass water pistons and piston rods and brass lined cylinders and stuffing boxes. The discharges of the pump are connected to a header which at one end leads directly to the feed line to the boilers, used only in case of emergency, and at the other end by a branch to the inlets of both feed-water heaters. The latter branch of the discharge header is fitted with a relief valve arranged to discharge the water into the exhaust receiver, if the pressure in the pump discharges exceeds an established limit. The outlets of the feed-water heaters enter near one end of a feed main, the other end of which connects to the inlet of the economizer. Two branches are taken from this main; one running across the front and the other across the rear of the boiler settings, the ends being connected so as to form a loop from which the individual front and rear boiler feed connections are supplied and into which the outlets of the economizer discharge.

The separate blow-off connections from the boilers, furnaces and economizer are connected to the main blow-off pipe in rear of the boilers.

This main blow-off pipe connects to both blow-off tanks and also directly to the sewer. The by-pass connection is only used, however, when washing out the economizer or one of the boilers. The two blow-off tanks are located in the boiler room, are 6½ feet in diameter and 5 feet high and have 5/16-inch steel shells with ⅜-inch bottom heads and removable covers made in three pieces. Each tank contains a coil of four turns of 2½-inch wrought iron pipe about 4 feet in diameter. The overflow from both blow-off tanks is taken from the bottom and arranged to maintain a certain water line in the tanks except when they are being drained. The tanks, being closed, are vented through a 6-inch vapor pipe which runs to, and up in, the vent shaft parallel to the exhaust riser. The cylinders of the drip and boiler feed pumps are drained to the discharge pipe from the drip pump and thence to the blow-off tanks, and the cylinder drip from the draft fan engine to the drip from the bottom of the exhaust riser. The drip from the exhaust pipe of the feed pumps is drained through a trap or siphon about 4 feet high into the drain from the heating system, while that from the exhaust riser is drained through a similar siphon into the overflow pipe of one of the blow off tanks.

The entire system of piping for the feed water is of wrought iron and lined with tin. All cold water pipes are of galvanized iron. The 12-inch exhaust pipe beyond the back pressure valve, and the 6-inch main vapor pipe are of spiral riveted pipe No. 16 gauge. Where pipes are carried in trenches they are supported on expansion rollers and chairs every 8 or 10 feet. The trenches are covered with cast iron plates ½ inch thick, the under side being lined with ½ to 1 inch of non-conducting fireproof plaster and the side walls and bottom plastered with ½-inch of cement.

A gauge board of Tennessee marble located in the engine room bears the following gauges, all with nickel-plated cases and 8-inch dials: One connected to the high pressure main in the engine room and graduated to 200 pounds, one on the medium pressure main reading to 150 pounds, one compound steam gauge graduated to 15 pounds and connected to the exhaust receiver, five reading to 200 pounds, one being connected to each boiler, and three water pressure gauges reading to 100 pounds and connected to different points of the heating system.

The plans for the building were drawn up in the office of Mr. James Knox Taylor, supervising architect of the Treasury Department, Washington, D. C., and the mechanical features were designed under the supervision of Mr. J. E. Powell, chief mechanical and electrical engineer in the office of the supervising architect.

The Hardy Catalpa for Posts and Ties.

Bulletin No. 37 of the Department of Agriculture contains papers by Messrs. William L. Hall and Hermann von Schrenk upon the hardy catalpa, a tree which, because of many good qualities, has attracted much attention in recent years. Of the trees used for commercial planting none have been planted more extensively in the region of southern Iowa and Nebraska and eastern Kansas than the hardy catalpa. In its native habitat along the Lower Wabash and Ohio rivers this tree nearly a century ago gained a reputation for rapid growth and durability. A few years' trial on the plains sufficed to prove its good qualities for that region. It was easily propagated, grew rapidly on prairie soil, had good form, was drought resistant, had few insect or fungous enemies, and above all was a lasting timber, adapted to many uses. In the regions named it took the lead as a commercial tree, especially for such purposes as fence posts, telegraph and telephone poles, and railroad ties.

Its value for most of these purposes has been quite fully demonstrated. As a post timber it has given excellent satisfaction. It ranks with black locust and osage orange in durability, while it surpasses them in rate of growth, form, penetrability, and freedom from checking. For telegraph and telephone poles its only deficiency seems to be a tendency toward crookedness, but possibly this can be overcome by special treatment. As a railroad-tie timber the hardy catalpa has not had sufficient trial to demonstrate what its rank should be. Experiments have left no doubt as to its resistance to decay. The only question lies in its resistance to wear. So far as tried it does not stand the wear and tear of a railroad track so well as white oak, especially under heavy traffic. In the middle west, however, the traffic on many railroads is comparatively light, while the decay of timber is particularly rapid. Under these peculiar conditions catalpa will probably outlast oak as a tie timber. Moreover, it is believed that proper tie plates will do much to remedy the difficulty.

The Farlington Forest, established by the Kansas City, Fort Scott and Memphis Railroad Company, is located one-half mile west of Farlington, Kan., and occupies an entire section of land, inclusive of a number of swales and ravines not planted. The land consists of undulating upland prairie with numerous ravines, forming a complete drainage system. The soil is a moderately fertile loam which overlies a rather tenacious clay subsoil of indefinite thickness.

The company began planting hardy catalpa in 1877 by setting trees on 45 acres. In the spring of 1879 a contract was let at $30 per acre for planting the trees and cultivating them until they reached a height of 6 feet. They were to be planted 4 by 4 feet, and a stand of 2,000 per acre was guaranteed. The contract planting began in the fall of 1879, when 75 acres were set. Twenty-five acres were planted in the spring of 1880, 125 acres in the spring of 1881, and over 100 acres in the spring of 1882. The trees were cultivated in the manner of a corn crop, three or four cultivations being given during the season. Within two years after planting most of them had reached the height specified in the contract and had passed out of the care of the contractors. As the trees on the poorer soil did not reach the required size in that time, they were cultivated during the third season.

By 1885 the terms of the planting contract were fulfilled. Thenceforth the plantation was managed by the railroad company. Aside from the plowing of fireguards no further work was done until the winter of 1894, when one-fourth of the trees were removed. One tree, usually the most inferior, out of every group of four, was taken, but no removal was made if one or more of the four trees had died. No use was made of the thinnings. The cost of the labor amounted to 62½ cents per acre. This was the last expense incurred.

The products of the Farlington plantation are estimated in posts and telegraph poles. Two classes of posts are made. Those between 3 and 6 inches in diameter and 6½ feet long are valued at 8 cents each. Those between 2½ and 3 inches, 6½ feet long, are called stakes and valued at 4 cents each. The trees between 6 and 9 inches in diameter are reckoned as two posts per cut. A straight, unbranched tree, 9 inches or over in diameter at 1 foot above ground and 5 inches at 25 feet above ground, is classed as a telegraph pole and valued at $1.50. The average value per acre is $390.21.

In reckoning the cost per acre of the plantation there is included—

Cost of establishing, as per contract	$30.00
Rent of land, 21 years, at $2 per year	42.00
Cost of thinning, 1894	.62
Estimated cost of marketing products at 1 cent per post	36.14
Cost of superintendence, 21 years, at $0.75 per year	15.30
Total cost per acre	$124.51

Subtracting from the gross value, $390.21, the cost, $124.51, there remains $265.70 as the net return on the investment. This is an average annual profit of $12.65 for the time the land has been occupied.

The plantation of Mr. George M. Munger, 8 miles north of Eureka, Kan., 135 acres of fertile clay loam gave a net annual acreage return, similarly computed, of $15. The Hunnewell plantation, 5 miles southwest of Farlington, 400 acres of finely divided, ashy clay loam, showed a net return of $14.78. On Mr. L. W. Yaggy's plantation, 4 miles northwest of Hutchinson, Kan., the soil varied considerably in fertility, and the return ranged from $7.25 to $21.55.

Some very important cultural points are made clear in the study of these plantations.

(1) It is shown in each plantation that the hardy catalpa reaches its best growth only on very rich soil. Depth and porosity are as important as fertility. The trees do not thrive unless their roots penetrate well into the ground. An impervious layer of clay near the surface is prohibitive of successful growth. If the clay is not too dense, however, and occurs beneath several feet of good soil, it is highly beneficial, as in that case it forms a foundation for the soil and retains fertility and moisture.

(2) Grown in pure stand or mixed with trees no taller than itself, and especially in plantations on the plains, the catalpa should be protected from prevailing winds by shelter belts of taller trees. A cottonwood belt on the windward side of a plantation will protect the edge trees and allow them to make much taller and straighter growth. Even an osage orange hedge, though not growing so tall as the catalpas, will greatly protect them.

(3) It is much cheaper for the planter to grow his trees from seed than to buy them from a nursery, if a large number are to be planted.

(4) Three of these plantations were planted 4 by 4 feet, thus giving 16 square feet to each tree; the other was planted 3 feet 10 inches by 6 feet, which gives each tree 23 square feet. Without severe crowding the catalpa will not produce the straight pole growth necessary for best use. With plenty of room it is a spreading round-topped tree with almost no tendency toward an elongated central axis, and pruning, while it may somewhat improve the form, will not sufficiently change it to make the tree of much use. At best, pruning can only remove the branches within 8 or 9 feet of the ground. Above that height it is entirely impracticable in a commercial plantation. The most important advantage of close planting for the catalpa is that it kills the lateral branches while young.

(5) The development of large side branches unfits the catalpa for practical use. While the stand may become so dense as finally to shade them out, they cling with such persistence to the growing trunk that it cannot cast them off. New wood is deposited around the dead branches, but does not unite with them. The holes thus formed lead straight into the heart of the tree. When the branch is finally released, it leaves a great hole leading to the decayed heart of the tree.

(6) The cutting back of the young trees after two or three seasons' growth from planting, and the training up of a single sprout from the stump greatly hastens height growth and prevents side branches on the lower part of the trunk. The season following the cutting back a numerous brood of sprouts will spring up from the stump, all of which, except the most vigorous one, should be removed. The survivor will make a straight, branchless growth of from 8 to 10 feet the first season.

(7) With close planting and cutting back two years thereafter, thinning will become necessary within eight or ten years from the time of planting. Some of the trees will be large enough for fence posts. Wherever there is a demand for small posts and firewood, the grower may expect considerable returns from the thinning of a 10-year-old plantation. In this thinning the stand may be reduced to 1,200 or 1,300 trees per acre, consisting of the straightest and best, though not necessarily the largest trees.

(8) When the first growth is for any reason bushy and undesirable, a better growth can usually be secured by cutting the stand clean and reproducing it by sprouts.

(9) A clean-cut stand should be protected by occasional strips of timber left uncut for the protection of the succeeding crop of sprouts. This is especially necessary on the prairies. The protective strips are best run east and west, as the most damaging winds are from the south.

(10) The best growth of catalpa is not obtained in pure plantations. The peculiar advantage of an associate tree is to supply undergrowth, and its effect would be seen in the following two ways: (a) In shading the ground, thereby keeping it cool, retaining moisture, and preventing the entrance of injurious weeds and grasses; (b) In growing up immediately under the crowns of the catalpa, forcing the tops upward and killing off the side branches while young, so that a long, straight, clean bole may be secured at least to a height of 18 to 20 feet. With cutting back and the use of the proper associate tree, side branches can practically be dispensed with. Not many trees are adapted to this purpose, and when the further requirement is made that they themselves shall have some commercial value, the list becomes very brief. In the middle west the two trees best suited for the purpose are the osage orange and Russian mulberry, both of which are adapted to about the same range for planting as the hardy catalpa.

(11) A high percentage of straight, limbless poles can not be secured from the catalpa without careful treatment. It must be cut back when young and then crowded into straight, tall growth by its own dense stand or proper mixtures. Some pruning may still be required, and even then not all the trees will have the form to make telegraph poles.

(12) The heartwood of the hardy catalpa forms nearly three-fourths of the volume of the entire tree, even at the early age of 5 to 10 years, and is durable in the soil if properly seasoned, regardless of age and rapidity of growth. Growers need not, therefore, hesitate about forcing the growth of their plantations as much as possible, nor does experience give them ground to claim a higher value for their products because they have grown slowly.

In spite of its light, porous structure, catalpa wood resists the weathering influences and the attacks of wood-destroying fungi to a remarkable degree. In fact no fungus has yet been found which will grow in the dead timber. The wood of the living trees, however, is attacked by two fungi, one causing a soft rot and the other a brown rot. The first of these causes the most trouble, and the growth of both can be entirely prevented by cutting back the trees when young and crowding the tops upward so as to avoid the growth of side branches, for the fungus spores gain entrance through dead side branches. After cutting off a branch care should be taken to coat the wound with some antiseptic substance, such as ordinary coal tar. Trees with the center partially rotted will serve as posts, for there does not seem to be any danger that decay will continue after the trees are cut.

Letters to the Editor.

Water-Works Charges for Private Fire Supplies.

Sir:—At the last annual convention of the New England Water-Works Association, the following motion, made by Mr. Frank C. Kimball, superintendent of water-works at Knoxville, Tenn., was unanimously passed: "That a committee of three be appointed by the president, whose duty it shall be to ask for the appointment of, and to confer with, similar committees from the American Water-Works and other kindred associations, and also with the various underwriters' associations, to agree, if possible, upon some adequate means of controlling private fire supplies acceptable to all parties concerned, including therein all questions relating to charges therefor and similar matters." Messrs. F. H. Crandall, of Burlington, Vt., R. J. Thomas, of Lowell, Mass., and Elbert Wheeler, of Boston, Mass., the committee appointed in compliance with the instruction contained in the above motion, would respectfully invite correspondence and suggestions from all interested in a fair and equitable assessment of the benefit conferred in supplying fire protection by means of private fire protective systems.

The committee, so far as its investigation has progressed, finds that nearly everywhere, both in case of public and private ownership, it is customary to recognize the service of the water-works to the public, in the line of fire protection. A frontage tax, hydrant rental, general appropriation, or an overdraft, serving as means to secure the assessment, upon the property benefited, of the cost of fire protection. The capacity of works necessary to supply the volume of water required to make private fire services of value, the leaks habitually permitted on unmetered services, to which fire services are no exception, and the stealing, which not infrequently takes place from such services, all entail expense, to cover which an assessment should be made upon the parties directly benefited. As in the case of schedule rate assessment, the convenience or advantage accruing from additional fixtures, together with the additional cost of the service, constitutes a basis for increased assessment, so in the case of fire protection, increased benefit and increased cost of service, constitute a basis for increased assessment. The individual benefit enjoyed by the possessors of private fire protective systems, is far in excess of that enjoyed by the general public, to which latter benefit, by reason of payment of taxes, all are, to a reasonable extent, entitled.

As the Honorable J. O. Hall, of Quincy, said at the 1902 convention of the New England Water-Works Association: "The individual tax-payer should not be compelled to bear any burden which, by any interpretation, can pass into an individual benefit to somebody else." That private fire protection should yield the company, or department, furnishing it, a fair return, that a request for a service for fire or any other purpose, unaccompanied by willingness to furnish correct and trustworthy information as to the amount of water used or wasted through it, is unreasonable; and that the size of services, for whatever purpose used, should be kept well within the capacity of the system to supply, without excessive loss of pressure, are conclusions easily and speedily reached. How to determine an amount constituting a fair return, is a question upon which the committee finds room for a greater difference of opinion. The committee promises to all communications and suggestions their thoughtful consideration.

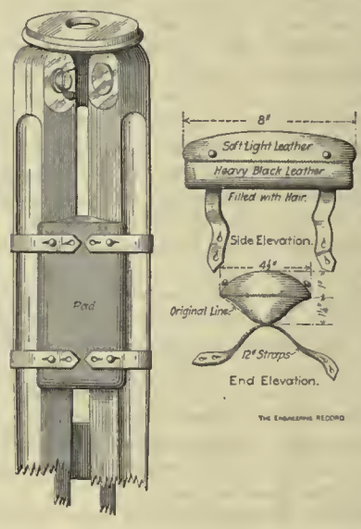
Yours truly,

F. H. Crandall, Chairman,
R. J. Thomas,
Elbert Wheeler,
} Fire Pipe Committee,
New England Water-Works Association.

Burlington, Vt., April 9, 1903.

Shoulder Pad for Surveying Instruments.

Sir:—Several years ago I had a pad made for the protection of the shoulder in carrying heavy instruments. Some instruments are carried with comfort and ease, but there are heavy transits and levels which are a burden to carry long distances. So I found it, and designed and had made the pad as shown in the accompanying sketch. This pad was made by a harness maker and cost $1. My corps would not be without it now. It is easily attached to transit or level-



tripod with either round or square legs, and when on the shoulder, by allowing the straps full play, is easily adjusted to the weight for balancing. The only remuneration I desire is that if any engineer sees fit to have one made he will kindly write me whether the pad has been of service to him. It is not patented and no patent is applied for.

Yours truly,

S. Cameron Corson,
Borough Engineer.

Norristown, Pa., March 25, 1903.

The Pavements of Harrisburg, Pa., were recently made the subject of a report to the Municipal League of that city by Mr. Nelson P. Lewis, of New York, who stated that the considerations to be borne in mind in the selection of new pavements for Harrisburg were, in the order of their importance: sanitary qualities, ultimate economy, attractive appearance, facility of cleaning, and ease of traction. There are few steep grades in the city, and the traffic is comparatively light; so that there is little need for granite block pavements. Mr. Lewis recommends Warren Brothers' bituminous macadam for a considerable amount of future paving, but until that has stood the test of time he considers that sheet asphalt should be the leading pavement. Vitrified brick is recommended to a limited extent for narrow, damp and poorly cleaned streets.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual Convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers.. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

Personal Notes.

Mr. James Stephenson, of Pocatello, Idaho, has received the appointment of assistant engineer of that State.

Mr. Ridgley Walter Hill has been awarded the alumni fellowship in architecture at the University of Pennsylvania.

Mr. E. H. Welch has been chosen city civil engineer of Lockhaven, Pa., and Mr. Charles F. Keller, water superintendent.

Superintendent R. R. Parkin of the water department of Elgin, Ill., has recently entered upon his sixteenth year in that capacity.

Mr. Porter J. Preston, superintendent of the Fort Lyon canal, Colorado, has been made deputy state engineer of Colorado under Professor Carpenter.

Mr. Clay Belsley, Jun. Am. Soc. M. E., of Peoria, Ill., has been engaged to take charge of the engineering work for a 40-mile interurban electric railway in Northampton County, Pa.

Mr. George W. Rafter, a member of the New York State water storage commission, delivered an address, April 6, before the Chamber of Commerce on "Present and Proposed Waterways in New York State."

Assistant Professor Arthur E. Watson, of Brown University, read a paper before the Providence Franklin Society March 31, on "Some Accomplishments, Attempts and Limitations in Electrical Engineering."

Mr. Frank E. Johnesse, of Idaho Connty, Idaho, has been appointed superintendent of construction of a wagon road from a point in Long Valley to Roosevelt, Thunder Mountain, at a cost of about $20,000.

Mr. John B. Hawley has been elected city engineer of Fort Worth, Tex.; Mr. Charles Crabtree, city electrician; Captain A. W. Scoble, superintendent of water works, and Mr. J. W. Renfro, street commissioner.

Judge George Hillyer has resigned as president of the board of water commissioners of Atlanta, Ga., and will be succeeded by Vice-President George W. Harrison. Mr. Frank P. Rice will succeed to the vice-presidency.

The following water commissioners have been appointed in Idaho: District No. 1, Mr. Edward J. Turner, of Cover, Bannock County, for six years; district No. 2, Mr. Frank J. Tibiett, of Albion, Cassia County, for four years; and district No. 3, Mr. J. H. Lowell, of Roswell, Canyon County, for two years.

Mr. F. G. Cudworth, Assoc. M. Am. Soc. C. E., for the past three years assistant engineer for the Manhattan Railway Co., New York City, will have charge of the construction work of the new power house for the Metropolitan Railway Co., of Kansas City, Mo., as assistant engineer for Messrs. Ford, Bacon & Davis. His address in that city will be 115 Grand Ave.

Mr. John S. Hodgson, during the last four years and for some years in the earlier stages of the works assistant engineer on the Metropolitan sewerage works, of Boston, has resigned to accept a position on the editorial staff of The St. Bride's Press, Ltd., London, proprietor of the "Surveyor" and other engineering publications. He expects to take up his new duties on May 2.

The following orders have been issued by the Navy Department: Commander R. G. Denig to additional duty as inspector of engineering material at the works of the Midvale Steel Co., Philadelphia; Civil Engineer L. F. Bellinger from the New York navy yard to the naval station at New Orleans; and Civil Engineer H. R. Stanford from the bureau of yards and docks at Washington to the navy yard at Pensacola, Fla.

On April 9 at the Columbian University, Washington, D. C., a branch of the American Institute of Electrical Engineers was organized with the following officers: Chairman, Dr. Frank A. Wolff, professor of physics and electrical engineering, Columbian University; secretary, Mr. Philander Betts, Potomac Electric Power Co.; executive committee, Col. Samuel Reber, U. S. A., Mr. W. H. Tapley, electrical engineer, Government Printing Office, and Mr. E. E. Clement, patent attorney.

Among recent railroad changes are the following: Mr. W. D. Trump has been appointed assistant general superintendent of the Pere Marquette Railroad with headquarters at Detroit, Mich., and will be succeeded as superintendent of the Saginaw division by Mr. P. N. Place. Mr. George F. Morse has resigned as assistant engineer of construction for the Lehigh Valley Railroad at Buffalo. Mr. I. G. Rawn is now general superintendent of the Illinois Central Railroad, his predecessor Mr. J. W. Higgins having been promoted to assistant to the second vice-president. Mr. George J. Ray has been appointed division engineer of the Delaware, Lackawanna & Western Railroad at Scranton, Pa., replacing Mr. J. I. Riegal. Mr. J. B. Kilpatrick, master mechanic of the Chicago, Rock Island and Pacific Railway, has been promoted to assistant superintendent of motive power succeeding Mr. A. L. Studer, resigned. Mr. Frank Beckwith, formerly division engineer of the Chicago, Burlington & Quincy Railway, at Burlington, has been made principal assistant engineer of the Lake Shore & Michigan Southern Railway, with headquarters at Cleveland.

Changes among the officers of the Corps of Engineers, U. S. A., are as follows: Lieut. Col. M. B. Adams from Nashville, Tenn., to Grand Rapids, Mich., relieving Major J. G. Warren. Majors J. G. D. Knight and G. W. Goethals and Captain D. DuB. Gaillard have been detailed for duty on the general staff. Major L. H. Beach in addition to his duties at Detroit, Mich., will relieve Captain Gaillard at Duluth, Minn. Major Knight at Chattanooga, Tenn., will be relieved by First Lieut. W. J. Barden. Captain E. E. Winslow will relieve Lieut.-Col. J. B. Quinn at Norfolk, Va., the latter proceeding to Savannah, Ga., to relieve Captain C. E. Gillette, who will take station at Newport, R. I., as the relief of Major Goethals. As soon as the Mississippi River flood subsides Captain C. L. Potter will relieve Major Beach of his Duluth duties and transfer the charge of the third district of the Mississippi River improvement to Captain E. W. C. Lucas and the work at Vicksburg to Captain C. S. Bromwell. When Lieut.-Col. C. B. Sears returns from the Philippines he will relieve Lieut. Barden at Nashville of charge of the works in that district, while the latter will be stationed at Washington barracks in command of Company E, Second Battalion of Engineers. Captain McManus has been ordered to Fort Totten to assume charge of construction of public buildings at that post.

Obituary Notes.

Mr. S. Morgan Smith, of York, Pa., president of the company bearing his name and one of the largest manufacturers of water wheels in the United States, died in Los Angeles, Cal., April 10, at the age of sixty-five years.

Mr. Henry Van Brunt, well known as an architect and as the designer of the electricity building at the Chicago World's Fair, died April 8, at his home in Milton, Mass. He was born in Boston in 1832 and graduated from Harvard in 1854. Memorial Hall at Harvard University is one of his best known designs.

Mr. Augustus Kurth, for many years a civil engineer and surveyor, died April 11 at his home in Brooklyn, N. Y., after suffering from general debility for nearly a year and a half. He was born in Brandenburg, Germany, in 1825 and was one of the founders of the German Technical Society. Later he was prominently identified with engineering societies in New York State.

Trade Publications.

The Wainwright steel-bound concrete curb forms the subject matter of an illustrated pamphlet from the Steel Protected Concrete Co., Real Estate Trust Bldg., Philadelphia. Some 50 miles of this curb have already been laid in various cities in the United States and according to the printed testimonials is giving greater satisfaction than the old granite curbing.

The National Oil Burner and Equipment Co., St. Louis, Mo., in catalogue No. 4 describe the Branch oil burner for boiler furnaces, tanks, etc., using steam or compressed air to inject the oil, which may be crude or kerosene, and domestic burners for house furnaces and stoves where steam or air is not available.

A pamphlet from the Thomas Hoey Supply & Mfg. Co., 404 Atlantic Ave., Boston, Mass., contains working drawings and a text description of a patent tide and back water gate for sewers. The gates may be made in any size or shape, single or double pattern, the material being wood with the working parts of tobin bronze to resist corrosion.

Pumping engines having valve gear with adjustable cut-off, but operating without fly wheels, are described in catalogue No. 3 from the Heisler Pumping Engine Co., Erie, Pa. The engines are built in single or multiple cylinder form; simple, compound or triple expansion; and condensing or non-condensing. The cata-

logue also deals with air compressors and contains some appended items of useful information, including a table of comparative steam consumption for various forms of pumps.

The Climax Road Machine Co., Marathon, N. Y., has recently brought out a new catalogue on road making machinery, including scrapers and plows; stone and ore crushers, portable and stationary, with or without folding elevating conveyors; screens; rollers; portable boilers, etc.

Publication No. 5,002 just issued by the Fort Wayne Electric Works, Fort Wayne, Ind., contains an interesting account of their methods of constructing transformers and how the high efficiency of insulation is attained. Other publications from the same concern are Bulletin No. 1,039, on small direct-current generators, type MP, No. 1,040, on motor starting rheostats with double release and combined switch and circuit breaker, and No. 1,041, on direct current belted motors, type LB; and Flyer No. 4,043, on commutator truing devices, and No. 4,044, on fan motors of the suspended revolving and desk types.

The Gurney Heater Mfg. Co., maker of heating apparatus for all classes of buildings, using either steam or hot water, is distributing a handsome leather covered pocket edition of its trade catalogue, containing illustrations of a number of its products, together with tables of sizes, capacities, prices, etc. Useful information is scattered throughout the book and memoranda pages are appended.

The April issue of "Graphite," the publication of the Joseph Dixon Crucible Co., Jersey City, N. J., is largely devoted to the adaptability of silica-graphite paint to various kinds of work.

A recent catalogue from the American Radiator Co., Lake and Dearborn Sts., Chicago, illustrates its many different patterns of radiators and gives useful hints on the selection of the types best suited for special conditions with directions for setting, and tables of overall dimensions and heating surfaces that will assist in calculations.

The Ransome Concrete Machinery Co., 11 Broadway, New York City, is distributing a catalogue which describes comprehensively the drum and continuous types of concrete mixers with several illustrations of them in use and the methods for driving.

A booklet from the Steel-Concrete Construction Co., 6 Beacon St., Boston, Mass., deals with the Ellkop system of reinforcing concrete girders and pillars and shows by detail drawings the schemes by which it is accomplished.

Two new bulletins have been received from the Sprague Electric Co., 527 W. 34th St., New York City. No. 101 pertains to direct-current generators of the single field coil type and No. 102 to direct-current generators of the split-pole type. Profuse illustrations of the distinctive features are found in both bulletins.

Andrew J. Morse & Son, 140 Congress St., Boston, Mass., manufacturers of diving apparatus and fire department supplies, have recently issued two circulars on the Morse monitor nozzle and submarine armor, respectively.

Horizontal boring, drilling and milling machines form the subject matter of a beautifully conceived catalogue of 48 pages received from the Niles-Bement-Pond Co., 136 Liberty St., New York City. In it appear very many halftones of machines remarkable for their size and the large and difficult work they are designed to handle, as emphasized in the text accompanying each cut. Another equally attractive booklet of the same size is confined to multiple drills and adjustable multi-spindle drilling machines of Pratt & Whitney, and Niles & Bement designs covering a wide range of work.

The H. W. Johns-Manville Co., 100 William St., New York City, is circulating an interesting leaflet on "How to Pack Gas Engine Cylinder Heads," a troublesome matter, as the experienced appreciate. Another leaflet cites an instance of long life of an asbestos high pressure packing ring on an elevator pump.

Cabot's brick preservative for water-proofing brick-work and preventing white efflorescence is described in a folder that will appeal to builders. It is manufactured by Samuel Cabot, 70 Kilby St., Boston, Mass.

The General Fireproofing Co., Youngstown, O., in a new catalogue entitled "Allsteel," presents an extensive line of filing cabinets, card indexes, book-shelves, desks, in short all kinds of office and library furniture in the construction of which nothing but steel is used.

Appertaining to the Westinghouse gas meter, the Pittsburg Meter Co., East Pittsburg, Pa., has issued a pamphlet particularly calling attention to the large output of that product during the last six months.

The Eugene Dietzgen Co., 181 Monroe St., Chicago, Ill., manufacturers of drawing materials, surveying instruments, etc., has issued a circular in the form of a supplementary price list to its regular catalogue to accord with a clearance sale now in progress.

Pawling & Harnischfeger, Milwaukee, Wis., have published a complete alphabetical list of users of their cranes and hoists, up to April, 1903. The list covers nearly 1,000 pieces of apparatus and gives with each the type, capacity and nature of the service in which it is employed.

Under the heading "Metal Structures," the Chicago Bridge & Iron Co., Throop and 125th Sts., Chicago, has compiled a neat booklet of cuts and facts concerning a number of notable installations of water towers, storage tanks, bridges and stacks erected by it, with an addendum of useful tables and statistics.

The American Linseed Co., 100 William St., New York City, has issued a booklet setting forth the merits of pure linseed oil soap for general cleaning purposes in connection with railroads, factories and offices. Lubrix, a machining compound, and foots, the sediment from oil filtration, useful in the foundry, are other products discussed.

The following have been received from the General Electric Co., Schenectady, N. Y.: Bulletin No. 4,315 on Thomson astatic instruments for continuous current switchboards; flyer No. 2,112 on the marking of motor gears and pinions for convenience in identification; an index to supply catalogues or price lists, and the following publications in the latter class: No. 5,107, principal parts of forms 10 and 11 direct current series enclosed arc lamps; No. 7,573, parts of form 2 carbon feed enclosed arc lamps for alternating current multiple circuits No. 7,574, parts of C-6 controller; and No. 7,575, parts of type B series parallel controllers.

Catalogue No. 2, 1903, from the Binsse Machine Co., Newark, N. J., describes a horizontal boring machine for quick and accurate work. It is made in 12 sizes ranging in greatest boring capacity from 10 to 24 inches. Various cuts illustrate the tool in operation, among them being a series showing the construction by stages of a small blower where this machine and a lathe did the entire work. An accompanying circular lists a line of small screw jacks for bed-plate blocking.

The last issue of the "United States Sprinkler Bulletin," a quarterly published by the General Fire Extinguisher Co., Providence, R. I., contains an interesting article on the enlarged store of Marshall Field & Co., in Chicago.

Bulletin No. 132 from the Stanley Electric Co., Pittsfield, Mass., contains matter of import regarding large transformers, oil insulated and water cooled, and special self-cooled transformers.

The "Imperial" type of pneumatic tools as manufactured by the Rand Drill Co., 128 Broadway, New York City, are described in circular No. 2 recently issued. Numerous cuts of the tools in use are given with brief statements to emphasize their especial features.

A device for cooling and drying air in warm weather is described in a pamphlet from the Nevo Co., 1312 19th St., N. W., Washington, D. C. The apparatus makes use of a mixture of ice and salt as a cooling medium and is stated to cool the air to or below 18 degrees.

The Lord & Burnham Co., Broadway and 26th St., New York City, horticultural architects and builders, and engineers and manufacturers of heating and ventilating apparatus, have just produced a catalogue of greenhouses containing over fifty beautiful reproductions of houses designed and erected by them and several drawings illustrating their standard methods of construction.

Catalogue H from James B. Clows & Sons, 342 Franklin St., Chicago, covers comprehensively a line of standard and sectional boilers for hot water and steam heating, radiators, etc. Accompanying leaflets deal with the Liberty fire extinguisher and the Jefferson patent union couplings.

The National Fire-Proof Paint Co., Chicago, is distributing a circular containing a very interesting account of a public fire test made on two small wooden structures, erected side by side, the one painted with ordinary paint and the other with its protective paint. A fire was built between the two and at the end of 32 minutes from the time of igniting the first building was entirely destroyed while the other, though considerably charred on the side towards the fire, was still intact.

The Chicago Belting Company, 67-69 South Canal St., Chicago, is issuing an attractive series of "Short Talks" regarding their "Reliance" Belting.

Engineer Draftsman.

The United States Civil Service Commission calls attention to the fact that the title of the structural steel draftsman examination has been changed to that of engineer draftsman, and that the examination will be held on April 21. From the eligibles resulting it is expected that certification will be made to vacancies in the position in the office of the supervising architect, Treasury Department, at a salary from $1,400 to $1,600 per annum. Promotion to higher salaries will depend upon the efficiency of the appointees. Applicants for this examination will be required to show that they have had at least one year's experience and graduation from a technical school.

Candidates should write at once to the United States Civil Service Commission, Washington, D. C., for application Forms 304 and 375 and a copy of the Manual of Examinations. The exact title of this examination as given at the head of this note should be used in the application.

The Eleventh National Conference for good city government, and the ninth annual meeting of the National Municipal League will be held in Detroit and Ann Arbor April 22-24. Uniform municipal accounting and other problems of city government will be discussed.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 25, 28 and 30.

WATER.

North Birmingham, Ala.—See "Power Plants, Gas and Electricity."

Gadsden, Ala.—R. A. Mitchell and associates are stated to have secured a franchise to construct water works.

Greeley, Colo.—The citizens are reported to have voted Apr. 7 to issue bonds for an additional water supply.

Jacksonville, Fla.—R. N. Ellis, Supt. Water Wks., writes that the following bids for a 12-in. centrifugal pump were received on Apr. 6: Morris Machine Wks., Baldwinsville, N. Y., $2,079; R. D. Wood & Co., Philadelphia, Pa., $2,250, and Lawrence Machine Co., 41 Cortlandt St., New York, N. Y., $2,300.

Chicago, Ill.—Bids are wanted Apr. 21 for furnishing and delivering on portions of Oglesby Ave. approximately 610 pieces of 36-in. c. i. water pipe. F. W. Blocki, Comr. of Pub. Wks.

Joliet, Ill.—The Chicago Bridge & Iron Co., of Chicago, has secured the contract for a steel water tower of 200,000-gal. capacity (bids opened Apr. 3) for $15,000.

Alton, Ill.—The estimated cost of a relief pump for the New England Water Co. is reported to he $10,000. T. A. Taylor, Receiver.

Vinita, Ind. Ter.—This city is reported to be figuring on putting water works and sewerage and paving streets in business portion of city.

Marion, Ind.—It is stated that $30,000 will be expended for water works improvements.

Hopkinton, Ia.—F. C. Reeve, City Clk., writes that the contract for constructing water works (bids opened Mar. 27) has been awarded to the Des Moines Bridge & Iron Wks., of Des Moines, for $7,960.

Harris, Ia.—It is stated that a system of water works is to be constructed here.

Monroe, La.—The City Council on Apr. 6 voted to purchase the plant of the Monroe Water & Light Co.

Baton Rouge, La.—As the city and the Water Works Co. are unable to come to terms, a municipal plant will probably be constructed.

Newroads, La.—See "Power Plants, Gas and Electricity."

Crowley, La.—Bids are wanted Apr. 21 for constructing a system of locks near the mouth of the Mermentan River in Cameron Parish. Geo. H. Tinker, Secy. of the Rice Irrigation and Improv. Assn.

Portland, Me.—It is stated that the Portland Water Co. will erect a standpipe 75 ft. high and about 40 ft. in diameter; probable cost, $35,000.

Boston, Mass.—The following bids were opened by the Metropolitan Water & Sewerage Bd. Apr. 9 for laying 9,900 lin. ft. of 48-in. c. i. water pipes in Newton—*a*, D. F. O'Connell, Dorchester (awarded contract); *b*, C. E. Trumbull Co.; *c*, Coleman Bros., Everett; *d*, T. Stuart & Son Co., Newton; *e*, Bruno & Milano; *f*, Eglee-Bunting Co.; *g*, H. A. Hanscom Co.; *h*, John T. Cavanagh; *i*, Geo. M. Byrne; *j*, E. W. Everson & Co., So. Boston; *k*, Hillpot & Oliver, New Brunswick, N. J.; bidders of Boston unless otherwise mentioned:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
Laying 48-in. c. i. pipe, 9,900 lin. ft.	$2.25	$2.45	$2.45	$2.48	$2.65	$2.69	$2.75	$2.89	$2.85	$3.00	$3.53
Lay. 36-in. & 20-in. c. i. pipe, 15 lin. ft.	2.25	2.45	2.45	1.75	2.00	2.00	2.00	2.00	2.85	2.00	2.50
Laying 12-in. c. i. pipe, 90 lin. ft.	1.00	1.50	.90	1.15	1.00	1.00	1.00	1.50	2.00	1.00	.80
Rock exc., above grade, 400 cu. yds.	3.50	3.50	3.00	4.00	3.00	4.00	4.50	4.00	3.00	4.00	3.00
Rock exc., below grade, 10 cu. yds.	5.00	6.00	6.00	5.00	3.50	7.00	5.00	4.00	5.00	6.00	4.00
Earth exc., below grade, 20 cu. yds.	1.25	1.00	2.00	1.00	1.00	2.50	2.00	2.00	.75	1.00	1.25
Setting air valves, 10	10.00	5.00	10.00	5.00	3.00	3.00	3.00	5.00	5.00	10.00	6.00
Chambers for 36-in. valves, 2	70.00	60.00	80.00	125.00	70.00	75.00	65.00	15.00	75.00	75.00	250.00
Chambers for blow-offs, 18	50.00	45.00	60.00	100.00	40.00	50.00	35.00	12.00	50.00	50.00	70.00
Concrete, 100 cu. yds.	5.00	7.00	6.00	8.00	8.00	6.50	7.00	7.00	8.00	6.00	8.50

Totals: *a*, $25,514; *b*, $27,587; *c*, $27,613; *d*, $29,252; *e*, $29,300; *f*, $30,201; *g*, $30,725; *h*, $31,452; *i*, $31,603; *j*, $33,250; *k*, $38,992.

West Boylston, Mass.—The following bids were opened by the Metropolitan Water Bd. at Boston on Apr. 14 for arch bridges and abutments at Oakdale, West Boylston, Mass.—*a*, The Geo. M. Atkins Co.,* Palmer; *b*, Eglee-Bunting Co., Boston; *c*, Ross & Fowler, Boston; *d*, McGawley & Coughlan, Boston; *e*, Francis A. McCauliff, Fitchburg; *f*, Winston & Co., Clinton; *g*, Thos. Kearney, Little Falls, N. Y.; *h*, Lawler Bros., Charlestown:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
Earth excavation, 3,000 cu. yds.	$0.50	$0.30	$0.99	$0.35	$0.40	$0.40	$0.50	$0.50
Rock excavation, 750 cu. yds.	2.00	2.50	1.76	2.00	2.50	3.00	1.90	2.00
Port. cem. concr., 1:2½:4½, 425 cu. yds.	7.00	7.00	8.17	6.75	10.00	7.00	8.40	8.00
Port. cem. concr., 1:3:6, 2,600 cu. yds.	6.00	6.30	7.25	6.50	9.40	6.00	7.90	7.75
Stone masonry, 1,100 cu. yds.	8.00	9.45	8.90	12.75	9.00	14.00	12.60	13.75
Ashlar masonry, 210 cu. yds.	16.00	26.50	19.00	15.00	16.00	28.00	29.00	23.00
Dimension stone masonry, 120 cu. yds.	20.00	26.50	27.80	35.00	23.00	40.00	29.00	37.00
Face dressing, 3,000 sq. ft.	.40	.40	.50	.65	.35	.60	.50	.45

*Awarded contract, at a total of $37,335.

Lexington, Mass.—E. B. Roberts, of Swampscott, is stated to have secured the contract for laying about 9,000 ft. of 12-in. pipe and necessary connections.

Falmouth, Mass.—The following bids for furnishing c. i. water pipe were received by the Water Comrs. Mar. 26: M. J. Drummond & Co., 192 Bway., New York, N. Y., $23,523 (awarded contract); Camden Iron Wks., Camden, N. J., $23,659; Reading Fdry. Co., Reading, Pa., $23,772; U. S. Cast Iron Pipe & Fdry Co., Philadelphia, Pa., $23,809; Warren Fdry. & Machine Co., New York, N. Y., $24,452; Chas. Miller & Son Co., Utica, N. Y., $24,726. M. J. Drummond & Co.'s bid for the pipe per net ton was as follows: For 4-in., $32.20; 6-in., $32; 8-in., $31.75, and 10 and 12-in., $30.90. Louis E. Hawes, Engr., Paddock Bldg., Boston.

The lowest bid received Apr. 10 for laying c. i. pipe was submitted by Burns & Milano, 293 North St., Boston, as follows, price given per lin ft.: For 1,968 lin. ft. of 12-in., 33 cts.; 16,300 lin. ft. 10-in., 25 cts.; 3,265 lin ft. 8-in., 22 cts.; 5,040 lin. ft. 6-in., 20 cts., and 2,404 lin. ft. 4-in. 19 cts.

Melrose, Mass.—The following bids were opened on Mar. 21 by the Bd. of Pub. Wks. for c. i. pipe and specials: U. S. Cast Iron Pipe Foundry Co., of Philadelphia, Pa., $16,671 (awarded contract); F. A. Hondlette & Son, Boston, Mass., $16,825; Chas. Miller & Son Co., Utica, N. Y., $16,901; M. J. Drummond & Co., New York, N. Y., $16,740, and Camden Iron Wks., Camden, N. J., $18,030. The detail of the successful bidder is as follows: For 463,393 gross tons of 4 to 12-in. pipe, $34.95 per ton; 5 tons of specials, at $83 per ton, and 1 reducer, $60.

Benton, Mich.—The Bd. Pub. Wks. is stated to have adopted plans for an addition to the pumping station. A new pump and engine will be installed.

Mt. Clemens, Mich.—The contract for a 3,000,000-gal. pumping engine, bids for which were received by Henry C. Benton, City Clk., Oct. 17, has been awarded to Henry R. Worthington & Co., New York, N. Y., for $7,955.

Grand Rapids, Mich.—L. W. Anderson, City Engr., writes that it was voted Apr. 6 to issue $170,000 bonds to extend the water mains and improve the water system.

Truman, Minn.—M. B. Hayes, Engr., Mankato, writes that the water works letting, set for Apr. 7, has been adjourned to Apr. 21.

South Stillwater, Minn.—See "Power Plants, Gas and Electricity."

Lake Park, Minn.—Prof. J. J. Flather, of Minneapolis, is stated to have been engaged to prepare plans for water works.

Goodhue, Minn.—Engineers Loweth & Wolff, of St. Paul, have plans for the proposed water works, to cost $8,000.

Ceylon, Minn.—It is reported that a water works system is to be installed.

Gulfport, Miss.—Wm. T. Wilcox, of Jackson, is reported to have been engaged by City Council to make a survey and estimate on the cost of establishing water works and a drainage system.

Lexington, Mo.—Gustav Haerie has purchased the plant of the Lexington Water Co., and will enlarge and extend the system as soon as franchise is received.

Cameron, Mo.—The City Council is stated to have authorized Hiram Phillips, of St. Louis, Pres. Bd. of Pub. Improv., to prepare plans and specifications for water works, to cost $80,000.

Bennington, N. H.—The Bennington water system is to be extended to the new paper mill under construction, and 8 hydrants and a sprinkling system put in for fire protection.

Troy, N. H.—The town has had surveys and plans made for a hydrant system to be supplied by the pumps at the Troy blanket factory.

East Las Vegas, N. M.—U. S. Hydrographer Davis is reported to be in the city for the purpose of investigating conditions for the establishment of a Government reservoir here.

Rochester, N. Y.—The contract for furnishing 315 tons of c. i. water pipe is stated to have been awarded to the U. S. Cast Iron Pipe & Fdry. Co. for $11.-163.

Buffalo, N. Y.—The Legislature is stated to have passed a bill empowering the city to issue $500,000 bonds, for the purchase of lands and the establishment of water works, to take water from Lake Erie.

Lockport, N. Y.—See "Sewerage and Sewage Disposal."

Yonkers, N. Y.—The Bd. of Water Comrs. is stated to have authorized Engineer Baldwin to prepare plans for raising the Grassy Sprain reservoir 5 ft. It is proposed to expend about $60,000 for this work.

Ilion, N. Y.—The citizens are stated to have voted Apr. 7 to issue $69,000 bonds for enlarging and extending the water works.

Syracuse, N. Y.—Bids are wanted Apr. 20 for furnishing and delivering on railway cars in said city 204 tons 6 to 24-in. c. i. pipe. W. H. Jones, Clk. Bd. of Contract and Supply.

Fargo, N. D.—J. M. Thomson, Supt. Water Wks., writes that no bids were opened on Apr. 6 for the 5,000,000-gal. pumping engine. Bond issue was defeated at recent election.

Steubenville, O.—Wm. M. Trsiner, City Clk., writes that it was voted Apr. 6 to issue $25,000 bonds for water works improvements.

Sandusky, O.—Bids will be received Apr. 20 by Henry Dehmel, Jr., Secy. Bd. of Water Wks., for furnishing f. o. b. cars 2,900 ft. 6 and 8-in. c. i. water pipe.

McKeesport, Pa.—T. H. Verner, Supt. Water Wks., writes that it is proposed to extend the intake water main, at a cost of $10,000.

Lebanon, Pa.—An ordinance has passed second reading in Council providing for an election June 9 to vote on issuing $500,000 bonds to be used for constructing an additional pipe line; the construction of a house and storm sewerage system, and for street paving purposes. Geo. W. Hayes, City Engr.

Reading, Pa.—The Water Bd. is reported to be considering the question of installing a 15,000,000-gal. engine at Maiden Creek station.

Philadelphia, Pa.—A permit has been issued to Geo. C. Dietrich for the erection of the engine and boiler house at the Lardner Point Pumping Station, on Delaware River, north of Robbins St. The buildings will be of fireproof construction, 1 story high, of brick and stone, with steel beams, girders and columns. The cost of the two will be $550,000.

Confluence, Pa.—The Confluence Water Co. has been incorporated, with a capital of $20,000, by C. S. Coughenour, of Confluence; H. M. Kephart, of Connellsville, and others.

Indiana, Pa.—The Rayne-Dixon Water Co. has been incorporated to supply water for commercial manufacturing purposes in Rayne Township. Capital, $5,-000. H. M. Bell, and T. E. Hildebrand, of Indiana, are among the incorporators.

Scottdale, Pa.—The Burrell Township Water Co. has been incorporated to supply water in Burrell Township; capital, $5,000. J. S. McKeason, Scottdale; Wm. S. Allen, and R. M. Mullin, of Indiana, are among the incorporators.

Allentown, Pa.—Water bonds amounting to $164,-700 have been sold.

Springfield, Tenn.—See "Power Plants, Gas and Electricity."

Taylor, Tex.—Oscar Frink, City Secy., writes that Jno. W. Maxey, of Houston, has been employed by this city to appraise the value of the present water works, and to prepare estimates on an entirely new plant. Estimated cost, $100,000.

Rockwall, Tex.—A press report states that as a result of the recent election the new Council will probably construct a standpipe and lay water mains.

Salt Lake City, Utah.—At a meeting in this city Apr. 4 of the Utah Light & Power Co. and the irrigation companies of Weber County, it was practically decided to construct a reservoir in Ogden Canyon to store water to be used for power and irrigation purposes; it will cost about $300,000.

Provo, Utah.—N. C. Larsen, City Recorder, writes it is probable that the city will extend its water works this season, to connect with springs in Provo Canyon. The water is now obtained from river; probable cost of work, $25,000.

Shenandoah, Va.—Engr. D. G. Adelsberger, 722 Pennsylvania Ave., Baltimore, Md., writes that the city of Shenandoah wishes to give a franchise for water works on gravity plan; 4½ miles of pipe from the city to water source; water source has 700 ft. elevation; pipe line will be cut in two parts to lessen pressure; probable cost of work, $28,000 to $30,000, according to size of reservoir decided on.

Richmond, Va.—E. E. Davis, Asst. Supt. of Water Wks., writes that the following contracts have been awarded, bids opened Apr. 6: For c. i. pipe from 4 to 24-in., to Hunter Frischkorn at $29.75 to $28.05 per ton, and special castings, 2¾ cts. per lb.; valves from 6 to 24-in., to the Southern Ry. Supply Co., from $9.34 to $150.50 ea., and fire hydrants, to Smith-Courtney Co., $24.50 ea. Contractors all of Richmond. Bids for standpipe under consideration.

Goldendale, Wash.—The city is stated to have purchased the water works from Hess & Cooper, and will make improvements in the pipe line.

Pomeroy, Wash.—It is stated that bids are wanted Apr. 21 for 5,000 ft. of 10-in. 2 lap-weld steel pipe, 9,935 ft. of 8-in. No. 1 lap-weld steel pipe, 300 ft. 4-in. No. 1 pipe; also 7 4-in. hydrants, 3 10-in. and 7 8-in. gate valves, reducers, Y's, T's, etc. S. S. Russell, City Clk.

Hinton, W. Va.—The Hunter Water, Light & Supply Co., of Hinton, has been incorporated, with a capital of $120,000, to supply Hinton and Avis with water. Incorporators: O. M. Lance and S. H. Hicks, of Kingston, Pa.; T. F. Ryman, of Wilkesbarre, Pa., and others.

Grantsburg, Wis.—See "Power Plants, Gas and Electricity."

Sheboygan, Wis.—The citizens are stated to have voted on Apr. 7 to construct new water works; probable cost, $200,000.

Baraboo, Wis.—The Baraboo Water Co. has been organized, with a capital of $50,000, by W. G. Maxey, of Oshkosh, and G. Garritt and F. H. Deane, of Baraboo, who recently purchased the water works at foreclosure sale for $75,000.

Madison, Wis.—See "Power Plants, Gas and Electricity."

Fennimore, Wis.—Wm. Weaver, Village Clk., writes that it was voted Apr. 7 to construct water works.

Ft. D. A. Russell, Wyo.—See "Government Work."

SEWERAGE AND SEWAGE DISPOSAL.

Manitou, Colo.—The citizens are stated to have voted Apr. 7 to issue $18,000 bonds for a sewerage system. E. E. Nichols, Jr., Mayor.

Denver, Colo.—The Oasis Ditch & Reservoir Co. has been incorporated by Geo. J. Humbert, Edw. A. Smith and Henry J. Porter, with a capital stock of $10,000, to construct a ditch in Adams County and the city and county of Denver, draining water from Long Branch and Second Creek and adjacent watersheds.

New Haven, Conn.—The lowest bid opened on Apr. 8 by the Dept. of Pub. Wks. for a sewer in Lombard St. is stated to have been submitted by Thos. F. Maher, for $13,540.

Hartford, Conn.—Henry F. Smith, City Clk., writes that it was voted Apr. 6 to expend about $80,000 for the relief of the Franklin Ave. sewer district. According to local press reports, it is proposed to do the work in 3 sections, A, B and C.

Harvard, Ill.—Bids will be received until Apr. 25 for digging a drain about 4½ miles long, 10 ft. deep and 12 ft. wide; probable cost, $7,500. C. J. Hendricks, Attorney, Harvard.

Danville, Ill.—See "Paving and Roadmaking."

Vinita, Ind. Ter.—See "Water."

Linton, Ind.—See "Paving and Roadmaking."

Eldora, Ia.—The citizens are stated to have voted Mar. 30 to issue $10,000 bonds for the construction of a sewerage system.

Independence, Ia.—Bids will be received Apr. 20 by the Sewer Com. of the City Council for furnishing material and constructing a sanitary sewer. A. Littlejohn, Chmn.

Louisville, Ky.—The Mayor in his annual message to Council, Apr. 7, urged that an ordinance be passed providing for submission to voters the proposition to issue bonds to make the sewerage system adequate.

Bangor, Me.—It is stated that the trunk line sewer is to be extended, at a cost of $10,000. John M. Ward, Supt.

Plymouth, Mass.—Of the bids opened Apr. 4 for constructing a sewer system, the award has been made to C. E. Trumbull, at $22,458. Details of his bid are: 420 ft. 15-in. pipe, $1.05; 1,900 ft. 12-in. pipe, 85 cts.; 2,600 ft. 10-in. pipe, 81 cts.; 9,450 ft. 8-in. pipe, $1.04; 1,880 ft. 6-in. pipe, 60 cts.; 500 ft. 4-in. subdrain, 45 cts.; 156 ft. 14-in. c. i. water pipe, $4; 1,300 ft. of 12x18-in. wooden box, $1.50; 20 ft. of 24-in. vit. pipe, $1.80; 700 ft. 6-in. standpipe, 30 cts.; 505 vert. ft. brick manhole, $4; 50 cu. yds. concrete, $7; 50 cu. yds. rock exc., $5; 1,000 cu. yds. embankment, 40 cts.; 200 lin. ft. special foundation, $1.50; 20 cu. yds. riprap, $1.50; 63 manhole rings and covers, $15.

Fitchburg, Mass.—David A. Hartwell, City Engr., writes that the following contracts have been awarded for furnishing material during 1903 to the Highway Dept., bids for which were received by the Bd. St. Comrs. Apr. 13: To Jere. Crowley, 23 Belmont St., sidewalk concrete at 40, 55 and 70 cts. for 1, 2 and 3 layer work; B. A. Cook & Co., 237 Main St., sewer pipe at 67 per cent. discount, car load lots; E. A. Goodrich, 99 Summer St., sewer brick at $8 per M., delivered on streets; Jere. Shea, 578 Main St., for granite curbing at 45 and 60 cts. per lin. ft., and for granite flagging at 47 cts. per lin. ft., and to O. E. Litchfield, 14 Arlington St., broken stone at 75 cts. per ton at crusher. Contract for sewer castings not yet awarded.

Palmer, Mass.—T. F. Foley, Town Clk., writes that it is proposed to construct a sewerage system, at a cost of $5,000.

Winchester, Mass.—E. D. Fletcher, Town Engr., writes that it is proposed to lay about 1,000 ft. 30-in. concrete (Portland cement) storm water sewer (town labor); estimated cost, $4,000.

Fairhaven, Mass.—The citizens are stated to have voted Apr. 9 to build 3,800 ft. of sewer in Pease district, at a cost of $23,150.

Lowell, Mass.—The City Council has adopted a resolution providing for the issue of $50,000 bonds for sewer construction.

Swampscott, Mass.—It is stated that $50,000 has been appropriated to cover the extra expense of sewer construction made necessary by vote to have connections made to the sidewalks as work on the surface mains progresses.

Coldwater, Mich.—The Senate has passed a bill authorizing this city to build a sewerage system.

St. Paul, Minn.—The contract for the construction of a sewer on Oxford and Sherburne Sts. is stated to have been awarded to P. J. Ryan, for $8,743.

According to press reports, City Engr. Rundlett estimates that the St. Anthony Park sewer will cost about $250,000.

Minneapolis, Minn.—A. P. Erickson, Clk. Bd. Co. Comrs., writes that the contract for furnishing 50 tons of 12 to 44-in. iron or steel culvert pipe (bids opened Apr. 6) has been awarded to Harris Mach. Co., of Minneapolis, Minn., at $40 per net ton f. o. b. wagons.

The Council Com. on Sewers is stated to have on Apr. 6 awarded the following contracts: For sewer brick, to the Wisconsin Pressed Brick Co., for 100,000 bricks, and the Menominee Hydraulic Co. for 50,000, at $10.15 per M.; castings, to the Northwestern Foundry Co. at $52 per ton, and for all sewer piping needed, to the Red Wing Sewer Co.

Gulfport, Miss.—See "Water."

Kansas City, Mo.—Daniel W. Pike, City Engr., writes that the following bids for sewer work in Sewer Dist. No. 9, Div. No. 5, were received by Pub. Improv. Com. on Apr. 8: Jas. A. Pringle, $27,368 (awarded contract); R. L. Dawson, $29,402; R. J. & W. M. Boyd, Con. Co., $35,257; Cotter, McDonnell P. & H. Co., $30,834; Parker Washington Co., $31,299; W. C. Mullins, $30,128; bidders of Kansas City. This work includes 10,289 ft. of brick and pipe sewers from 10-in. to 4 ft. 2 in. in diameter, 31 manholes and 24 catch basins.

Guttenberg, N. J.—The citizens are stated to have voted Apr. 7 for the conatruction of sewers; probable cost, $30,000.

Bayonne, N. J.—Bids will be received Apr. 21 by the City Council for constructing sewers in W. 43d and E. 16th Sts. W. H. Hamilton, City Clk.

Albany, N. Y.—Bids will be received Apr. 20 by the Bd. of Contract and Supply for constructing 12-in. vitrified stoneware pipe sewer in portions of 3 streets, including bends, branches, house connections, manholes and other appurtenances. Isidore Wachsman, Clk. of Bd.

Amityville, L. I., N. Y.—The Dirs. of the Brunswick Home Co. are stated to have decided to construct a sewerage system, at a cost of $15,000.

Troy, N. Y.—Bids will be received until Apr. 27 by the Bd. of Sewer Comrs. for constructing sub-main lateral sewers, manholes, flush tanks, etc. H. Allen, Secy.

Lockport, N. Y.—Bids will be received about May 4 for the construction of 1,200 ft. of 10-in. drain and 6-in. water pipe in Evans St. Julius F. Frehsee, City Engr.

Corinth, N. Y.—The following bids were opened by the Bd. of Village Trus. Apr. 7 for a sewerage system and 2 septic tanks: Albert M. Banker, Gloversville, $19,832 (awarded contract); B. Gaffney & Sons, Saratoga, $24,538; Golden & Hall, Troy, $24,641; Thos. O'Dea, Cohoes, $17,883 (withdrawn). The detail bid of the successful bidder is as follows: 976 ft. 18-in. pipe, $1.20 per ft.; 2,200 ft. 15-in. pipe, $1.10; 2,582 ft. 12-in., $1; 6,491 ft. 10-in., 75 cts.; 4,913 ft. 8-in., 60 cts.; 45 manholes, ea., $50; 4 flush tanks, ea., $80; 370 bbls. cement, $2.40 per bbl.; 250 cu. yds. concrete, $4 per cu. yd., and 250 cu. yds. excav., $2.50. Stone and cement furnished by village for all concrete. Engineer, Saml. Mott, of Saratoga Springs.

Canajoharie, N. Y.—The following bids for furnishing material and constructing a sewer system were received by Bd. Village Trus. Apr. 8: Albaugh & Beckwith, Schenectady, $37,436; W. H. Cookman, Niagara Falls, $44,006; C. Dwyer, Amsterdam, $47,568; Eveline Contracting Co., Waterford, $32,361; A. M. Banker, Gloversville, $39,034; F. N. Lewis & Co., Herkimer, $39,000; Fr. Pidgeon, Saugerties, $40,988; John N. Siegrist, Utica, $40,789; J. Vaughn, Stamford, N. Y., $34,000, and Robt. H. Strong, Albany, $32,305 (irregular). The work includes 27,742 ft. of pipe sewers from 8 to 20 in. in diameter, 32 manholes and 2 flush tanks. The trench is expected to average 6 to 7 ft. in depth and will be excavated in limestone rock and alluvial and clay soil. Morrell Vrooman, of Gloversville, is the Engr.

Plain City, O.—It is stated that bids are wanted Apr. 24 for constructing main, sub-main and lateral sewers. J. R. Woods, Village Clk.

Troy, O.—Bids will be received Apr. 27 by the Bd. of Sewer Comrs. for furnishing material and constructing main, sub-main and lateral sewers with manholes, flush tanks and other necessary appurtenances. Horace Allen, Secy.

Glenville, O.—Bids are wanted May 4 for constructing sewers in portions of St. Clair St. and Lakeview Ave. B. F. Davies, Jr., Village Clk.

Portsmouth, O.—Bids are wanted Apr. 21 for furnishing material for constructing the Jackson St. branch of the Mill St. sewer; approximate quantities, 1,780 lin. ft. 15, 18 and 20-in. vitrified sewer pipe, 8 catch basins with stone covers and iron gratings, 6 manholes, etc. Filmore Musser, City Clk.

Bowling Green, O.—Bids are wanted May 9 for furnishing material for constructing circular pipe sewers in portions of certain streets. Alex. Williamson, City Clk.

Cleveland, O.—Robt. Fisher, Contract Clk., writes that the Bd. has recommended that the contract for 20,000 lin. ft. 15-in. sewer pipe (bids opened Apr. 13) be awarded to the Central Builders' Supply Co., for $7,560.

York, Pa.—Mayor Gibson in his message to Council suggests that of the $400,000 loan authorized for sewers, the sum of $100,000 be borrowed during this year so as to be available for use of Bd. of Pub. Wks. in prosecuting the work by engaging a civil engineer to draft and properly locate the system, so that the main sewer at least can be laid during the year.

Altoona, Pa.—Harvey Linton, City Engr., estimates the cost of necessary storm water sewers at $150,000.

Lebanon, Pa.—See "Water."

Woonsocket, R. I.—Bids will be received Apr. 20 by the Bd. of Sewer Comrs. for constructing 2,680 ft. 8-in. pipe sewer with appurtenances in portions of 4 streets. Frank E. Holden, Chmn.; Frank H. Mills, City Engr.

Columbia, S. C.—Bids will soon be asked for installing a sewerage system in South Carolina College; appropriation, $7,500.

Aberdeen, S. D.—It is stated that bids are wanted May 1 for constructing 8,800 ft. of sewer, estimated to cost $12,000. D. C. Washburn, City Engr.

Nashville, Tenn.—The Bd. of Pub. Wks. is reported to be about to ask for bids for work, to cost about $60,000, in connection with the improvement of Murphy property, taken into city by recent act of Legislature. A sewer about 2,430 ft. in length, varying from 9 to 9½ ft., will be built through the property. A tract of 66 acres is to be laid off into streets, which are to be macadamized and graded.

Bids will be received Apr. 30 by the Bd. of Pub. Wks. for constructing an extension of the Lick Branch sewer, being about 2,500 ft. long and requiring about 14,500 cu. yds. excavation and about 1,750,000 bricks; also for constructing and laying lateral pipe sewers and water mains, grading and macadamizing portions of 8 streets. Wm. W. Southgate, City Engr.

Ft. Ringgold, Tex.—See "Government Work."

Beaumont, Tex.—Bids will be received until May 5 by W. A. Ives, City Secy., for constructing approximately $75,000 worth of brick and pipe sewers. Merritt W. Yenter, City Engr.

Tacoma, Wash.—Norton L. Taylor, City Engr., writes that Geo. Milton Savage, of Tacoma, has received the contract for sewers in Dist. No. 127 for $13,728, and F. A. Keasel, of Tacoma, for the sewers in Dist. No. 129, for $4,237 (bids opened Apr. 1).

Milwaukee, Wis.—Bids will be received by the Bd. of Pub. Wks. until Apr. 23 for constructing pipe sewers in 3 streets in W. Sewerage Dist. and in 2 streets in S. Sewerage Dist. Chas. J. Poetsch, City Engr.

Madison, Wis.—See "Power Plants, Gas and Electricity."

BRIDGES.

New Haven, Conn.—Press reports state that Mayor John F. Studley has received from Secy. of War Root an order that a bridge must be built over West River, the dividing line between this city and the town of Orange, within 1 year. It will cost about $200,000.

Wilmington, Del.—Press reports state that the Pennsylvania R. R. Co. contemplates the building of a 2-track bridge, with a 52-ft. draw, across Brandywine River, this city.

Cleveland, O.—The following bids were opened on Apr. 2 for a sewer in Iona St.—*a*, Jas. Duff; *b*, Chr. Burkhart; *c*, W. C. Gayer; *d*, Wm. L. Clements; *e*, Wm. Eggers; *f*, C. T. McCracken & Co.; *g*, Beers & Doolittle:

Items and quantities.	*a*	*b*	*c*	*d*	*e*	*f*	*g*
Excav., A, 16,600 cu. yds.	$0.99	$0.95	$0.90	$0.85	$1.07	$0.90	$0.99
Excav., B, 15,800 cu. yds.	.99	.95	...	...	...	...	...
Brick masonry, A, 610 cu. yds.	9.35	9.95	9.55	10.50	10.10	11.00	9.85
Brick masonry, B, 456 cu. yds.	9.35	9.95	...	...	...	...	...
No. 2 brk. masonry, A, 1,350 cu. yds.	7.85	7.25	8.15	9.00	9.10	8.00	8.20
No. 2 brk. in manhole, B, 45 cu. yds.	8.75	9.95	9.00	9.00	9.25	10.00	8.20
Portland cem. concr., B, 950 cu. yds.	11.95	9.50	8.60	9.60	9.90	8.93	9.30
Natural cem. conc., A, 1,050 cu. yds.	4.95	5.25	6.00	4.69	4.90	4.87	5.20
Natural cem. concr., B, 687 cu. yds.	4.95	...	...	...	...	...	...
Steel in place, B, 42,400 lbs.	.12½	.09	.06	.07	.07	.04	.08
Oak grillage, A, 75.4 M. ft.	24.00	24.00	25.00	16.00	24.00	22.00	24.00
Oak grillage, B, 75.5 M. ft.	24.00	...	...	...	...	...	...
Sheeting, etc., A, 192. M. ft.	16.00	16.00	18.00	18.00	17.00	17.00	19.00
Sheeting, etc., B, 192. M. ft.	16.00	...	...	...	...	...	...
Cast iron in manhole, A, 4,750 lbs.	.03	.06	.05	.04	.06	.04	.04
Cast iron in manhole, B, 4,750 lbs.	.03	...	...	...	...	...	...
12-in. pipe, A, 200 ft.	.75	.75	1.00	.80	.95	.80	1.25
12-in. pipe, B, 200 ft.	.75	...	...	...	...	...	...
12-in. junction, A, 16	1.00	1.00	.70	1.00	1.00	1.00	1.00
12-in. junction, B, 16	1.00	...	...	...	...	...	...
6-in. junction, A, 240	.30	.30	.30	.30	.50	.40	.75
6-in. junction, B, 240	.30	...	...	...	...	...	...
6-in. standpipe, A, 1,680 ft.	.25	.35	.50	.28	.35	.30	.45
6-in. standpipe, B, 1,680 ft.	.25	...	...	...	...	...	...
Catch basin, A, 10	40.00	39.00	40.00	40.00	40.00	38.00	40.00
Catch basin, B, 10	40.00	...	...	...	...	...	...
Total, Plan A	$42,135	$43,582	$45,220	$43,623	$48,096	$43,875	$46,262
Total, Plan B	44,295	42,816	40,895	39,917	44,340	39,456	43,522

Portland, Ore.—Frank T. Dodge, Supt. Water Bd., writes that the following bids for furnishing 38,200 lin. ft. of 4 to 20-in. pipe, 30 tons special castings, ties, etc., were received on Apr. 8; prices per ton f. o. b. cars Portland, Ore.:

	4-in. pipe, 10 tons.	6-in. pipe, 290 tons.	8-in. pipe, 55 tons.	14-in. pipe, 10 tons.	16-in. pipe, 50 tons.	16-in. pipe, 450 tons.	20-in. pipe, 413 tons.	Special castings, per lb.	Totals.
Oregon Iron & Steel Co., Portland*	$42.00	$40.00	$40.00	$39.50	$39.50	$39.00	$39.50	$0.035	$52,554
Martin Pipe & Fdy. Co., San Francisco, Cal.	41.00	41.00	41.00	41.00	41.00	41.00	41.00	.035	54,498
W. P. Hofius & Co., Seattle, Wash.	43.00	42.00	41.00	41.00	41.00	41.00	41.00	.035	54,808
R. D. Wood & Co., Philadelphia, Pa.	43.00	43.00	43.00	42.50	42.50	42.50	42.50	.034	56,533

*Awarded contract.

Sunbury, Pa.—J. Hummel Slear, City Clk., writes that the Council is discussing the question of constructing a sewerage system.

Allentown, Pa.—A correspondent writes that the city will let contracts for about $20,000 worth of sewers on May 5th.

New Kensington, Pa.—See "Street Cleaning and Garbage Disposal."

Washington, Pa.—Bids will be received Apr. 20 by the Town Council for constructing about 6,205 ft. 6 and 8-in. sewer pipe; also about 3,500 ft. 4-in. house branch sewer in portions of 5 streets. J. K. Weir, Secy.

McSherrystown, Pa.—The Hanover Sewer Co., of Hanover, is stated to have petitioned Town Council for a franchise to construct a sewerage system here.

Washington, D. C.—Local press reports state that all bids received for constructing a highway bridge across Potomac River have been rejected, the lowest received being in excess of the appropriation.

Gen. Gillespie, according to local press reports, has approved the recommendation of Col. Allen to award the contract for constructing Pier No. 5 of the Aqueduct Bridge to the Penn Bridge Co., Beaver Falls, Pa., at $54,956.

Kansas City, Kan.—Mayor Craddock has signed the contract for a viaduct which is to be constructed by the Union Pacific and Rock Island Railroads and the Metropolitan St. Ry. Co., at 10th St.

Topeka, Kan.—The Co. Comrs. have decided to construct a 92-ft. steel bridge across Mission Creek.

Columbia, Ky.—It is stated that the Adair Fiscal Court will build an iron bridge across Russell Creek near Columbia.

Peoria, Ill.—Bids will be received Apr. 28 by Robt. M. Orr, City Clk., for improving the approaches to the Upper Free bridge across Illinois River in Peoria Township.

Muncie, Ind.—The Indiana Bridge Co., of Muncie, is reported to have secured the contract to construct 2 bridges in Delaware Co., at $6,000 each.

Frankford, Ind.—Bids will be received May 6 by the Co. Comrs. for constructing several small steel bridges. Lincoln Cox, Chmn.

Bangor, Me.—City Engr. Coombs is preparing plans for a bridge to be built from Water St. West Side to Washington St.

Westernport, Md.—The Allegany Co. (Md.) Comrs. and the Mineral Co. (W. Va.) Comrs., according to reports, are contemplating the construction of a steel bridge across Potomac River, to take the place of the present structure, connecting Westernport, Md., and Piedmont, W. Va.

Cumberland, Md.—It is stated that probably 8 bridges will be built on the connecting link of the Wabash R. R. between Cumberland and Cherry Run, each costing, according to reports, about $125,000. W. S. Newhall, Ch. Engr., St. Louis, Mo.

Haverhill, Mass.—The Legislative Com. on Bridges is reported to be in favor of constructing a bridge across Merrimac River, in this city, at a probable cost of $200,000.

North Adams, Mass.—It is reported that the Hoosic Valley St. Ity. Co. is contemplating the building of a bridge on its line to Williamstown. W. T. Nary, Supt., Main and State Sts.

Williamstown, Mass.—The Aberthaw Construction Co., of Boston, is reported to have secured the contract to construct a concrete arch bridge at E. Main St. for $9,000.

Taunton, Mass.—A correspondent writes that a new draw bridge will probably be constructed across Taunton River. Luther Dean, City Engr.

Winchester, Mass.—E. D. Fletcher, Town Engr., writes that it is proposed to build a concrete and steel highway bridge this season; estimated cost, $8,500.

Newton, Mass.—The Metropolitan Park Comrs. are reported to be considering the building of a bridge across Charles River, between Newton and Wellesley.

Port Gibson, Miss.—The Virginia Bridge Co., of Richmond, Va., is reported to have secured the contract to construct a bridge in Clairborne Co. for $12,000.

Buffalo, N. Y.—The Chief Engr. of Grade Crossing Comn. writes that the following bids for viaducts at Perry St.—*a*, over Lake Shore & Michigan Southern Ity., and *b*, over Erie R. R.—were received, *a*, on April 4 and *b*, Apr. 11: Substructure—McKeown & Johnson, *a*, $106,893 (awarded contract); *b*, $67,644. Kehr & Felton, *a*, $109,007. The German Rock Asphalt & Cement Co., *a*, $111,683; *b*, $65,713. Mosier & Summers, *a*, $114,632; *b*, $65,494. Miller & Franklin, *a*, $115,346; *b*, $63,565. Henry P. Burgard, *a*, $115,556; *b*, $64,236. E. C. Rumrill, *a*, $122,098; *b*, $65,339. Frank J. Reap, *a*, $122,162; *b*, $63,537 (awarded contract). Superstructure—American Bridge Co., N. Y. City, *a*, $69,049 (awarded contract); *b*, $86,667 (awarded contract). The King Bridge Co., Cleveland, O., *a*, $74,500; *b*, $91,774. Buffalo Structural Steel Co., *a*, $79,523. The Brackett Bridge Co., Cincinnati, O., *a*, $84,145. New Jersey Bridge Co., N. Y. City, *a*, $86,833; Owego Bridge Co., *b*, $90,910. Bidders of Buffalo, unless otherwise mentioned.

New York, N. Y.—Bids will be received Apr. 23 by the Bd. of Park Comrs. for constructing a concrete steel arch bridge with stone parapet walls and stone arch facings over the Bronx River, at the crossing of Bronx and Pelham Parkway. Wm. R. Willcox, Chmn.

Syracuse, N. Y.—C. J. Sullivan, 112 W. Genesee St., is stated to have secured the contract for constructing a stone culvert over Harbor Brook at Hiawatha Ave., for $6,663.

Buffalo, N. Y.—The building of a bridge at Ohio St. is reported to be under consideration.

Tiffin, O.—The Co. Comrs. recently opened a new road which crosses the Sandusky River; the same will require a bridge about 200 ft. long.

Delaware, O.—It is stated that plans are being prepared for a 240-ft. bridge which is to be built by the Union Electric Ity. Co. across Scioto River, this city, at a probable cost of $12,000.

Portland, Ore.—The building of a steel bridge at Grand Ave. is being considered.

Astoria, Ore.—It is stated that bids are wanted May 5 for constructing a steel draw bridge across Lewis and Clark River. J. C. Clinton, Co. Clk.

Harrisburg, Pa.—Bids will be received May 5 by the Bd. of Comrs. of Pub. Grounds and Bldgs., for rebuilding the substructure and superstructure of the bridge over Schuylkill River near Auburn. Jas. M. Shumaker, Supt.

Pottstown, Pa.—Local press reports state that the Philadelphia & Reading R. R. Co. has submitted to the Boro. Highway Comrs. plans for a bridge which said Co. proposes to build at Keim St., this city. Wm. Hunter, Ch. Engr., Philadelphia.

Allentown, Pa.—Mayor Lewis, according to local press reports, has vetoed the ordinance appropriating $35,000 to construct a bridge at Allen St.

Woonsocket, R. I.—The Finance Com. has recommended to the City Council the appropriating of $36,000 for the reconstruction of the Globe bridge at So. Main St.

Carthage, Tenn.—A bill has passed the Senate authorizing Smith County to appropriate $60,000 for building bridges.

Nashville, Tenn.—It is reported that the Louisville & Nashville R. R. Co. has completed plans and specifications for building a bridge over Red River near Adams Station on the Henderson Division. R. Montfort, Ch. Engr., Louisville, Ky.

Tacoma, Wash.—The City Council has adopted an ordinance authorizing the appropriating of $14,000 for the construction of a bridge across Puyallup River.

Bids are wanted Apr. 28 for constructing an iron or steel bridge about 350 ft. long across gulch adjacent to city reservoir, to be used to support sewer and water main. R. W. Clark, Comr. of Pub. Wks.

Wheeling, W. Va.—Press reports state that the bridge engineers of the Baltimore & Ohio R. R. are working on plans for reconstructing and strengthening bridges on the Wheeling division. J. M. Graham, Ch. Engr., Baltimore, Md.

Appleton, Wis.—It is reported that the Chicago, Milwaukee & St. Paul R. R. Co. will construct a new drawbridge in this city in place of present structure. D. J. Wittemore, Ch. Engr., Chicago, Ill.

Milwaukee, Wis.—Bids will be received May 19 by the Comr. of Pub. Wks. for constructing a highway bridge at W. Water St. Chas. J. Poetsch, City Engr.

Montreal, Que.—Local press reports state that the Canadian Pacific Ry. Co. has awarded contracts for steel bridges, which are to replace present wooden bridges, as follows: 69 to the Canada Foundry Co., Toronto; 7 to the Hamilton Bridge Co., and 160 to the Dominion Bridge Co. They will vary in length from 20 to 100 ft., and the approximate total cost, according to reports, is $250,000.

PAVING AND ROADMAKING.

San Francisco, Cal.—The Barber Asphalt Paving Co. is reported to have secured the contract to pave with basalt block on a portion of 3d St., at $79,120.

Litchfield, Conn.—Bids will be received Apr. 24 by the Bd. of Selectmen for constructing a telford road in Litchfield Township. Truman Catlin, 1st Selectman.

Augusta, Ga.—The Council on Apr. 6 passed a resolution calling for bids on asphalt, brick, Belgian block and bituminous macadam for Broad St., about 52,000 yds. Nisbet Wingfield, City Engr.

Boise, Idaho.—The Governor has appointed Frank E. Johnesse superintendent of the wagon road to be built to Thunder Mountain from Warren's Ranch in Long Valley. The State appropriated $20,000 for the work, contingent upon as much more being raised by private persons. The proposed road will be about 70 miles in length.

Bloomington, Ill.—It is proposed to resurface with asphalt the brick pavement on So. Center St. Elmer Folsom, City Engr.

Danville, Ill.—Bids are wanted Apr. 23 for 10,000 yds. pavement, 5,000 ft. stone curbing and 3,500 ft. of 8-in. sewer. W. H. Martin, City Engr.

Chicago, Ill.—Bids will be received Apr. 22 by the Bd. of Local Improv for grading, curbing and paving with asphalt, vitrified paving brick, granite blocks, etc., portions of numerous streets. Andrew M. Lynch, Pres. of Bd.

Moline, Ill.—An ordinance has been adopted by the City Council to lay this year 3 miles of cement and 7 miles of tile sidewalks, at an estimated cost of $29,890.

Vinita, Ind. Ter.—See "Water."

Terre Haute, Ind.—Local press reports state that the City Engr. has been instructed to prepare plans and specifications for paving with brick on a portion of 4th St.

Elwood, Ind.—The City Council has recommended the construction of nearly $100,000 worth of street and sidewalk improvements.

Linton, Ind.—Press reports state that the City Council is receiving bids for paving with vitrified brick the principal streets of the city and for a sewerage system.

Versailles, Ind.—Bids are wanted May 5 for constructing 5 miles of macadamized road in Johnson Township. John A. Spencer, Co. Aud.

Evansville, Ind.—Bids are wanted May 9 for 12,000 sq. yds. asphalt on 1st Ave. and 1,200 sq. yds. asphalt on Governor St. Aug. Pfafflin, City Engr.

Hammond, Ind.—Bids will be received Apr. 21 for improving Indiana Boule. and Summer St. by paving, curbing and constructing cement walks.

Red Oak, Ia.—Evan J. Evans, of Red Oak, is reported to have received the contract to pave with brick in this city, at $41,999.

Waterloo, Ia.—C. Wilson, City Engr., writes that the following bids for paving about 70,000 sq. yds. with brick and for 17,400 ft. curb were received on Apr. 10—*a*, Flint; *b*, Purington; *c*, Galesburg: Wm. Harribin, Iowa City, *a*, $1.36; *b*, $1.49; *c*, $1.53; curb, 35 cts.; total for Flint block, $91,634 (awarded contract). Snouffe & Ford, Cedar Rapids, Ia., *a*, $1.38; *b*, $1.48; curb, 40 cts.

Ft. Riley, Kan.—See "Government Work."

Atchison, Kan.—Fred Giddings, City Engr., writes that the following bids for paving So. 6th St. with brick, about 15,802 sq. yds. paving, 10,596 lin. ft. concrete curbing, and 5,332 ft. of brick sidewalks, were received by City Council Apr. 10: J. McGuire, Leavenworth, $41,226; C. Crawford, Atchison, $42,518; Thos. Beattie, Atchison, $42,610; O. E. Seip, Atchison, $41,375; Rackcliffe & Gibson, St. Joseph, Mo., $39,923. The lowest bid being above the estimate, all bids were rejected and will again be received on May 4th.

The city has purchased a 15-ton steam roller from the Kelly Springfield Road Roller Co. Fred Giddings, City Engr.

Opelousas, La.—Bids will be received May 1 by Mayor B. A. Littell for constructing about 13,640 ft. cement, shell and dirt sidewalks, with brick and wooden curbing.

Alexandria, La.—Bids will be received until May 12 for paving with brick on Elliott and Jackson Sts., approximately 8,500 and 10,500 sq. yds. respectively, and for paving with either brick or asphalt on 3d St., approximately 19,000 sq. yds. F. M. Welch, Mayor

Lenox, Mass.—At a recent town meeting it was voted to appropriate $20,000 for a state highway from Church hill to the Pittsfield line, on the condition that the state highway commission allot a like sum for the construction of about 3½ miles of road.

Westfield, Mass.—Town Engr. O. E. Parks estimates the cost of paving Park Sq. as follows: Vitrified brick with concrete base, $22,500; asphalt, $25,700; macadam, $7,000; granite blocks with sand foundation, $19,000, and with concrete and pitch, $27,500.

Boston, Mass.—The lowest bid opened by Supt. of Sts. Jas. Donovan, Apr. 15, for paving Broad St. with granite blocks, was submitted by W. H. Ellis, for $11,113.

Fitchburg, Mass.—See "Sewerage and Sewage Disposal."

St. Paul, Minn.—R. L. Gorman, Clk. Bd. Pub. Wks., writes that the following bids for paving with asphalt on a portion of 6th St., 12,030 sq. yds., were received on Apr. 6: Barber Asphalt Paving Co., New York, N. Y., $23,884, and R. F. Conway Paving Co., Chicago, Ill., $25,900. This includes resetting some curbing.

Final order for the paving University Ave., from Rice to Dale St., with asphalt, estimated cost $45,443, and E. 7th St., from Hope to Phalen St., with brick, estimated cost, $45,788, have been sent to the Council by the Bd. of Pub. Wks. for approval, and on their return a call for bids will be issued.

Great Barrington, Mass.—Geo. W. Mellen, Chmn. Bd. Selectmen, writes that at the town meeting in March, it was voted to appropriate $20,000 for paving a portion of Main St.

Grand Rapids, Mich.—L. W. Anderson, City Engr., writes that the following lump sum bids for paving with vitrified brick on Wealthy Ave. on a 6-in. concrete foundation, were received on Apr. 3—all local bidders—*a*, Buckeye; *b*, Nelsonville; *c*, Metropolitan; *d*, Trimble; *e*, Malvern; Jas. McDermott & Son, 315 Bowery, *a*, $39,980; *b*, $40,545; *c*, $40,600 (awarded contract). Kloote & Vander Veen, *a*, $42,533; *b*, $42,885; *c*, $42,635; *d*, $42,485; *e*, $42,100. L. Schneider, *a*, $43,485; *b*, $44,050; *c*, $43,825; *e*, $43,145, and Richd. Pickett, $45,983.

Saginaw, Mich.—A resolution has been adopted by the Bd. Pub. Wks. authorizing the City Engr. to prepare plans and specifications for paving with brick on a portion of Court St.

Lansing, Mich.—The following bids were opened Apr. 13 for paving Franklin St. with brick on a gravel foundation; Geo. H. Kneal, $11,750; M. Fitzpatrick, $11,775; Kloote & Vander Veen, $11,800; W. J. Kieth, $11,864, and Elkhart Constr. Co., $22,158.

Marshall, Mich.—Geo. H. Kneal, of Lansing, is reported to have secured a contract for paving the business street in this city, at $28,100.

St. Joseph, Mo.—Bids are wanted May 9 for paving with macadam portions of Ashland Ave. and Rochester Road. Theo. Steinacker, Co. Surv.

Omaha, Neb.—Local press reports state that a contract for paving Florence Boule., a distance of about a mile, has been awarded to the E. D. Van Court & Winn Co., at 61 cts. per yd.; probable total cost, $12,000.

Trenton, N. J.—Bids will be received Apr. 21 by the Common Council for paving with sheet asphaltum and dressed belgian block portions of 5 streets. C. Edw. Murray, City Clk.

Woodbury, N. J.—The City Council is reported to have under consideration the paving of a portion of Cooper St., at a probable cost of $30,000.

Newark, N. J.—The St. Com. has decided to recommend to the Bd. of Pub. Wks. the paving with granite block of a portion of Plane St.

The Barber Asphalt Paving Co. is reported to have submitted the lowest bid for paving on Mt. Pleasant Ave. with asphalt, at $1.88 per sq. yd.—total, $20,997; or with Mack shale brick, at $1.93 per sq. yd—total, $30,636.

Morristown, N. J.—Bids will be received until May 4 by the Com. of the Bd. of Chosen Freeholders for macadamizing a section of the Newark and Pompton Turnpike, a distance of about ¾ of a mile. G. A. Becker, Dir. Bd. Chosen Freeholders.

Vailsburg, N. J.—R. C. McMains is reported to have secured the contract to construct a speedway from Vailsburg to Irvington, at $20,038.

Freehold, N. J.—The Bd. Chosen Freeholders of Monmouth Co. have, according to reports, authorized the following road improvements: A stone road from Red Bank to Shrewsbury, on Sycamore Ave., 2.45 miles long, and estimated to cost $24,791, and a stone road from Freehold to Colts Neck, estimated to cost $39,600.

Jersey City, N. J.—The following bids were opened by the Bd. of Freeholders at Jersey City, Apr. 2, for the paving and improving of Belleville Turnpike Road, in Town of Kearny—*a*, W. A. Noonan & Co., 89 Van Winkle St.; *b*, Jos. T. Harrington, 454 Wayne St.; *c*, Edward P. O'Neill, 57 Concord St.; *d*, Jas. Mannix, 61 Bright St.; *e*, Henry Waddington, Hoboken; *f*, Robt. Wright, East Orange, N. J.; *g*, Palisade Constr. Co., 15 Exchange Pl.:

	Embkmnt., 40,000 cu. yds.	Telford macadam, 27,250 sq. yds.	Bridge No. 1, complete.	Bridge No. 2, complete.	Totals.
a.....	$0.30	$1.60	$1,800.00	$600.00	$58,000
b.....	.65	1.10	550.00	500.00	57,025
c.....	.83	1.03	200.00	200.00	61,668
d.....	.49	.89	400.00	400.00	44,583
e.....	.65	1.07	500.00	500.00	56,158
f.....	.69	.97	450.00	350.00	54,153
g.....	.02	1.87	11.00	11.00	51,780

Rochester, N. Y.—Local press reports state that Whitmore, Rauber & Vicinus have secured the contract for paving with asphalt on Clifford St., at $20,000.

Albany, N. Y.—A law has been noticed for passage by Council for the resurfacing of So. Pearl St. with sheet asphalt, about ⅞ of a mile.

New York, N. Y.—Bids will be received Apr. 27 by Louis F. Haffen, Pres. Boro. Bronx, for regulating, grading, curbing, flagging sidewalks and paving with asphalt and asphalt blocks on portions of numerous streets; Engineer's estimate, 2,910 sq. yds. asphalt pavement, including binder course, 110,640 sq. yds. asphalt block pavement, 14,770 cu. yds. concrete, 127,790 cu. yds. earth excavation, 198,450 cu. yds. rock excavation, 320,940 cu. yds. filling, 332,250 sq. yds. new flagging, 95,030 lin. ft. new curbstone, 57,000 sq. ft. new bridgestone, 11,260 lin. ft. 12, 15 and 20-in. vitrified stone ware pipe, etc.

Cohoes, N. Y.—The following bids were received by the Pub. Improv. Com. (Edw. Hayes, Engr.) Mar. 26 for paving—*a*, Columbia St.; *b*, Saratoga St.; *c*, Amity St.; *d*, Imperial Ave.; *e*, Ontario St.; *f*, Johnston Ave.; *g*, Reservoir St., prices given being per sq. yd.: Warner-Quinlan Asphalt Co., Syracuse, asphalt, *a*, $2.43; *b*, $2.44; *c*, $2.53; *e* and *f*, $2.32; *g*, $2.48—total, $103,580; brick, *a*, $2.83; *b*, *c* and *d*, $2.88; *e* and *f*, $2.77—total, $119,807; granite block, *a*, $3.47; *d*, $3.73; medina sandstone, *a*, $3.45; *c* and *d*, $3.70—$85,525; catch basins on all streets, $85 ea.; furnishing straight curb on all above streets, 50 cts. per ft., and $1 per ft. for circular curb. Warren Bros. Co., with bitulithic pavement, *a*, $2.28 and $2.26; *b*, $2.65 and $2.60; *c*, $2.35; *d*, $2.43; *e*, $2.42 and $2.38; *f*, $2.35 and $2.28; *g*, $2.45; catch basins on all streets, $85 ea.; straight curb, 50 cts. per ft., and circular curb, $1.07 per ft.—total, $105,150. Barber Asphalt Paving Co., sheet asphalt, *a*, $2.31; *b*, $2.38; *c*, $2.24; *d*, $2.31; *e*, $2.19; *f*, $2.22; *g*, $2.33—total, $103,091; medina sandstone, *a* and *d*, $3.05; brick, *a*, $2.50; *b* and *c*, $2.53; *d*, $2.51; *e*, $2.50; *g*, $2.55—$112,243; and catch basins, $80, $85, $95 and $100 each according to the street and kind of pavement used. Straight curb, 50 cts.; circular curb, 95 cts. and $1. There will be required about 40,314 yds. pavement and 18,459 ft. granite curbing.

Albany, N. Y.—Bids will be received Apr. 20 by the Bd. of Contract and Supply for furnishing material for improving portions of 3d St. by grading, curbing and paving the carriage way with vitrified paving block, repairing and laying sidewalks with flags and vitrified bricks and building receiving basins. Isidore Wachsman, Clk. of Bd

Brooklyn, N. Y.—Bids will be received Apr. 29 by J. Edw. Swanstrom, Boro. Pres., for regulating, grading, laying sidewalks, and paving with asphalt and granite on concrete and sand foundation portions of 14 streets; engineer's estimate, 31,409 sq. yds. asphalt, 6,208 sq. yds. granite block with sand joints, 4,737 cu. yds. concrete, 53,210 sq. ft. cement sidewalk, 9,246 lin. ft. concrete curb, etc.

Bids will be received Apr. 29 by the Boro. Pres. for furnishing material for construction 56,435 sq. ft. cement concrete sidewalks on portions of various streets; also for regulating and repaving with wood block pavement on a concrete foundation portions of 5 streets; engineer's estimate, 10,040 sq. yds. wood block pavement, 4 in. thick; 1,790 cu. yds. concrete, including mortar bed; 4,620 lin. ft. new curbstone, etc.

Hamburgh, N. Y.—The macadamizing of Main and a portion of Union Sts., at an estimated cost of $17,000, is reported contemplated.

Geneva, N. Y.—Press reports state that the Bd. Pub. Wks. has decided to pave, during the coming summer, the following streets: With brick, on Wadsworth and Castle Sts.; Bradford, with Medina stone and Lake St., with macadam.

Press reports state that bids will be received Apr. 23 for $46,500 street improvement bonds.

New York, N. Y.—The following are the lowest bids opened on Apr. 7 by J. A. Cantor, Pres. Boro. of Manhattan, for asphalt paving on present pavement relaid as foundation on 39 streets, and have been recommended for award: Uvalde Asphalt Paving Co. (16 streets), $159,281; Barber Asphalt Paving Co. (14 streets), $98,878; Asphalt Constr. Co. (7 streets), $79,607; Continental Asphalt Paving Co. (1 street), $4,986, and Sicilian Asphalt Paving Co. (1 street), $5,688.

The following are details of the two largest of the above contracts—*a*, Asphalt Constr. Co.; *b*, Barber Asphalt Paving Co.; *c*, Century Constr. Co.:

106th St.—1st to Lexington Aves.

Bidders.	Asph., 11,700 s. yd.	Relay, 11,780 s. yd.	Concr., 175 c. yd.	New curb, 3,350 ft.	Old curb, 140 ft.	Manhole covers, 15.	Totals.
a.....	$1.10	$0.40	$5.50	$0.85	$0.35	$20.	$21,741
b.....	1.11	.42	5.48	.89	.38	20.	22,228
c.....	1.30	.33	5.50	.87	.40	20.	23,330
	131st St.—Park to 8th Aves.						
	12,000	*12,100*	*330*	*6,270*	*260*	*45*	
a.....	$1.10	$0.30	$5.50	$0.85	$0.35	$20.	$24,926
b.....	1.12	.40	5.48	.89	.38	20.	26,628
c.....	1.30	.33	5.50	.87	.40	20.	27,827

A preliminary injunction was granted the Barber Asphalt Paving Co. Apr. 13 to prevent J. A. Cantor, Pres. Boro of Manhattan, from entering into a contract for paving 7th Ave., from 110th to 120th Sts., with Warren Bros.' bituminous macadam, bids for which were to have been opened Apr. 15.

Buffalo, N. Y.—Bids are wanted Apr. 24 for repaving Perry St., a distance of about 450 ft. Francis G. Ward, Comr. Dept. of Pub. Wks.

Glenville, O.—Bids are wanted May 4 for grading, paving and improving with asphalt or bituminous macadam portions of St. Clair St. B. F. Davies, Jr., Village Clk.

Pottstown, Pa.—The Town Council has passed a resolution for 3,500 yds. additional street paving. Thos. Kochel, Chmn. Highway Com.

Lebanon, Pa.—See "Water."

Butler, Pa.—Bids will be received Apr. 21 by H. E. Coulter, Secy. Town Council, for grading, curbing and paving portions of W. Penn St.

Erie, Pa.—Frank P. Coyle is stated to have secured the contract for paving on a portion of 16th St., at $1.62 per sq. yd. for Mack brick, and 60 cts. per ft. for curbing. They also received, according to reports, the contract for paving on 12th St., at $1.91 per sq. yd. for Mack brick; total, $8,707.

Braddock, Pa.—Bids will be received Apr. 22 by Wm. Howat, Supt. Pub. Wks., for grading and paving portions of 5 streets

Woonsocket, R. I.—Local press reports state that $26,000 has been appropriated to pave a portion of Clinton St. with bitulithic paving.

Nashville, Tenn.—See "Sewerage and Sewage Disposal."

Jackson, Tenn.—The Co. Court has decided to issue $150,000 bonds for grading all roads from Jackson 5 miles in every direction.

Beaumont, Tex.—Bids will be received by W. A. Ives, City Secy., until May 5 for paving with brick or asphalt, and for curbing with brick, stone or cement, on 11 streets, requiring in all about 80,660 sq. yds. of paving and 28,202 lin. ft. of curbing. Merritt W. Yeater, City Engr.

Hampton, Va.—The Hampton Town Council has decided to issue $25,000 street improvement bonds.

Christiansburg, Va.—The Superv. of Montgomery Co. have decided to issue $20,000 in bonds for improving the road between Christiansburg and Blacksburg, the site of the Virginia Polytechnic Institute.

Spokane, Wash.—Bids will be received Apr. 23 by the Bd. of Pub. Wks. for improving by paving, curbing and guttering portions of Monroe St. L. B. Handley, Secy.

Wheeling, W. Va.—Bids will be received Apr. 24 by the Bd. of Co. Comrs. for macadamizing numerous county roads.

La Crosse, Wis.—At the Council meeting Apr. 10 plans were ordered prepared for 15,000 sq. yds. of brick pavement and 29,000 sq. yds. of macadam.

Milwaukee, Wis.—Bids will be received by the Bd. of Pub. Wks. until Apr. 21 for improving portions of Highland Ave. and Galena St. by grading and macadamizing. Chas. J. Poetsch, City Engr.

Ashland, Wis.—The city will lay about 8 blocks of asphalt and 10 or 12 blocks of macadam the coming season. M. T. Dozer, City Engr.

Toronto, Ont.—City Engineer Rust has recommended the following work: Rosedale Rd., tar macadam, $4,850; Farley Ave., tar macadam, $3,530; Eastern Ave., macadam, $10,640; Cherry St., macadam, $5,770; Front St., macadam, $10,720. Cement Concrete Walks: Macdonell Ave., $4,438; Springhurst Ave., $1,244 (east side) and $1,232 (west side), and Marley Ave., tar macadam, $4,850.

Orillia, Ont.—This city is arranging to spend $20,000 on granolithic sidewalks. C. E. Grant, City Clk.

Ottawa, Ont.—The ratepayers of Carleton County propose to spend $270,000 on good roads this summer. J. P. Featherston, Co. Clk.

Montreal, Que.—The sum of $220,000 is to be spent at once on eleven street squares and subways in this city, $150,000 on other streets, and $35,000 on repairing sidewalks

POWER PLANTS, GAS AND ELECTRICITY.

Bessemer, Ala.—The City Council is stated to have granted the Birmingham Ry. Light & Power Co. a franchise to construct a gas plant.

North Birmingham, Ala.—W. B. Hillhouse, City Clk. and Treas., writes that the citizens voted Apr. 6 to issue bonds as follows: $15,000 for an electric light plant, $25,000 for water works, and $20,000 for 2 schools.

San Diego, Cal.—Press reports state that bids will be opened June 1 for an electric light plant. Address City Clk.

Eureka, Cal.—It is reported that the Van Duzen Electric Power Co. has completed surveys for the power system to Eureka and every point in Eel River Valley. Arrangements will be made for a plant of 2,000-H.-P., to be established at once on the Van Duzen. Five other plants will follow, aggregating a total of 10,000-H.-P.

Denver, Colo.—The Arapahoe Electric Light & Power Co. has been incorporated; capital, $50,000. Nelson Rhoades, Arthur G. Reynolds and Wm. C. Sterne are the incorporators.

Littleton, Colo.—The citizens are stated to have voted Apr. 7, to grant a franchise to Nelson Rhodes, Jr., to construct an electric light, heat and power plant.

New Britain, Conn.—It is reported that the New Britain Gas Light Co. has asked for permission to issue $200,000 bonds for extending its plant.

Quincy, Ill.—The Quincy Gas & Electric Co. has sold its plant to the J. T. Lynn Co. It is proposed to lay new gas mains and also improve the electric system. J. C. Sloan, Mgr.

Des Moines, Ia.—Bids will be received Apr. 21 by the Bd. of Pub. Wks. for lighting the public parks with naphtha incandescent mantle lamps of not less than 60 c. p. ea. for a term of 5½ mos. from May 1st. B. O. Hanger, Chmn.

Victor, Ia.—The citizens are stated to have voted bonds for a gas plant.

Lewis, Ia.—The citizens are stated to have voted to grant Stevens Bros. a franchise for an electric light plant.

Monroe, La.—See "Water."

Newroads, La.—The City Council is stated to have granted W. H. Fleming, of New Orleans, representing the Safety Electric Mfg. Co., of New Orleans, a franchise for an electric light plant and water works.

Marshall, Mich.—Burdette L. Bowne writes that about $7,000 will be expended in improvements to the gas plant recently purchased.

North Adam, Mich.—The citizens are reported to have voted Mar. 31 for electric lights.

Schoolcraft, Mich.—Electric light bonds amounting to $11,450 are reported sold.

Slayton, Minn.—It is stated that B. I. Weld has secured a franchise for a gas plant.

South Stillwater, Minn.—Prof. J. J. Flather, of Minneapolis, is stated to have been engaged to prepare plans for an electric light plant and water works, to cost about $23,000.

Lester Prairie, Minn.—W. F. Volkenant is reported interested in the construction of an electric light plant.

Stillwater, Minn.—The Western Gas & Electric Co. is reported to have absorbed the Stillwater Gas & Electric Co. and the Apple River Power Co., and will develop the power at Apple River still further and transmit same to this city.

Slayton, Minn.—A franchise to establish a gas plant is stated to have been granted to B. I. Weld.

Huntsville, Mo.—The Huntsville Gas & Electric Co., of Huntsville, has been incorporated; capital, $15,000. Incorporators: W. C. Knight and J. T. McClanahan.

Geneva, N. Y.—The Empire Coke & Gas Co. has been organized, with a capital of $1,000,000, for the manufacture of coke, gas and by-products. The plant will cover 5 acres, produce 150 tons of coke a day and enough gas to supply all the near-by cities and towns and manufacturing establishments, besides a large quantity of coal tar, ammonia and other products. Incorporators: Lansing G. Haskins and Edw. H. Palmer, of Geneva; Austin Lathrop, of Corning, and others.

Defiance, O.—The Council has granted John F. Frost and Martin W. Steinberger a franchise for an electric light and heating plant.

Oberlin, O.—The Council has granted L. B. Fauver and A. E. Hay, of Elyria, a franchise for a heating and electric light plant.

Columbus, O.—The stockholders of the Ohio Fuel Supply Co. will meet at Zanesville Apr. 29 to vote on an increase of capital from $2,500,000 to $4,000,000. Its purpose is to buy out the Federal Gas & Fuel Co., of Columbus, O., and to build a 12-in. pipe line from Columbus to the Knox and Licking County gas fields, a distance of 40 miles.

South Bethlehem, Pa.—The Consumers' Heat & Power Co., of South Bethlehem, has been incorporated, with a capital of $5,000.

Norristown, Pa.—The City Council has granted the Norristown Subway Co. a franchise to lay subways and conduits under the streets, for electric wires and other purposes.

Reading, Pa.—A press report states that the Schuylkill Navigation Co. will construct an electric plant at Kissingers' Dam. It will furnish lighting for the Reading shops, the shifting and freight yards, stations, etc., and for the various plants of the Reading Iron Co. The plant will use the power of the Schuylkill by means of a large turbine wheel.

Custer, S. D.—R. M. Fuller and Fred Beardshear are stated to have secured a franchise for an electric light, power and heating plant, telephone and telegraph system.

Columbia, Tenn.—The Bd. of Mayor and Aldermen has granted to John H. Carpenter a franchise for an electric light plant.

Trenton, Tenn.—The Senate has passed the bill authorizing the city to issue $15,000 electric light bonds.

Springfield, Tenn.—The House has passed the bill authorizing the city to issue $35,000 bonds for an electric light plant and water works.

Memphis, Tenn.—The Memphis Consolidated Gas & Electric Co. will expend about $93,000 to extend its conduit system in Memphis.

Spokane, Wash.—The City Council has granted the Spokane Light & Power Co. a franchise for a term of 42 yrs.

Grantsburg, Wis.—The citizens are reported to have voted for water works and an electric light plant.

Sauk City, Wis.—The Secy. Citizens Com. writes that preliminary steps are being taken to ascertain the cost of a municipal electric light plant; probable cost, $8,500.

Sheboygan Falls, Wis.—The Dirs. of the Sheboygan & Elkhart Lake Ry. & Electric Co. are stated to have decided to equip the Elkhart Lake sub-station with apparatus for lighting and power.

Waupaca, Wis.—The Waupaca Electric Light & Ry. Co. is stated to have secured a 10-year contract for 27 or more 2,000 c. p. arc lights, every night from dusk until dawn, at $6.36 per light per month.

Madison, Wis.—O. S. Norsman, City Clk., writes that it was voted Apr. 7 to construct a municipal power, heating and lighting plant; a garbage disposal and sewage disposal plant and a pumping station, but that nothing will be done in the matter in the near future.

Prince Albert, N. W. Ter.—Wm. Knox, Chmn. of Com., writes that the lowest bid received on Mar. 26 for an electric light plant was from the Stuart Arbuthnot Machy. Co., of Winnipeg, Man., for $9,700.

Johannesburg, South Africa.—A press report states that the construction of an electric traction, lighting and general power system for Johannesburg is estimated at about $8,000,000 by Moodey & Dawbarn, of London, England, whose plans have been accepted by the municipal authorities.

ELECTRIC RAILWAYS.

Huntington, Ark.—The Huntington, Sugar Loaf & Rapid Transit Co. has been organized, with a capital of $100,000, to build an electric railway to connect Huntington, Prairie Creek, Montreal, Burmah and other mining towns. Bennett Brown, Pres.; O. M. Harwell, Secy.

San Bernardino, Cal.—The San Bernardino & Highlands Electric Ry. Co., which plans to build an electric railway from San Bernardino to Highlands, a distance of about 7½ miles, expects to award the contracts for building the road and furnishing the equipment within 30 days. The company will secure power from the San Bernardino Valley Traction Co. Henry Fisher, Pres.; Geo. B. Ellis, Secy.

San Francisco, Cal.—The Bd. of Pub. Wks. has appointed J. C. Stut to make the estimates as to the cost of changing the present Geary Park & Ocean R. R. into an electric line.

Oakland, Col.—J. H. McDonald is stated to have secured a franchise through Pleasant Valley.

Redwood City, Cal.—It is stated that bids will be received by the Co. Bd. of Superv. until June 1 for an electric railway franchise.

Los Angeles, Cal.—The Los Angeles Railway Co. has applied for a franchise on 6th St., and bids for said franchise will be received, according to reports, until May 4. Address City Clk.

Cripple Creek, Colo.—C. L. McKesson and J. E. Little, of Colorado Springs, are interested in the plan to build an electric railway from Cripple Creek to Gillett, thence to the summit of Pike's Peak, and ultimately to Colorado Springs.

Colorado Springs, Colo.—Fred C. Adams, of Denver, is interested in the construction of an electric railway to connect Colorado Springs with Denver and Pueblo.

Bristol, Conn.—The Dirs. of the Bristol & Plainville Tramway Co. have authorized the construction of the line between Bristol and Plainville. E. C. Smith, Ch. Engr., Bristol.

Atlanta, Ga.—The Georgia Ry. & Electric Co. has in contemplation the extension of its lines to Marietta. W. Bloxham, Ch. Engr., Atlanta.

Chicago, Ill.—The Northern Illinois Traction Co., of which W. D. Ball, of Chicago, is consulting engineer, is surveying for lines north of Chicago.

Indianapolis, Ind.—The Union Traction Co. has under consideration the construction of a line to connect New Castle and Anderson, passing through Sulphur Springs, Honey Creek and Middletown. Geo. F. McCulloch, Gen. Mgr., Indianapolis.

Indianapolis, Ind.—The Madison, Greensburg & Indianapolis Ry. Co. has been incorporated, with a capital of $50,000, to build an electric railway to connect Indianapolis and Madison. Incorporators: Richard Johnson, Nicholas Heruff, and others.

Logansport, Ind.—Articles of incorporation have been filed at Indianapolis by a company to build an electric railway to connect Logansport and Fowler. Newland T. De Pauw, of New Albany, and Geo. E. Ross, of Logansport, are interested.

Dubuque, Ia.—The Iowa, Illinois & Wisconsin Interurban R. R. Co. has been organized, with a capital of $750,000, to build an electric railway from Dubuque to Platteville, Wis., a distance of 30 miles. Peter Keine, Pres., Dubuque, and Chas. Peaslee, Secy., Duhuque.

Elkton, Md.—The Council has granted a franchise to the Cecil & Kent Ry. Co. to build an electric railway between Elkton and Fredericktown via Chesapeake City.

Westernport, Md.—The Westernport & Keyser Traction Co. has been incorporated to build an electric railway along Potomac River from Westernport to a point near Keyser, W. Va.; capital, $20,000. Incorporators: Jas. L. Luke, of Luke, Md.; N. U. Bond, of Bond, Md.; David P. Miller, of Cumberland, Md., and others.

Falmouth, Mass.—The Railroad Comrs. have issued an order authorizing the Cape Cod St. Ry. Co. to construct its proposed road in Falmouth. Geo. E. Dean, Secy., Falmouth.

Worcester, Mass.—The Aldermen have granted a franchise to the Worcester Consolidated St. Ry. Co. for locations in W. Boylston and other streets.

Fall River, Mass.—It is reported that the Watuppa branch of the New York, New Haven & Hartford R. R. will probably be equipped with electricity. Col. M. Ingersoll, Jr., Ch. Engr., New Haven, Conn.

Chisholm, Minn.—The Mesabe Electric Ry. Co. has secured a franchise through Chisholm.

Patchogue, N. Y.—The Village Trus. and the Brookhaven Town Highway Comrs. have signed the franchise granting the South Shore Traction Co. the right to build an electric railway the entire length of the town from the Islip Town line, at Blue Point, to Connetequot River, at Brookhaven. The Traction Co. plans to build an extensive system connecting towns on the South Shore of Long Island.

Seneca Falls, N. Y.—A survey has been completed from Seneca Falls to Cayuga Lake, for an extension of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Co. to connect with the electric railway at Auburn. W. C. Gray, Mgr., Seneca Falls.

Utica, N. Y.—It is understood that the increase in the capital stock of the Utica & Mohawk Valley Ry. Company from $3,100,000 to $6,300,000, is to furnish funds for the construction of extensions. It is said that extensions will be built to Rome on the west and Little Falls on the east, and ultimately a connection is to be made between the Utica & Mohawk and Albany & Hudson systems. C. Loomis Allen, Gen. Mgr., Utica.

Oneida, N. Y.—The Oneida Ry. Co. is reported to be securing the right of way through Verona and Westmoreland for its line from Oneida to connect with the Utica & Mohawk Valley R. R. at Stanwix in Rome. H. C. Clark, Mgr., Syracuse.

Doylestown, Pa.—Contracts will soon be placed for material for the new line to be built between Trenton and Lambertville by the Delaware Valley Traction Co.

Kennett Square, Pa.—The Council has granted the Kennett-Wilmington Electric Ry. Co., permission to lay tracks on W. State St.

Pittsburg, Pa.—Governor Pennypacker has granted charters to the Squirrel Hill & Wilkinsburg St. Ry. Co., Pittsburg, to build 15 miles of road; Iron City St. Ry. Co., Pittsburg, to build 8 miles; Pittsburg Rapid Transit Co., Pittsburg, to build 12 miles. Incorporators: Walter F. Render, M. J. McGinn, and others. Combined capital, $225,000.

Uniontown, Pa.—T. A. Maddas is reported interested in the construction of an electric railway from Masontown to McLane's Landing, at a cost of $25,000.

Uniontown, Pa.—The Webster, Monessen, Bellevernon & Fayette City Street Ry. Co. has decided to extend its lines to Uniontown. John McBride, Mgr., Monessen.

Stroudsbury, Pa.—A company has been organized to build an electric railway from Mt. Pocono to La Anna, a distance of 12 miles. J. B. Williams, Pres.; E. D. Dunning, of South Sterling, Secy.

Philadelphia, Pa.—The ordinance granting the Philadelphia Rapid Transit Co. permission to lay a double track on Broad St. has been approved by the Bd. of City Surveyors. John B. Parsons, Mgr.

Smithville, Tenn.—It is reported that Fechelmer and Keifer, and the Rothchilds Banking Co., both of Cincinnati, are interested in the construction of an electric railway between Smithville and Watertown.

New Braumfels, Tex.—A. J. Dull, of Harrisburg, Pa., and Thos. Pierce, of Boston, Mass., are reported interested in the construction of an electric railway between New Braumfels and Sequin, a distance of about 14 miles.

Seattle, Wash.—The Seattle & Renton Ry. Co. is to build 8 miles of double track. F. H. Osgood, Mgr., Seattle.

Salem, W. Va.—Col. John McGraw, counsel for the Baltimore & Ohio R. R., and a syndicate of W. Va. capitalists are reported interested in the construction of an electric railway between Salem and Adamston that will form a connecting link between Clarksburg and Parkersburg.

New Martinsville, W. Va.—The New Martinsville & Proctor St. Ry. Co. is being organized to build an electric railway here. Jacob Koontz and D. H. Cox, of New Martinsville, are interested.

RAILROADS.

Dardanelle, Ark.—The Arkansas Central R. R. Co. has been organized, with a capital of $3,000,000, to build a railway from Paris to Dardanelle, and thence by way of Ollo and Onyx to Hot Springs. Directors: F. A. Molitor, J. C. Hart, and others.

San Francisco, Cal.—The Dirs. of the San Francisco Terminal Ry. & Ferry Co. are stated to have passed a resolution to create a bonded indebtedness of the corporation to the extent of $6,000,000 for the purpose of constructing its railroad and of purchasing equipments and rolling stock.

Washington, D. C.—It is reported that the Washington, Potomac & Chesapeake R. R. Co., now building from this city toward the Chesapeake Bay, is to be extended to Point Lookout, a distance of 80 miles. W. W. Early, Gen. Mgr., Brandywine, Md.

The Dist. Comrs. are stated to have received from the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia, Pa.) plans for the proposed tunnel to be built under Capitol Hill for the passage of trains from the south into the new union station, in connection with the elimination of grade crossings. The first work in connection with the terminal project is to be the construction of the tunnel. Col. Biddle, Engr. Comr.

Lawrenceburg, Ind.—A press report states on Apr. 20 the Big Four R. R. Co. (G. W. Kittredge, Ch. Engr., Cincinnati, O.) will relet the contract, for reducing the grade from 83 to 55 ft. to the mile between Lawrenceburg and Sunman, Ind., and for putting in a double track. The work will cost about $1,000,000.

Iowa Falls, Ia.—It is stated that the Chicago, Milwaukee & St. Paul R. R. Co. will construct a line between Iowa Falls and Mason City, a distance of 50 miles. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Des Moines, Ia.—A press report states that bids will be received May 10 by the Des Moines & Southern R. R. Co. for constructing a line from Greenfield to Cummings and Norwalk, a distance of about 98 miles.

Dubuque, Io.—The Iowa, Illinois & Missouri Ry. Co. has been incorporated to build a new short line from Dubuque to St. Louis. Principal office to be at Rock Island, Ill. Incorporators: Geo. T. Cram, St. Louis, Mo.; Eugene Carey, Chicago, Ill.; Alphona Matthews, Dubuque, Ia., and others.

Grand Rapids, Mich.—It is stated that the Pere Marquette R. R. Co. will expend about $200,000 in improvements. F. H. Alfred, Ch. Engr., Detroit.

St. Poul, Minn.—An ordinance, granting the Soo Line rights of way into the city, has been introduced in the Assembly. It desires to build 3 tunnels to run under Lafayette, Mississippi and Westminster Sts. Thos. Greene, Ch. Engr., Minnespolis.

Glenwood, Minn.—The Minneapolis, St. Paul & Sault Ste. Marie R. R. Co. is stated to have decided to extend its line from the main line at Glenwood and continue north through Alexandria, crossing the Northern Pacific east of Detroit. Thos. Greene, Ch. Engr., Minneapolis.

Mexico, Mo.—The Burlington R. R. Co. (I. S. P. Weeks, Ch. Engr., Lincoln, Neb.) is reported to be preparing to let contracts for the construction of a short line between Mexico, Mo., and Old Monroe, Mo., to be used jointly by the Chicago & Alton and Burlington in running from St. Louis to Kansas City.

Old Monroe, Mo.—A resolution has been filed with the Secy. of State by the Chicago, Burlington & Quincy R. R. Co. providing for the construction of a branch line from Old Monroe to Mexico, Mo. It will be about 60 miles in length, and cost $2,000,000.

Thedford, Neb.—It is reported that the Burlington R. R. Co. will build from Thedford, Neb., to Oneill, connecting with the Great Northern line from Sioux City west. I. S. P. Weeks, Ch. Engr., Lincoln.

Rhodes, Nev.—The Tonopah R. R. Co. has been incorporated, with a capital of $2,500,000, to construct a railroad from Rhodes to Tonopah, a distance of about 63 miles. Incorporators: Wm. T. N. Braun, Saml. W. Greene, and others, all of Camden, N. J.

Blackwell, Okla. Ter.—A charter has been granted to the Blackwell, Fairmount & Southern R. R. Co., with a capital of $500,000, to build a railroad about 100 miles in length from Blackwell to El Reno.

Pittsburg, Pa.—Contracts are about to be let by the Pittsburg, Chartiers & Youghlogheny R. R. Co. for its new yards to be constructed at Scully, to cost about $500,000. They will lie between Carnegie and Duff, and be used for all switching and yard work. Jas. B. Safford, Supt., Pittsburg.

Lilly, Pa.—Contracts will soon be let by the Pennsylvania R. R. Co. for the construction of an additional track between Lilly and Portage, a distance of 4½ miles, making the system a four-track one between these points. W. H. Brown, Ch. Engr., Philadelphia.

Martin's Creek, Pa.—The Martin's Creek & Riverton R. R. Co. has been incorporated, to construct a railroad to connect with the cement plants constructed or about to be constructed at Martin's Creek and Belvidere and vicinity. The road will be about 8 miles in length. Incorporators: Wm. Lurkington, of Philadelphia; R. B. Reading, of Lambertville, N. J.; Robt. K. Lerch, of Easton, and others.

Connellsville, Pa.—Surveys are reported to have been made by the Baltimore & Ohio R. R. Co. (J. F. Irwin, Div. Supt., Connellsville) and rights of way have been secured for double tracking the Pittsburgh, Fairmont, Clarksburg & Richwood division from Connellsville to Smithfield, about 20 miles. This work will probably cost about $150,000.

Jackson, Tenn.—It is stated that rights of way are being obtained by the Illinois Central R. R. Co. for an extension from near Jackson to the Birmingham mineral district. H. U. Wallace, Ch. Engr., Chicago, Ill.

Chattanooga, Tenn.—It is stated that the Louisville & Nashville R. R. Co. will extend its line to Chattanooga from Wetmore. R. Montfort, Ch. Engr., Louisville, Ky.

San Augustine, Tex.—The Governor has approved the consolidation bill passed by Legislature, authorizing the Gulf, Colorado & Santa Fe Ry. Co. to purchase the Gulf, Beaumont & Kansas City Ry. and the Gulf, Beaumont & Great Northern Ry. The latter is now under construction from San Augustine to Center, 20 miles, and is projected further north in the direction of Shreveport, La. W. C. Nixon, Gen. Mgr., Galveston.

Spring, Tex.—The International & Gt. Northern R. R. Co. is making surveys with the view of extending its Ft. Worth division east from Spring, via Kountze, to Alexandria, La., there to connect with the T. & P. Ry. and Mo. P. Ry., penetrating the pine forests of Tex. and La. L. Price, Gen. Mgr., Palestine, Tex.

Milwaukee, Wis.—The Milwaukee Southern Ry. Co., which proposes to construct a steam railroad from Milwaukee to East St. Louis, has petitioned City Council for a franchise. The company has been incorporated, with a capital of $50,000, by Earl Parcells, of Chicago, Ill., and John B. Wallace and Harry A. Porter, of Mukwonago, Wis.

Sundance, Wyo.—Articles of incorporation have been filed with the Secy. of State of Wyo., at Cheyenne by the Wyoming & Black Hills R. R. Co., with a capital of $2,500,000. The company proposes to build 8 miles of road into the coal fields of Crook County, Wyo., near Sundance. L. C. Twombly, Pres.

PUBLIC BUILDINGS.

New Decatur, Ala.—Bids are wanted May 1 for erecting a Catholic Church. Address M. Henry, Pastor.

Denver, Colo.—T. McLaren, of Colorado Springs, is reported to be preparing plans for rebuilding the Trinity Memorial Episcopal Church; estimated cost, $20,000.

Flora, Ill.—Bids are wanted Apr. 28 for erecting a library. J. W. Gaddis, Archt., Vincennes, Ind.

Morshall, Ill.—The contract for the erection of the fire-proof court house is stated to have awarded to H. B. Walter, of Danville, for $44,830.

Rock Island, Ill.—Bids will be received Apr. 20 at the office of Leonard M. Drack, Archt., for erecting a 3-story county infirmary. T. R. Lees, Chmn. Bldg. Com.

Oak Park, Ill.—The citizens are stated to have voted to issue $35,000 bonds for erecting a town hall.

Brazil, Ind.—Local press reports state that bids will be received by the Library Bd. Apr. 21 for erecting a library to be either brick or stone.

Des Moines, Ia.—Bids will be received Apr. 24 by Dr. W. N. Heaton, Chmn. Bldg. Com., for fireproofing, iron stairs, electric wiring, etc., for the new library. Smith & Gage, Archts., 300 Youngerman Bldg.

Junction City, Kan.—T. W. Dorn, City Clk., writes that it was voted Apr. 7 to issue $30,000 bonds for a court house.

Topeka, Kan.—Bids will be received May 6 by the Kansas Comrs. of the Louisiana Purchase Exposition at the State Capitol building for erecting the Kansas State building at said exposition. W. W. Rose, Archt., Postal Telegraph Bldg., Kansas City, Mo. Address John C. Carpenter, Pres.

Carrollton, Ky.—Bids will be received May 15 by the Rev. I. M. Ahmann, for constructing the superstructure of St. John's Catholic Church. Leon Coquard, Archt., Detroit, Mich.

Newport, Ky.—Bids will be received May 4 by the Fiscal Court for removing old heating apparatus and installing a new overhead hot-water system of heating for the Campbell Co. court house, at Newport. H. D. Phillips, Chmn. of Com.

New Orleans, La.—An ordinance is stated to have been passed providing an appropriation of $150,000 for an annex to the city hall.

The contract for erecting the Ancient Cabildo Bldg. for the La. Purchase Exposition at St. Louis, Mo. (bids opened Apr. 10), has been awarded to W. O. & C. G. Burton, of St. Louis, Mo., for $22,000.

Boston, Mass.—The Trus. of the Hospital for Insane on Apr. 10th awarded the contract for the new group of buildings for women to be erected at Austin Farm, to Alex. A. Sanborn, of Boston, for $44,399.

Taunton, Mass.—All bids received Apr. 3 for erecting the Public Library were in excess of the appropriation, which is reported to be about $60,000. The plans will probably be changed.

Flint, Mich.—Thos. J. Allen Co. Clk., writes that it was voted Apr. 6 to erect a court house, at a probable cost of $100,000.

Corunna, Mich.—The citizens are stated to have voted to issue $75,000 bonds for the erection of the Shiawassee County Court House.

St. Paul, Minn.—The Bd. of State Capitol on Apr. 8 awarded contracts for interior stone and marble at $782,000, and interior woodwork at $111,703, for Minnesota State Capitol, to Butler Bros., of St. Paul.

Bids for painting and glazing and all labor and material required for the elevators will be received May 5th. Channing Seabury, Vice-Pres. Bd. State Capitol Comrs.

St. Louis, Mo.—The Congregations of the Mount Cabanne and Central Christian Churches are stated to have purchased a site at Union Boule. and Von Versen Ave., for the erection of an edifice for the consolidated churches; probable cost, $50,000.

Carthage, Mo.—Bids will be received Apr. 23 at the office of A. F. Lewis for erecting a library at 7th St. and Garrison Ave. Garstang & Ren, Archts., Joplin.

St. Joseph, Mo.—It is stated that the Francis M. E. Congregation is considering the erection of a new edifice, to cost $70,000. Dr. C. M. Bishop, Pastor.

Billings, Mont.—Foley & Crowe, of this city, are stated to have submitted the lowest bid ($74,913) for erecting the court house and jail here.

Trenton, N. J.—The Governor is stated to have signed the bill providing for an appropriation of $125,000, to rebuild or erect an armory for the First Troop of Cavalry of New Jersey.

Newark, N. J.—Thos. Cressey, 800 Broad St., is stated to have been appointed advisory architect for the erection of the addition to the County Hospital for the Insane and improvements to the jail at Overbrook; probable cost of both, $150,000.

Paterson, N. J.—It is stated that the Second Presbyterian Congregation will erect an edifice to cost about $100,000. H. T. Stephens, Archt., 266 Main St.

Albany, N. Y.—The Assembly is stated to have passed the following bills: Providing an appropriation of $52,450 for improvements to the Woman's Reformatory at Bedford; $49,000 for improvements to the Clinton Prison, and $1,070,000 for improvements to the State Hospital for the Insane.

Buffalo, N. Y.—The Senate is stated to have passed a bill authorizing an expenditure of $100,000 for library improvements.

Albany, N. Y.—Plans are being prepared by the City Archt. for a hospital for contagious diseases to be erected in connection with Albany Hospital. The Council has appropriated $40,000 for this purpose.

There is an extension proposed to St. Peter's Hospital on Bway., to cost about $60,000.

The Albany Homeopathic Hospital and Dispensary has plans for a new building on N. Pearl St. It will be 100x42 ft., several stories high, and cost about $100,000.

New York, N. Y.—Bids will be received Apr. 22 by Homer Folks, Comr. Dept. of Pub. Charities, for furnishing material for erecting a male servants' dormitory at the City Hospital, Blackwell's Island.

Plans are stated to have been prepared for a 5-story stone building to be erected at 82d St., Central Park West, for the N. Y. Red Cross Hospital and Training School for Red Cross Sisters; to cost about $70,000.

The following bids were opened by the Bd. of Park Comrs. Apr. 9 for erecting a new wing for the heating, power and electric light plant of the American Museum of Natural History: Thos. Cockerill & Son, 147 Columbus Ave., $184,500; Thos. Dwyer, $189,750; Thos. B. Leahy, $194,920; Murphy Bros., $210,000; J. R. Sheehan & Co. (Inc.), $198,000; Williams & Gerstle, $202,894.

Bids will be received Apr. 23 by the Bd. of Park Comrs. for furnishing material for erecting a bird house in the N. Y. Zoological Park; also for installing plumbing fixtures in the stone buildings near Lorillard Mansion, in Bronx Park. Wm. R. Willcox, Chmn.

Elizabethtown, N. C.—Bids are wanted May 19 for erecting a jail. C. P. Parker, Chmn. Bd. of Co. Comrs.

Jamestown, N. D.—Bids will be received May 5 by the Bd. of Trus. for erecting a ward building at the State Hospital for the Insane. M. E. Beebe, Archt., Fargo; Chas. F. Mudgett, Secy. of Bd.

Lorain, O.—Bids are wanted Apr. 20 for erecting a library. Patton & Miller, Archts., Chicago, Ill.

Cleveland, O.—Bids will be received until May 7 by the Pub. Library Bd. for furnishing material and erecting a library, work to include ventilating, heating, plumbing, electric wiring, etc., Harry Dixon, Secy.

Columbus, O.—Bids will be received May 9 by the Bd. of Dir. for furnishing material and erecting a connecting building between the cell block and present main building, including necessary connecting walls, etc., and such additions and alterations in the present buildings at the Columbus Work House, and the ventilating and heating of the new cell block. J. S. Walters, Secy.

Scranton, Pa.—The contract for foundations and cutstone for Alms House Buildings for Scranton Poor District has been awarded to Woelkers & Bellman for $23,190.

Philadelphia, Pa.—Melody & Keating, 2118 Diamond St., are stated to have received the contract for erecting the $250,000 edifice at 8th and York Sts. for the Congregation of St. Edward the Confessor's Church.

Pittsburg, Pa.—Marius Rousseau, 307 Smith Blk., is stated to have prepared plans for a stone edifice for the St. Lawrence Roman Catholic Church, Penn and Atlantic Aves.; estimated cost, $200,000.

Philadelphia, Pa.—It is stated that Herman Miller, Crozer Bldg., will soon invite estimates for the erection of the 7-story brick addition to the Medico-Chirurgical Hospital at 18th and Cherry Sts.; probable cost, $140,000.

Redfield, S. D.—Bids will be received Apr. 21 by the Carnegie Library Bd. for erecting a library. M. Hockman & Co., Archts., Watertown; H. S. Comer, Secy.

Webster, S. D.—Fred Gross Constr. Co., of La Crosse, Wis., is stated to have received the contract for erecting the Day County Court House for $56,500.

Spokane, Wash.—It is stated that Andrew Carnegie has offered this city $75,000 for the erection of a Carnegie Library.

Milwaukee, Wis.—Bids are wanted Apr. 28 for furnishing material for erecting 2 branch police stations on 3d and Hadley Sts., including ventilating, heating, plumbing, sewerage, gasfitting, cast and wrought iron work, etc. Chas. J. Poetsch, Chmn. Comrs. of Pub. Wks.

Appleton, Wis.—It is reported that Co. G, 2d Regt. Wis. N. G., will soon ask for bids for the erection of an armory; estimated cost, $15,000. Address Capt. M. S. Peerenboom.

BUSINESS BUILDINGS AND DWELLINGS.

Mobile, Ala.—It is reported that Patk. Lyons will build a $50,000 store building on Commerce and St. Michael Sts.

Boulder, Colo.—The Enterprising Hotel Co. is reported to be considering the erection of a hotel here, to cost $100,000. Otto Kappler is reported interested.

Washington, D. C.—T. F. Schneider, Bond Bldg., is stated to have prepared plans for a 7-story brick apartment house to be erected at Connecticut Ave. and H St. by F. H. Duehay; probable cost, $700,000.

Atlanta, Ga.—The Fulton Bldg. Co. is reported incorporated, with a capital of $100,000, to erect a building, probably 14-story, at Peachtree and Marietta Sts. Incorporators: W. P. Inman, Capt. J. W. English, and others.

Springfield, Ill.—It is stated that Dr. Elmer E. Hagler will erect a 3-story brick apartment house, at a cost of $50,000.

Richmond, Ind.—Jones Bro. Wholesale & Retail Hardware contemplates erecting an addition to its present building; cost, $40,000. O. Yates, of Richmond, is preparing the plans.

Indianapolis, Ind.—The Merchants' National Bank is stated to have purchased a site for a 12-story office building. John P. Frenzel, Pres.

Ft. Dodge, Ia.—It is stated that the Illinois Central (B. Gillens, Div. Supt.) will erect a depot on Central Ave., to cost $150,000.

Covington, Ky.—Sydney Arthur expects to build a flat at 6th and Greenup St., to cost $18,000. Werner & Adkins, Archts., Cincinnati, O.

Detroit, Mich.—Joy & Bancroft, 407 Ferguson Bldg., are stated to have completed plans for a 60x100-ft., 8-story addition to the Madison Apartments at Randolph St. and Madison Ave., at a cost of $125,000.

Escanaba, Mich.—Charlton & Gilbert, of Marquette, are stated to have prepared plans for a building for S. B. Rathfon; estimated cost, $30,000.

St. Louis, Mo.—Plans are stated to have been prepared for a hotel to be erected at Washington Boule. and Euclid Ave. by the Co-operative Missionary Union, to cost $40,000. Rev. T. G. Atterberry, 1211 N. Garrison Ave., is reported interested.

It is stated that plans are being prepared for an 8-story building to be erected at 7th and Olive Sts. J. A. Parker, agent Holland Bldg., is reported interested.

East Orange, N. J.—It is stated that Marcus W. Adams will erect a residence at Central and Munn Aves., at a cost of $50,000.

Buffalo, N. Y.—Cyrus Porter & Son, 73 W. Eagle St., have prepared plans for a 6-story store for the Buffalo Realty Co., to be erected on Main St. near Mohawk, to cost about $370,000.

Rochester, N. Y.—Local press reports state that bids will be received May 10 by the officials of the Rochester & Sodus Bay Ry. Chas. Latz, Ch. Engr., Rochester, for erecting a car barn, 75x300 ft., at E. Rochester.

Litchville, N. D.—It is stated that bids are wanted May 1 for erecting a brick bank building. A. P. Hansen, Cashier; C. Albrant, Archt., Fargo.

Avondale, O.—Plans are stated to have been prepared for a 5-story apartment house to be erected here, to cost $80,000. Rapp, Zettel & Rapp, Archts. probably, of Cincinnati.

Dayton, O.—It is stated that Geo. A. and Fred C. Dickson will erect a 4-story brick theatre at Main and 5th Sts.; estimated cost, $175,000.

Coshocton, O.—The contract for the erection of the Sixth St. Theatre is stated to have been awarded to Adams Bros., of Zanesville; estimated cost, $40,000.

Cleveland, O.—C. J. Close, of Columbus, is stated to have received the contract for erecting the round house and shops of the Pennsylvania R. R. Co. (W. H. Scriven, Div. Supt., Cleveland); probable cost, $500,000.

Bradford, Pa.—Bids will be received Apr. 20 by H. H. North, Secy. Bd. of Trus., Tuna Lodge, No. 411, I. O. O. F., for furnishing material and reconstructing the I. O. O. F. hall, to cost about $50,000.

Oakmont, Pa.—It is stated that the Oakmont Country Club have had plans prepared for a 2-story club house, to cost $30,000.

Tyrone, Pa.—Bids will be received Apr. 28 by the Bldg. Com. for erecting a building on 14th St. and Burley Ave. for the P. R. R. Y. M. C. A. Address W. P. Whitney, 1547 Logan Ave.

Pittsburg, Pa.—Saml. Hamilton is reported to be having plans prepared for a 10-story building to be erected at 624 Penn Ave.; probable cost, $150,000.

Pittsburg, Pa.—Wm. Miller & Sons, Carnegie Bldg., are stated to have received the contract for erecting a 12-story building at Diamond St. and Cherry Alley. Contracts for ventilating, heating and lighting have not been let; probable cost in all, $450,000.

Knoxville, Tenn.—R. T. Wardrup has secured the contract for erecting a business block at 310 Gay St., for about $32,500.

Salt Lake City, Utah.—Judge Jas. A. Miner is reported to be considering the erection of a hotel at Beck's Hot Springs; probable cost, $300,000.

Seattle, Wash.—Bebb & Mendel, 110 Washington Bldg., are stated to have prepared plans for alterations to the Butler Hotel; probable cost, $100,000.

NEW YORK, N. Y.

26 Broome St, 6-story br tenemts and stores; c, $50,000; o, Selder, Stotler & Teitelbaum; a, Bernstein & Bernstein.

Hudson and Beach Sts, 8-story br warehouse; c, $180,000; o, Protestant Episcopal Soc for Promoting Religion and Learning in State N Y; a, Chas C Haight.

306 Madison St, 6-story br tenemt and stores; c, $45,000; o, Louis Frank; a, Bernstein & Bernstein.

141 Ridge St, 6-story br tenemt and stores; c, $35,000; o, Nierberg Bros; a, Sass & Smallheiser.

332 E 4th St, 6-story br tenemt and stores; c, $46,000; o & b, Max Kessler; a, G F Pelham.

276 Ave A, 2 6-story br tenemts and stores; c, total, $75,000; o, Max Gold; a, Horenburger & Straub.

Ave B cor 4th St, 6-story br tenemt; c, $75,000; o & b, Urry Goodman; a, Alfred E Badt.

73 Ave C, 2 6-story br tenemt and stores; total c, $76,000; o & b, Meyer Frank; a, G F Pelham.

2d Ave cor 6th St, 6-story br tenemt and stores; c, $28,000; o, Braverman, Silverson & London; a, Sass & Smallheiser.

24th St and 11th Ave, 6-story br stable; c, $50,000; o, Jas J Duffy; a, Horgan & Slattery; m, Thos D Comas.

27th St and 2d Ave, 6-story br tenemt; c, $30,000; o, Siegel Lisman; a, Wm J Fryer.

157 E 32d St, 5-story br stable; c, $55,000; a, John H Friend.

100th St and 1st Ave, 2 6-story br tenemts; total c, $56,000; o, Louisa Lomonte; a, John Caggiano.

124th St and Bway, 6-story br tenemt; c, $85,000; o, A A Edelman; a, P H Peppmuller.

SCHOOLS.

North Birmingham, Ala.—See "Power Plants, Gas and Electricity."

Merced, Cal.—Press reports state that bids will be received May 6 for $30,000 School Dist. bonds.

Peru, Ill.—The citizens are stated to have voted to issue $35,000 bonds for the erection of a school.

Peoria, Ill.—Fred Meints, 205 State St., is stated to have received the contract for erecting the school at 1st and Webster Sts., for $28,433.

Montezuma, Ia.—Bids are wanted May 4 for erecting an addition to the high school. H. F. Morton, Secy. Bd. of Educ.

Ft. Dodge, Ia.—Bids will be received until Apr. 23 by Rev. Father Heelan for erecting a 2-story and basement brick parochial school. J. H. Albright, Archt., Dond Blk.

Arthur, Ia.—Bids are wanted May 2 for erecting a school. Address E. A. Shaw, Secy.

Topeka, Kan.—J. H. Squires, City Clk., writes that it was voted Apr. 7 to issue $131,500 bonds for new schools.

Lexington, Ky.—Local press reports state that bids will be received until Apr. 24 by the Bldg. Com. for erecting on So. Limestone St. a 2-story and basement brick and stone experiment station for the State College. Probable cost, $20,000.

Webster, Mass.—The citizens are stated to have voted to issue $60,000 bonds for the erection of a high school.

Lawrence, Mass.—Ward No. 2 School Comn. (Mayor A. L. Graot, Chmn.) has been authorized to erect a $70,000 grammar school. The School Com. has recommended a set of plans for acceptance, and bids for construction will soon be asked.

Boston, Mass.—The School House Comn. has appointed A. Wadsworth Longfellow, Tremont Bldg., to prepare plans for a grammar school to be erected on the old Christopher Gibson site, Dorchester, and Chas. B. Perkins, 8 Beacon St., to prepare plans for completing the Francis Parkman School, Jamaica Plain.

Bids will be received Apr. 21 by the Schoolhouse Comrs. for installing a plumbing system; also for mason, carpentry, and other work in the Phillips St. school. R. Clipston Sturgis, Chmn.

Grand Rapids, Minn.—It is stated that bids are wanted May 8 for heating and plumbing a school. E. B. McCarthy, Clk. of School Bd.

Savannah, Mo.—The citizens are stated to have voted to issue $35,000 bonds for the erection of a schoolhouse.

Charleston, Mo.—It is stated that a school will be erected here, to cost $20,000.

Dillon, Mont.—It is stated that the contract will soon be let for the addition to the State Normal College, to cost $25,000. Haire & Fennell, Archts., Butte.

Omaha, Neb.—The plans of Thos. B. Kimball, McCague Bldg., are stated to have been accepted for the 2-story brick Monmouth Park School; estimated cost, $45,000.

Plainfield, N. J.—An ordinance is stated to have been adopted authorizing the issue of $125,000 bonds for erecting a high school.

New York, N. Y.—It is stated that the Knowlton Hall Co. will erect a 7-story dormitory at 124th St. and Bway. for Columbia Univ.; estimated cost, $250,000. Fred. A. Goetze, Chas. P. Northrop and others are reported interested.

New York, N. Y.—Contracts for school work, bids opened Apr. 13, have been awarded as follows: For sanitary work in Public School No. 31, Boro. of Manhattan, to Matthew J. Crowley, Heath Ave., for $12,198 and for installing electric light wiring, fixtures and bell system in School No. 6, Boro. of Manhattan, to L. F. Benn, 725 Bway., for $6,200.

Batavia, N. Y.—Bids will be received Apr. 27 by the Bldg. Com. Bd. of Educ. for erecting a 2-story 8-room brick school. A. J. Squires, Clk. Bd. of Trus.

New York, N. Y.—Bids will be received Apr. 27 by C. B. J. Snyder, Supt. of School Bldgs., for erecting School No. 37; also for installing passenger elevators in the Morris High School, Boro. Bronx.

Buffalo, N. Y.—Bids will be received by the Bd. of Educ. Apr. 22 for electric light wiring the Lafayette High School.

Brooklyn, N. Y.—Bids will be received Apr. 27 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work in School No. 142, also improving sanitary conditions and alteration in Schools Nos. 27 and 43.

Oxford, O.—All bids received for the erection of the dormitory for girls at the Miami Univ. are stated to have been rejected, being in excess of the $35,000 appropriation. New bids will be received.

Lakewood, O.—Bids will be received May 1 by Maurice Welfare, Hamlet, Clk. Bd. of Educ., for $75,000 school bonds.

Coventry, O.—Bids will be received Apr. 24 by the Bd. of Educ. for erecting a school. H. C. Spicer, Clk.

Martin's Ferry, O.—The Bd. of Educ. is stated to have rejected all bids received for the erection of the high school, being in excess of the $45,000 appropriation. New bids will probably be received.

Lima, O.—The citizens are stated to have voted to issue $75,000 bonds for the erection of a high school.

Norristown, Pa.—The Bd. of Educ. is stated to have decided to erect a school at Sandy and Walnut Sts., to cost $25,000.

Philadelphia, Pa.—It is stated that $55,000 has been appropriated for an X-Ray plant and isolation building for the Hospital of the Univ. of Pennsylvania.

Hazleton, Pa.—Owen McGlynn, of Wilkesbarre, is stated to have been selected to prepare plans for a school to be erected here, to cost $60,000.

Nashville, Tenn.—Bids will be received Apr. 20 by Bd. of Educ. for erecting a school on Cleveland St. Robt. Sharp, Archt., Rm. 21, Cole Bldg.

Waco, Tex.—The citizens are stated to have voted to issue $60,000 bonds for schools.

Austin, Tex.—Edwards College is reported destroyed by fire.

Seattle, Wash.—It is stated that bids are wanted Apr. 25 by F. A. Sexton, Archt., Seattle, for erecting the Kent School, exclusive of heating.

Milwaukee, Wis.—Local press reports state that the Bd. of Trus. of the State College will receive bids May 6 for erecting the central college building.

Bear Valley, Wis.—Bids are wanted Apr. 25 for erecting a school in Dist. No. 3. Address Jos. Schmitz, Clk.

STREET CLEANING AND GARBAGE DISPOSAL.

Louisville, Ky.—The Bd. of Pub. Wks. is stated to be considering a petition from Col. J. B. Gathright, for permission to establish 2 or more plants in Louisville for the disposal of garbage.

Reading, Pa.—C. C. Fisher is stated to have secured the contract for the disposal of garbage, at $2.24 per ton.

New Kensington, Pa.—A correspondent writes that this city is figuring on cost of a garbage plant; also expects to construct a short sewerage system.

Chester, Pa.—Wm. J. Clayton is stated to have secured the contract to collect garbage for 1 yr. from Apr. 1, 1903, for $1,550.

Madison, Wis.—See "Power Plants, Gas and Electricity."

GOVERNMENT WORK.

San Francisco, Cal.—The lowest bid for dredging in Redwood Creek, Cal., 58,600 cu. yds. (bids opened Apr. 9) was that of Willis G. Witter, Call Bldg., San Francisco, at 11 cts. per cu. yd.; total, $6,446.

Ft. Logan, Colo.—Bids are wanted Apr. 23 for furnishing material for sinking a 6-in. well at this post. Address Lieut.-Col. J. W. Pope, Ch. Q. M., Denver.

Hartford, Conn.—Bids are wanted May 14 for constructing (except heating apparatus and passenger elevator) the extension of the U. S. Custom House and Post Office at Hartford. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Washington, D. C.—Bids are wanted May 4 for furnishing plumbing and electric supplies, etc., for use of the Government Printing Office during the fiscal year ending June 30, 1904. F. W. Palmer, Pub. Printer.

Ft. Riley, Kan.—Capt. G. O. Cress, Q. M., writes that no bids were received on Apr. 6 for constructing vitrified brick walks and pavements at this post.

Grand Rapids, Mich.—The following bids for extension of the West Breakwater, improving harbor at Petoskey, Mich., were received on Apr. 11 by Maj. J. G. Warren, Corps Engrs., U. S. A.—*a*, Nelson J. Gaylord, Ludington, Mich.; *b*, T. J. Bennett & Co., Muskegon, Mich.:

	a	*b*
To remove N. Breakwater cribs and replace in W. Breakwater	$8,000	$9,000
To remove founda. and riprap N. Breakwater and replace in W. Breakwater, 990 cords	10.50	10.50
White oak timber, 1.296 M. ft	50.50	60.00
White pine, yellow pine or Douglas fir, 77.533 M. ft	38.00	34.00
White or yellow pine for deck, 39.510 M. ft	32.50	32.00
Hemlock or Norway pine, 146.856 M. ft.	26.00	25.00
Drift bolts, 20,373 lbs	.04	.035
Screw bolts, 1,009 lbs	.04	.035
Spikes, 3,600 lbs	.05	.035
Stone, 533 cords	6.50	8.90
Totals	$31,249	$32,873

Marquette, Mich.—The following bids were opened at Duluth, Minn., April 11, by Capt. D. D. Gaillard, Corps Engrs., U. S. A., for about 6,000 bbls. of Portland cement, to be delivered at Marquette, Mich., price given per bbl.: F. E. Spear & Sons, Marquette, Mich., $2.76; Alpena Portland Cement Co., Alpena, Mich., $2.30 (awarded contract).

Biloxi, Miss.—The following bids for dredging in harbor at Biloxi were received by Capt. W. E. Craighill, Corps Engrs., U. S. A., at Mobile, Ala., Apr. 9, price given per cu. yd.: Geo. G. Barker, Wilmington, Del., 23 cts., and Rittenhouse Moore, Mobile, Ala., 22 cts.

Helena, Mont.—The contract for heating the U. S. Pub. Bldg. at Helena is stated to have been awarded to the Chas. B. Krause Mfg. Co., of Milwaukee, Wis., for $14,640.

New York, N. Y.—Bids will be received at the U. S. Engr.'s Office, Army Bldg., May 15 for dredging in Hudson River and Saugerties Harbor, N. Y., as advertised in The Engineering Record.

The following bids were opened by Maj. W. L. Marshall, Corps Engr., U. S. A., at the Army Bldg., N. Y. City, Apr. 6, for furnishing 5,000 bbls. of cement at Ft. Wadsworth; bidders all of N. Y. City—*a*, price bid in bbls., per bbl.; *b*, price bid in sacks, per bbl., 4 sacks to bbl.:

	a	*b*
Hiram, Snyder & Co	$2.24	$2.39
John P. Kane Co	2.15	2.29
Fredenburg & Lounsbury	2.30	2.40
Vulcanite Portland Cement Co	2.30	2.40
Atlas Portland Cement Co	2.16	2.27

The following bids were opened at the same time and place for furnishing 9,000 bbls. of cement at Ft. Hamilton, N. Y.; bidders all of N. Y. City—*a*, price bid in bbls., per bbl; *b*, price bid in sacks, per bbl, 4 sacks to bbl.:

	a	*b*
John P. Kane Co	$2.15	$2.29
Hiram, Snyder & Co	2.12	2.25
Vulcanite Portland Cement Co	2.30	2.40
Atlas Portland Cement Co	2.16	2.27

A rebate of 10 cts. will be allowed by all bidders for return of each empty sack, with the exception of Fredenburg & Lounsbury, who will allow 9¾ cts. on each sack returned.

The following bids were also opened at the same time and place for furnishing, *a*, 3,000 cu. yds. of broken stone at Ft. Wadsworth and, *b*, 6,000 cu. yds. broken stone at Ft. Hamilton, price given per cu. yd.: Clinton Point Stone Co., 170 Bway., *a*, $1.10; *b*, $1.05. Jacob E. Conklin, 135 Front St., *a*, 89 cts.; *b*, 94 cts.

Elmira, N. Y.—Bids are wanted May 11 for constructing the approaches at the U. S. Post Office and Court House at Elmira. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Buffalo, N. Y.—The bid of the Buffalo Dredging Co. is stated to have been accepted for work to be done by the Government at Little Sodus Bay and Cape Vincent on Lake Ontario; contract reported to amount to $80,000.

Ft. Lincoln, N. D.—Bids are wanted Apr. 30 for constructing 1 administration building and a powder magazine at this post. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Flandreau, S. D.—Bids will be received May 6 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing at the Flandreau Indian School 1 brick warehouse and office, including plumbing and steam heating; and brick shop, including plumbing and electric light. Address Chas. F. Peirce, Supt. Indian School, Flandreau.

Chattanooga, Tenn.—The following bids for constructing the upper section of the Colbert and Bee Tree Shoals Canal on Tennessee River were received by Maj. John G. D. Knight, Corps Engrs., U. S. A., Apr. 11—*a*, Sheridan-Kirk Contract Co., Madison, Ind.; *b*, Christie & Lowe, Chicago, Ill.; *c*, O'Brien & Hoolihan and E. Brown Baker, Syracuse, N. Y.:

	a	*b*	*c*
Concrete, 44,000 c. yds	$8.28	$10.00	$8.75
Earth exc., 54,000 c. yds	.50	1.80	.50
Rock exc., 143,000 c. yds	1.98	1.80	2.25
Iron & steel, 15,000 lbs	.07	.10	.05
Masonry, 13,100 c. yds	6.00	7.50	3.00
Riprap, 200 c. yds	2.00	3.00	2.00
Stone, 100 c. yds	10.00	5.50	5.00
Coping, 560 c. yds	24.00	18.00	15.00
Face stone, 100 c. yds	16.00	9.00	10.00
Special stone, 300 c. yds	24.00	20.00	15.00
Timber, 1.6 M. ft	50.00	200.00	80.00
Test holes, 150 lin ft	.60	.30	.50
Totals	$777,920	$912,845	$788,803

Ft. Ringgold, Tex.—Bids are wanted May 1 for extending the sewerage system at this post. John L. Clem, Ch. Q. M., San Antonio.

Ft. Douglas, Utah.—The contract for constructing 2 barracks, not including heating, plumbing, gas piping and electric wiring, at this post, bids for which were received by Capt. Saml. V. Ham, Q. M., Salt Lake City, Utah, Mar. 2, has been awarded to G. W. Atkinson & Son, Colorado Springs, Colo., for $110,880.

Ft. Douglas, Utah.—Bids will be received until May 4 by Capt. Sam. V. Ham, Q. M., Salt Lake City, for plumbing, heating, gaspiping and electric wiring 2 double cavalry barracks at Ft. Douglas.

Ft. D. A. Russell, Wyo.—Bids are wanted May 8 for furnishing material necessary to extend the water system at this post; consisting of 10,550 ft. 4 and 6-in. c. i. pipe, including valves and fire hydrants. Address Capt. W. S. Scott, Constructing Q. M., Cheyenne.

Cavite, P. I.—The Navy Dept. is stated to have on Apr. 9 awarded the contract for the Philippine floating dry dock to the Maryland Steel Co., of Sparrows Point, Md., for $1,124,000. It is to be completed in 27 mos. and delivered to Government on the Atlantic coast.

NEW INDUSTRIAL PLANTS.

The Ocilla, Ga., Oil & Fertilizer Co. intends to erect a 2-press oil mill with a fertilizer plant and ginnery. There will be six buildings averaging 50x100 ft. in size. T. W. Coleman, Secy. & Treas.

The West Palm Beach, Fla., Electric Light & Power Co. intends to install ice machines in the fall. A. R. Beaujon, Secy. & Gen. Supt.

The Donalds, S. C., Oil Mill Co. will erect a 20-ton mill, providing for one of 40 tons' capacity, and will require boiler and engine for larger mill and also boiler and engine for six to eight 70-saw gins and a steam power press. J. W. Brock, Pres.

A correspondent writes that the Peters Shoe Co., St. Louis, Mo., will erect a 4-story, 170x160-ft. factory of mill construction, to cost about $75,000. Matthews & Clarke, Archts.

The Morey & Michel Mfg. Co., Elizabeth, N. J., expects soon to erect a foundry to make its car replacers, but plans have not been matured.

The Hidden Fortune Gold Mining Co., Lead City, S. D., has had plans prepared for a 60x120-ft. hoist building, and expects to install a hoist capable of sinking 1,000 ft., a 10-drill air compressor and an electric light plant.

The Planters' Mfg. Co., Gainesville, Ga., is in the market for machinery for a 40-ton cottonseed-oil mill and four 70-saw gins. J. Carter, Mgr.

The G. W. Chase & Son Mercantile Co., 102-108 So. 2d St., St. Joseph, Mo., confectioners, is having a new plant erected and power will be furnished by an electric light station near by.

A correspondent writes that the Whitmore Mfg. Co., Holyoke, Mass., will erect a 3-story, 100x200-ft. factory of brick. Electric apparatus and elevators will be installed.

The Litchfield Mfg. Co., Webster City, Ia., will erect a new plant at Waterloo, Ia., to include five buildings ranging in size from 50x100 to 90x100 ft. The power plant will be electrical and the company is in the market for motors, roofing material, Portland cement, lime and plumbing material.

Geo. A. Hormel & Co., Austin, Minn., pork packers, will build a 65x125 or 130-ft. addition and a 44x46-ft. power house. The additional power required will be an engine of about 125-H.-P. capacity and 100-Kw. electric generator.

MISCELLANEOUS.

Pomona, Cal.—The citizens are stated to have voted Apr. 3 to issue $30,000 bonds for city parks.

Chicago, Ill.—Bids are wanted Apr. 21 for furnishing and delivering to the city between 20 and 40 side dump cars. F. W. Blocki, Comr. of Pub. Wks.

Baltimore, Md.—The Bd. of Awards is stated to have awarded the contract for dredging 265,000 cu. yds. to the Maryland Dredging & Contracting Co., at prices ranging from 18 to 21 cts. per cu. yd.

Fall River, Mass.—The lowest bid received by the Park Comn. on Apr. 5 for the grading, drainage, seeding, macadamizing and masonry work at Ruggles Park is stated to have been submitted by Thos. J. Kelly, of Brookline, Mass., for $22,523.

Tekamah, Neb.—C. G. Clark, Co. Clk., writes that the contract for constructing a ditch (bids opened Apr. 7) has been awarded to E. S. Beatty, of Blair, Neb., at 9.9 cts. per yd. for 13,082 cu. yds.

Brooklyn, N. Y.—Bids will be received Apr. 29 by J. Edw. Swanstrom, Boro. Pres., for furnishing, erecting, maintaining and illuminating street sign boxes for a term of 1 year, and attaching same to electric light poles.

New York, N. Y.—Bids will be received Apr. 27 by Louis F. Haffen, Pres. Boro. Bronx, for furnishing, erecting and maintaining 6,050 street signs and posts for a term of 3 years; also for furnishing and delivering 45,000 yds. best quality 1¼-in. trap rock stone and 15,000 yds. best quality 1½-in. trap rock stone screenings.

New York, N. Y.—The following bids were opened Apr. 14 by McDougall Hawkes, Comr. Docks and Ferries, for furnishing about 10,000 piles: Empire Timber Co., 258 Bway., $20.90 ea.; Nichols Bros., $20.98; J. H. Burton, $21.50.

Troy, N. Y.—Bids will be received Apr. 28 by the Bd. of Contract and Supply for rebuilding the 19th, 6th, 2d, Bond, Washington, Monroe, Federal and Liberty St. docks. Jas. M. Riley, Clk of Bd.

Portland, Ore.—Bids are wanted by the Port. Comrs., 666 Worcester Blk., until Apr. 23 for furnishing 1,000 ft. of shore pipe for the 20-in. hydraulic dredge.

Grafton, W. Va.—Press reports state that bids will be received May 2 for $90,000 improvement bonds.

Milwaukee, Wis.—Bids will be received by the Bd. of Pub. Wks. until Apr. 20 for dredging the several rivers and canals in this city. Chas. J. Poetsch, City Engr.

BUSINESS NOTES.

The Pittsburg, Pa., Boiler & Engine Co., 904 Park Bldg., has been formed to furnish complete all requirements of power plants, or parts thereof, embracing steam power, and is prepared to furnish estimates and specifications for boilers, engines, hoisting engines, pumps, condensers, economizers, etc., and act as consulting engineers in an advisory capacity and make tests of capacity and economy of steam plants. D. Asbworth is manager, and S. A. Williamson, engineer.

The new works of the Ball Engine Co., Erie, Pa., are rapidly being completed and the machine tools, which will be electrically driven, will soon be placed in position. The present works of the company are crowded with work for many months ahead, and it is probable that both works will be operated for some time to come. The company reports the following among recent orders: Monongahela Valley Electric Co., Belle Vernon, Pa., engine for a 300-H.-P. unit; Morrean Gas Fixture Co., Cleveland, O., a 175-H.-P. engine to be direct-connected to a 100-Kw. Westinghouse generator.

Among the orders recently received by the Burt Mfg. Co., Akron, O., for Cross oil filters are: A 50-gal. for a large electric light plant at Mexico City, Mex.; four to be used on steamers now being built by the Eastern Shipbuilding Co.; two to be used in one of the pumping stations of the City of New York; one for the Piano works of the International Harvester Co.; the 18th order from the American Sheet Steel Co.: eight for San Francisco; one to Portugal, and its agent at Mexico has just ordered 16 and reports business good.

The Stanley Electric Mfg. Co. has sold the following apparatus to the New York Edison Co., supplementing the half million dollar contract reported some months ago: 1,000-Kw. S. K. C. generators and seven 150-Kw. booster sets. The company has also contracted to furnish three 550-Kw. S. K. C. synchronous motors to the Municipal Gas Co. of Albany.

The contract for excavation, clearing of lands, removing old buildings, and foundations for the new plant of the Passaic Steel Co., Paterson, N. J., mentioned March 14, has been given to J. W. Ferguson, Paterson; for brick work on furnaces to the Porter-Miller Engineering Co., Pittsburg; for electric cranes, etc., to the Morgan Engineering Co., Alliance, O.; electrical work to the Westinghouse Electric & Mfg. Co., Pittsburg; engines to the Buckeye Engine Co., Salem, O. The steelwork for the buildings will be made in the company's own shops.

Westinghouse, Church, Kerr & Co. continue to receive numerous export orders for power apparatus. A new central electric illuminating plant at Tripolis, Greece, will contain two Westinghouse vertical three-cylinder producer gas engines for generator driving, supplied with gas generated from native lignite by Taylor producers furnished by R. D. Wood & Co. An electrical supply company in Lima, Peru, will install a 330-H.-P. Westinghouse compound engine for generator driving, this being an extension to their present plant; 200-H.-P. engine-type generating outfits have also been supplied to Negociacion Minera de Promontorio, Durango, Mex., and to S. Pearson & Son, Ltd., Salina Cruz, Mex. The latter firm has also purchased a number of standard engine generating outfits. The Mexican National Iron & Steel Co., Durango, will install a 45-H.-P. compound engine for general power work, and a 150-H.-P. Westinghouse compound engine type outfit will be installed by Michaelis Hallenstein & Co., Footscray, Victoria, Australia, for lighting and power work. The two 1,000-Kw. Westinghouse steam turbine generating units for the De Beers mines at Kimberly, South Africa, have recently been shipped. These are reported to be the largest steam turbines that have been exported from this country.

The Empire State-Idaho Mining & Developing Co., Spokane, Wash., has purchased of the Westinghouse Electric & Manufacturing Co. three motors for driving concentrating mill machinery and a large air-compressor in the Coeur d'Alenes. These motors will be supplied with power from the 2,300-volt secondary circuits of the Washington Water Power Co., of Spokane, whose 50,000-volt transmission line is now extending into the Coeur d'Alenes in Northern Idaho, a distance of approximately 90 miles. There are two 150-H.-P., three-phase, 2,300-volts, 580 R. P. M. induction motors to be supplied; one for driving the air-compressor of the Empire State mine at Wardner, Idaho; the other to operate the Sweeney concentrating mill a short distance from Wardner. The third motor will be of the synchronous type, 240-H.-P., 2,300-volts, three-phase, 514 R. P. M., and will drive the concentrating mill of the Tiger-Poorman mines at Burke, Idaho.

Barnum & Bailey have recently arranged for seventy Nernst lamps, ranging in size from the one-glower to the six-glower type, for illuminating their large canvas pavilions. To furnish current for operating the Nernst lamps, they have purchased special engines to generate power.

The Allis-Chalmers Co., Chicago, reports the following among its engine sales for March, 1903, the engines being Reynolds Corliss unless otherwise stated: Tremont & Suffolk Mills, Boston, Mass., one 21 and 48x48, 1890 cross compound; Carnegie Steel Co., Pittsburg, Pa., one 42 and 66x60 tandem rolling mill engine; Oliver Iron Mining Co., Duluth, Minn., one 16x36, 1890 frame; Lenoir, N. C., Cotton Mills, one 28x42 low pressure side; Dawson, Ga., Square Bale, Gin & Mill Co., one 16x42 girder frame; Lummis & Co., Suffolk, Va., one 12x36 girder frame; Charles L. Vickers, Houston, Tex., one 18x36 1890 frame; Woodward, Ala., Iron Co., three 44 and 84x60 vertical long crosshead blowing engines; Marietta, Ga., Knitting Co., one 12x36 girder frame; Milwaukee Chair Co., one 20x42 girder frame; South Side Elevated Ry. Co., Chicago, Ill., one 34 and 70x54 1890 horizontal cross compound; Washburn-Crosby Co., Minneapolis, Minn., one 26 and 58x60, 1890 cross compound condensing; Illinois Steel Co., Chicago, two 46 and 86x84, and 84x60 vertical steeple cross compound blowing engines; International Traction Co. of New Jersey, Jersey City, N. J., two 34 and 68x48, 1890, cross compound condensing; Schmelchel & Lange, Sutley, S. D., one 10x30 girder frame; Hunter Milling Co., Wellington, Kan., one 12x42 jet condenser; Lyon Cypress Lumber Co., Chicago, Ill., one 26x48, 1890 frame; Scranton, Pa., Bolt & Nut Co., one 18x36, 1890 frame; Griffin Wheel Co., Chicago, one 18x48 1890 frame, with compressor attachment; Pennsylvania Railroad Co., one cross compound Riedler air compressor, 15 and 24x36; Wild Goose Mining & Trading Co., Alaska, spare parts for Riedler pumping engine; Charles Butters & Co., Ltd., Mexico, one 14x42 1890 frame, and two horizontal tubular boilers, E. C., 66 in. x 16 ft.

Joseph McCreery, 637-652 Infirmary Road, Toledo, O., reports receiving contract for ventilating apparatus for steamer "City of South Haven," which is being built by the Craig Ship Building Co., and is intended for passenger service between Chicago and South Haven, Mich.; from the Eastern Ship Building Co. for combined coolers and heaters and articulated sectional elbows for air discharges and for air cooling and cleaning devices in the Federal building in Chicago.

Pawling & Harnischfeger, Milwaukee, Wis., state that the fire in their plant April 15 was confined to one building and, as there are six other buildings, no delay of any importance will occur in getting out work.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Apr. 20.	Sandusky, O.	Apr. 18
Apr. 20.	Syracuse, N. Y.	Apr. 18
Apr. 21.	Pomeroy, Wash.	Apr. 18
Apr. 21.	Truman, Minn.	Apr. 18
Apr. 21.	Crowley, La.	Apr. 18
Apr. 21.	Chicago, Ill.	Apr. 18
Apr. 22.	Norwalk, Conn.	Apr. 11
Apr. 24.	Cleveland, O.	Apr. 4
Apr. 24.	Minneapolis, Minn.	Apr. 4
Apr. 27.	Tacoma, Wash.	Apr. 11
Apr. 27.	Willipeg, Man., Adv. Mar. 28, Apr. 4	Mar. 27
Apr. 27.	Cleveland, O.	Apr. 4
Apr. 30.	Strathroy, Ont.	Apr. 11
May 1.	Chinook, Mont.	Feb. 7
May 2.	Ft. D. A. Russell, Wyo.	Apr. 4
May 5.	Atlantic City, N. J., Adv. Apr. 18	Apr. 11
May 7.	Newark, N. J.	Apr. 4
May 8.	Cheyenne, Wyo.	Apr. 11
May 12.	Toronto, Ont.	Mar. 21
Aug. 1.	Allegheny, Pa.	Apr. 4
———	Quincy, Mass.	Mar. 28
———	Lonaconing, Md.	Mar. 28
	SEWERAGE AND SEWAGE DISPOSAL.	
Apr. 20.	Washington, Pa.	Apr. 18
Apr. 20.	Albany, N. Y.	Apr. 18
Apr. 20.	Independence, Ia.	Apr. 18
Apr. 20.	Woonsocket, R. I.	Apr. 18
Apr. 21.	Bayonne, N. J.	Apr. 18
Apr. 21.	Portsmouth, O.	Apr. 18
Apr. 21.	New York, N. Y.	Apr. 11
Apr. 21.	Trenton, N. J.	Apr. 4
Apr. 22.	Cincinnati, O.	Apr. 4
Apr. 23.	Milwaukee, Wis.	Apr. 18
Apr. 23.	Danville, Ill.	Apr. 18
Apr. 23.	Cleveland, O.	Apr. 4
Apr. 23.	Rockford, Ill.	Apr. 11
Apr. 24.	Plain City, O.	Apr. 18
Apr. 25.	Harvard, Ill.	Apr. 18
Apr. 27.	Troy, O.	Apr. 18
Apr. 28.	St. Louis, Mo.	Apr. 11
Apr. 28.	Cape May, N. J.	Mar. 28
Apr. 30.	Nashville, Tenn.	Apr. 18
Apr. —	Crookston, Minn.	Feb. 21
May 1.	Aberdeen, S. D.	Apr. 18
May 1.	Connersville, Ind., Adv. Apr. 18	Apr. 18
May 1.	Ft. D. A. Russell, Wyo.	Apr. 4
May 2.	Crookston, Minn.	Apr. 4
May 4.	Lockport, N. Y.	Apr. 18
May 4.	Glenville, O.	Apr. 18
May 4.	Ft. Missoula, Mont.	Apr. 11
May 4.	Ardmore, Pa., Adv. Apr. 11, 18	Apr. 11
May 5.	Beaumont, Tex.	Apr. 18
May 5.	Allentown, Pa.	Apr. 18
May 5.	Olathe, Kan.	Apr. 11
May 9.	Bowling Green, O.	Apr. 18
May 12.	Beaumont, Tex., Adv. Apr. 11	Apr. 11
May 15.	Tonah, Wis.	Apr. 4
	BRIDGES.	
Apr. 22.	Spencer, Ind.	Apr. 4
Apr. 23.	New York, N. Y.	Apr. 18
Apr. 25.	Dayton, O.	Apr. 4
Apr. 27.	Coshocton, O.	Apr. 11
Apr. 28.	Peoria, Ill.	Apr. 18
Apr. 28.	Tacoma, Wash.	Apr. 18
Apr. 29.	South Bend, Ind.	Apr. 11
May 1.	Indianapolis, Ind.	Apr. 11
May 4.	Quincy, Cal.	Mar. 28
May 5.	Astoria, Ore.	Apr. 18
May 5.	Harrisburg, Pa.	Apr. 18
May 5.	Atlantic City, N. J.	Apr. 11
May 6.	Frankford, Ind.	Apr. 18
May 7.	Columbus, O.	Apr. 11
May 18.	Fredericton, N. B.	Apr. 4
May 19.	Milwaukee, Wis.	Apr. 18
	PAVING AND ROADMAKING.	
Apr. 20.	Albany, N. Y.	Apr. 18
Apr. 21.	Milwaukee, Wis.	Apr. 18
Apr. 21.	Butler, Pa.	Apr. 18
Apr. 21.	Trenton, N. J.	Apr. 18
Apr. 21.	Hammond, Ind.	Apr. 18
Apr. 21.	Linton, Ind.	Apr. 11
Apr. 21.	Massillon, O.	Apr. 11
Apr. 21.	Tampa, Fla.	Apr. 11
Apr. 21.	Nevada, Mo.	Mar. 28
Apr. 21.	Cincinnati, O.	Mar. 28
Apr. 21.	Shawnee, Okla. Ter., Adv. Mar. 21 to Apr. 18.	Mar. 21
Apr. 22.	Braddock, Pa.	Apr. 18
Apr. 22.	Chicago, Ill.	Apr. 18
Apr. 22.	Holland, Mich.	Apr. 11
Apr. 23.	Spokane, Wash.	Apr. 18
Apr. 23.	Danville, Ill.	Apr. 18
Apr. 23.	Lakewood, O.	Apr. 11
Apr. 24.	Wheeling, W. Va.	Apr. 18
Apr. 24.	Buffalo, N. Y.	Apr. 18
Apr. 24.	Litchfield, Conn.	Apr. 18
Apr. 26.	Vallejo, Cal.	Apr. 4
Apr. 27.	New York, N. Y.	Apr. 18
Apr. 27.	Lafayette, Ind.	Mar. 28
Apr. 28.	Cape May, N. J.	Mar. 28
Apr. 29.	Brooklyn, N. Y.	Apr. 18
Apr. 30.	Nashville, Tenn.	Apr. 18
May 1.	Opelousas, La.	Apr. 18
May 1.	Watertown, N. Y., Adv. Apr. 18	Apr. 18
May 1.	Cincinnati, O.	Apr. 11
May 4.	Atchison, Kan.	Apr. 18
May 4.	Morristown, N. J.	Apr. 18
May 4.	Glenville, O.	Apr. 18
May 4.	Newton, N. J.	Apr. 11
May 4.	Johnstown, N. Y.	Apr. 11
May 5.	Beaumont, Tex.	Apr. 18
May 5.	Lisbon, O.	Apr. 11
May 5.	Marion, Ind.	Apr. 4
May 5.	Versailles, Ind.	Apr. 18
May 9.	St. Joseph, Mo.	Apr. 18
May 9.	Evansville, Ill.	Apr. 18
May 12.	Alexandria, La.	Apr. 18
May 14.	Norfolk, Pa., Adv. Apr. 11, 18	Apr. 11
———	Muncie, Ind., Adv. Mar. 21	Mar. 21
	POWER, GAS AND ELECTRICITY.	
Apr. 21.	Des Moines, Ia.	Apr. 18
Apr. 24.	Columbus, O.	Apr. 11
May 11.	Toronto, Ont., Adv. Apr. 4 to 18	Apr. 4
May 12.	Copenhagen, Denmark	Apr. 4
Jun. —	Narth Yamkill, Ore.	Apr. 4
Jun. 1.	San Diego, Cal.	Apr. 18
Jun. 18.	Portland, Ore., Adv. Apr. 18	Apr. 18
	GOVERNMENT WORK.	
Apr. 20.	New York, N. Y., Adv. Mar. 21 to Apr. 11.	Mar. 21
Apr. 20.	Ft. McKinley, Me., Adv. Apr. 4 to 18	Apr. 4
Apr. 21.	Springfield, S. D.	Apr. 4
Apr. 21.	Ft. Dade, Fla., Adv. Apr. 4 to 18	Apr. 4
Apr. 22.	New York, N. Y., Adv. Mar. 28 to Apr. 18.	Mar. 28
Apr. 22.	Nashville, Tenn., Adv. Mar. 21, 28, Apr. 11, 18.	Mar. 21
Apr. 22.	Ft. Fremont, S. C.	Apr. 4
Apr. 23.	Ft. Logan, Colo.	Apr. 18
Apr. 23.	New York, N. Y., Adv. Mar. 28 to Apr. 18.	Mar. 28
Apr. 23.	New London, Conn., Adv. Mar. 28 to Apr. 18.	Mar. 28
Apr. 23.	Ft. D. A. Russell, Wyo.	Mar. 28
Apr. 23.	Ft. Lawton, Wash.	Apr. 4
Apr. 24.	Marquette, Mich., Adv. Mar. 28 to Apr. 18.	Mar. 28
Apr. 24.	Port Townsend, Wash., Adv. Apr. 4 to 18.	Apr. 4
Apr. 24.	San Francisco, Cal.	Apr. 4
Apr. 25.	New Brunswick, N. J.	Apr. 11
Apr. 25.	Ft. Gaines, Ala., Adv. Mar. 28	Mar. 28
Apr. 25.	Boston, Mass.	Mar. 28
Apr. 27.	Richmond, Ky.	Apr. 4
Apr. 28.	Denver, Colo., Adv. Mar. 28 to Apr. 18	Mar. 28
Apr. 29.	Grand Junction, Colo.	Apr. 11
Apr. 30.	Ft. Lincoln, N. D.	Apr. 18
Apr. 30.	Tongue River Agency, Mont.	Apr. 11
Apr. 30.	Portland, Ore.	Mar. 28
Apr. 30.	Washington Barracks, D. C., Adv. Apr. 4 to 18.	Apr. 4
Apr. 30.	Kalamazoo, Mich., Adv., Apr. 4	Apr. 4
Apr. 30.	Norfolk, Va., Adv. Apr. 11	Apr. 4
May 1.	Ft. Ringgold, Tex.	Apr. 18
May 1.	Rapid City, S. D.	Apr. 11
May 1.	West Point, N. Y., Adv. Apr. 4 to 18	Apr. 4
May 1.	Boston, Mass.	Apr. 4
May 4.	Ft. Douglas, Utah	Apr. 18
May 4.	Washington, D. C.	Apr. 18
May 4.	Ft. Brady, Mich.	Apr. 11
May 4.	Catlettsburg, Ky., Adv. Apr. 4 to 18	Apr. 4
May 4.	Memphis, Tenn.	Apr. 4
May 5.	Denver, Colo.	Apr. 18
May 5.	Greensboro, N. C., Adv. Apr. 4, 11	Apr. 4
May 6.	Flandreau, S. D.	Apr. 18
May 6.	Grand Rapids, Mich., Adv. Apr. 11, 18	Apr. 11
May 6.	Norwich, Conn.	Apr. 4
May 8.	Ft. D. A. Russell, Wyo.	Apr. 18
May 11.	Elmira, N. Y.	Apr. 18
May 12.	New Orleans, La.	Apr. 11
May 12.	Beaumont, Tex., Adv. Apr. 11, 18	Apr. 11
May 14.	Hartford, Conn.	Apr. 18
May 15.	Des Moines, Ia., Adv. Apr. 18	Apr. 18
May 15.	New York, N. Y., Adv. Apr. 18	Apr. 18
May 15.	New London, Conn., Adv. Apr. 18	Apr. 18
May 18.	Zanesville, O., Adv. Apr. 18	Apr. 18
May 25.	Lockport, N. Y., Adv. Apr. 18	Apr. 18
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 15.	Manila, P. I., Adv. Mar. 14 to Apr. 18	Mar. 14
	BUILDINGS.	
Apr. 20.	School, Nashville, Tenn.	Apr. 18
Apr. 20.	Infirmary, Rock Island, Ill.	Apr. 18
Apr. 20.	Library, Lorain, O.	Apr. 18
Apr. 20.	Bus. Bldg., Bradford, Pa.	Apr. 18
Apr. 20.	School, Brooklyn, N. Y.	Apr. 11
Apr. 20.	School, Long Island City, N. Y.	Apr. 11
Apr. 20.	Schools, New York, N. Y.	Apr. 11
Apr. 21.	Library, Brazil, Ind.	Apr. 18
Apr. 21.	Library, Redfield, S. D.	Apr. 18
Apr. 21.	School, Boston, Mass.	Apr. 18
Apr. 21.	School, Camden, N. J.	Apr. 11
Apr. 21.	Pub. Bldgs., Great Bend, Kan.	Apr. 4
Apr. 22.	School, Buffalo, N. Y.	Apr. 18
Apr. 22.	Dormitory, New York, N. Y.	Apr. 18
Apr. 22.	Pub. Bldgs., Texarkana, Ark.	Apr. 4
Apr. 23.	School, Ft. Dodge, Ia.	Apr. 18
Apr. 23.	Pub. Bldgs., New York, N. Y.	Apr. 18
Apr. 23.	Library, Carthage, Mo.	Apr. 18
Apr. 23.	School, Mansfield, O.	Apr. 4
Apr. 23.	Hospital, Gallipolis, O.	Apr. 4
Apr. 24.	School, Lexington, Ky.	Apr. 18
Apr. 24.	School, Coventry, O.	Apr. 18
Apr. 24.	Library, Des Moines, Ia.	Apr. 18
Apr. 24.	School, Chicago, Ill.	Apr. 11
Apr. 24.	Asylum, Attica, Ind.	Apr. 11
Apr. 24.	Library, Denison, Ia.	Apr. 11
Apr. 25.	School, Seattle, Wash.	Apr. 18
Apr. 25.	School, Bear Valley, Wis.	Apr. 18
Apr. 25.	Fire station, Youngstown, O.	Apr. 11
Apr. 25.	School, Sarnia, Ont.	Apr. 4
Apr. 27.	School, Brooklyn, N. Y.	Apr. 18
Apr. 27.	School, Batavia, N. Y.	Apr. 18
Apr. 27.	School, New York, N. Y.	Apr. 18
Apr. 27.	Pub. Bldg., Akron, O.	Apr. 11
Apr. 27.	School, Olivia, Minn.	Apr. 4
Apr. 28.	Pub. Bldg., Milwaukee, Wis.	Apr. 18
Apr. 28.	Bus. Bldg., Tyrone, Pa.	Apr. 18
Apr. 28.	Library, Flora, Ill.	Apr. 18
Apr. 28.	Library, Cleveland, O.	Apr. 11
Apr. 29.	Pub. Bldg., St. Louis, Mo.	Apr. 11
Apr. 30.	School, Deseronto, Ont.	Apr. 11
May 1.	Bank, Litchville, N. D.	Apr. 18
May 1.	Church, New Decatur, Ala.	Apr. 18
May 1.	Hospital, Toledo, O.	Apr. 11
May 1.	Pub. Bldg., Springfield, O.	Apr. 11
May 1.	Bus. Bldg., Newcastle, N. B.	Apr. 11
May 1.	School, Le Sueur, Minn.	Apr. 11
May 1.	School, Hamilton, O.	Apr. 4
May 2.	School, Arthur, Ia.	Apr. 18
May 2.	School, Rome, Ia.	Apr. 11
May 4.	Court house, Newport, Ky.	Apr. 18
May 4.	School, Montezuma, Ia.	Apr. 18
May 4.	Court house, Albany, Ga.	Apr. 11
May 4.	Court house, Abbeville, Ga.	Mar. 21
May 5.	Pub. Bldg., St. Paul, Minn.	Apr. 18
May 5.	Hospital, Jamestown, N. D.	Apr. 18
May 6.	School, Milwaukee, Wis.	Apr. 18
May 6.	Pub. Bldg., Topeka, Kan.	Apr. 18
May 7.	Library, Cleveland, O.	Apr. 18
May 8.	School, Grand Rapids, Minn.	Apr. 18
May 8.	Htg. Court house, Shakopee, Minn.	Mar. 28
———	Paper Plant, etc., Seven Islands, Que., Adv. Mar. 21 to Apr. 4.	Mar. 21
May 9.	Pub. Bldg., Columbus, O.	Apr. 18
May 10.	Bus. Bldg., Rochester, N. Y.	Apr. 18
May 14.	Library, Johnson City, Tenn., Adv. Apr. 18.	Apr. 18
May 15.	Church, Carrollton, Ky.	Apr. 18
May 19.	Jail, Elizabethtown, N. C.	Apr. 18
	MISCELLANEOUS.	
Apr. 20.	Dredging, Milwaukee, Wis.	Apr. 18
Apr. 20.	R. R. Work, Lawrenceburg, Ind.	Apr. 18
Apr. 21.	Dump Cars, Chicago, Ill.	Apr. 18
Apr. 21.	Dredging, New York, N. Y.	Apr. 11
Apr. 23.	Portland, Ore.	Apr. 18
Apr. 23.	St. Signs, St. Mary's, O.	Apr. 18
Apr. 24.	Pier, Brooklyn, N. Y.	Apr. 11
Apr. 27.	Signs, etc., New York, N. Y.	Apr. 18
Apr. 28.	Docks, Troy, N. Y.	Apr. 18
Apr. 29.	Signs, Brooklyn, N. Y.	Apr. 18
Apr. 30.	Dredging, Honolulu, H. I.	Mar. 28
May 1.	Dam, Hartford, Vt.	Apr. 11
May 1.	St. Cleaning, etc., Washington, D. C., Adv. Apr. 4 to 18.	Apr. 4
May 4.	St. Ry. franchise, Los Angeles, Cal.	Apr. 18
May 10.	R. R. Work, Des Moines, Ia.	Apr. 18
May 18.	Garbage Plant, Shreveport, La.	Apr. 18
May 20.	Dredging, Falmouth, Jamaica	Apr. 11
Jun. 1.	El. Ry. franchise, Redwood City, Cal.	Apr. 18
May 2.	'04 R. R., Oodnadatta, So. Australia	Feb. 21

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Good Politics.

A few months ago an esteemed British contemporary gently took The Engineering Record to task for some favorable comments on the American habit of regarding business ability and tact equally as important as professional ability in engineering offices having to do with public affairs. A recent instance of an appointment to political office of great importance illustrates clearly the practice which this journal commends as an example of good politics.

In a general way, the statement is reasonably true that Colorado depends mainly on irrigation for the successful pursuit of agriculture. For many years the construction of reservoirs and canals has been steadily carried on by private and public interests alike. In the early period of this work there was little clashing of interests, for water was abundant for everyone. But, later, questions of water rights came up in the courts, a tangle of judicial decisions ensued, and it became necessary to follow the example of Wyoming by delegating to the State Engineer important duties relating to the impounding and distribution of waters. The State Engineer to-day enjoys official power second in importance only to that of the Governor, and it is highly necessary that he should be a man of broad attainments.

In the matter of the distribution of water, the State Engineer has to decide almost daily between important and pugnacious opposing interests. He has a large part in the litigation between Colorado and Kansas in the United States Supreme Court over their respective rights to the flow of the Arkansas River, a case of the greatest importance to the legal and engineering professions. He is responsible for guiding the State safely through its present transitory condition in respect to the water control within its boundaries, and must organize a bureau to which any citizen can appeal for advice with perfect confidence that its decision will be equitable, legally correct and based on sound engineering practice. The selection of a man for this office is naturally a matter of the highest political importance to the Governor, for upon the tactful and honest enforcement of engineering principles depends the success of his administration in no small measure. The British contemporary will find the Governor's course in this case of interest, and The Engineering Record can vouch for its being a typical and not exceptional case. An investigation of the engineers of high standing in the State showed that one of them was so highly appreciated as to enjoy the unique distinction of once serving as expert witness for both sides of a suit and as technical adviser to the judge as well, if memory is not at fault. He had assisted in numerous important litigations in State and Federal courts and had administered delicate executive offices with much tact. The appointment was therefore tendered to him without any previous intimation that his name was being even considered. The Engineering Record has already announced that Prof. Carpenter has accepted the duties, and it is glad to learn that the funds at his disposal will be much larger than the State Engineer has previously been allowed, and that the more important assistants in his office have been placed under civil service regulations.

Many such instances of good politics occur annually in this country, but they are rarely mentioned because they are becoming the rule. The poor appointments which are always held up to ridicule in the daily press give our critics across the Atlantic a wrong impression. There are many men holding public engineering offices to-day whose political views are as unknown to their neighbors and the officers appointing them as are those of Prof. Carpenter. It is because of this fact that shrewd young men leaving technical schools are turning toward branches of work bringing them into touch with public enterprises. They see the really large prizes to be won in engineering and contracting for State and municipal enterprises and are not scared by the political bogie man of alleged bad morals.

Good Roads.

The "Good Roads" movement certainly has made notable progress during the past few years in awakening public interest, in educating the people, in obtaining action by governing bodies of various ranks and in the accomplishment of much improved construction in rural and suburban roads and city streets. While conventions have sometimes been improperly managed and much of the agitation has been carried on by interested parties for more or less selfish ends, nevertheless, on the whole, good has eventuated..

A good road is one that will reasonably meet the peculiar demands of the locality and its conditions as to character of traffic, topography, available materials and financial resources. For many routes a very narrow roadway will suffice. With infrequent travel of comparatively light vehicles only, a light construction at a corresponding cost will be permissible. At the other extreme, for roads over which many wagons heavily loaded with ore, metals or quarry products, and drawn by many mules or horses, even the most substantial form of the ordinary classes of construction, at all within financial possibility, is often inadequate, and in such places some form of steel road may be found more economical, in first cost as well as in maintenance. Some localities are favored with good gravel or stone with which hard roads can be built at small expense, and their topography and soil are favorable to easy and thorough drainage, an important consideration. Some localities can obtain best results, in proportion to expenditure, by intelligent use of local sand and crude oil. In some sections, deep, loose sand with no binder readily available, and in others heavy, sticky clays with no gravel to be had, discourage attempts to create good roads just where they are most sorely needed.

Climatic conditions, also, are an important element in the road problem. In many a section the roads are good excepting when the frost is working out, and at that season not only are the highways temporarily impassable, but permanent injury is frequently done. Proper formation and thorough drainage will probably accomplish much for the betterment of this condition. In regions of light rainfall, during the long dry spells the roads generally become insufferably dusty. The proper use of trees to afford shade and to screen from the wind may add not a little to the comfort of travel on a road, as well as to its wearing quality; but the possible effects upon the formation of snow-drifts must be kept in mind, and in wet climates, spots which do not drain readily must not be too much sheltered from the drying effects of sun and wind. The gospel of wide tires has been widely preached, and so nothing need be said on that subject here.

In sparsely settled regions the dirt road will have to stay for many years, and there will, doubtless, always be places where nothing better can be afforded. It has frequently been treated with contempt, as beneath the notice of engineers, and for poor treatment has given poor results. A sympathetic attention, intelligent study and scientific treatment of dirt roads and their possibilities, in many localities, will surely yield results of which even an engineer with a reputation need not be ashamed. Probably also, still better results will yet be attained with light macadam construction than have hitherto been realized.

"It is a short road which has no turning," and likewise few roads are without bridges, culverts and other structures. So much has appeared in the pages of The Engineering Record in time past concerning highway bridges, their design, construction and methods of purchase, that little need be written here, excepting to call attention to articles on that subject in other columns of this issue. However, it may be well, in passing, to emphasize the importance and economy of well-built, properly located and adequate structures with safe foundations.

Along with the increasing demands for, and the growing intelligence concerning, good roads, there has been a development of improved machines and tools for making roads. Implements and machines, however, must be selected judiciously according to the local requirements of materials, topography and class of construction. The graders, for example,

which accomplish such large results on the prairies would have a sorry time in the "rock-ribbed" hills of New England or in its boulder-rich glacial drift. Improved tools and suitable materials will not alone make a good road or street. Skilled intelligence is even more necessary, and to furnish this is the function of the engineer. Money spent in obtaining the services of a capable engineer at the right time will result in economy and prevent disappointment. But every engineer is not a road engineer, and it is barely possible that even some road engineers have not yet fully comprehended the economics of road construction. There still exists, in some quarters, at least a mild contempt for the more modest forms of construction as unworthy of professional attention, but just here is an opportunity to do a large public service by thoroughly adapting seemingly inadequate means to the satisfactory accomplishment of a much-desired end.

The people need, also, to be taught how to use good roads after they are built. One little example of what should not be done is the habit of following the same track in the middle of the road, which soon produces ruts by concentrating the wear both of the wheels and of the horses' feet. To meet this difficulty, in some parts of the country signs have been put up along the roadside with admonition: "Do not keep in the middle of the road," or some similar suggestion to distribute the traffic over the whole width of the roadway. Experience with various materials, implements, methods of construction and maintenance, and types of bridges and structures is yielding useful knowledge which should be made as widely available as possible for the benefit of those having charge of road and street work. There is no better medium for the interchange of such information than the pages of the technical journal.

A Few Thoughts on Present Practice of Road Construction.

By James Owen, M. Am. Soc. C. E.

While the writer's experience has been somewhat extensive in road construction, yet it has been limited to a very small section of our country, and it may therefore be open to question whether the results of such experience can be formulated for general practice. There are certain principles of road work that are fundamental and not open to discussion; others that are tentative and may be adopted or rejected without vitally affecting results, and there are still others that are strongly advocated by thinking men, yet are fatal in their consequences and should be classed as heresies. The early principles advocated by the two pioneers of road construction, Telford and Macadam, some seventy years ago, are, in the main, the principles on which all road work is based to-day. The improvements that have been made are mostly in the line of executive work of construction, more improved machinery and a keener appreciation of the small vital points in management which make or mar good results.

In considering the three subject heads outlined above, the first needs no extensive allusion here. Proper grading, complete drainage, easy grades and the furnishing and laying of the broken stone are factors all so uniformly accepted that only the most ignorant or niggardly would depart therefrom. The second heading opens a field of endless discussion and in the opinion of the writer, in view of the large sums now expended in many states for a number of years on road construction, the collation of facts should supersede discussion, and the resultant figures would probably remove a number of causes of speculation and direct the practice into the economical direction the figures would indicate, according to the experience in varying localities. Take for instance the question of the thickness of the road proposed to be constructed and the character of the foundation. Differences existed seventy years ago in England on these two problems and the same differences exist to-day, yet it would seem seasonable to suggest that while both are permissible and proper, the results of recent experience should show which of the two were preferable under given conditions.

Take for instance the results of road construction in two small municipalities coming under the writer's observation. They are of about the same area, population and mileage of roads, and of similar physical and topographical conditions. Both put down a system of roads, practically covering the whole territory, at the same time and spent the same amount of money, about $75,000. The roads of one town were built of telford pavement from 6 to 12 inches thick. The other town laid down 6-inch macadam. At the end of ten years the telford roads were all in as good condition as when built, and a careful inspection of the macadam roads made a year ago showed that an expenditure of $25,000 was necessary to put them in good and proper shape. Money had been raised annually for the repair of both systems. The appreciation of these facts would seemingly end discussion on that topic under such conditions. On the other hand, in a sparsely populated mountainous district with heavy grades, macadam roads can be built at a less cost and would give all necessary transit facilities with a minimum expense for repairs, provided that a reasonable thickness of broken stone is used, and here it may be stated, without controversy, that less than 6 inches is not a reasonable thickness. With a 4-inch road the supporting power of the remaining material after a moderate amount of wear is so small that it amounts to a large waste.

In selecting material for roads endless discussion can be and is held as to what is proper or improper. Yet the main factor is and always will be that of transportation. In a granite and trap rock country there is little question of selection, and the same may be said of limestone, but in a territory absolutely bare of native rock, the cost of carrying the material is a potent factor and its selection becomes a matter of solicitude. Is it better to pay more for trap rock than for limestone, and how much? Facts and figures must govern the final decision, coupled of course with results as to whether a good or indifferent road surface can be maintained. Then there is the question of packing. Should it be used or should a clean stone road be insisted upon? If used what should it be? Clay, gravel, loam or sand? As a fact this item of road work is not so much a question of money as of results, and is governed almost entirely by the character of the material used in constructing the road. Limestone requires no packing; granite but little, and then only with the harder varieties; some kinds of trap rock absolutely require it, and other kinds do not need it at all. As to whether it is better to have sand, gravel, clay, loam or earth the writer has found that he can use any kind with equally good results, provided proper consideration is given to its character and intelligent care given in its application.

Then as to rolling, this question is, to a large extent, a financial one and enters more largely into maintenance account than into construction, and it may be here stated parenthetically, that the final disposition of almost all the road question will be found in the maintenance and not in the construction; for however well a road may be constructed originally, poor maintenance will nullify the original good work, but a poorly constructed road can be made equal to any by care and watchfulness. The writer has constructed roads with steam rollers, and light and heavy horse rollers, and in most cases has achieved good results, and this has been obtained by careful consideration of the future use of the road. In a rural district with light travel much rolling can reasonably be dispensed with; but in city streets, especially where trolley tracks are laid, better results are obtained with heavy steam rollers, because a more uniform wearing surface is obtained, thus giving better general satisfaction. The financial end has here, however, to be disregarded.

The size of stone to be used is also a matter of judgment, and in the writer's opinion is dependent on the character of travel. The standard size for general travel is 1¾ inches. This should be increased to 2 or 2¼ inches for heavier city traffic, and may be decreased to 1 inch in rural districts. The screenings used are incidental to achieve a quick wearing surface and as a rule soon disappear, so the quality and character are unimportant.

The third heading of this article, namely that of heresies, should not lead to discussion so much as to denunciation, and that in no measured terms; and in this part of road construction and maintenance, the question of trade practice enters and creates difficulties sometimes hard to overcome. The principal point under this heading is the uniformity of the size of the stone to be used. Macadam laid it down as a principle, that all stone used in a given part of a road should be of uniform size, and this rule should hold good to-day. Yet in one of the engineering papers one writer boldly held forth the doctrine that the best material for road surfacing was the unscreened stone as it was delivered from the breaker. A moment's reflection will show the danger of such a practice. A 6-inch trap-rock block laid in a city street will show but little appreciable wear in twenty-five years. It may lose an inch to an inch and one-half in thickness in that period. The same trap rock block, broken into 1½-inch stone, on the same street, with the same travel, would be probably all worn away in from two to three years, and if broken into dust would last six months. The output from the average stone breaker runs from 4 inches to fine stone dust, which, if delivered on to a road for surfacing, would present for wearing stones varying from 4 inches to ½ inch, with a resistance to wear of six months to four years, so the result is that in two years after the application of unscreened material on the road there would be undulations in the surface of from 2 to 3 inches, a condition simply deplorable. Yet one of the most difficult problems for the road engineer to overcome is to get the stone delivered in uniform size, that is to say, to have it properly screened. There is so large a demand for unscreened stone in certain sections of the country for other purposes, that it practically amounts to breaking up trade regulations to get the stone properly screened, and only persistency and a full appreciation of bad results will obtain the required material.

Another practice that is somewhat open to criticism and only excused under the plea of expediency is that of building very thin roads. As cobblestones, in earlier times, were an improvement on aboriginal mud, so an immediate good service of a thin macadam is better for the farmer than being mired. The cobblestone pavements persist in staying, and while objectionable they still perform their function,

but with the thin macadam a few years' wear, a few heavy washes and they are gone, and practically a new road has to be built, or else, as I have seen in many cases, after the first enthusiasm of road building in a community has evaporated there is an actual reversion to primeval conditions. I know of some 4-inch macadam roads that are now things of the past.

Some engineers also persist, where conditions seemingly allow nothing else, in building roads on a level grade, expecting to get proper drainage by crowning. This is a policy of doubtful expediency as the crown wears flat; then there is no drainage and the water stands in the surface continually, and standing water is a menace to a permanent good surface. If possible, and it is generally possible, let there be a longitudinal fall to supplement the crown and a better road will be the result.

The personal equation is an important factor in road construction and road maintenance, and the generally accepted theory that any one can build a good road is open to controversy. A large amount of brain power has been expended in perfecting good machinery for breaking and screening stone, for its transportation and for grading and surfacing the bed, yet all this energy is nullified by incompetent engineers or indifferent contractors. The building of roads is now an art of itself, and the outsiders who are flocking into the business are experiencing the effects of the doctrine of selection and the survival of the fittest, and when any community has got through the weeding process they can confidently expect good results. Until then there is apt to be chaos. With a good engineer and a good contractor with fair prices, perfect results can be obtained. Good results can be obtained with a poor engineer and a good contractor—better than with a good engineer and a poor contractor; but when in any locality both are indifferent, as sometimes happens, the cause of good roads receives such a setback as to partially paralyze future efforts.

The Colorado State College is soon to erect for its department of civil and irrigation engineering a two-story, basement and attic building 60x120 feet in plan. The building will contain class-rooms, laboratories, offices and a museum, a hydraulic laboratory in the basement and draughting, blue-print and photographic rooms in the attic. There will be fireproof vaults for records. The state legislature has appropriated $40,000, and additional sums will be furnished from the college funds.

A Steel Truss Highway Bridge with Concrete Floor.

A 100-foot span highway bridge, now under construction for Portage County, Ohio, has riveted, steel, pony, Warren trusses, 12 feet deep and 16 feet apart on centers, which carry plate girder floor beams, supporting longitudinal stringers and a roadway platform of reinforced concrete, a novel combination designed to secure economy and durability. The bridge is proportioned for a live load of 80 pounds per square foot of roadway surface, or for a steam road-roller weighing 21,000 pounds, whichever would produce the greater stresses. Allowance for impact was made by adding to the live load stress, an amount obtained by the following formula:—

$$I = L\left(\frac{L}{L + D}\right)$$

in which I = the amount of impact to be added to the live load stress, L = the live load stress, D = the dead load stress. The members were proportioned for unit stresses of 20,000 pounds per square inch in tension, and the compressive stresses were determined by the following formula:

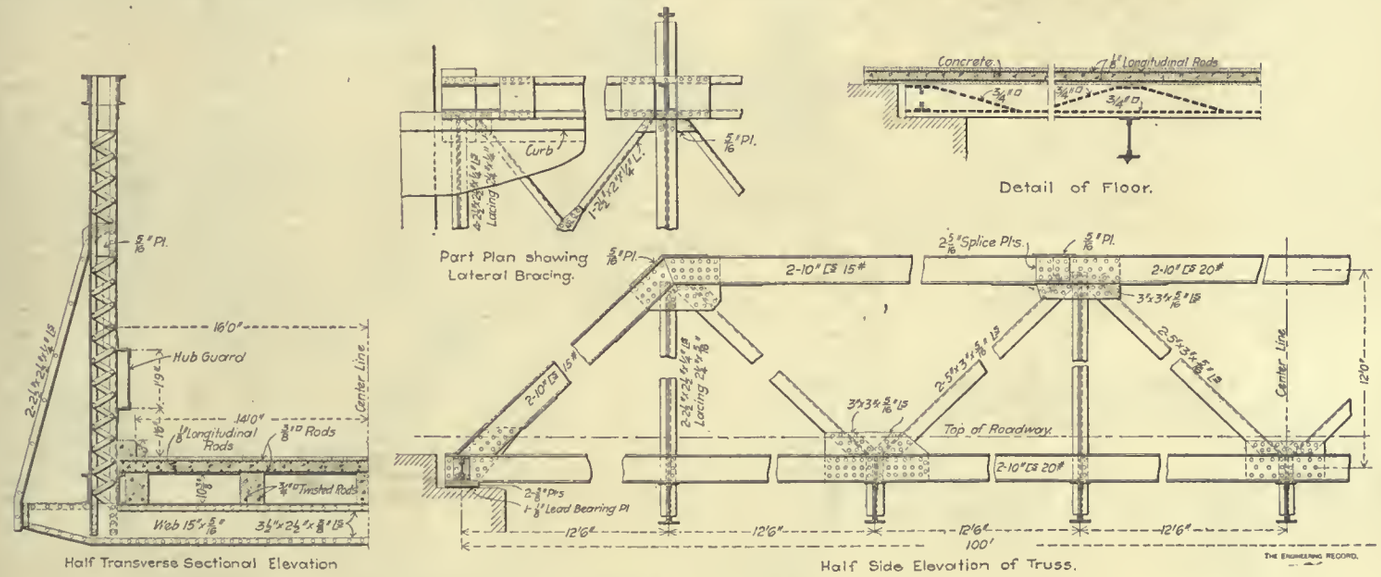
$$S = \frac{20{,}000}{1 + \frac{l^2}{36{,}000\ r^2}}$$

where l = the length between supports in inches and r = the least radius of gyration in inches. The ratio of $\frac{l}{r}$ was not allowed to exceed 120. In applying this condition, however, the length of members fixed at the end was divided by 2, in accordance with the theory of columns.

Concrete was assumed to weigh 125 pounds per cubic foot, and this increased the dead load of the bridge from about 375 pounds per linear foot for the trusses and floor beams alone to a total of 1,800 pounds per linear foot for the completed structure, as against about 750 pounds per linear foot for a bridge with the same trusses and floor beams having steel longitudinal joists and a plank floor 4 inches thick.

The riveted work is first-class, and the trusses are built under the standard specifications for highway bridges, of the Osborn Engineering Company. Soft steel was used for the trusses. The concrete was made in the proportion of 1:2½:5 of Portland cement and 1½-inch broken limestone, and reinforced by steel bars either twisted or otherwise providing for mechanical bonding to the concrete. Its strength was computed by the formula of Mr. A. L. Johnson, C.E., given in the "Transactions' of the American Society of Civil Engineers, Vol. xlvi, 1901, as well as in pamphlets issued by the St. Louis Expanded Metal Company.

The estimated quantities for the bridge include 37,500 pounds of structural steel, 5,000 pounds of steel rods and 42 cubic yards of concrete. The cost of the structure is calculated to be little, if any, greater than when using wooden floor and steel joists, and it is believed to have great advantage in permanency and rigidity. The trusses are of very simple construction and are designed to be very rigid without the use of heavy members. The top and bottom chords and end posts are made of pairs of 10-inch channels latticed on both flanges and having pairs of connection plates riveted to the inside of their webs and receiving the vertical and diagonal members. The latter are all composed of pairs of angles, latticed together and shop-riveted to the chords. The floor beams project 2½ feet beyond the truss centers to receive the knee braces which stiffen the trusses laterally, and their webs are engaged between the angles of the vertical posts, to which they are field riveted, thus securing a simple and efficient connection, with the load carried entirely by rivets in shear. The vertical posts are made with a single angle in each flange, turned in opposite directions so that the cross-section resembles a Z bar.



PORTAGE COUNTY HIGHWAY BRIDGE WITH CONCRETE FLOOR.

At the lower chord panel points, where there are no vertical posts, short lengths of vertical angles, corresponding to the flanges of the vertical posts, are riveted across the lower chord webs and project below them to receive the floor beams in the same manner that the vertical post angles do. The concrete longitudinal floor joists bear directly on the top flanges of the floor beams and on the masonry seats of the abutments. Their reinforcement bars and those of the floor slab are not coupled together but overlap at adjacent ends far enough to develop the strength of the bar in the concrete between them. The curbs 6 inches high and 6 inches wide are integral with the roadway surface, and their outer faces are flush with the web members of the trusses. Above them there is a hub-guard, consisting of a very light lattice-girder, having single top and bottom flange angles, which is bracketed out from the face of the web members to prevent impact against the latter from moving vehicles. At one end of the span the lower chord is anchor-bolted tightly to the abutment masonry, but at the other end, it is seated, as shown in the detail, on a sliding plate and secured by anchor bolts through slot-

ted holes, allowing for temperature movements. All bed plates rest upon ⅛-inch sheet lead, placed between them and the masonry. At the sliding end, the joists and floor platform have two thicknesses of oiled paper placed between them and the abutment masonry, so as to insure a plane of separation and provide for the longitudinal movement of expansion and contraction. The end transverse lateral struts pass through the concrete joists and the lateral X-braces of single angles clear the concrete and are riveted at intersections with the lower chords.

The bridge was designed by the Osborn Engineering Company, of Cleveland, Ohio, and the steel work was manufactured by the Bellefontaine Bridge & Iron Co., of Bellefontaine, Ohio.

Types and Details of Bridge Construction.—III.

By Frank W. Skinner, C. E.

Spandrel-Braced Arches, Continued.

The Panther Hollow highway bridge in Schenley Park, Pittsburg, which was illustrated in The Engineering Record of June 4, 1898, is 60 feet wide and has four 360-foot three-hinge, spandrel-braced steel arch trusses of 45 feet rise and 4½ feet depth at crown. The top chord is horizontal and the bottom one forms chords of a parabolic arc. Both are of ordinary trough section, built up of plates and angles, the lower one being latticed top and bottom and the upper one having a top cover plate. The vertical and diagonal web members are all struts. After the span was swung, rivet holes in the pin plates of different members at the same panel points were reamed to match and the connections were also riveted. By this means it was calculated that the pins should transmit only dead load stress.

The crown hinge is in the bottom chord only, the top chord middle sections having expansion clearance at the center point. The crown and skewback pins are 10 inches in diameter and the pedestals have right-angled base plates to transmit pressure to the vertical and horizontal surfaces of the pier masonry. The trusses are spaced 13½ feet apart and are braced with top and bottom transverse struts, and with transverse X-bracing between vertical posts. There is also top and bottom lateral bracing between the two outer trusses on each side of the bridge, but none between the center trusses. All braces are made of angles and have riveted connections at ends and intersections.

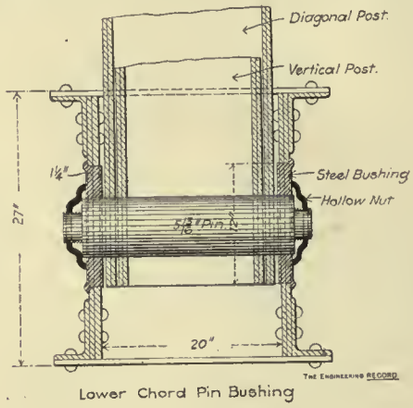
A 9¾-foot cantilever sidewalk is bracketed out from each outer truss. The floor joists are parallel to the bridge axis and have their top flanges in the plane of the top chords, supporting a solid steel trough floor filled with ashes, concrete and asphalt. The floor was proportioned for a live load of 150 pounds per square foot on the roadway and 100 pounds on the sidewalk, the trusses being proportioned for 89 and 60 pounds per square foot of roadway and sidewalk respectively. The superstructure weighed about 2,000,000 pounds. The trusses of the semi-arch spans were erected separately, on cambre blocks, with pin connections, on trestle falsework which was independent for the two halves and was not built for one until the other was completed.

The Canadian Pacific Railway crosses Surprise Creek on a single track spandrel-braced three-hinge arch span about 180 feet high, which was described in The Engineering Record of July 16, 1898. There are two trusses, of 293 feet 4½ inches span and about 80 feet rise, each battered 1:8 so that their top chords are 16 feet apart, and the bottom chords 38 feet apart at the skewbacks. The straight top chord is on a grade of 2.2 per cent., and this, together with the fact that the skewbacks are at different heights and that there are five panels on one side of the crown and six on the other side gives the truss an unsymmetrical appearance. Both chords are pin-connected with full holes in the top chord web splices and half holes with clearance at the bottom chord panel points. The center lower chord pin forms the crown hinge and the center top chord pin has half hole open bearings with expansion clearance between the ends of the chord sections. The floorbeams have web connections and kneebraces to the tops of the vertical posts. There are lower chord and intermediate horizontal transverse braces, and top and bottom chord lateral and vertical transverse X-braces. All members are compression members and all secondary connections have riveted gusset plates and angle clips.

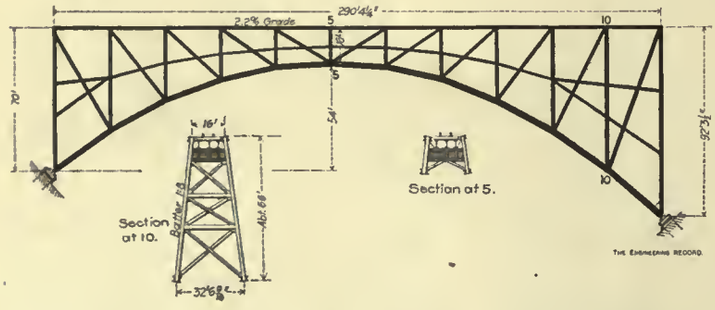
All truss pins are 6 inches in diameter, but this did not give sufficient bearing area in the lower chords so the chord webs were bushed with steel discs, 12 inches in diameter. The end vertical posts are field-riveted to gusset plates, shop-riveted to the webs of the lower chords. The skewback hinges are ball and socket joints made with a spherical casting bolted to transverse flanges on the end of the bottom chord and engaging a concave pedestal. The pedestal is seated on a 6x8-foot grillage of I-beams, anchor-bolted to the masonry; and the grillage, pedestal, shoe and chord are tied together by a 3¾-inch bolt, 9 feet long, which passes through the center of the spherical joint and takes bearing at the upper end with a nut and a washer-plate across the ends of longitudinal diaphragms at right angles to each other riveted to the webs and cover plates of the chord. The lower end of the rod has a nut bearing on a saddle plate across the flanges of the upper tier of grillage beams. The span was proportioned for a live load of 50,000 pounds at every panel, and weighs about 1,040,000 pounds. The trusses were erected on trestle falsework with bottom sills and two vertical and two batter posts in each bent; the falsework was carried up to top chord level and every third panel was braced to form a tower. All bents were made in panels 25 feet high.

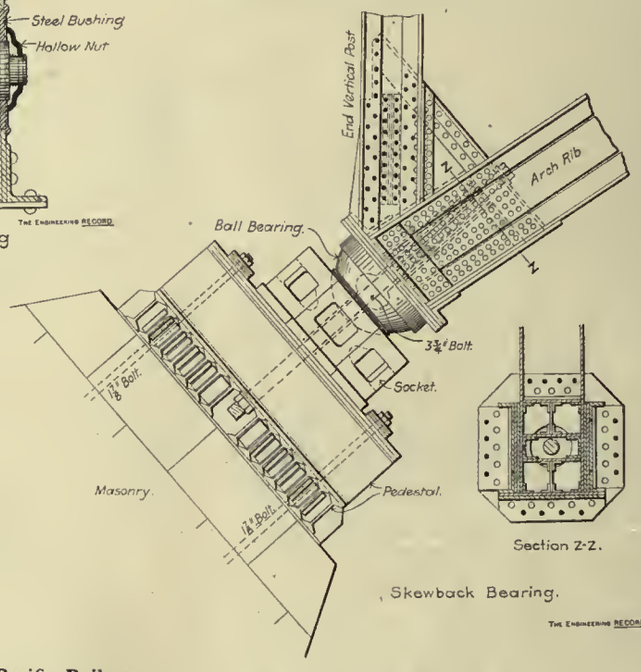
About 600 feet below the falls at Rochester, N. Y., the Driving Park bridge carries a city street across the Genesee River, over 200 feet above the water. The bridge, which was described in The Engineering Record of July 18, and August 1, 1891, rises from solid rock ledges of red and white sandstone and blue limestone, which produce a very striking effect. The 416-foot main span has two three-hinge spandrel-braced arch trusses of 67 feet rise. The top chords are slightly inclined from the horizontal and are 20 feet apart on centers, while the trusses batter so as to make the distance between center lines of bottom chords 46 feet at the skewbacks. The trusses are about 80½ feet deep at the skewbacks and 12 feet at the crown, and are proportioned for a live load of 90 pounds per square foot of floor and sidewalk surface. They are divided into 26-foot 9-inch panels and the spandrel posts are braced by two lines of horizontal longitudinal struts connected by web splices which are continuous across the post intersections. The verticals and diagonals are made with pairs of built channels, latticed, and the chords are made of the usual top chord section with bottom flange reinforcement plates projecting beyond the insides of the webs of the lower chords.

The top chords are disconnected at the center of the span, where there are expansion clearance and double floorbeams to provide complete lateral bracing. The bottom chords are also in two sections, making complete independent semi-trusses, united by the floor system and by the semi-cylindrical bearings of the lower chords on the crown hinge pin. At the crown the 24x30-inch closed rectangular bottom chord

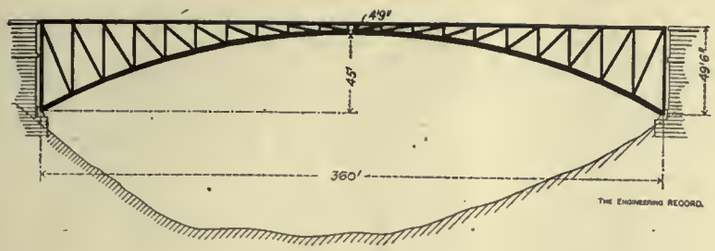


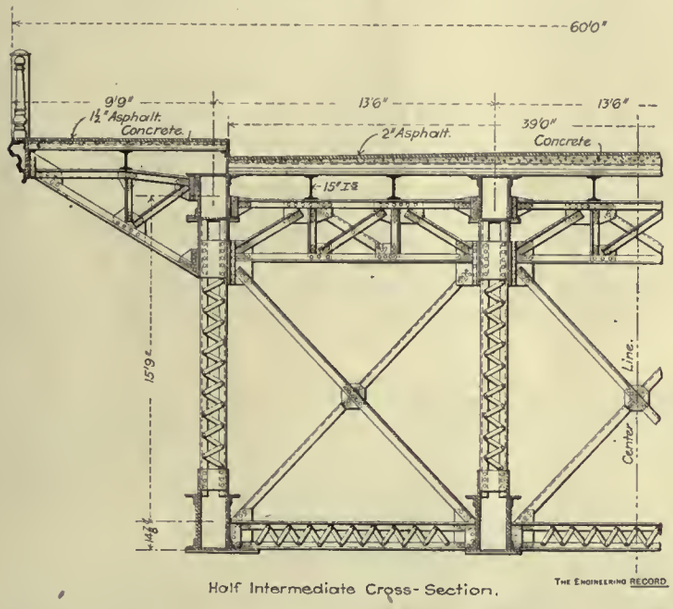
Lower Chord Pin Bushing



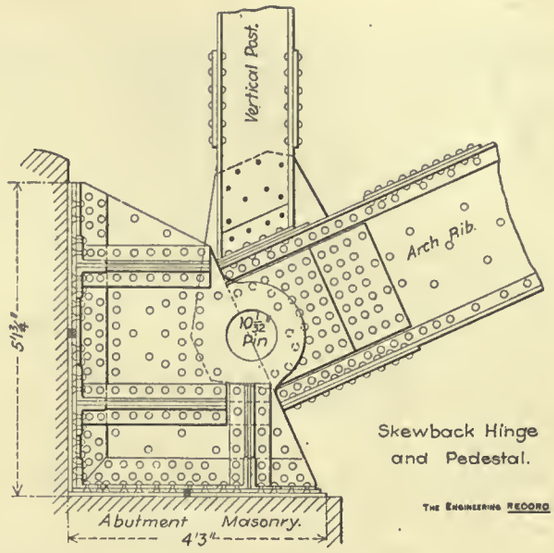


Surprise Creek Arch, Canadian Pacific Railway.

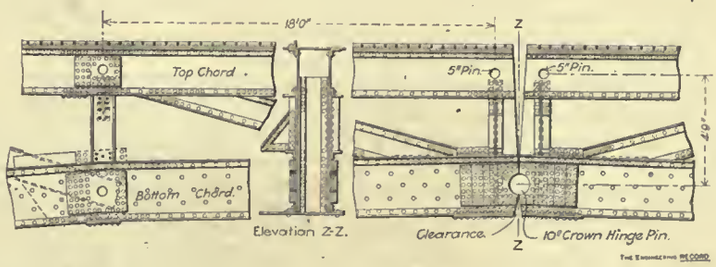




Half Intermediate Cross-Section.

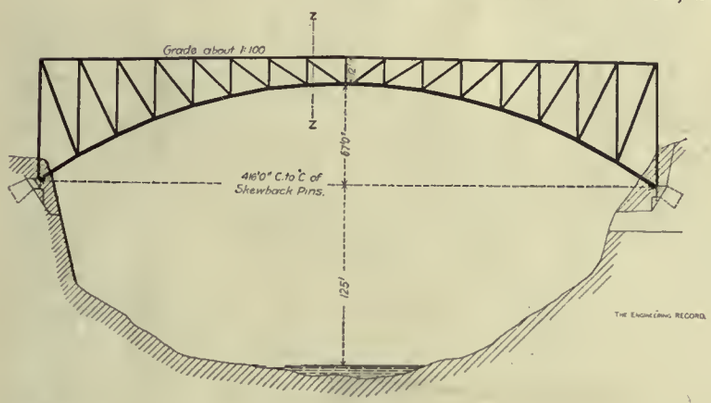


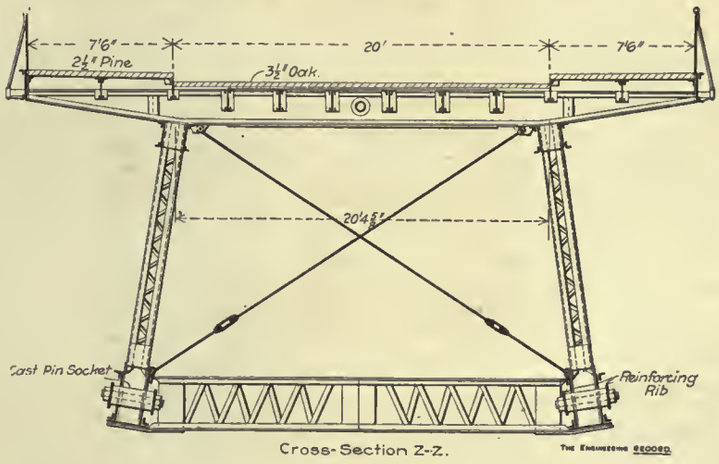
Skewback Hinge and Pedestal.



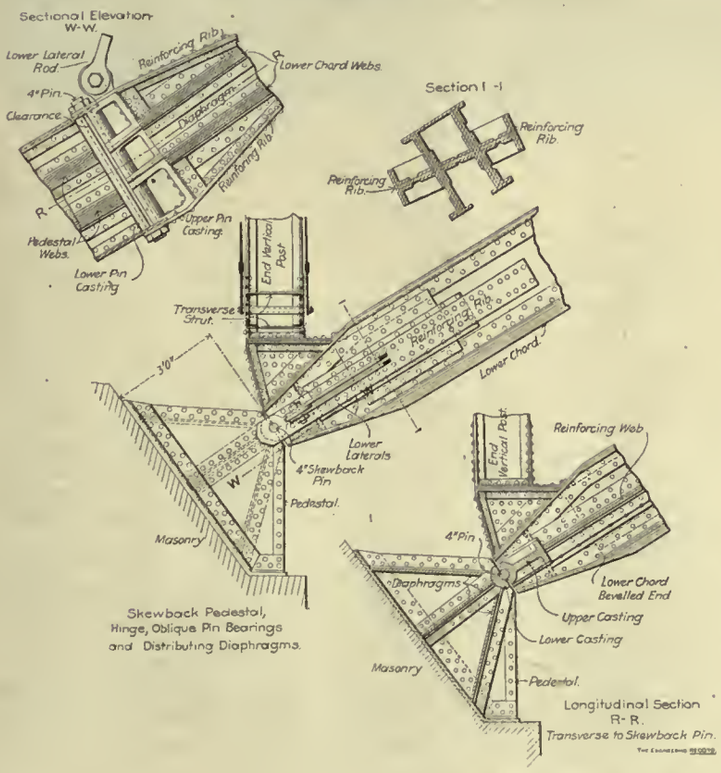
Crown Hinge.

PANTHER HOLLOW BRIDGE, SCHENLEY PARK, PITTSBURG.

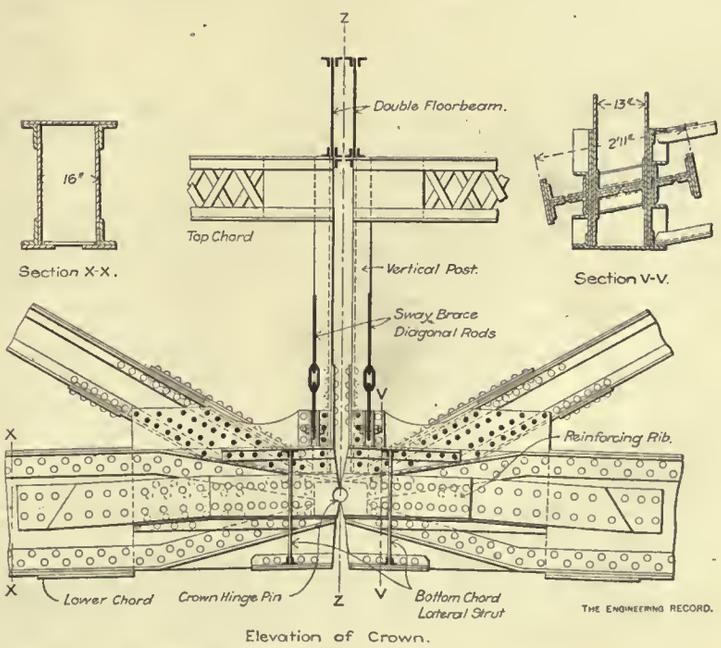




Cross-Section Z-Z.



Skewback Pedestal, Hinge, Oblique Pin Bearings and Distributing Diaphragms.



Elevation of Crown.

DRIVING PARK BRIDGE OVER GENESEE RIVER, ROCHESTER, N. Y.

sections have their webs tapered and their cover plates converged towards the crown pin, making a flattened section which is widened by an oblique center diaphragm with flanges, which virtually makes a wedge shaped plate girder with horizontal web and flanges diverging from their connection to the chord webs. The web of the girder forms a continuous bearing for a steel casting which is enclosed by the projecting ends of the flange plates and forms a trough or bushing for the full length bearing of the crown hinge pin, 4 inches in diameter and 3½ feet long. The ends of the chord sections are beveled to give clearance at the pin, and the center vertical post and bottom lateral strut are made double, one of each being riveted to each semi-truss.

The lower ends of the bottom chords are similarly flattened and extended to give long solid bearings in the planes of the horizontal skewback pins, 4 inches in diameter and 4 feet long, which are seated in pairs of upper and lower cast steel bearing boxes supported on the transverse webs of the chords and the pedestals respectively. The end of the chord is faced square with its axis, and the angle with the pin axis is made by beveling the upper casting, one end of which projects through a slot in the flange of the stiffening rib and is bored to receive the end bottom lateral connection pin. The pedestal has three intersecting transverse webs in the plane of the skewback pin which afford continuous bearing on their upper edges for the three sides of the cast-steel pin bearing, and connect the longitudinal side plates and reinforced intermediate webs. The pedestals thus have closed triangular cross-sections and bent base plates with two bearing surfaces, one 6 feet square, normal to the lower chord axis, and a horizontal one 6 feet by 13 inches, which prevents the possibility of slipping down. The pedestals are bedded with rust joints on single granite cap stones 2 feet thick and have piers of ashlar masonry with concrete footings in pits sunk at an angle 12 or 15 feet into the solid shale ledge to be beyond the possibility of injury from weathering.

The trusses are connected by 35-foot floor-beams with tapered cantilever ends which have their inclined lower flanges seated on the top chords of the arch trusses. There are horizontal top, bottom and intermediate transverse struts with riveted connections and there are pin-connected diagonal rods in the vertical transverse planes, in the planes of the longitudinal struts and in the planes of the top and bottom chords. The crown pin rises and falls about 8 inches with temperature variations. The span weighs over 600 tons. It was designed to be erected by the cantilever method, but was finally assembled on trestle falsework, which was remarkable for its very heavy construction and had a wide middle opening spanned by combination trusses to give a free water way. The erection was commenced in the fall and was discontinued through the severe winter weather, when the structure was drenched by spray from the falls which enveloped it in a thick coating of ice.

(To be continued.)

A Semi-Portable Bitulithic Paving Plant.

What is known as the Bitulithic pavement, laid by Warren Brothers Company, has become so well known that there remains little to be said in regard to the methods of laying it. The accompanying photographs illustrate one of the semi-portable plants used by this company at Worcester, Mass., for mixing the ingredients of the pavement. One of the photographs was taken looking toward the front of the rotary dryers, the piles of crushed stone being on the slope at the right. This crushed stone ranges in size from 1½ inch down to impalpable powder, and is fed into the dryers by the two conveyors shown at the front of the machine, one on each side of the dryers. The latter consist of two 18-foot rotating cylinders encased in sheet iron, and the fire box at the front. The products of combustion travel forward under and around the cylinders and return through them, being carried off by the exhaust fan shown behind the tool box in the second photograph. The stone in the dryers is raised to a temperature of about 250 degrees.

After passing through the dryers the crushed stone is carried up the long conveyor shown in the photographs, to the grading screen on top of the storage bins. It is there screened into six different sizes, each of which falls into a separate compartment. From the bottoms of these compartments the materials are drawn out and proportioned by exact weight in a weighing box resting on special scales. These scales are arranged with seven beams, thus permitting each size to be accurately weighed, the weight of the first size together with its tare forming the tare for the second size, and so on. By this means the materials are all weighed in one box and discharged by gravity into a mechanical mixer, together with the bituminous composition. The latter is prepared for use on the platform shown at the left of the first photograph, and is carried over to the mixer in an iron receptacle hung from a small trolley wheel running on a light steel frame or trackway. The scales by which the bituminous composition is weighed are very sensitive, and by means of the entirely independent trackway from which the composition bucket is hung, the effect of the vibration of the machinery on the scales is done away with, and absolutely accurate weights are obtained. The temperature of the bitulithic composition and the materials in the mixer is kept at about 200 degrees, Fahrenheit.

After the stone and the bitulithic material have been dumped into the mixer, the latter is revolved until the whole is thoroughly homogeneous, when it is discharged by means of a slide gate in the bottom of the mixer into the carts, which back under the structure. The whole plant, including the portable engine and boiler by which the power is supplied, occupies a space of roughly 80 by 30 feet. Sixteen of these plants are in use, and six more are being built.



BITULITHIC PAVING PLANT, LOOKING TOWARD DRYERS.

The Dirt Road.

By G. A. Roullier, M. Am. Soc. C. E.

The principal trouble with the dirt road is that anything is considered good enough for it; that it is not worthy of systematic treatment; and, consequently, the very conditions which cause its deplorable state are seldom, if ever, removed, notwithstanding that its supersensitiveness requires that its "sanitation" should receive greater attention than that of the highly improved road, which has, within itself, certain elements of resistance not possessed by the dirt road. If the same attention were given to the grading, both transverse and longitudinal, of the dirt road as is given to that of the better class of roads, a very different condition would soon ensue. Dirt roads usually suffer from a total lack of proper drainage, or from scour caused by too rapid drainage. A radically different condition would be obtained if gradual but systematic grading were resorted to. Not that kind of grading which consists in taking the top off a hill and dumping it into the bottom of the nearest hollow; a style of grading which is quite prevalent in country districts, and which results only in shortening the length of the slope, but in no way modifies the grade or rate of inclination. In many instances a reduction of grade would be of material benefit to the road. A grade line starting from the summit of the hill and extending to the bottom of the hollow, thus removing the "shoulder" of the summit and filling in the end of the hollow, would reduce the rate of inclination and prevent scour.

Longitudinal unevenness of road bed is a constant source of trouble. The sunken spots, between two very slight rises, could be obliterated

with but little labor, and water-holding pockets removed. Frequent complaints are heard as to the impossibility of draining some low point at which the water from the surrounding hills gathers. Ditch the sides and use the material to raise the road bed above the general water level. It may be claimed that these operations are too costly, and that the district can not afford to do such work. It might be too costly if undertaken all at once, but if done gradually by using the annual appropriations in carrying out a well defined and studied plan for each road, a steady improvement would be developed from year to year, until finally completed, and a permanently satisfactory condition secured by the removal of the features which are the underlying causes of bad conditions. No mention has been made of the necessity of transverse drainage, as the crowning of the road bed so as to secure lateral drainage is generally well understood. But one thing that is not so clear to the average highway commissioner is that the crown should be made to vary with the nature of the soil. In heavy clay soils, which retain water readily, the crown should be pronounced, whereas, in lighter, sandy soils, which absorb water and allow it to drain through, the crown can be materially modified; in fact, heavy crowns on roads of such soil are apt to be troublesome, as the material will be washed into the side gutters and destroy the drainage.

The benefit of side-ditches seems to be not clearly understood. Not only do they act as channels to convey the water along the road to some convenient point of discharge, but they also serve to keep the road bed dry by underdraining it, that is, by keeping the surface of the water well below the road bed. These channels should not be mere gutters scooped out with a scraper, but well-formed ditches ranging from 2 to 3 feet in depth, according to the locality. Again the question of expense will be brought up, but this work will not cost as much as, at first glance, it would appear, as the ditches will be partly formed by raising the road bed with the material excavated from the channels. These ditches might prove an element of danger if placed at the immediate sides of the road bed proper; it is, therefore, advisable, to locate them a few feet away. In the majority of cases they will answer every purpose at a distance of 8 or 10 feet, providing they are deep enough.

In many instances a much better condition of road bed could be secured if, when the annual repairs are made, the "dead" material on the road surface were removed instead of being buried under a coating of new surfacing. The constant accumulation of this "dead" soil tends to destroy the vitality of the new material, and gradually causes excessive crowning in cases where the road is looked after regularly, that is, where the crown is not allowed to be absolutely destroyed before the repairs are made. If this "dead" material is removed, as suggested, it will be found that a much lesser quantity of new material will be necessary to renew the surface.

Next we come to the selection of material for the purpose of surfacing the road bed. In many localities the material is uniformly of a fair character, and no transposition is necessary; but in sections where the material along the route varies, it may be desirable to do the surfacing, at some points, with material from some other point. In that event, economy demands that the smallest amount possible be moved. It frequently occurs that a better result can be secured by an admixture of material, instead of a heavy coat of surfacing material. For example, a *small* amount of sand placed over a clay road, or *vice versa*, during wet weather, so that the traffic will cause the two materials to mingle thoroughly, will completely change the complexion of the road bed for an entire season.

These spots along the road which are overshaded, that is, which are not touched by the sunlight, and consequently dry out but slowly after rain, should be cleared of undergrowth and the trees trimmed, so as to admit of the sun's rays striking the road bed during a few hours each day. Care should be taken, however, that in doing this the other extreme is not reached, and the road so exposed that it will dry out to such an extent that the material will turn to dust. A good middle condition is desirable where it can be obtained. In very sandy localities where clay can not be obtained, a desirable modification of the sandy condition can be secured by placing dead leaves, or damaged straw, on the road, and allowing the traffic to grind them in. In doing this, it is advisable to place a small amount of sand over the straw or leaves. After two or three treatments of this kind, a very marked change will take place.

Roads graded and drained on the general lines suggested above will not only give better satisfaction, but will be in line for improvements of a more permanent character, such as a thin coating of macadam or gravel, which work can also be carried on from year to year, treating the worst spots first, thus gradually bringing about a uniformly better condition.



GRADING SCREEN AND ENGINE OF BITULITHIC PLANT.

An English Gas Engine Pumping Station.

Early last winter a new water supply plant was opened at Madeley, in Shropshire, England, which according to the London "Engineer," is the largest pumping plant in that country operated by gas engines and producer gas. The following description of the plant is condensed from an article which recently appeared in the journal just mentioned. The well from which the water is taken is 9 feet in diameter and sunk through red sandstone to a depth of 141 feet below the surface, where it is connected by a 6x6-foot heading 28 feet long to the bore hole, which extends 431 feet below the surface. A pumping test showed the yield of water to be 600,000 imperial gallons per 24 hours. The buildings consist of an engine house with gas plant house and store room under one roof, and a cottage for the caretaker. The pumps are in duplicate and interchangeable, each capable of delivering to Madeley reservoir 250,000 imperial gallons in 12 hours. The fixing of the well pumps has been carried out through a depth of 75 feet of water. With all the pumping that was done in filling three reservoirs and washing out the mains, the water level in the well was reduced by only 25 feet.

The Madeley reservoir has a capacity of 466,000 imperial gallons, and that for Brosely, an adjacent district, 160,000 gallons. Each of the reservoirs is constructed of brick and concrete, the arches for the roof being supported on cast iron columns and girders, and covered with 1 foot of soil. The water is always drawn from 1 foot below the surface, by means of a floating arm.

The gas engines furnishing the power for the pumps are each of 90 brake horse-power. They are both fitted with duplicate tube-igniters, which does away with the risk of any interruption in the water supply in the event of one tube bursting, as the other comes automatically into operation, and enables the engine-driver to replace the broken tube without stopping the engine. All the bearings and working parts are automatically lubricated, thus reducing the engine-driver's duties to a minimum. The exhaust valves are equilibrated and are cooled by means of water circulated through them. Each engine has two fly-wheels, and drives the pumps by means of belts. A Crossley pump starter is provided for each engine; and the water for cooling the cylinders is contained in a large overhead tank. The pumps are in duplicate, and consist of two sets of three-throw deep-well pumps, 10½ inches diameter by 24 inch stroke, each capable of lifting 20,834 imperial gallons per hour from the well 142.8 feet deep, and delivering the water into

a tank below the engine-room floor, whence at the same time another set of three-throw pumps, 9½ inches diameter by 24 inch stroke, also in duplicate, lifts it 342 feet through the rising mains to the reservoirs. The total head, including friction, is about 500 feet.

The gas plant is of the Dowson type and uses anthracite. It consists of a generator, small vertical boiler, hydraulic box, coke and sawdust scrubbers. It is capable of producing gas sufficient to run one of the engines at its rated capacity. A gasholder 10 feet in diameter by 8 feet lift is placed outside the engine house. The gas plant is duplicated throughout, except the gasholder, so that there is always a complete set of the working parts of the plant in reserve. Gearing is arranged which automatically regulates the admission of steam to the gas generators by the rise and fall of the gasholder. Messrs. Crossley Bros., Limited, of Manchester, were the contractors for the pumping plant, the pumps being made by Messrs. F. Pearn & Company, Limited, of West Gorton, Manchester. The engineer for the plant was Mr. T. S. Stooke, of Shrewsbury.

A Small Concrete Arch at West Hartford, Conn.

The concrete arch shown in the accompanying illustrations was built to replace an old wooden truss bridge over Trout Brook at Fern Street, West Hartford, Conn., which failed under traffic, letting a horse and wagon through it into the bed of the stream. The old bridge was moved downstream to form a temporary crossing during the construction of the arch. The center line of the 30-foot clear roadway over the new structure forms an angle of 72½ degrees with the axes of the arches. There are three segmental arches, the central one having a span of 26 feet and a rise of 5 feet, and the outside ones having a span of 10 feet and a rise of 3 feet. The span was divided into three parts because it was desired to keep the level of the roadway as low as possible, and it was not thought best to place a pier in the center of the stream. The radius of the intrados of the central arch is 19 feet 6 inches and the thickness of the arch ring 2 feet, the surface of the roadway being 6 inches above the crown of the arch. The two piers in the stream are 4 feet thick, with vertical sides and the cutwaters on the upstream ends of these are sharply pointed, as shown in the photograph of the completed structure.

For the smaller arches the radius of the intrados is 5.6 feet and the thickness of the arch ring 1 foot 4 inches. The thickness of the abutments at the springing line of the arches is 3 feet 6 inches and the outside of the abutments have a batter of 1 in 5. This outside line of each abutment was carried up 2 feet 4 inches above the springing of the arches and the spandrels filled in with concrete tangent to the outside lines of the arch rings. The tops of the parapet walls are 2 feet 6 inches above the crown of the large arch, or about 2 feet above the surface of the roadway. An interesting feature in connection with the construction of the parapet walls was the provision for any cracks which might appear in them due to temperature changes or other causes. To insure such cracks taking place along predetermined lines, there were placed in each of the parapet walls over the quarter points of the large arch strips of ordinary sheet iron. These strips were of a width somewhat less than the thickness of the walls, and extend vertically from the extrados of the arch to the top of the parapet wall. Since the bridge was constructed cracks have appeared along the lines where these strips of sheet iron were placed.

This structure was built without steel reinforcement of any kind. For the actual arches the concrete was mixed in the proportion of 8 cubic feet of sand and 16 cubic feet of broken stone to each barrel of Portland cement, equivalent to about 1:2:4 mixture. All other concrete was mixed in the proportion of 12 cubic feet of sand and 24 cubic feet of stone to each barrel of cement. The arrangement of the centering and the forms for the parapet walls is shown on one of the accompanying photographs. The centering was made as though the bridge had not been built on a skew. That is, at each end of each of the arches, one corner of the centering projected beyond the outside surface of the parapet wall, the end of the arch being simply determined by the mold for the parapet wall. This bridge was built by the Hartford Paving & Construction Company, under the direction of Mr. Charles M. Crawford. The contract price for the bridge was $4,050, the old wooden bridge being removed by the town of West Hartford at its own expense.



Forms and Centering for Fern Street Bridge.



Fern Street Bridge, West Hartford, Conn.

Supervision and Maintenance of Roads.

Again and again has it been emphasized that it is in the long run more economical to keep a road in repair all the time than to let it go to pieces and then practically rebuild it when its condition finally becomes unbearable. To secure the proper maintenance of roads it is necessary to have competent road supervisors. The duties and qualifications accompanying such a position have been very concisely set forth by Mr. Robert A. Meeker, state supervisor of roads of New Jersey, in the 1902 report of the commissioner of public roads. It may be stated that after a road has been improved under the New Jersey state aid law, it is the duty of the Board of Chosen Freeholders of the county in which the improvement is located to appoint a supervisor of roads, "who shall hold his office for 3 years and until his successor is appointed." The duties and qualifications for this office are given by Mr. Meeker as follows:

First. They should be men accustomed to outdoor work, and should know what is a day's work for a man with a pick and shovel.

Second. They should be able to take measurements and estimate the quantity of material required for a given piece of work. For this purpose they should always carry a memorandum book, tape measure, and 2-foot rule with them. They should always enter on the spot, with the date, a clear and distinct measurement of any work or materials which are to be paid for by measurement; this will be found to be of great use in case of dispute.

Third. They must keep an accurate account of the materials spread upon each mile of road. Statements of the quantities of materials received and the amount spread and on hand should be prepared every three months.

Fourth. They should keep an accurate account of the tools, machines and other property belonging to their department, showing where and in whose charge they are, and a statement of this account should be made annually.

Fifth. They should make annual estimates of the cost of road maintenances in detail, showing the number of tons, price per ton and the total cost of road materials, the cost of labor and any miscellaneous expenditures that may be required beyond the ordinary maintenance for every mile of road.

Sixth. They should be good judges of the quality of road material available, and thus be able to select the best. A good road material should be hard, tough and not affected by weather.

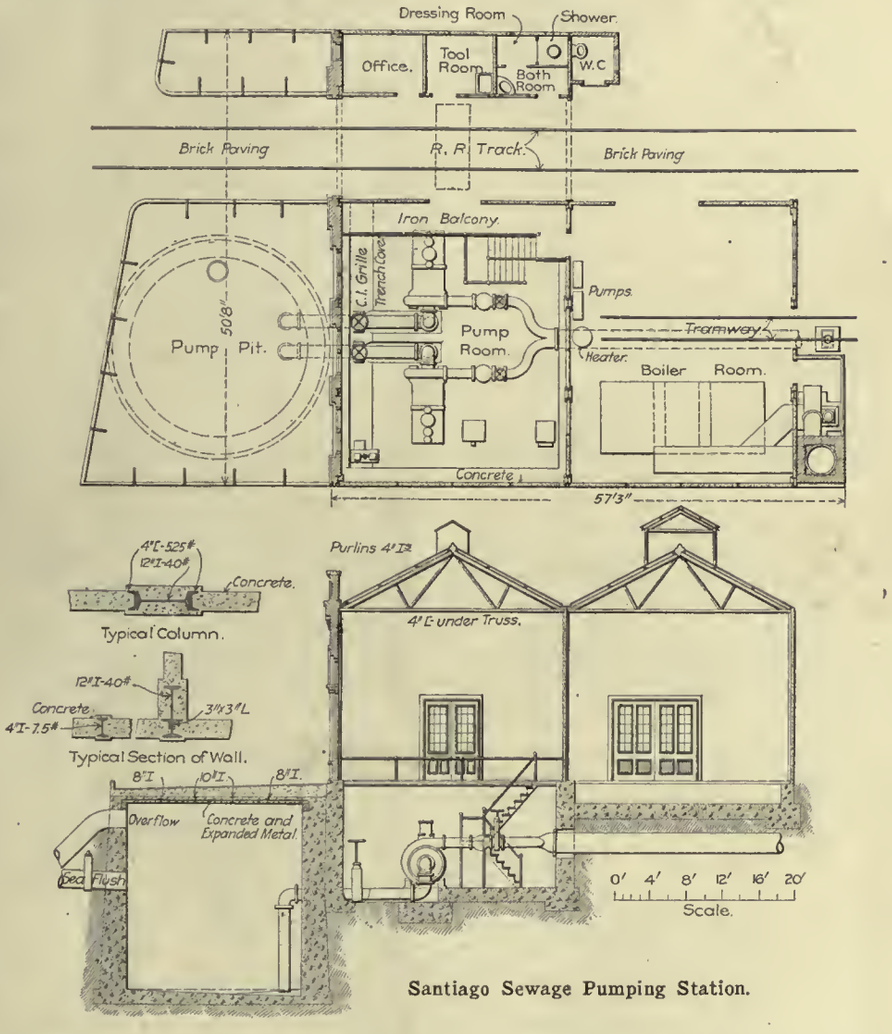
Seventh. They should know when and how to apply the new material so as to obtain the best results. Generally speaking, the best time to do repair work is in the fall and spring. The metal placed upon a road during the dry, summer season is largely wasted.

Eighth. They should fully realize the necessity and importance of drainage. To this end they must keep all ditches, culverts and gutters free from all obstruction, in order that the water may be carried away from the road as quickly as possible; indeed, other care is almost thrown away upon a road the drainage of which is neglected. Drainage almost always requires attention, and there is generally a good deal that can be done to improve it at slight expense, and nothing pays so well in the end.

A New Topographic Map of part of Jefferson County, New York, known as the Theresa sheet, has recently been published by the United States Geological Survey, at five cents a copy.

A Sewage Pumping Station at Santiago, Cuba.

There has recently been erected at Santiago, Cuba, a receiving tank and pumping station, to provide for the discharge of the sewage of the city. It was thought by the authorities inadvisable to allow the sewage to drain directly into the harbor, as the long bottle-like shape of the basin would not permit the sewage to be carried out by the action of the tides. It was therefore determined to provide means for pumping it beyond the summit of the nearest divide, from whence it might be carried by gravity to tide water. To accomplish this a building was erected to contain two centrifugal pumps and two boilers, as well as several small rooms for the accommodation of the employes. The plant also includes the receiving tank and extensive coal sheds. A railroad track to serve the necessities of the plant passes through the main building, and to a point near the coal sheds at the rear. Coal is taken from the sheds by hand cars over a special tramway to the boiler room, where the track is directly in front of the boilers.



Santiago Sewage Pumping Station.

As nearly all the materials for building operations had to be imported, the government engineers, in their original call for bids, suggested that only the front of the building be built of brick, and that the remainder should be of monolithic concrete construction. In designing the building it was, however, found very much less expensive to construct the walls of a combination of structural shapes and concrete filling, and it was thought that such a building would better resist earthquake shocks. The work, therefore, was planned and carried out on these lines. Excepting the front, which was of brick, for the sake of appearances, all walls were formed in panels with small I-beams and T's, and then filled in solid with concrete composed of one part of Portland cement, two parts of sand and five parts of broken stone—the stone being of such size that all pieces would pass through a 1-inch ring.

No panels were formed larger than 6x9 feet, and all the framing was braced diagonally with 1¼-inch, upset end, iron rod. The columns supporting the building were of 12-inch I-beams, and other verticals were as a rule 4-inch I-beams. The horizontal members of the panels were formed by 4-inch T's, placed with the leg horizontal so that there might be no flange to interfere with the placing of the concrete. The inside and outside of the concrete forms were roughly sheathed with 1½-inch plank, properly braced, leaving a space at the top of each panel into which the concrete was dropped. When this had properly set, the planking was removed and all surfaces were plastered with a coat of Portland cement and sand, in the proportion of 1 to 2, and trowelled down to give a smooth, hard surface. The flanges of all beams were covered with wire cloth of ¼-inch mesh previously to the placing of the boarding, and on the exterior surfaces the steel work was plastered with two coats of mortar, the first consisting of one part cement and three of sand, and the second of equal parts of cement and sand.

For the sake of economy all steel work was in easily obtainable, standard shapes. Where extra strength was required, the I-beam columns were reinforced by angle iron, riveted to the webs and where the walls butted against such columns a similar method was employed to form a pocket for the edge of the concrete panels.

All the foundations and walls below the surface of the ground were composed of concrete in the proportion of 1 part Portland cement, 2 parts sand and 5 parts clean broken stone, the latter broken to pass a 2-inch ring, and screened over a ½-inch mesh to clear it of dirt and dust. The floor and walls of the pump pit to a point 6 inches above the natural surface of the ground were water-proofed on the outside with ten thicknesses of tar paper and asphalt of approved quality, thoroughly swabbed together so as to make it water-tight. The concrete floors of the building were finished off with ½-inch of Portland cement and sand mixed in equal quantities, smoothly floated down.

In the rooms provided for the accommodation of the employes, a cement base-board was provided, 10 inches high and projecting 1 inch from the walls, with rounded top. The cement for this was mixed with ½ part of fine sand. The interior partitions of the building were lathed on both sides with diamond mesh expanded metal and plastered with cement, omitting the white coat except in the living rooms. In the bath room and water closet the finished coat of plaster for a height of 5 feet above the floor was ruled off into 6x3-inch rectangles, and the entire surface down to the floor was painted with enamel paint. A small plaster moulding was run around the top of this wainscoting. The interior of the building with the exception of the wood and iron and sheet metal work was rendered with asbestine.

The top of the pump pit was covered with 8 and 10-inch I-beams, with concrete slabs in which expanded metal was embedded, filled in between them. The bottom of the pit is below sea level, and a Y-branch was provided, the lower branch of which can be opened when it is desired to flush out the system with sea water. The upper branch of the Y acts as an overflow to the harbor in case the sewage rises above a certain level.

In preparing the plans for this pumping station it was originally proposed to make the plant very complete by the installation of many labor saving devices such as coal and ash conveyors, forced draught, etc. It was finally decided, however, that some of these would not result in sufficient economy to be practicable. The plant contains two Morris centrifugal pumps, run by Morris vertical compound engines. The capacity of the pumps is 2,500 gallons per minute. Steam is supplied by two Worthington water tube boilers. The plant is built in duplicate throughout, with each part of the full capacity of the plant. Automatic registering devices are provided to determine the height of the sewage, and a mercury column for the pressure main. Electric lights for the plant are supplied by a 3¾-kilowatt Westinghouse generator run by a 6-horse-power engine of the same make. A 30x60-foot coal shed was built entirely separate from the main building. This consisted of steel framing covered with corrugated iron.

Messrs. Ludlow & Valentine, of New York, were the architects of the building, and M. J. Dady Company, of Brooklyn, were the general contractors. All structural iron work was furnished by Milliken Bros., of New York, and the boilers, engines, etc., for the plant were supplied and erected by Messrs. James Beggs & Company of the same city. Face brick, cement, corrugated iron roofing and other materials required for the construction of the building were likewise supplied by contractors in the vicinity of New York City.

The Worcester, Mass., Polytechnic Institute has recently received the gold medal, awarded at the Pan-American Exposition, for its educational exhibit. The Institute was awarded a gold medal at the Charleston Exposition also.

Coal-Tar Pavements in Northern New England.

In the summer of 1901 a coal-tar pavement was laid on Main Street, Hanover, N. H., which was to some extent experimental. During the past summer another section of this pavement was constructed, contiguous to that previously laid, and although it is too soon to say very much in regard to the wearing qualities of this pavement, it presents several features which should be of considerable interest to municipal officers, especially in small towns where it is not possible to obtain asphalt pavement except at prohibitive prices.

The total thickness of the pavement is 9 inches, consisting of a 4-inch foundation course of concrete, a thin cushion coat of clean sand, a 2-inch course of tarred gravel not exceeding 1½ inches in greatest dimension, a 1-inch course of tarred pea gravel, and a 2-inch wearing surface composed of a special paving cement and clean, sharp sand. The concrete for the foundation course was composed of one part Rosendale cement, two parts sand, and four parts coarse gravel, with no stones larger than 2½ inches and very few less than ¼ inch in smallest dimension. The concrete was allowed to set for at least one week before the succeeding courses were laid. The bottom surface layer of gravel was coated with No. 4 coal-tar paving cement, in about the proportions of 1 gallon of paving cement to 1 cubic foot of gravel. This course was thoroughly rammed and rolled while in a hot plastic condition. The 1-inch course of pea gravel above this was treated in a similar way.

The paving cement for the wearing surface was composed of 66⅔ per cent. of coal-tar pitch, 11⅓ per cent. of Trinidad asphalt, and 22 per cent. of coal-tar. It was mixed with the sand in the proportion of 120 gallons of paving cement to ⅔ cubic yard of sand, and was put down so as to be 2 inches thick when compacted, the whole being again rolled while in a plastic condition. The specifications state that "the coal-tar used shall conform to a standard satisfactory to the engineer in charge and be free from excess of sooty matter, napthaline and creosote oils; the Trinidad asphalt shall be well refined and as far as possible freed from foreign organic and animal matter and volatile oil and of a uniform standard of purity and specific gravity, containing not less than 60 per cent. of bituminous matter soluble in bisulphide of carbon."

The gutters on both sides of the street were paved with granite blocks for a width of 4 feet. This was done largely on account of the excessive wear coming on this part of the pavement due to the hitching of horses at the curb. These blocks were bedded in 6 inches of gravel, and the joints filled with gravel and coal-tar.

The cross-section of the street is a parabola, with a rise of 8 inches from the gutter to the crown. The total width of the street is 60 feet and it has a grade of 2½ per cent. About 1,500 square yards of the pavement were constructed each year. The cost of the first section was $1.50 per square yard and of the second, $1.85, the increase being due to a 66 per cent. advance in the price of coal-tar. The granite block gutters cost $2.50 per square yard.

Main Street, as its name signifies, is the principal street of the town, and a great number of vehicles pass over it in a day, although there are comparatively few very heavy loads. It is too soon to say much as to how the pavement wears, but so far there has apparently been very little wear, and no cracks have appeared, as had been predicted by some. The pavement is not slippery. The hardest wear comes on it just before it is covered with snow and after the horses have calks on their shoes. The engineer on whose specifications and under whose direction this pavement was constructed is Professor John V. Hazen, of the department of engineering of Dartmouth College. He states that on the whole it gives good satisfaction, although a good many opposed its use at first. The worst objection to it seems to be that it dries off quickly and gets dusty easily, and on windy days clouds of dust sweep down through the street. The greater part of this, however, is caused by the dirt brought on to the pavement by the traffic from the adjacent unpaved streets. At first the pavement was cleaned by removing the droppings every morning, and sweeping it all over about once a week. This last year owing to the frequent rains, it has only been necessary to clean off the droppings every morning, at a cost for the 3,000 yards of 35 cents a day for six days in a week.

In connection with the preceding information relating to the Hanover pavement, Professor Hazen has also furnished much of the following data concerning similar pavements in other places in New Hampshire and Vermont. Practically the same kind of pavement has been used in Woodsville, and Littleton, N. H., and in St. Johnsbury and Barre, Vt.

The Woodsville pavement, built by Mr. S. D. Tilton, who is the engineer of Littleton, N. H., has been down 4 years, and shows thus far very little wear. The foundation consists of a 4-inch course of 1:2½:4 natural cement concrete. Upon this was put a cushion coat of 2 inches of sand, and above this 2 inches of gravel coated with tar and rolled. The next course was 2 inches of pea gravel tarred and rolled, and the wearing surface was 2 inches of coal-tar concrete composed of 120 gallons of paving cement mixed with 1½ yards of sand. The paving cement was composed of 66⅔ per cent. of pitch, 11⅓ per cent. of asphalt, and 22 per cent. of coal-tar. This pavement was laid on three different grades—3.2 per cent., 6.12 per cent., and 1.5 per cent. At first the steepest grade proved rather slippery, but after the horses got accustomed to it, the pavement gave very little trouble in this direction. It cost about $1.50 per yard in 1898, with a total of 9,500 yards.

The St. Johnsbury and Littleton pavements were cheaper, costing only $1 per yard. The foundation in these cases was composed of cobblestones set by hand to a firm base something like a telford base, but not so closely set and without the spaces between the stones being packed with spawls. The pavement at Littleton consisted of first these cobblestones 5 inches thick, then 1½-inch gravel coated with coal-tar, 2 inches thick, then 2 inches of ½-inch gravel coated with coal-tar, and then the surface coat 2 inches thick of sand mixed with coal-tar and pitch. In this case and in St. Johnsbury no asphalt was used.

The pavement at Littleton was put down in 1894, '95 and '96, in all about 14,000 square yards. Mr. S. D. Tilton, the engineer of that place, states that it has stood well during the 8 years of its use under a heavy traffic. Only a few places wore out so that it was necessary to renew the top layer. The 4 inches of concrete for the foundation of the Woodsville pavement was used in order to bridge any small soft places there might be in the roadbed.

The pavement at St. Johnsbury, consisting of about 3,200 square yards, was built in 1892. In 1900 a new surface coat was put on at a cost of 60 cents per yard. There has been no further pavement of this kind laid in St. Johnsbury. Macadam is used quite extensively there. Mr. M. J. Russell is superintendent of streets.

In Barre, Vt., a pavement like that at Littleton was built in 1890. It was constructed under rather adverse conditions, and it has been subjected to pretty heavy traffic, and has not proved very satisfactory. The street where it is laid has the heaviest traffic in the city, both in number of teams and in weight of loads. It is no unusual sight to see 20 to 40 loads in a day varying from 4 to 12 tons each, and a 20 or even 40-ton load occasionally. These loads are mostly drawn on four-wheeled trucks, with tires varying from 3 to 6 inches in width. The pavement was built without engineering inspection and with no specifications, under a five-year guarantee and at a cost of $1 per yard. The part of the contract price held back on the guarantee was all used up in repairs in three years. Since the guarantee expired $500 has been expended by the city in repairs, and most of the time the city has had a very poor road. Street Commissioner R. S. Currier states that little but the foundation now remains. This past season it was dressed over with gravel, and it is intended to repave with granite blocks.

Water Supply for Lynchburg, Va.

A proposed new gravity water supply from Pedlar River, recommended by Mr. L. P. Shaner, city engineer, has recently been reported upon by Mr. James H. Fuertes, of New York City. Mr. Fuertes finds the project, as submitted by Mr. Shaner, to be feasible; but suggests certain modifications in the plan whereby the stream may furnish, for a sum no greater than required for carrying out Mr. Shaner's plan, more than twice as much water daily and water less likely to be turbid or polluted. It is proposed to take the water from Pedlar River at a point about 25 miles from the city and 160 feet above the distribution reservoir. In view of the cheapness of land it is recommended that the city purchase the entire watershed to enable it to prevent the pollution of the tributary streams. The river is capable of furnishing water of satisfactory quality as to freedom from pollution and turbidity, but is flashy in flow, varying from about 2,750,000 gallons per day in a very dry spell to about 1,000,000,000 gallons in a heavy rain.

A large storage reservoir is recommended not only for the purpose of supplying the deficiency of stream flow during dry weather, but also to assure the supplying of water free from turbidity and safe, through the agency of sedimentation, dispersion and oxidation, if, through accident, some of the feeding streams should become polluted. The works proposed include a dam 60 feet high and a pipe line comprising 19.5 miles of 36-inch wooden stave pipe; 1.1 miles of 30-inch riveted steel pipe, at places where the pressure is too great for the economical use of the wooden stave pipe, and 2.4 miles of 30-inch cast iron pipe in the streets of Lynchburg and under stream crossings. The capacity of this pipe line is regulated by the 30-inch cast iron and steel portions, which under the heads available will allow the composite pipe to deliver about 12,500,000 gallons daily into the Lynchburg reservoir. By duplicating the cast iron and steel portions, at a later day, the composite pipe could deliver 18,000,000 gallons daily to the city. The estimated cost of the works for a daily capacity of 12,500,000 gallons is $710,000. To increase the supply to 18,000,000 gallons daily it would be necessary, in addition to duplicating the cast iron and steel portions of the pipe line, to construct a second dam about 40 feet high across the river 6 miles above the first dam. These additional works are estimated to cost $225,000.

Road Laws of Illinois.

By Ira O. Baker, professor of civil engineering, University of Illinois, and author of "A Treatise on Roads and Pavements."

It is believed that the road laws of Illinois and the practice under them are substantially the same as in other North Central States. It is proposed to briefly set forth the essential features of the laws of Illinois relating to the construction and care of wagon roads.

Organization. The wagon roads of Illinois are entirely under the control of small and local administrative bodies. The state has one hundred and two counties, all but about twenty of which are under township organization, and in these the public highways are under the sole charge of three elective township officials known as highway commissioners. The townships, usually six miles square, are divided into three districts, for each of which a highway commissioner is elected once in three years. The highway commissioners have almost unlimited powers, except in the amount of the taxes they may assess. The law permits the commissioners to employ a superintendent, but usually each commissioner assumes general oversight of the work in his own district. In townships working under the "labor system," i. e., the system under which part or all of the property road-tax may be paid in labor, the highway commissioners must divide the township into districts and appoint an overseer or "Road Boss" or "Pathmaster" for each, who has oversight of the laborers on the road. In counties not under township organization, the board of county commissioners appoints local road officials, and the result is substantially the same as in counties under township organization.

Road Taxes. There are three forms of road taxes in Illinois, viz.: (1) a tax upon the traveler; (2) a capitation tax; and (3) a property tax. The first form of tax leads to toll roads. There never were many toll roads in Illinois, and most of them have been acquired by the public and made free. The capitation tax is in quite general use in Illinois, as well as in most, if not all, of the states of the Mississippi Valley. A poll tax of not less than $1 and not more than $2 per annum may be levied upon all able bodied males between the ages of 21 and 50 years, except that school directors, who receive no pecuniary compensation, are exempt from poll road-taxes, as are the inhabitants of cities and incorporated villages. This tax may be paid in cash or in labor at the rate of $1.25 for eight hours of labor of a man with a spade, axe or shovel. The poll tax may be abolished by a majority vote at the annual town meeting. Under certain conditions, as stated in the next paragraph, the taxes upon property for road purposes may be paid in labor, in which case the poll tax may be not less than one day nor more than three days per annum.

The law makes all property road-taxes nominally payable in cash; but permits the annual town meeting by majority vote to adopt the labor-tax system, and nearly all townships have done so. There are then really two forms of road taxes upon property, the "district road tax" which may be paid in labor, and the "road and bridge tax" which must be paid in cash. The former must be expended in the district from whence collected, but the latter may be spent anywhere in the township. The district road tax is supposed to care for the road and make minor repairs, and the road and bridge tax is expended for bridges, machinery, lumber, tile, etc., and to pay the overseers. The highway commissioners are paid out of general township funds.

In townships under the cash road-tax system, the highway commissioners may levy a road tax of 60 cents per $100 of the assessed value of all property, and by special authority of the town auditors an additional 40 cents per $100. In townships under the labor tax system, a tax of 40 cents per $100 may be levied by the commissioners and an additional 40 cents if authorized by the annual town meeting. The assessed valuation is one-fifth of the nominal cash value. Any road taxes collected from property within the limits of cities and villages must be turned over to the authorities of the incorporation, and the incorporation may abolish road taxes within its own limits. When new bridges, even small ones, are to be built it almost invariably is the custom to levy the maximum for at least two successive years preceding. When bridges of considerable size are required, it is usually necessary to issue bonds. Many townships assess the maximum tax year after year, and are continually improving the quality of the roads.

Table I. gives the details of the average expenditures in labor and cash for road purposes in nineteen townships in a prairie county. It is not known that any similar data were ever before collected, and hence there is no means of knowing whether these data are representative; but it is probable that the expenditures for new bridges is more than the average for the state. There are 1.97 miles of road per square mile of area outside of cities and villages. All the roads have a black loam surface.

TABLE I.

AVERAGE EXPENDITURES PER MILE OF EARTH ROADS IN CHAMPAIGN CO., ILL.

1. New steel bridges (exclusive of county aid).	$16.20
2. Drainage	6.32
3. Tile culverts	1.32
4. Repairs of bridges and culverts	2.93
5. Grading (not simply smoothing & leveling)	1.43
6. Smoothing and leveling (not grading)	2.83
7. Mowing the roadsides	1.14
8. Administration	2.69
Total	$34.86

There are unquestionably some inherent defects in the labor-tax system; but on the other hand there are just as certainly some economic and administrative advantages. Unfortunately its defects are usually magnified, and even misrepresented, while its advantages are entirely ignored. A careful and intimate study of the roads of central Illinois during a dozen years reveals no difference in their quality or cost between townships working under the labor system and those working under the cash system. Good results are found under both systems, and poor results are also found under each system. Good results are never found under either system except under energetic and intelligent commissioners, and then usually only with those having considerable official experience. Generally the communities are willing to continue in office an efficient commissioner, and tenures of 10 to 20 years are not uncommon, and one case is known of a man who served 37 years and declined re-election. It is not true that members of rural communities, at least in Illinois, are not interested in road improvement, for many instances could be cited where men give a good deal more labor than is exacted, and many other instances could be shown where farmers have given largely of money and labor to secure radical improvements in the roads which they use.

Hard-Road Law. Since 1883 the state has had a law permitting townships to levy a special tax of $1 per $100 for building hard roads. The statute provides all the necessary legal machinery and gives most excellent general direction, including an obligation to have all the work performed under the direction of a competent engineer; but its one vital defect appears to lie in the provision for selecting by a vote of the township the first road to be improved. There is nothing in the law to provide for a continuance of the good work, and it has been found impossible to induce taxpayers on back roads, or those living on roads not likely to become improved thoroughfares, to vote taxes liable to be expended several miles outside their own neighborhood. A want of faith in the township's perseverance appears to be fatal to the execution of the law. A careful and extended inquiry failed to reveal a single instance in which the law had been applied.

State Aid. The Illinois legislature meets biennially, and at the session preceding the present one a bill was introduced providing for state aid in road building. Considerable skilful and successful missionary work was done before the bill was presented to the legislature, and early in the session there was some promise that it might pass; but the bill was never considered on its merits, even in committee, partly on account of an unusually early adjournment of the legislature. The bill was before the public long enough, however, to arouse active opposition, particularly among the farmers. In the northern third of the state, where there is considerable gravel and stone suitable for macadam roads, the bill was objected to on the ground that they had already built many miles of hard road and hence it was not fair to ask them to help build all the roads in other parts of the state. In the central third, where there is no road building material and where hard roads will be very expensive, the bill was objected to on the ground that hard roads were impossible in that portion of the state and hence the bill would simply compel the central portion to help build roads in the north end of the state. In the southern third, which is not as wealthy as the other portions, the objection was that they could not afford hard roads at any price and consequently the only effect would be to make them help build roads in the other parts. In all parts some of the most intelligent citizens contended that the wagon roads are matters of only local concern and should be left wholly to local authorities. The prospects for the passage of any law for state aid for road building decreased rapidly with the continued discussion of the subject. The former bill was promoted by interests that expected to profit by its enactment, and the fact that no similar bill has been introduced at the present session probably indicates that those interests have concluded that there is no present hope of getting such a law.

Some wise friends of better roads claim that a law permitting the application of the principle of special assessments and the issuing of bonds would greatly stimulate road improvement. It is certain that a law permitting such cooperation in drainage matters has been of incalculable benefit to the state of Illinois by making possible the construction of long drainage canals which serve as outlets for tile drains. Similar laws in Indiana and Ohio have materially stimulated the building of hard roads in those states. To secure such a law in Illinois applicable to road building would require an amendment to the constitution, and as only two amendments can be submitted each biennial period and as there are numerous interests clamoring for amendments, there is little hope for aid to road improvement from this direction. The cities and incorporated villages do not lack for legal machinery for the improvement of their streets.

Present Condition of the Roads. The wagon roads of Illinois have rapidly improved in recent years, probably as fast as is reasonable to expect and certainly at least relatively as rapidly as the several communities have advanced in other lines, as for example, in education, in agriculture, in house building, or in sanitary

science. Many, perhaps most, of the roads have been underdrained, and the surface of nearly all of them has been crowned, and they have fair side ditches. The streams and ditches have been provided with bridges or culverts. In many cases the bridges are substantial steel structures, often with stone abutments; and many of the culverts consist of vitrified pipe. In many communities the road sides are seeded to grass, and are mowed and kept free from unsightly weeds. In recent years there has been a rapid increase in the amount of money spent for drainage, tile culverts, steel bridges, and road machinery. Nevertheless in the spring of the year, particularly just as the frost goes out of the ground, the roads are next to impassable, but tile drainage has materially shortened the period of impassability. Large sums are spent annually to restore the form of the surface after the break up of the spring; but this phase of road work is probably most in need of attention and improvement. Illinois is at least equal to many much older states in the care bestowed upon the surface, in the attention given to the roadside, in the money spent for steel bridges and tile culverts, in the expense incurred for tile drainage, and in the attention given to restoring the surface.

In the northern part of the state, there are about 7,000 miles of hard roads outside of the cities and villages; in the central part there are only about 1,000 to 1,200 miles of hard road; and in the southern part there are 400 to 500 miles of permanently hard roads.

There are a number of ways in which the present methods of road management and road maintenance can be greatly improved, which improvements will redound to the social advantage of all members of the community, but would-be road reformers should be willing to recognize signs of progress and to admit the difficulties in the way of improvements. What is most needed in discussions of the road problem is more light and less heat.

Massachusetts State Highways.

By A. B. Fletcher, Secretary Massachusetts Highway Commission.

The state highway work of Massachusetts is done under the provisions of Chapter 47 of the Revised Laws. The present statute is practically the same as the original Act of 1893, save for a few amendments of a more or less minor nature. The work is administered by the Massachusetts Highway Commission, a board consisting of three persons, one of whom is appointed annually by the governor for a term of three years. Each commissioner is paid a modest salary. Provision is made in the law for a secretary, clerks, engineers and other expenses, the appropriations for which are made annually from the general tax levy. In addition to the regular state highway work the commission is required by law to compile statistics relating to public ways in the commonwealth; to map certain roads; to collect and collate information relative to materials suitable for road-building; and to give advice without compensation to officers having charge of the roads in the cities and towns of the commonwealth concerning methods of construction and maintenance of their roads. The highway commission is also required to make an annual report of its doings to the legislature with recommendations as to the general policy which should be adopted by the commonwealth relative to state highways. The major portion of the time of the commission and its agents is taken up, however, in laying out, constructing and maintaining state highways.

If a petition is received from the county commissioners of a county, the mayor and aldermen of a city, or the selectmen of a town, and the highway commission determines that public necessity and convenience require that the way petitioned for should be laid out and taken charge of by the commonwealth, and files certain plans and certificates in the offices of the county and municipal clerks, the way becomes thereafter a state highway, and is constructed and maintained by the commission. The state assumes entire control of the whole width of the highway between the property lines, and its duties are not completed when the traveled way is built, as is the case in some of the other States. Provision is made in the law for the payment of damages sustained by persons whose property has been taken for or has been injured by the construction of a state highway. Cities and towns, however, may by vote agree to indemnify and save harmless the commonwealth against all claims for such damages, and in such cases they are required ultimately to pay the amount of any such verdict.

In constructing a highway, the commission gives the cities and towns through which the road passes an opportunity to take the contract for the work. If the municipality does not elect to take the contract within a period of 10 days from the date of the submission of the specifications to it, the highway commission advertises for bids for the work. After the award of the contract the work is done under the direction of the commission and its agents. It has always been the policy of the commission to carefully supervise all the work done, and a resident engineer has usually been placed on each section of road. While the entire original expense of state highways is paid by the commonwealth, the law provides that one-fourth of any money expended in a county for a highway shall be paid back to the commonwealth within six years, with interest, by the counties in which the highways are located.

On the completion of a state highway the road is maintained by the highway commission, but the municipalities retain police jurisdiction over them and may make temporary necessary repairs without notifying the state board. Provision is made in the law for the repair of state highways by contracts with the municipalities in which they are located, or with private persons, and such contracts can be made without advertisement. The cities and towns pay for the cost of maintenance up to the limit of $50 per mile per year. Any expenditure in excess of this amount per mile is borne by the commonwealth. The law provides that "No opening shall be made in any such highway nor shall any structure be placed thereon, nor shall any structure which has been placed thereon be changed or renewed, except in accordance with a permit from the commission, which shall exercise complete and permanent control over such highways."

After the highways are completed the commonwealth becomes liable for injuries sustained by persons traveling thereon in the same manner and subject to the conditions provided by the statutes relating to roads other than state highways. The commonwealth is not liable, however, for any injuries received by any persons during the construction of a highway, nor for any injuries received upon a sidewalk of a state highway.



ROAD IN RUSSELL, MASS., BEFORE IMPROVEMENT.

By an act passed in the year 1900, known as the "Small Town Act," the commission is authorized, upon petition from the selectmen, to expend in towns having a valuation of less than $1,000,000, and in which no state highway has been built, a sum not exceeding 40 per cent. of the annual average appropriation made by such town for the five years last preceding the date of the petition. The amount available which the commission can devote to such work is limited to 5 per cent. of the annual appropriation for state highway purposes. The commission may also expend in towns the valuation of which exceeds $1,000,000, in like manner, under practically the same restrictions, a further 5 per cent. of the total appropriation made for state highway purposes, providing the towns appropriate an amount equal to the allotment of the commission in addition to their regular highway appropriations. By another section of the law, 17 steam road rollers and several portable crushing plants have been purchased by the commission. The title to these machines is in the commonwealth, but they are used in building and repairing high-

ways by the commission and by towns having less than 12,000 inhabitants.

In the years 1894 to 1902, inclusive, the sum of $4,500,000 has been appropriated for state highway purposes, an average of $500,000 a year. The money is raised by the issuance of 30-year, 4 per cent. bonds. An appropriation of $2,500,000 to be used at the rate of $500,000 per year for a period of five years is now being considered by the legislature.

The law, in general, has proved to be very satisfactory. While it appears at the first glance to be rather complicated, in practice it has been found to be not difficult to operate under. Since the beginning of the work in 1894, about 485 miles of road have been constructed under its provisions. Of this length, 446 miles are state highways—nearly all macadam roads—and 39 miles are roads improved under the so-called "Small Town Act." Many of the "Small Town" roads are also of the macadam type. The example set by the commonwealth in the construction of the state highways has resulted in the building of many miles of macadam road by the municipalities, patterned after the state roads. The specifications for a large number of these roads were drawn by the commission.



ROAD IN RUSSELL, MASS., AS IMPROVED BY HIGHWAY COMMISSION.

State Highway Laws of New Jersey.

On April 1, 1903, there was approved a new state aid highway law in New Jersey, which is in the main a codification of the old one and its various supplements and amendments, although several changes have been made which it is thought will simplify the working of the law. As the state of New Jersey was the first to undertake in a systematic way state aid road improvement, the experience gained there should be of great value to states which are only now initiating legislation in this direction. The original state aid law of New Jersey was approved April 14, 1891, but was superseded by that of March 22, 1895, and several additions and amendments have since been made. A year's trial will be given the law just passed before the old one is repealed. The reports and other matter from which this article has been prepared were furnished by Mr. Henry I. Budd, the state commissioner of public roads.

Old Law.—All road taxes are paid in money, and the office of overseer of highways is abolished. The roads of a township are placed under the management of the governing body of the township, and money for improving them may be raised by township bonds authorized by vote at the annual town meeting. Under the county act the board of chosen freeholders of any county may designate certain roads as county roads and improve them by the issue of county bonds, townships to pay one-third of the cost. Under the county-state aid law (March 22, 1895) the freeholders may declare any road a county road, and by resolution improve the same; or whenever the owners of two-thirds, either in linear feet or area, of the lands fronting on any public road will undertake to pay one-tenth of the cost of improving the same, the board of chosen freeholders may cause such improvements to be made, the state paying one-third of the cost up to, at present, the limit of $250,000 per year. Under this law the board has the preliminary plans and specifications prepared and submitted to the state commissioner of public roads, who exercises his judgment as to the order in which such roads shall be improved. When the plans and specifications have been approved by the commissioner, the board advertises for bids in the usual way. The estimated amount of contracts awarded in any one year by any county under this law, together with the estimated cost of repairs to roads already constructed, must not exceed one-fourth of one per cent. of the ratables of the county for the preceding year.

After a copy of the contract and specifications has been filed with the commissioner of public roads, the latter, provided it is the first road to be constructed in the county under this act, appoints a supervisor for the work. This supervisor receives $3 per day from the county, gives his whole time to the work, enforces the provisions of the contract, certifies all payments, and prepares a final itemized statement of the cost of the improvement. After the first road has been built in this way in any county, it is the duty of the board of freeholders to appoint a county supervisor of roads, who holds office for three years and until his successor is appointed, and whose salary is fixed by the board. The board of freeholders is compelled to keep the roads improved under this act in proper repair.

Whenever the board of freeholders is petitioned by the owners of at least two-thirds of the lands fronting on any road for the improvement of such road under this law, practically the same procedure is followed as though the county had inaugurated the work, except that the cost is apportioned one-third to the state, seventeen-thirtieths to the county, and one-tenth to the owners of property fronting on the improvement. On the completion of the work three commissioners are appointed by the circuit court of the county to estimate and assess the benefits conferred by the improvement. If a road is a boundary between two counties, the freeholders of both unite in appointing an engineer to supervise the work of improvement, which is carried on as already described, the cost being borne equally, and the road being divided into two equal parts for maintenance. It is further provided that property owners may improve highways at their own expense, plans for such work to be submitted to the board of freeholders for approval before the contract is awarded. In such cases the owners have control of the expenditures, subject to the approval of the supervisor of the county. Upon the completion of such a road, if the county does not declare it to be a county road it remains an ordinary public highway.

Under the township-state aid law, whenever owners of two-thirds the frontage on any public road will undertake to pay one-tenth of the cost of improving it, and petition the township to have it done under such conditions, the governing body of the township may cause such road to be improved "in the same manner, as far as practicable, as in the case where a petition is presented to the board of freeholders of any county." The supervisor in this case is nominated by the township governing body and appointed by the state commissioner of public roads, and receives his salary from the township. Of the cost of improvement, seven-thirtieths are paid by the state, the remainder being borne by the township. The benefits are assessed in the same manner as under the county-state aid law. Roads built under the township-state aid law are maintained by the township.

The 10 per cent. clause of the state-aid law has been severely criticized, it being claimed that it discriminates against the owners of property fronting on the road and in favor of those having property only a short distance back from the road. This 10 per cent. clause, however, was largely a provision to start the state-aid law in operation, for if the property holders petitioned for the improvement, agreeing to pay 10 per cent., the freeholders were forced to recognize them and improve the road.

When state aid is asked by the property owners, if the law is enforced they are required to pay the full 10 per cent. of cost; but in some counties the freeholders have not collected this, saying that the cost of collection is too high, and that as roads are being built all over the county and all parts are equally benefited, they think it the better policy not to collect it. In some counties the townships voluntarily pay the 10 per cent. for the property owners; and in others the freeholders build the roads by resolution without waiting for a petition from the property owners.

Under the act for the acquirement for free

public use of turnpike or toll roads, whenever the owners of two-thirds of the land fronting on any such road petition the commissioner of public roads to have it acquired for free public use, stating that they are willing to pay 10 per cent. of the entire cost of purchasing and improving it, the governor of the state appoints five commissioners to estimate the fair value of the road. If the state road commissioner ratifies this estimate, the board of freeholders of the county may purchase the road, the state paying one-third of the total cost up to the limit of $40,000 for any one year. Roads obtained in this manner become county roads. The township-state aid law is not popular, and only seven roads have been built under it, making a total length of about 10 miles. Under the turnpike law only two small roads have been acquired; and no roads at all have been built by the property owners alone.

During 1902 there were built and paid for 155 miles at a cost to the state of $250,000. In addition, 46 miles were completed too late to be paid for from the 1902 appropriation. These roads have been built, as far as practicable, of local materials—gravel, macadam, oyster shells, etc. They have been almost entirely 12, 14 and 16 feet wide, and the surfacing material has been varied from 4 to 10 inches in thickness. Since the passage of the state aid law 797 miles of road have been built at a cost to the state of $1,265,170. The average total cost per mile has been about $5,000.

New Law.—The new law provides that when the improvement of a highway is petitioned for by the owners of two-thirds of the frontage, it is to be made as if started by a resolution of the board of chosen freeholders. The petitioners are therefore relieved of the payment of 10 per cent. of the cost. However, "the board of chosen freeholders may, before approval of any road, require as a condition of said approval that the township or townships, or other municipality, through which said road runs shall pay 10 per cent. of the cost of said improvement." When more roads are applied for than can be constructed in any one year, the freeholders and the state commissioner have the power to select the ones to be constructed first.

As before, the plans and specifications are made by the board and submitted to the commissioner, but the latter has more power, and can veto or approve not only the specification but also the contracts. Each bid for this work must be accompanied by a certified check for $1,000, and a bond is required of the successful bidder at least equal to the estimated cost. "The time and manner of payment for work done under any contract awarded under this act shall be set forth in said contract," and 5 per cent. is to be retained until a year after the completion of the work. The new law allows the counties to make contracts up to one-half of one per cent. of the ratables, with the state appropriation for road purposes added, which gives the counties power to raise more than twice as much for road purposes as under the old law. The freeholders may now award contracts for road improvements at any time of the year, even in anticipation of the annual May appropriation, which they had not been allowed to do before, thus generally making it impossible to begin work until June or July.

Between December 15 and 31 of each year the governor and state commissioner of public roads are to certify to the state comptroller the amount to be paid to any county for that year; and the board of freeholders on or before the regular meeting of the county board of assessors certifies to the latter two-thirds of the estimated cost of all work contracted for since the last meeting. Instead of collecting the two-thirds of the cost as a regular tax levy, the board of freeholders may, by a two-thirds vote of all members, issue county "road improvement bonds," either coupon or registered, payable in not less than 6 nor more than 30 years with interest not exceeding 5 per cent.

In order to compel proper maintenance by the county of these roads it is provided that when repairs are not made after 60 days' notice from the state commissioner, the latter notifies the state comptroller and he withholds payment to the county of any money already appropriated or to be appropriated by the state. The provision for supervisors of roads is practically the same, except that such officers are held more strictly accountable, a $1,000 bond being required, and they must also subscribe to an oath of office.

A section has been added providing for a more rapid acquisition of land for changing the location of a road if necessary. If a price cannot be agreed upon between the board of freeholders and the owners, the board has power to acquire the land by condemnation proceedings, the cost to be paid from any money applicable for road improvement, or to be raised by a temporary loan. Formerly the freeholders were hampered by the lack of this power. That portion of the law allowing property owners to improve a road at their own expense has been extended to include the managers of any state lands. Section 17 sates that "The provisions of this act shall extend to townships, towns, boroughs, villages or any municipality or municipalities, all proceedings conforming, as near as possible, to the provisions of this act, and the governing bodies . . . . shall have the same power and perform the same duties as are conferred and devolve upon the board of chosen freeholders."

The main feature of this new law is that it allows of more liberal construction being carried on. Commissioner Budd states that many counties have become so anxious for improved roads that they want to spend twice as much money as they have been allowed to raise. It was intended to increase the state appropriation this year to $400,000 but the efforts made to secure this were unsuccessful.

New York State Aid Road Laws.

The state aid road law of New York, known as the Higbie-Armstrong law, was approved by the Governor March 24, 1898. Several amendments have been made from time to time, and an abstract of the law as amended to March 1, 1903, follows. The board of supervisors of any county may, and upon being petitioned by the owners of a majority of the frontage on a public road, must pass a resolution for the improvement of such road, provided it does not lie within the boundaries of any city or incorporated village. The state engineer, upon receipt of such resolution, certifies his approval or disapproval of it, and if the latter, his reasons. If approved, the state engineer causes a map, plans and specifications to be made, "specifying in his judgment the kind of road a wise economy demands." State Engineer Edward A. Bond has carried the work beyond the building of macadam and gravel surfaces, and has inaugurated a system of improving dirt roads by state aid in such a manner that if it is ultimately desired to macadamize such a road the cost of the initial improvement will not have been thrown away.

In preparing the plans for the improvement, the width of the permanent roadway is limited to between 8 and 16 feet except in special cases, 12 feet being the narrowest and 20 feet the widest yet built. Provision must be made for steel plate or other flat rail construction if such is requested in the resolution of the board of supervisors, although this clause has not as yet been made use of. The engineer's estimate is sent to the board of supervisors, and upon a majority vote of the board the resolution for construction may be adopted. The board must make provision without cost to the state for securing the requisite right-of-way, if there is any deviation from the lines of the old road. Bids for construction are advertised for in the usual way by the state engineer, and the latter may at his discretion award the contract to the board of supervisors of the county, or to the local town boards.

No award is to be made at a greater sum than is provided for in the preliminary estimate, although the latter may be amended if deemed necessary. A suitable bond is required of the contractor and the state is in no case to be held liable for any damages suffered. Under the amendment approved this year, payments may be made the contractor in 90 per cent., monthly instalments, 10 per cent. to be retained until final acceptance. Formerly these percentages were 75 and 25 respectively.

Whenever a county engineer has been appointed in the county in which work under this law is to be done, he has general charge and supervision under the direction of the state engineer. If there is no county engineer, someone competent to supervise the work is provided by the state. Chapter 396 of the laws of 1902 provides that the board of supervisors of any county may appoint a county engineer for a period of three years, fix his salary, and remove him at pleasure. When appointed, his duties and the actual time of his service (whether all the time or only on certain days of the week) are to be designated. Such an engineer, in addition to his duties under the state aid law, acts as a consulting engineer for the highway commissioners of the various towns within his jurisdiction. On the first of November the highway commissioners make a full report in writing to the county engineer on the condition of the roads, bridges, culverts, etc., in their respective towns.

One-half the expense of construction of a road under the Higbie-Armstrong law is borne by the state, and the other half is in the first case a county charge, but so apportioned by the board of supervisors that if built by resolution without a petition, 35 per cent. of the total is borne by the county at large and 15 per cent. by the town. If the road was petitioned for in the first place by a majority of the property holders, 35 per cent. is borne by the county at large and the 15 per cent. by the owners of the adjacent property in proportion to the benefits accruing to them, as determined by the town assessors. In the majority of cases, the supervisors pass a resolution asking for the road. In two or three cases only have the property owners made the petition, this method of obtaining the improvement being the exception. The roads are improved under this law in the order of the receipt by the state engineer of the resolutions of the boards of supervisors approving the construction.

Twenty days after the completion and acceptance of the work by the state engineer, it becomes a county road, subject to maintenance as such. The board of supervisors may apportion the expense of maintenance upon the town or towns which it deems benefited, and the commissioners of highways of the towns must keep the roads in repair "under the direction and supervision of the state engineer and surveyor and such rules and regulations as he may prescribe." As amended in 1902, if any board of supervisors or any commissioner of high-

ways shall neglect to perform such maintenance work within such time as may be prescribed by the state engineer, the latter "may cause the same to be performed and the expense thereof to be paid by the state treasurer . . . and the amount thereof shall be charged by the comptroller against the county in which such improved highways shall be located."

Whenever the state engineer deems it advantageous to construct a section of road not exceeding a mile in length, to connect improved roads already built, he may serve notice to that effect on the board of supervisors, and it is then the duty of the board to provide for the construction of such a connecting highway within one year. This has not as yet been done. All persons owning property abutting on a road improved by state aid, or residing on it, are obliged to pay all highway taxes assessed against them in money.

In addition to his other duties, the state engineer is directed to compile statistics relative to the public highways throughout the state, and investigate various methods of construction and maintenance of roads and bridges. He may be consulted at any time by county, city, town, or village officers regarding road matters; and is directed to hold each year at least one public meeting in each county. In 1902 a section was added to the law, stating that no street surface railroad is to be constructed upon a state-aid road except under such conditions as the state engineer may prescribe.

In 1898 and '99 the state appropriation under the Higbie-Armstrong law was $50,000, and for the next three years it was $150,000, $420,000 and $795,000, respectively. The total mileage of roads completed under this act up to the first of January was 187, and 167 miles were under construction. The total mileage petitioned for up to January 1 is 2,414.

What is known as the Fuller law, passed at the same time as the Higbie-Armstrong law, provides for a change from the labor to the money system of taxation for repair of highways, and a system of state aid in connection therewith. The Higbie-Armstrong law provides for the proper construction and maintenance of the main market roads, and the purpose of the Fuller law was to obtain better maintenance of the present roads as well as of the roads built by state aid and to extend a system of state-aid to what might be termed the lateral roads, where such surfacing as macadam is out of the question. As originally passed, 25 per cent. of amount raised by the town for the cost of maintenance of these roads where the money system was adopted, was to be paid by the state. In 1902 this was increased to what was originally intended, 50 per cent.

The Fuller law provides that "Any town voting in favor of the money [instead of the labor] system, shall annually raise by tax, to be levied and collected the same as other town taxes, for the repair of the highways, an annual sum of money, which shall be equal to at least one-half of the value of the commutation rates, of the highway labor which should be assessable under the labor system." Incorporated villages are excluded from the aid furnished by this act; and the law does not apply to charges for laying out or altering any road, or for erecting or repairing any bridges.

After the amount which the town is to pay has been certified by the highway commissioner to the board of supervisors of the county, a statement is sent on or before January 1 to the state comptroller by the clerk of the board, giving the name of each town voting for the money system, and the amount of the tax levied therein during the preceding year. Fifty per cent. of the amount so levied is paid by the state to the county and then to the town. The sum paid by the state to any town in this way must not exceed in any one year one tenth of one per cent. of the taxable property of such town. For the year 1901 there were 139 towns in 24 counties which received aid to the amount of $102,500 under this law, and for 1902, 258 towns in 40 counties received $246,000.





STATE HIGHWAY CONSTRUCTION IN NEW YORK.

Oil as a Road Material in the West.

Abstracted from an article by Capt. H. M. Chittenden in the Report of the Chief of Engineers, U. S. Army, for 1902.

The use of crude petroleum in laying dust on public highways and in otherwise improving them is of very recent origin, and has not yet emerged from the experimental stage. Instructive articles relating to such uses of oil were printed in The Engineering Record March 30 and November 30, 1901, and February 22, 1902. While enough has been done to give oil a definite standing among the recognized materials in future road construction, it still remains to be shown what its full possibilities are, and how it can be most effectively applied. Comparatively little has been written upon the subject, and it is desirable that an investigation should be made, to cover the following points: (1) It should determine the different grades of crude petroleum as obtained from the different oil fields and show their relative value for use in road work. (2) The effects of oil upon different soils, as not every soil can be treated advantageously with petroleum. (3) The best method of applying the oil. A mooted question at present is whether it should be applied hot or cold. It seems to give better results applied hot, but the increased cost may more than offset the advantages. (4) Its effect in shedding storm water and keeping the roads from becoming muddy. (5) The effect of oil upon different grades of construction, ranging all the way from simple earth roads to the best macadam. There are vast areas of country in the central west where stone is not available for macadam except at great cost of transportation. If earth roads can be maintained in good condition by the use of oil at a reasonable cost, it will be a great benefit to the people of these sections. (6) Attention should be given to the relative cost of oil and water in sprinkling streets, and their relative advantage.

In only a general way can any of the above questions be answered at the present time, and it is to be hoped that the Government Bureau of Public Roads inquiries will, in the near future, make complete investigations. Oil has been used on the roads in the vicinity of Bakersfield, Cal., and the conditions there are most favorable. There is an abundant oil field near by. The oil possesses in a high degree the qualities considered essential for successful road use. The soil is well adapted to the absorption and incorporation of oil. It is a sandy loam of more than ordinary stability, and for light travel wears well in its natural condition. Under heavy traffic, however, it cuts badly, and the dust was said to have been well nigh unendurable. Fruit trees along the leeward side of the road were said to have been destroyed from this cause. The use of oil on these roads has certainly been a success. As yet it is applied in only the simplest and crudest way, and there is no systematic grading, no system of repairs and no attempt to keep the road crowned. The real benefit of the oil is thus largely obscured by the neglect of ordinary care of the roads. Nevertheless, the dust has been effectively laid, and roads that had not been sprinkled in two months looked as if a sprinkler had just passed. It is evident that if pains were taken to crown the surface, and do ordinary work of maintenance, the addition of the oil would produce a road but little inferior to an asphalt pavement.

The writer examined the roads in Golden

Gate Park, San Francisco, which have been treated with oil for two seasons, and certainly nothing superior to them in the line of beautiful driveways exists or can be desired. So far as the odor is concerned, nothing more offensive was noticed than might be experienced in driving over an asphalt pavement on a hot day. The annoyance from getting oily dust or dirt on the clothing depends upon the degree of absorption of the oil in the road surface; but, if the oil is carefully applied, there should be little trouble.

The results of experience to date in the use of oil upon public highways in California may be summarized as follows: (1) This system of road improvement is rapidly becoming a recognized policy throughout the state. It is considered to offer the best, cheapest, and most satisfactory solution of the road problem, and has given complete satisfaction wherever applied. (2) The oil is a crude petroleum with a large percentage of asphaltum, nearly free from water, and 15 to 17 degrees specific gravity, Beaumé scale. (3) The oil works best in a sandy soil such as prevails extensively in the valleys of California. In many instances a layer of sand from one-fourth inch to one inch thick is put on at the time of oiling. Clay does not absorb the oil well, and is liable to ball up and give trouble, and thus on such soils sand is necessary to produce the best results. (4) The road should be carefully graded, crowned, rolled, and otherwise prepared as if to receive a macadam surface. The immediate surface should be scratched up with harrows to facilitate the absorption of the oil. (5) The best results are obtained by putting the oil on hot, in the heat of the day in summer, when the road surface is warm. The oil is more active under these conditions, and is more thoroughly absorbed. Good results, however, have been obtained by cold sprinkling, and the cost is about one-third less. (6) Nothing especially characteristic has been developed in the line of a sprinkling plant, except that a certain patented device consists of a main oil tank (about 600 gallons capacity) followed by a two-wheeled tender provided with sprinkling jets and two sets of barrow teeth, one in front and one in the rear of the jets. It is important to avoid spraying the oil lest it cool off too much, and it should be released under uniform pressure, as far as possible, to secure a uniform sprinkling. (7) For an 18-foot roadway, experience to date leads to the belief that for satisfactory work 120 to 150 barrels of oil should be used per mile for the first sprinkling; 70 to 80 barrels for the second sprinkling, and 25 to 30 barrels for the third sprinkling. These sprinklings occur in successive seasons, and a smaller quantity would apply to the fourth and subsequent seasons. Each kind of soil will have its own requirements and of course no universal rule can be given. (8) The contract price of sprinkling with heated oil in Bakersfield, Cal., was $1 per barrel. The cost at any particular place will be a function of the cost of oil and the cost of transportation. (9) It is fully recognized that a careful system of construction and maintenance should be combined with the oil sprinkling in order that the latter may yield its best results.

The Collection of Garbage in Duluth, Minn., is recommended by Health Commissioner J. M. Robinson to be placed in the hands of some three or four regularly appointed scavengers—giving each a district, and making each scavenger responsible for the prompt removal of the garbage in his territory. He recommends that the householders pay a moderate sum, regulated by ordinance, for the removal of garbage.

Road Construction and Maintenance in Europe.

The Department of the Interior of the Austro-Hungarian empire in 1899 ordered one of its engineers to report on the best methods of construction and maintenance of roads. In three years Mr. R. Izkowski traveled on wheel over some 6,800 miles of roads in Europe and made a thorough study of them. Some of the conclusions reached differ widely from the general practice in this country, and the following abstract is offered as an indication of what is the European practice. The most important requirement of a good road is low resistance to traction, when dry or after a prolonged rain. This depends on the smoothness, cleanliness, hardness, drainage and impermeability of the surface. These conditions vary with the quality of the material, the construction and the maintenance. To obtain proper drainage the roadway should be crowned, with slopes of 5 per cent. for softer material and 6 per cent. for harder, at the edges, and a circular arc for about 7 feet of the width at the middle. The cross-section thus becomes similar to a parabola which is known by experience to be the most suitable curve. The surfacing material should be tested to determine its compressive strength dry and wet; its hardness or abrasive resistance, its absorption as determined by immersion in water for 14 days, and its tendency to soften in water.

For the foundation layers of the roadway a softer material may be used if it be frostproof, but for the wearing surface, as far as possible, only the hardest. The same materials must be used for repairs, as otherwise depressions and ruts will soon appear. Binding is another very important quality of the surfacing material. This depends on the mineralogical constituents, and for a given material, on the size of the stones. The smaller the individual stones, the greater is the ratio of their contact surfaces to their volume and the greater, therefore, their binding power. Experience fixes the limit of size for any given material. Most important is the greatest possible uniformity in size to obtain good cohesion and a smooth wearing surface, which in turn will reduce wear. The sharper the individual stones the better their cohesion, and therefore, broken stone binds better than gravel. For this reason broken stone may be used without binding material, but gravel should have about 12 per cent. of binder. The impermeability can be obtained only by forming a compact mass of stone without earthy substances. A broken stone road will, therefore, be more impermeable than a gravel road with its admixture of clay. Other things being equal, the former will, therefore, be preferable. The foundation should be well drained so that any water percolating through the surfacing may find an easy outlet. Should the water not drain away its worst effect will be felt in winter when it will freeze and lift the surfacing from the foundation. A road built without a foundation layer of stone should be made stronger and more impermeable than if built with a foundation; and if the underlying soil does not easily drain, a layer of sand 8 to 12 inches thick should be provided. The roadway should form a compact mass 16 to 20 inches thick with the larger stones in the lower layers and the finer towards the top.

A new roadway should be thoroughly rolled. The weight of the roller should vary with the pressure required to compress the paving material and, hence with its hardness. For steam rollers this pressure was found by observation to range from 280 to 775 pounds per inch of width of roller. The latter value is necessary for the hardest stones, as for the very hard basalts. For common grades of stone the required pressure per inch of roller may be taken at 580 pounds. If at the beginning too great a pressure be exerted by the roller good results are not obtained, since an excessive movement of the surfacing then takes place longitudinally. Rollers of variable weights are therefore considered advisable. The speed of the steam roller has an important effect on the rolling; to avoid any creeping of the surfacing material it should not at the beginning exceed 2 feet per second, and may be gradually increased to 3 feet. The rolling should begin on the sides of the road, the roller going forward on one side and back on the other, gradually approaching the middle, and should continue until no motion of individual stones can be observed. In the absence of sufficient moisture the road should be sprinkled before rolling, but excessive wetting should be guarded against, and in case of prolonged rains, the rolling should be postponed. Towards the end of the rolling, the stone dust formed should be swept and rolled in; and a thin layer of dust of the same material as the surfacing or of sharp sand should then be spread over the roadway. This top layer should not exceed ⅜ inch and will serve both to fill open interstices and to protect the surfacing. It is advisable to renew this layer from time to time. Excepting freezing weather, rolling can be done at any time. The thorough rolling of a new broken-stone road requires, by experience, ten to fifteen trips per foot of width. Thus for an 18-foot roadway 180 to 270 trips of the steam roller are necessary, according to the degree of hardness of the material.

The maintenance of roads is done by the patch system or by renewal. The former method consists in filling the depressions and ruts with surfacing material and leaving the compacting to the traffic. The renewal method lets the surfacing wear down and then adds a layer of material on the whole width of the roadway, thoroughly rolling it to a smooth surface. From the point of view of traffic convenience, the renewal method is to be preferred. If the travel is inconsiderable it may be that the atmospheric influences will do more damage than the travel, and the patch system would then prove economical. For a heavy traffic the renewal process will prove to be more economical by about 30 per cent. In either system every kind of dirt and refuse as well as obstructions of all kinds which impair the smoothness of the road must be removed. The road must also be kept free from grass or weeds. The quantity of surfacing material required yearly by the renewal system is, for steam rolled surfaces, on the average, for good gravel roads about 0.65 cubic yard per mile of length and per foot of width, and for broken stone, one-half of this. In both cases one-third is required for the surfacing proper and two-thirds for the finer material. The length of service of a surfacing layer can only be determined by experience in each case. Ten to eleven years may be taken as the limit of age, but will only be reached under the most favorable conditions. These notes were taken from the synopsis of Mr. Izkowski's report published in "Oesterreichische Wochenschrift für den öffentlichen Baudienst."

Tin Has Been Found in paying quantities in the Cape York district, Alaska, especially along some of the creeks on the Arctic slope. According to the "Pacific Coast Miner" some of the stream tin deposits pan well and the black tin assays 70 to 80 per cent. metallic tin. No vein has yet been reported.

Street Improvements in Havana.

By Charles E. McDowell, C. E.

There are but two cities in Cuba that have modern pavements, Havana and Santiago. The smaller cities and little towns have only dirt roads and poor macadam of native limestone of inferior quality. There are but few roads outside the cities and much of the communication must be carried on over trails. The improvements of highways instituted by the American engineer officers are being continued by the Cuban authorities. A short time ago $700,000 was appropriated for these purposes, $100,000 to each province and an additional $100,000 to the city of Havana. Recently Senor Diaz, secretary of public works, stated that the construction of roads for which applications are on file would cost about $10,000,000 and that probably $5,000,000 could be expended judiciously, if available.

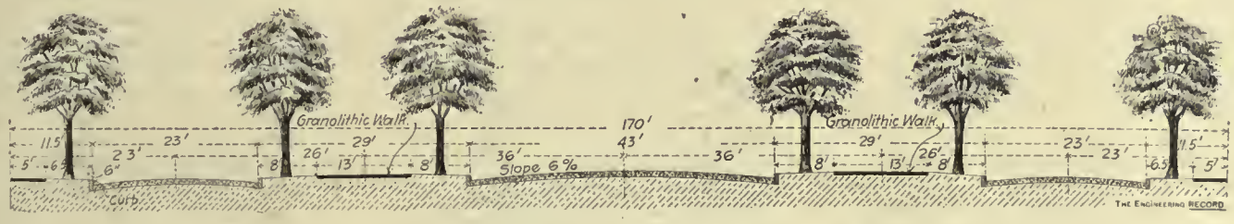
The city of Havana is shaped somewhat like a fan with the old and narrower part at the water front. As the city grew the main highways to the country diverged, and suitable cross roads were not built beyond the thickly settled part of the city. Recently a new boulevard has been planned to afford communication between these main lines of travel and relieve streets which are now crowded. The accompanying illustration is a cross-section prepared from the signed official plans. This boulevard will be 170 feet wide over all and will include a main driveway 43 feet wide and two roadways at the sides, each 23 feet wide, all to be surfaced with telford macadam or bituminous macadam. At either side of the boulevard and in the middle of the spaces between the driveways there will be cement sidewalks, and six rows of trees are to be planted in grassed spaces, as shown. This parkway is expected to cost nearly $100,000. A proposed extension to the south is estimated to cost $50,000 more. Another boulevard in the center of the city to cost about $35,000 and a park of 200 acres on the high ground of the western part have been projected.

The streets in the older part of the city follow closely the direction of the water front of the Bay of Havana, and are very narrow, many being only 22 to 25 feet wide between the house lines. These streets are, as a rule, paved with Belgian and Boston blocks brought in large part from the United States, although much of this material came as ballast from Spain, France and Belgium. These pavements were laid years ago and, under heavy traffic, have worn dangerously smooth. It is not an unusual sight to see 15 or 20 mules fall in a walk of a half hour through this section. These conditions are to be remedied and a new sewerage system for the city provided as the result of a contract made with the McGiveney & Rokeby Construction Company, of New Jersey, the work under which, however, has been delayed during the past 18 months for the lack of the necessary funds. Havana now has about 26,500 square yards of Boston block and 310,240 square yards of Belgian block pavements. In addition, the Havana Electric Railway Company is obliged to pave between its tracks and for a foot beyond the rail. This paved strip is 8 feet wide for single track and 16½ feet for double track.

In the interim from May 20, 1902, when General Wood left, to December 31, 1902, the following work was done on the pavements:

	Square yards.	Unit cost.
Old granite blocks relaid.....	10,970	$1.60
Old granite blocks repaired....	8,020	.73
New macadam streets built....	8,475	.84
Macadam renewals	65,530	.76
Macadam repairs	113,000	.38

The allowance for the street department is $20,000 per month, and it has 400 employes. The streets will now compare favorably as to cleanliness with those of the northern cities of the United States. The report of the street cleaning department for the last six months of 1902 shows that 4,055,000 square yards of streets were swept once and picked twice daily, and 300 tons of garbage were removed each day. This department uses 140 carts, and the drivers are paid $1 per day, American money. The 40 sprinkling carts sprinkle on an average 2,400,000 square yards a day. The cost of the department for the six months was $231,844. A number of interesting articles on the previous conditions and the improvements in Havana were printed in The Engineering Record during 1900 and 1901.



New Boulevard, Havana, Cuba.

Modern Road Machinery.

The American genius for inventing labor saving devices is well illustrated in the various types of road machinery put on the market in recent years. Even such common implements as wheelbarrows are now constructed on scientific principles. Plows are now constructed entirely of steel for use on highways, and large wing plows with extra long moldboards, for filling or cleaning ditches. Another implement which can be used to advantage in cleaning out ditches or filling over tile drains is the flat board scraper, 4 feet wide, with a steel edge, wooden handles, and curved draw bars. The tongue scraper, built with back and sides is useful in moving large quantities of earth short distances, and in finishing the surfaces of earth cuts and side ditches. The ordinary drag scraper, holding from 3 to 7 cubic feet, is made with or without runners, or double bottoms, the latter replaceable when worn out. The buck scraper, holding 12 to 18 cubic feet, is built so that it can be dumped gradually and without stopping. If the haul is as long as 200 feet, wheeled scrapers are usually more economical. These have capacities ranging from 9 to 17 cubic feet, and can be supplied with either wooden or metal wheels.

For a haul longer than about 700 feet, wagons are ordinarily to be preferred to scrapers. There are now several makes which allow the material to be dumped either all at once or gradually as the wagon moves along, the whole process being controlled by the driver from his seat. Some are made with a device at the bottom for spreading the material as it drops. Such wagons may sometimes be advantageously employed in trains of three or four, to spread broken stone, being drawn by traction engines. Asphalt dump wagons of 2 and 2½ cubic yards capacity are constructed with a steel lining and asbestos packing between the steel and the wood of the wagon body, and mounted on coil springs to reduce the vibration.

The use of road machines or scraping graders in building and maintaining earth roads has become general, and there are numerous makes, each having details peculiar to itself. Different styles are made for use in different sections of the country. Nearly all are reversible and have some arrangement for shifting the wheels laterally. With the blade reversed, some types can break up and level the large lumps moved to the center of the road; and a special rooter blade may be used to break up old macadam preparatory to repairs, or to loosen hard and stony ground for grading. The elevating grader, which deposits the earth at one side by means of a conveyor, is applicable only for very large work, on the smooth prairies. Attempts have been made to make this machine more easily handled, by combining with it a traction engine. As ordinarily used either 8 or 12 horses are required.

A machine has been devised for excavating trenches for tile drains. It consists of a heavy platform on wheels, at one end of which is an upright engine and at the other a large excavating wheel, the buckets of which cut the faces of the ditch and deposit the material into a chute above the surface, at each revolution. Entire stone crushing plants and other kinds of road machinery are now made in portable form. One type of crusher is constructed so that its balance wheels serve as the rear wheels of the truck when the machine is to be moved, and all that is necessary is to attach a two-wheeled truck to the other end of the crusher. A combination crusher and folding elevator, mounted on a four-wheeled frame, is a machine of which several types have recently been placed on the market. In one of these the crusher has a solid cast steel frame, and the elevator, from 10 to 16 feet long, can be folded down on top of the crusher in compact form for transportation. The total weight with 16-foot elevator is 9,500 pounds. It is claimed that some of these machines can be set up ready for work in 10 or 15 minutes. Portable rotary screens and stone bins are also used to a considerable extent. A combination water tank, fuel wagon and road sprinkler has been brought out by one company, which is of great advantage as an adjunct to traction engines and steam rollers.

A machine for loosening old macadam and preparing the road for the addition of new material, recently devised, and known as the road scarifier or "porcupine," is a small, compact implement that may be dragged by a traction engine or steam roller. It has been found difficult to accomplish this satisfactorily by the use of spikes on the wheels of steam rollers. Steam rollers are now built in many sizes ranging from 3 to 18 or 20 tons, the lighter ones being used mainly for asphalt work, rolling turf, etc. Horse rollers are made in sizes from 3½ to 10 tons, and several ingenious arrangements have been devised to facilitate reversing.

Progress of Steel Roads.

By General Roy Stone.

The steel road laid in Murray Street, New York, in December last, and described in The Engineering Record of December 13, 1902, has come through the winter apparently without varying a hair's breadth either in line or level, and has given general satisfaction in all sorts of weather. This is contrary to the expectations of many people and even of its projectors, who were afraid that horses would slip upon it at times, the grade being considerable. No complaint, however, has been made in this regard and the expected ease of traction has been thoroughly demonstrated in practice. Although no complaint of slipping has been heard in rolling the steel hereafter slight indentations will be made which will prevent the slipping of horses' feet or of the rubber tires of driving wheels without roughening the tread for wagon wheels.

When the test was made, of hauling a load by a rope with a spring balance interposed, no account was taken of the grade, and as the comparative traction shown was 100 pounds on the rails and 160 pounds on the stone pavement, the advantage was stated at 60 per cent. The grade, however, being 2 per cent. the actual lift in both cases was equal to 2 per cent. of the total load and as the wagon weighed 3,700 pounds, the lift was 74 pounds; this deducted from the amounts named, 100 and 160, leaves the comparative traction due to rolling and axle friction, that is the comparative pull on a level, in proportion of 26 to 86. This corresponds closely with the German tests which are reported as varying from 1 to 3 up to 1 to 5, for the comparative traction on steel and other roads. Reduced traction evidently reduces in like proportion the wear and tear on road, vehicle and power, whether animal or mechanical. The durability of the roads may be assumed from this fact, together with some corroborating data from actual experience, which indicate a life of 30 or 40 years or more. The Murray Street experiment has been carefully watched by the city engineers and many others. The engineers of the Dock Department have reported in favor of the adoption of the rails on portions of the docks where the traffic is especially heavy and is too severe for planking or asphalt. The president of the Borough of Manhattan has called for the specifications preparatory to inviting bids for various lines in the city. The state engineer of New York desires to lay a steel road from the Ulster slate quarries to the Hudson River. The U. S. Government through its Road Bureau at Washington is asking for steel for a road in the District of Columbia. Commissioner Budd, of New Jersey, favors a steel road across the Hackensack Meadows, and a special inquiry comes from the public works of London City.

Automobile Roads. It is estimated that the number of automobiles in the United States at the end of this year will be 50,000, and there is strong disposition to move for special roads, in certain localities, in order that these vehicles may have freedom to develop their highest usefulness without danger or annoyance to the general public. Such roads could be made with one or two tracks of the steel plates, and the intermediate and outside spaces covered with grass. Such a road will be free from dust and mud and would be safe from wash by rains, and as the rubber tires would have no effect upon the rail, there would be practically no wear of the road. Travel on such a road would be like driving over a fine lawn, except that the power required would be much less. This saving again, would increase the radius of vehicles with a given amount of fuel or stored power. For such roads there are many routes available about New York, to the eastward along the backbone of Long Island, northwest and southwest across the meadows of New Jersey, northeast into the Connecticut hills, and north under the shadow of the Palisades. Such roads would relieve the congestion of travel and add new and beautiful regions for the development of suburban homes. Motor vehicles requiring only a low headroom, their special roads could easily run under the public roads at crossings.

Highways. It will not be necessary to use as heavy plates as those on Murray Street for country highways, nor to make them so wide, and in general a single track will be sufficient, with perhaps occasional turnouts of macadam, though as a rule the grass will grow close up to the plates and the turf will be firm enough to turn out upon. At each joint of the rail there might easily be a projection which would replace a vehicle on the track, though as a rule the tracks would be laid a little lower than the surface alongside and there would be no difficulty in returning upon the rail at any point.

Loss from Bad Roads. Among its multitudinous activities, some years ago the government at Washington, at the solicitation of the writer, required its 10,000 crop correspondents to report on the cost of hauling and the average distances of wagon transportation for farm products and supplies. These reports, carefully tabulated and averaged, with the census returns, from which were computed the total weight of farm products, with proper allowance for home consumption, altogether established the fact that a total of $900,000,000 is expended annually in such hauling; and the average rate per ton per mile, 25 cents, was found to be 3 times as great as that in Europe or on good roads in America, thus making the net loss by bad roads in this country $600,000,000 annually.

Advantages of Steel. The successful adoption of steel for road construction would not only reduce the expense of hauling far below the European standard, but it would open its own way to provide the means for construction throughout the country. In the first place it would practically eliminate the question of repairs for at least a generation, whereas in stone roads the cost of maintenance is most serious, amounting in some caes to 10 or even 15 per cent. of the original cost of the road. In the second place, while in the case of stone roads there is nothing that can be pledged as security for a loan, steel rails and their attachments will afford an available security, since they can be removed and laid elsewhere. This additional security added to the credit of a county, which credit will itself be greatly enhanced by the improvement of its highways, should entitle the county to the guaranty of the state, and by this means the county road improvement bonds can be made sufficiently secure to be accepted by the general government as security for national bank circulation or for the investment of postal savings.

Supposing the track metal to cost $2,000 per mile, which would be a fair price in average times, and that the additional expense of laying is paid by local taxation or contribution, the bond issue would only then be $2,000 per mile and the interest only $40 per mile yearly, which is no more than the present cost of keeping a much traveled earth road in repair. Comparing this simple method of providing means with the arduous one of procuring direct appropriations year by year from state and national governments or the still more difficult and oppressive method of local taxation, the securing of good roads for the whole country becomes an easy task.

New Methods of Road Construction.

By Fred J. Warren.

There has been a general demand for good roads. The public at large almost without exception recognizes this demand. The questions arise: What is a good road? and, Have good roads been available to meet the public demand? Macadam undoubtedly presented the best economical road which was ever produced for country districts. The writer is of the opinion that the principal reason why the "Good Roads" movement has not met with greater success is that no road has been available which was sufficiently durable to convince all the people who were affected by its cost, that it was worth the money. Practically the only road material which has been available for country districts has been stone in one form or another, and so far as the writer is informed no other materials have ever been used intelligently in country districts. Recently in Florida a county had appropriated $400,000 for road building, and the only materials being considered were ordinary red clay and a soft sandstone which could be whittled with a jackknife. The road was to be constructed on a natural sand base which in itself would furnish most excellent drainage. The writer suggested the mixing of bitumen with the sand and spreading two inches of such a mixture on the sand foundation, the county using a portable paving plant and getting the work constructed at its first cost. Such a wearing surface if built at first cost would be cheaper per square yard than the pavement made of clay and worthless sandstone, and while sand is a defective material to use with bitumen, it is nevertheless true that a sand converted into a mortar with a hard grade of bitumen will furnish a road surface vastly superior to the materials which were actually used.

The use of bitumen in one form or another (bitumen having been proven by nature to be one of the most indestructible of materials when used in solid form) mixed with stone, will produce a waterproof road surface at an expense varying, according to locality. The writer believes that the future road will be a bituminous concrete road, of some form or other, manufactured in a scientific or semi-scientific manner, and that the variations which are possible in the combination will provide roads for all classes of service, no matter whether the money available is an unreasonably low amount or an unreasonably high one. A careful investigation of the subject leads me to think that, at any given price, greater efficiency can be procured by use of bitumen and stone combined in a scientific way than by the use of any other road which has yet been constructed. I would venture the assertion that under some conditions of traffic a bituminous road could be built which would last for twenty years or more, and that the cost of construction under favorable conditions as to supply of materials would not exceed 80 cents to $1 per square yard, or about $8,000 per mile for a 15-foot road. The above estimate is based on the assumption that good roads will be used to an extent which will justify modern and complete equipment, with resultant economy, and that the use of the material will be based on scientific investigation, and not upon prejudice.

There is probably no class of material which is used on prejudice to the same extent as are the bitumens. The industry has been developed commercially almost entirely, and some so-called chemists who claim to have information on the subject are simply copyists of errors which have crept into the industry from prejudice and practice. The substances known as bitumen

are divided into two general classes and each of the classes have been sub-divided commercially into two or three classes, when as a matter of fact it is posible to sub-divide them into thousands of combinations. They can be used with stone in all sorts of conditions from an extreme fluid to an extreme solid. They can be tempered scientifically and worked so as to materially increase their life by their proper use with non-bituminous matter to bring about toughness. The writer has personally proven to his own satisfaction that the use of certain grades of non-bituminous matter in the right proportions with a fixed grade of bituminous matter may increase its life under any given exposure over one thousand times. Since such a common and easy thing as this so permanently affects bitumen it is a material which must be of necessity handled by experts in order to get the best results.

The writer wishes to suggest that the greatest abomination of modern road building is the contract system. A contractor is asked and expected to make investments which cannot be permanent by virtue of the system. He is asked to give bonds, is required to have tremendous investments on account of the bonds, and the public money in this way is diverted from road building to surety companies and financiers. The cost of a guarantee for five years on 10,000 square yards of roadway, if of the bituminous class, might be $50, and if it is the only contract a contractor has be might have to maintain an investment of over $10,000 in order to be equipped to make necessary repairs. For this reason a cautious contractor has to charge an unreasonable price for a pavement laid under guarantees. The only way to build country roads is for the authorities to have their own equipment and build their roads at cost. There is no reason why a municipality or a county should ask a contractor or a bonding company to stand between the municipality and the ordinary wear and tear of the road. It is fair to call attention to the fact that the value of a scientific system of bituminous road building should not be judged by the mis-application of unscientific material in an unscientific way. That the telephone was never successfully used until twenty years ago is no reason why the telephone is not a great success.

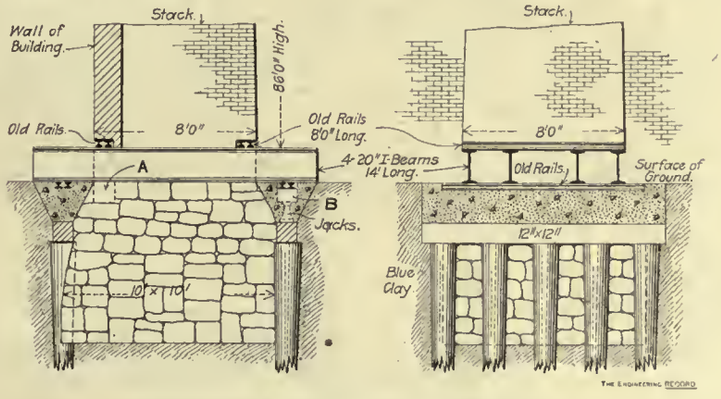
Plumbing a Brick Chimney.

The power house for the Portsmouth, Kittery & York Street Railway Company, at Kittery Point, Maine, was built in 1898, and being made to sell, the evident design of the builders was to secure the lowest possible first cost. In order to secure a cheap and abundant supply of water for condensation purposes it was located on a small salt marsh alongside a creek. The brick chimney is 8 feet square outside at the base, 4½ feet square at the top and 86 feet high. The brick wall of the power house is bonded into the side of the chimney to save masonry, and its foundations, as well as those of the chimney, are built on the soft ground without pile footings. The base of the chimney, however, has a 10x10-foot foundation of rubble masonry 8 feet deep carried down to soft blue clay.

It is stated that during construction the chimney settled before it was built up to a height of 25 feet, but no other settlement was observed and no damage was apparent for several years. After the road was built and equipped it was sold to the present owners, and in the summer of 1901 a crack appeared in the brick walls of the boiler room adjacent to the chimney which attracted some attention, but was not considered serious. Early in 1902 this crack began to open, and observations taken on the chimney showed that it was gradually settling away from the building and in danger of falling unless the settlement was checked. If the chimney had been entirely separate from the building, it would probably have settled plumb without serious injury; but it was so closely attached to the wall that the bearing on that side was increased and the settlement retarded, the outer edge sunk more rapidly and threw the chimney about 39 inches out of plumb at the top. In order to plumb the chimney and to prevent future settlement, it was determined to lift the outer edge and to permanently transfer a portion of the weight to new pile foundations built outside of the old base and dividing with it the total weight of the chimney.

A row of five piles was driven across the base of the chimney inside the building in a space 3 feet wide between the common wall of the chimney and a battery of upright boilers. This clearance was too small for an ordinary pile driver, so the work was done by a hammer guided between a pair of special 8x8-inch leads braced to the wall and the boilers. A similar parallel row of piles was driven just beyond the opposite face of the chimney and both of them were capped with hard pine timbers just below high tide.

Holes were cut through the boiler room wall and the opposite side of the chimney, and four steel needle beams were inserted in them supporting on their upper flanges pairs of old steel rails in the thicknesses of the walls. The needle beams were wedged to bearing on a temporary distributing beam A carefully bedded in a recess cut in old masonry foundation. The opposite ends of the needle beams were seated on another temporary beam B which was supported by fourteen jack screws set on the cap of the outer row of piles. These jacks were simultaneously screwed up about 4 inches so as to revolve the needle beams through a small vertical arc around the beam A as a center and raise the outer edge of the chimney about 3½ inches, which was sufficient to plumb it.



Reinforced Foundation for Brick Chimney.

Portland cement mortar was then rammed into the triangular space between the bottom of the brick work and the top of the old rubble foundation, grouted and allowed to set for 48 hours. The jacks and the timbers A and B were then removed, and the trenches over the pile tops were filled with Portland cement concrete in which old steel rails were bedded parallel to the boiler house wall to give bearings for the permanent steel needle beams. By this arrangement it was believed that the estimated 150 tons weight of the chimney would be chiefly carried by the old foundations, and that the new pile foundations would relieve it from excess load and receive only enough weight to prevent future settlement. The chimney has a lining separate from its outer walls which originally rested on the masonry foundation. Before the plumbing was commenced this was permanently supported on the two center needle beams, and lifted with the outer walls of the chimney.

The repairs were successfully executed, without developing cracks in the brickwork, at a cost of about $550, including labor, materials and all other expenses. It was considered that the chimney might have been merely straightened more cheaply by lowering the high side instead of lifting the low side and building new foundations; but this was unadvisable because it would have necessitated cutting it loose from the boiler house wall, and because the foundations were below ground water line. The method adopted not only straightened the chimney but pushed the boiler house walls back into their original position, so that they could be repaired at small cost by filling up the original cracks. The work was planned and executed under the general supervision of Mr. Lee Treadwell, M. Am. Soc. C. E., acting for Mr. W. G. Melloon, general manager of The Portsmouth, Kittery & York Street Railway Co.

Report of the United States Steel Corporation.

The first report of the United States Steel Corporation for a complete calendar year, 1902, a quarto pamphlet of 40 printed pages, 22 pages of half-tones showing views of the properties and a map giving their locations, contains many interesting figures indicating the magnitude of the holdings and operations of this great corporation, a few of which are here given without comment. The total outstanding stock December 31 was $1,018,583,600, and the bonded, debenture and mortgage debt, $363,655,485.84. The total volume of business for the year was $560,510,479.39 and the total net earnings $133,308,763.72. Dividends of 7 per cent. on preferred, and 4 per cent. on common stock to the amount of $56,052,867.50 were paid. The report states that the physical condition of the properties has been fully maintained and the cost charged to current operation, the expenditures for maintenance, renewals and extraordinary replacements amounting to $29,157,010.73. Extraordinary replacement funds are "to be used to improve, modernize and strengthen the properties."

The principal products of the several properties included 16,063,179 tons iron ore, 9,521,567 tons coke, 709,367 tons coal (exclusive of that used for coke), 7,802,812 tons pig iron, 9,743,918 tons steel ingots and 486,357 barrels cement. There were 8,197,232 tons finished iron and steel products manufactured. The average number of employes was 168,127 and the aggregate payrolls, $120,528,343. Of the employes 27,379 were allotted 48,983 shares of preferred stock on applications in accordance with the profit-sharing plan submitted by the board of directors on December 31, 1902.

The New York Stock Exchange.

The New York Stock Exchange formally opened its new building April 22. In announcing the practical completion of the building, the opportunity is presented to record some statistics regarding a structure which besides possessing interesting features in various lines of engineering, belongs to an institution known throughout the financial world. The figures are those not usually easily obtainable and sometimes regarded as of a popular nature. The building needs no introduction to the readers of The Engineering Record, as the difficult work involved in constructing its foundation, the special design and methods of erection of its steel frame-work and its interesting water-supply system have already been described at length.

The building has a frontage of 137 feet 8½ inches on Broad Street, 152 feet 10 inches on New Street and 14 feet 8 inches on Wall Street. It is 156 feet high above Broad Street, and contains 4,300,710 cubic feet. The floor of the cellar is 42 feet below that street and is surrounded by a concrete caisson dam, bonded together to form a continuous wall and resting on solid rock 5 to 7 feet below the cellar floor. This floor, thus protected, is 36 feet 7 inches below ground water. There are 27 interior caissons, sunk to solid rock after completion of the dam, on which iron columns were erected, and the floors were constructed from the sidewalk downward, the earth being excavated as the floors were put in. The main or board room is 144 feet wide, 109 feet long, 74½ feet high in the clear, and contains 1,169,350 cubic feet. Over this room, supporting the upper stories, are four trusses 115 feet 3⅝ inches long, 15 feet deep and arranged in pairs, 7 feet 10 inches on centers. They carry a load to each pier of 1,200 tons. The number of rivets used to put the trusses together was about 48,000. The ceiling of the room required 230 tons of plaster, on 27,000 square feet of wire lath.

There is a steel safe deposit vault in the basement, 118 feet 7 inches long, 21 feet wide and 9 feet 10½ inches high, with a body 10 inches thick and weighing 776 tons, including the vestibules, which weigh 110 tons. It is carried on steel beams and columns at a height of 33 feet 4 inches above the cellar floor. It is enclosed by a cold-rolled, steel partition of bars 1⅝-inches diameter on 4-inch centers, 276 feet in total length and weighing 40 tons.

There are four Babcock & Wilcox water-tube boilers, aggregating about 800 horse-power. There are 76,385 linear feet of steam piping in the building. The ventilating apparatus provides for the delivery of about 12,000,000 cubic feet of air per hour. In the summer the air for the board room and the rooms below is cooled by passing the air over 25,000 linear feet of cold pipe connected with three absorption machines of 150 tons capacity each. Arrangements are made to extract 1,000 pounds of water from the air when the external air is 85 degrees Fahrenheit and the humidity 85 per cent. For the circulation of air ten Sturtevant centrifugal fans 8 to 11 feet in diameter are installed, driven by C. and C. electric motors aggregating 179 horse-power. The total weight of the ducts is 197 tons and 165,250 square feet of non-conducting material were used to prevent radiation of heat from steam pipes and ducts. The elevator installation consists of six Otis passenger elevators, three direct lifts and five electric dumb waiters. There are 4 miles of cables, over 1 mile of piping and 260 controlling valves in the system. A pneumatic tube system is installed in the building, requiring about 6 miles of brass and iron tubing and 175 automatic terminals.

The refrigerating equipment, which was built by the Carbondale Machine Company, has a cooling effect equivalent to the melting of 450 tons of ice per day. Besides cooling the board room, it supplies refrigeration for a luncheon room in the upper stories and for ice water distributed about the building. The electric generating plant comprises three units of Ball & Wood tandem-compound engines and General Electric dynamos aggregating 1,040 horse-power. There are 6,000 incandescent and 68 arc lights in the building. The steel conduit, containing the light, telephone, call bell and other wires, weighs 1,144 tons. There are 208 miles of copper, weighing 12 tons. There is a storage battery, furnished by the Electric Storage Battery Company, of 135 cells with a capacity of 400 lights for eight hours. There are two annunciators, one on each side of the board room, each having 1,200 numbers, each number occupying a space 9 inches square. For this work there are 8,000 separate wires, which have a total length of 247 miles. Mr. George B. Post, of New York, is the architect.

Ventilation and Heating in Rockefeller Hall, Vassar College.

The Rockefeller Hall at Vassar College, Poughkeepsie, N. Y., is a two story and basement building with a frontage, facing south, of 150 feet, a greatest depth of 85 feet and covers a ground area of 11,540 square feet. The building is practically rectangular and has a nearly semi-cylindrical wing at the rear which accommodates two auditoriums on the first and second floors and the ventilating equipment in the basement. This was the only mechanical apparatus for which space was necessary in the basement, since the steam for heating is furnished from a central boiler plant, therefore it was possible to utilize the remainder of the basement as well as the two upper floors for class rooms.

The greater part of the building, that is, all but the two auditoriums, is heated at all times by direct radiation and ventilated during school hours by air tempered to 70 degrees, consequently the radiators are not required to warm the changing air but only to compensate for the heat lost through the walls, windows, and to other parts of the building that may be slightly cooler. A different arrangement prevails in the auditoriums. Here it was possible to dispense with direct radiation, the air supply being proportionately greater than elsewhere, and it was found necessary only to supply the fresh air at a little above a tempered condition to maintain the desired temperature. This was possible partly because in a fairly crowded room a considerable amount of heat is radiated from the bodies of the occupants.

The supply of air at both degrees of temperature is established by a single 160-inch blower of the American Blower Company's manufacture, having a 55x54-inch top discharge and an inlet 60 inches in diameter. It is belt driven by a horizontal engine at a speed of 200 revolutions per minute, at which it is guaranteed to deliver 40,000 cubic feet of air per minute. The intake of the fan connects to a heating chamber containing the tempering coils. These consist of two banks of six stacks each arranged as shown on the accompanying basement plan. The upper bank of stacks is made up of 60 sections of Bundy indirect radiators of the Newport type and contains 1,200 square feet of surface. The lower bank contains an equal number of Bundy Climax type indirect radiators giving 750 square feet of heating surface. The total surface in both is 1,950 square feet, which means about .7 square foot of surface to 1 square inch of fan inlet area, or 1 square foot of surface to each 22 cubic feet of air passed in one minute.

The chamber is enclosed by an 8-inch wall and covered with heavy galvanized iron supported by wooden battens from the overhead beams, the latter being protected from the heat of the radiators to guard against fire. The stacks are supported in their elevated position on I-beams imbedded at their ends in the side walls of the chamber. The air from out-of-doors is received through three adjoining windows in the center of the rear of the bay, opening directly into the heating chamber, and passes partly over and partly down through the coils, the by-pass damper being suspended over the coils and connected by a cord over pulleys with a similar damper below the coils so that both open and close an equal amount simultaneously. The arrangement is such that the one counterbalances the other and the regulation may easily be effected through a diaphragm valve by a Johnson thermostat located in the warm air duct near the fan discharge.

The fresh air distributing duct system, the general layout of which may be seen on the basement plan, is excavated beneath the basement floor and branches to the bases of the flue risers in the walls. The ducts have concrete bottoms and brick side walls, 8 inches thick, and are covered with 3-inch stone slabs. Where the main branches become smaller than 24 inches wide, and where short, small side branches are taken off, tile pipe and fittings were used. For the supply of the auditoriums two 20x26-inch branches are taken from the main duct near the fan, each dividing again into two 20x13-inch ducts, one of which supplies the first floor auditorium and the other the second. The auditorium heating, being by indirect radiation alone, is obtained by passing the air from each of the smaller ducts through an additional heating stack consisting of 15 sections of Newport radiator and containing 300 square feet of surface. The stacks are encased in galvanized iron and suspended from the basement ceiling by wrought iron hangers and angle irons. At the point where the small ducts enter the stack casings a volume regulating damper is placed. The fresh air flues to all other rooms in the building are provided with similar dampers placed usually 8 feet from the floor of the basement.

The flues, both fresh air and vent, are of No. 22 galvanized iron, the former having a single opening placed about 8 feet from the floor, while the latter each have two openings, one near the floor and the other near the ceiling. The openings are covered in all cases with either cast iron registers or wire gratings, and have dampers which may be operated from the room. The flues and air inlets to the rooms are proportioned to replace the cubic contents once in five minutes and to discharge the air at a velocity of about 230 feet per minute. In all rooms containing less than 4,000 cubic feet but one fresh air register is used, the largest being 35 inches square; beyond that volume two registers are used. There being two vent outlets to each air inlet they are made of smaller sizes so that the velocity of discharge is about the same as that of admission.

The first floor auditorium is the larger of the two due to the greater ceiling height. Its contents is 26,100 cubic feet and the calculated amount of air supplied in one minute is 4,890 cubic feet, which changes the air very nearly once every five minutes and according to the guarantee of 30 cubic feet of air per minute per pupil, will allow the room to hold about

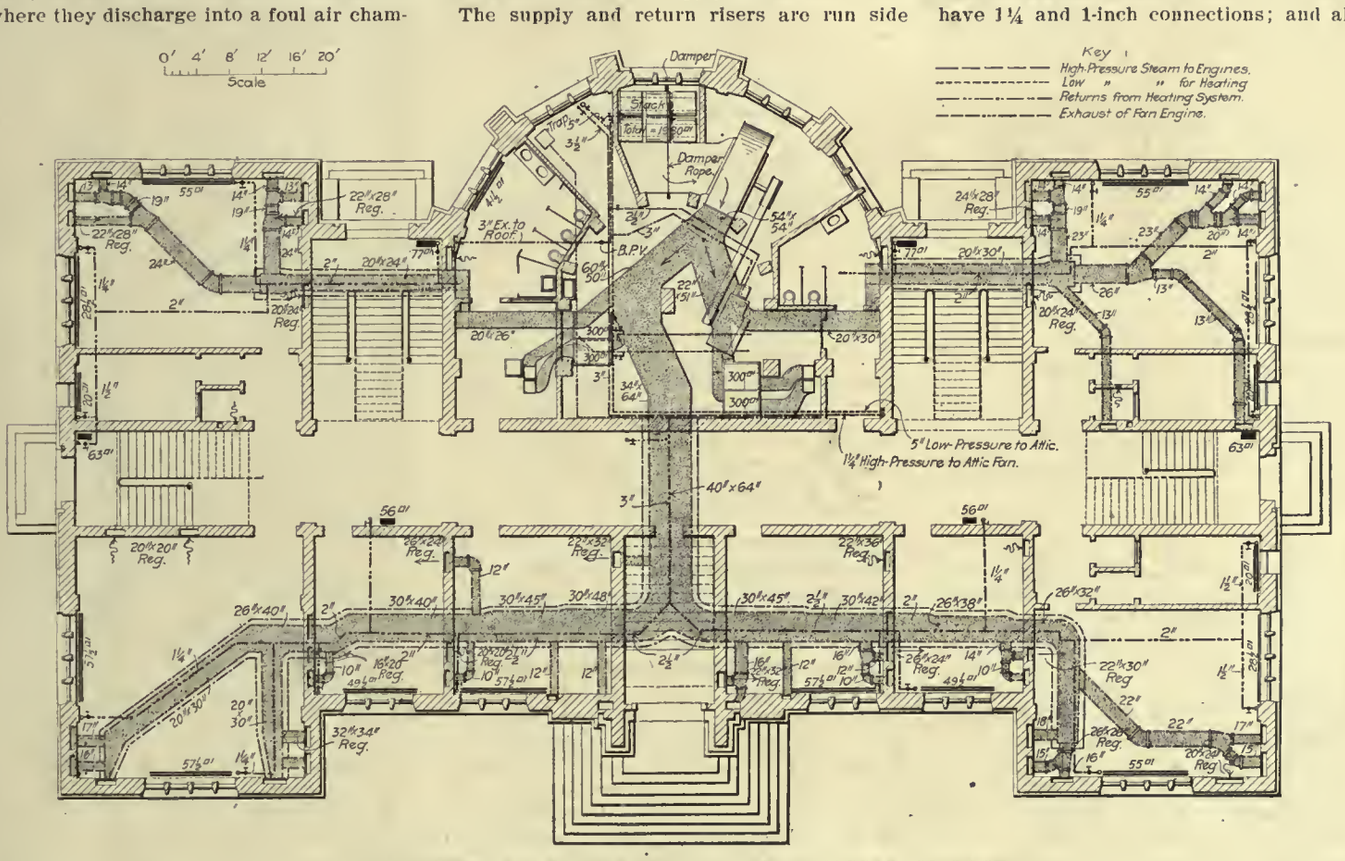
160 persons at one time. In addition to two 30x36-inch registers placed at either side of the stage, 11 feet from the floor, there are a number of smaller ones well distributed about the room in the seat rises, the flues supplying them being carried beneath the raised seat platforms. For the removal of the foul air there are four 24x30-inch registers at the back of the stage, two at the floor and two at the ceiling. The second floor auditorium is similarly arranged for its fresh air supply but has a different disposition of vent registers. Two 24x30-inch registers are placed near the floor at the sides of the stage, one 30x36 inches is placed near the ceiling at the middle of the wall behind the stage, and a 3-foot round register is located in the center of the ceiling. In a few cases very small rooms have been equipped with vents but no fresh air registers, it being assumed that they will be supplied by the overplus of nearby rooms.

The vent flues start from the floor of the room they serve and are continued up to the attic where they discharge into a foul air chamber formed by tightly enclosing the attic space. The air is exhausted from the chamber by a 5-foot Blackman disk fan, of Howard & Morse make, driven at about 275 revolutions per minute by a Solano engine having three radial 3½-inch cylinders, 120 degrees apart and acting directly on the fan shaft. The discharge of the fan is carried by a duct to an Emerson 5-foot ventilator above the roof. A silk check damper is provided in this duct to prevent the building from being chilled by an indraft of cold air when the vent fan is not running.

The steam main from the central boiler station is brought to the middle of the rear of the building and, upon entering, is divided into two systems; one 3½-inch line carries steam at boiler pressure for the supply of the engines; the other, 5 inches in diameter, contains a valve to reduce the pressure to or below 5 pounds for the supply of the stacks and radiators, this pressure having been guaranteed sufficient to heat all locations in zero weather to 70 degrees. A 3½-inch branch from the low pressure main supplies the stacks in the heating chamber, two of these being arranged with double connections so that as an alternative they may be fed by exhaust steam from the blower engine. The engine also has a free exhaust to the atmosphere, carried up on the outside of the building, with a surmounting exhaust head dripped to the nearest leader. From a point near the auditorium stacks two 2½-inch low pressure branches are led; one supplying the first floor and the other the second floor stacks and each controlled by a diaphragm valve regulated by a thermostat in the room affected. A 2½-inch branch from the high pressure main supplies the blower engine, beyond which it continues as a 1¼-inch line along the basement ceiling and parallel to the low pressure main. Both mains are carried up through a 6x8-inch chase in the wall near the center of the building to the attic, where the high pressure supplies the exhaust fan engine and the low pressure branches to the different radiator supply risers.

The supply and return risers are run side by side in chases in the walls, there being 21 sets in all which are identical except for the sizes of the branches to radiators. The supply riser starts in the attic 2 inches in size and reduces one size at each floor, being dripped at the base by a ¾-inch connection to the return riser. The latter starts as a ¾-inch pipe in the attic and increases one size at each floor, finally ending in a 1¼-inch connection to the main returns. The system of return mains, the form of which is indicated on the basement plan, is supported on plates and rollers in brick trenches beneath the floor, or where possible, within the fresh air tunnels, and discharges through a large trap or by-pass into the main return to the central station. A separate return having a float trap which discharges it into the main return line, relieves the stacks which are supplied with exhaust steam by the fan engine.

In the main hallways on the three floors and in two small rooms on the first floor, cast iron radiators are used, otherwise all direct radiation consists of 1¼-inch pipe coils, disposed below the windows where they can best counteract the cooling due to the dissipation of heat through the walls, and varying in amount of surface according to the volume of the room, the proportion of outside wall and glass surface and the direction of its exposure. The total volume of the rooms heated by the direct radiation is 199,744 cubic feet; the total surface of the coils supplying the heat is 2,201 square feet, consequently for the entire building there is an average of 1 square foot of radiating surface to 91 cubic feet of room contents. Individual rooms give different ratios; for example, one of the most protected rooms has as high as 140 cubic feet of space to 1 square foot of radiating surface, while a corner room on the third floor has but 56 cubic feet of contents to 1 square foot of radiating surface. All radiators and coils containing 50 square feet of surface or under, have a 1-inch supply and a ¾-inch return connection; those containing from 50 to 125 square feet have 1¼ and 1-inch connections; and all over 125 square feet have 1½ and 1¼-inch connections.



BASEMENT PLAN, ROCKEFELLER HALL, VASSAR COLLEGE.

The heating and ventilating equipment has been in use for some time and its performance is said to have been very satisfactory, especially in summer, as the fresh air supplied by the blower has proved sufficient to ventilate the rooms without the assistance of the exhaust fan, except in unusually sultry weather.

The building was designed by Messrs. York & Sawyer, architects, New York City, and Evans, Almirall & Company, of the same city, were the designing engineers and contractors for the heating and ventilating work.

Another Bridge across the Harlem River, New York City, will probably soon be constructed, at 207th Street, Manhattan. The Board of Aldermen has appropriated $5,000 for the necessary surveys and soundings. A lift bridge is proposed, 60 feet wide, 24 feet above mean high water, and with a clear opening of 140 feet. The estimated cost is $500,000.

Letters to the Editor.

The Two-Hinged Arch.

Sir:—In your issue of the 11th inst., in an article by Mr. A. R. McKim on the Two-Hinged Arch, this statement is made: "The elasticity of the web members affects the deflection much less than that of the chord members, and therefore the effect of the web members may be neglected." I should like to ask if this statement is based on calculations of the effect of elasticity of the web members of any arch, or on "traditions of the elders." Prof. Johnson, in "Framed Structures" seems to make it emphatic enough that the web members must be reckoned with in finding deflections in trusses. The present writer, taking as an example a two-hinged arch given by Mr. McKim in an article on this subject published in "The Engineering News," August 24, 1899, found that the effect of the web members alone was more than double that of one chord and nearly seven times that due to the other in producing horizontal deflection of one support. The resultant effect of the chords was found to be only about one-third that of the web members. Moreover, while the effect of one chord counteracted that of the other, with the exception of one member, the effect of the web members was cumulative throughout. It would seem more in place to neglect the effect of the chords than the web members, if either must be dropped to simplify the work. The method used in finding these deflections was the common deflection formula based on the same principle as that used by Mr. McKim in the articles referred to. A description of that method will be found in The Engineering Record, December 27, 1902.

The writer has further found in the case of draw-bridges that consideration of the effect of the extension of web members almost completely changed the face of the reaction diagram.

Yours truly,

Edward Godfrey.

Pittsburg, Pa., April 13, 1903.

[The above letter was referred to Mr. McKim and his reply is printed below.]

Sir:—Yours received inclosing proof of a letter from Mr. Edward Godfrey asking whether my statement that "The elasticity of the web members affects the deflection much less than that of the chord members, and therefore the effect of the web members may be neglected" was based on actual calculations of the effect of the elasticity of the web members of any arch, or on the "tradition of the elders."

That the results of the approximate formula based on this assumption vary but little from the exact formula has now been accepted some ten years by the very best authorities and borne out by the best practice, and it should not be questioned without strong proof of its inaccuracy. Graphische Statik, published in 1892 by Professor H. Mueller-Breslau, of the Technische Hochschule of Berlin, Band II., page 186, treating exactly this subject, gives the following, which I translate: "In all important cases it is permissible, in order to shorten the work (without materially affecting the result), to neglect the web members in the calculations of the horizontal reactions." I do not know of any better authority anywhere at the present time than Professor Mueller-Breslau, nor any book comparable with his Graphical Statics.

However, abundant evidence will be found in the foreign engineering magazines giving the methods of calculation of recent arches. These show that nearly all the competitive designs for the big arches at Berne, Dusseldorf, Bonn and Worms were calculated with this assumption. I give these so that any one interested in this subject can look the matter up, for I have found that some, who are supposed to make a specialty of this class of work, are not acquainted with the best scientific treatment and practice.

Most truly yours,

Alex. Rice McKim.

New York, April 18, 1903.

An Impostor.

Sir:—Within the last thirty days I have received letters from three engineers in the Northwest stating that they had been called upon by a young man who gave his name as Earle Clayton and, representing himself as being a son of mine, asked for a loan of a few dollars until he could get a remittance from home. This young man is evidently an impostor, as I have no children, and I should be glad if you would publish a notice in your paper giving this statement, so as to put the profession on guard. I know of no better way to stop this proceeding than by asking your assistance.

Yours very truly,

R. M. Clayton, City Engineer.

Atlanta, Ga., April 16, 1903.

New Books Received.

Under this heading books received from publishers will be punctually announced. Reviews may be published in subsequent issues. Publishers are requested to send retail price with each book.

The Principal Species of Wood: Their Characteristic Properties. By Charles Henry Snow, C. E., Sc. D., Dean of the School of Applied Science, New York University; M. Am. Soc. C. E., etc. New York: John Wiley & Sons. 203 pages, illustrated. Price, $3.50.

Book Notes.

A Discussion of Composition, Especially as Applied to Architecture. By John Vredenburgh Van Pelt, Professor in Charge in the College of Architecture, Cornell University. New York: The Macmillan Company. 275 pages, illustrated. Price, $2.00 net.

This book treats of the principles of art underlying architectural and other constructive and decorative designing, and embodies the substance of a course of lectures delivered at Cornell University between 1897 and 1900. The subject matter is divided and subdivided so as to present the material in a convenient and logical classification; first stating the fundamental laws, then developing the principles which should govern design in particular branches of art, and finally exemplifying the application of laws and principles to concrete, definite classes of ornaments and structures. For example, there are chapters on Sincerity, Truth, Decisiveness; Technical Laws, Balance, Unity of Character, Style, Color and Scale; Optical Effects; Style; Practical Suggestions in Design; Practical Suggestions in Planning various kinds of buildings. The work is interesting and instructive in style, and is quite as valuable for indirect suggestion as for explicit statement. It will prove helpful to several classes of readers, but, of course, especially to architects and other designers in whose works esthetic considerations have a prominent place. A perusal of the book suggests again the advisability of securing the cooperation of men who have cultivated the esthetic sense and acquired by experience familiarity with the laws of composition when engineers are charged with the design and construction of works which will be frequently or prominently in view.

Kinematics of Machines. An Elementary Text-Book. By R. J. Durley, B. Sc., Ma. E., McGill University, Montreal. New York: John Wiley & Sons. 379 pages, illustrated. Price, $4.

Although the title of the book does not indicate that it deals with more than the geometry of the motions of mechanism, it contains much that usually appears under the head of Mechanics of Machinery. There is also much space devoted to descriptions of mechanism rather than their kinematic study. The kinematic classification of mechanism receives considerable discussion although it is practically never considered by the modern designer of machines. The presentation is more after the style followed in a lecture than the concise method that has been almost generally adopted by American writers of technical books. For this reason it is easier to read, but not so convenient for reference. On the whole the book contains many good things. They are presented more from the point of view of the mathematician than that of the designer. Their value would be greatly enhanced by increasing the consideration of practical conditions, and this, it is hoped, the author will do in future additions.

A Solar Engine.

Of all the chimerical schemes that have been launched within recent years one of the most amusing to engineers is the solar furnace for running a steam engine by the heat of the sun. A company is inviting subscriptions to 3,000,000 shares of stock. Although the par value of the stock is one dollar per share, a few thousand are offered to the general public at five cents per share with a bonus in the form of a guarantee to stockholders that they will be given work on the construction of a factory, that will be required to meet the enormous demand for the solar engine, at from $1.75 to $6 per day, depending upon the class of work the stockholder is capable of and willing to do.

An illustration of the solar engine, given in the prospectus, shows that steam is to be generated by reflecting and conveying the rays of the sun by means of a curved mirror upon a boiler that looks much like an electric search light. The mirror is moved in the arc of a circle by clock work, the boiler being located at the center of the arc, in order that the movement of the sun be provided for. The boiler is shown connected to a Corliss engine of such a size that the amount of heating surface in the boiler seems to be about the same in extent as the cross sectional area of the engine cylinder. However, two square yards of sunlight, it is said, will generate sufficient steam for one horse power. How great the intensity of heat obtained is and the possibilities of the solar furnace are touched upon in the following extract from the prospectus: "The possibilities of the Solar Furnace are practically unlimited. It is impossible in a small circular to tell but a small fraction of the many things that it can be used for. Stop and try to realize what it means to be able, without fire or fuel, to produce a heat so intense that it is hundreds of times greater than has ever before been developed by the greatest scientific men in their most powerful furnaces, to smelt any and all kinds of ores and minerals right at the mines without expense of shipping, often many hundreds of miles to smelter, to pump water to irrigate millions of acres of land that is now worthless, but with proper irrigation would make homes for thousands of people, to run dynamos and generate electricity to run street cars, light towns and cities, heat and light houses, cook any and all kinds

of food, have hot water always ready day or night, and thousands of other purposes that it can be used for without fire, fuel, smoke or dirt, using only clean, pure sunshine that costs absolutely nothing."

Oil Treatment for Leaks in Concrete.

From the Report of the Chief of Engineers, U. S. Army, 1902.

In the fortification work at Fort Caswell, North Carolina, it has been found almost impossible, with the unstable subsoil, to prevent unequal settlement and consequent cracking of the concrete. Various schemes have been tried to stop the leaking produced by these cracks (waterproofing not having been used in the concrete walls), but to Assistant Engineer S. F. Burbank, in local charge, is due the credit of a device which has resulted in an apparently complete solution of this difficulty. It was noticed that water falling on the concrete surfaces near the guns, which had been coated with the oil used on the guns, was not absorbed. This led to a coating of the entire concrete mass with boiled linseed oil. Where large cracks occur, they are filled with cement grout, and the linseed oil is poured in as long as it is absorbed. There is formed in the crack a gum from the oil which ultimately fills it to the top, after which the entire surface is coated with successive applications of the oil until it ceases to be absorbed.

Previous to the trial of this method the two 12-inch emplacements were notably leaky, and for the purpose of experiment the worst of the two was selected and treated as above outlined, with the result that it was made perfectly water-tight. Since then all of the emplacements of the post have been treated similarly, and may now be considered water-tight.

It is probable that it will be necessary to give a coating of oil, at least near cracks, when the concrete expands and contracts in the spring and autumn, but this will be comparatively inexpensive and take very little time. A gratifying result of this oil treatment is the prevention of the glare from the concrete surfaces, which heretofore has been particularly objectionable. The resulting color is a brown, which is restful to the eye and blends with the color of the surrounding sand hills, making the emplacements very difficult of detection from a distance.

Lowering a Tall Flagstaff.

Lowering a 200-foot flagstaff at the grounds occupied by the Chicago Exposition of 1893, was very simply and ingeniously accomplished by Mr. E. F. Terry without the use of any large derricks, gin poles or complicated apparatus. The pole had a total height of about 175 feet above the surface and extended 20 feet below the ground in a mass of concrete and riprap. It was made of two timbers, the lower one about thirty and the upper one about 22 inches in diameter. The upper one was seated on a step clamped to one side of the lower piece a few feet from its top and was secured by two heavy iron bands around both pieces. A narrow trench was excavated in the surface of the ground on a line in which the pole was to be felled. It was commenced close to the flag pole and carried down nearly to its lower end and as fast as it was opened the pole inclined towards it so as always to be supported for a minimum of 20 feet on the sloping face of the trench. The concrete, riprap and earth was carefully picked out from under the bearing on the side of the pole, thus lowering it very gradually and increasing the length of contact and diminishing the angle of the slope as the top of the pole gradually revolved downward and the bottom tended to rise in the opposite direction, but was held by the weight of earth and riprap above it.

The pressure at the foot of the pole gradually increased with the surface of contact and the movement was slow and regular with no signs of tearing out the foundations. When the pole had revolved a considerable distance and the trench had been opened a long ways from its base, its angle with the horizontal became so small that the splice between the upper and lower timbers could be supported on a trestle bent from the surface of the ground. This was done and the upper end of the pole was removed for fear that the increasing flexure might break the splice between the timbers. Afterwards the remainder of the pole was lowered flat on the ground and the work completed without difficulty or accident. The work was done by ten men in four days.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

Personal Notes.

Mr. D. H. Sawyer has been elected city engineer of Paris, Ill.

Mr. J. W. Crook has been elected city engineer of Paris, Tex.

Mr. Elmer H. Beard has been elected city engineer of Reading, Pa.

Mr. J. Ross Robertson has been reelected city engineer of Keokuk, Ia.

Mr. Fred Giddings has been reappointed city engineer of Atchison, Kan.

Mr. Emmett C. McAnelly has been elected city engineer of Fort Collins, Col.

Mr. Norman A. Taylor has been appointed assistant city engineer of Troy, N. Y.

Mr. Martin Hayme has been elected to the new office of street commissioner of Kaufman, Tex.

Mr. James F. Fisher has been reelected for a term of three years as city engineer of Williamsport, Pa.

Mr. R. Winthrop Pratt, of Boston, will succeed the late Mr. B. H. Flynn as engineer of the Ohio state board of health.

On April 18 the St. Louis Engineers' Club visited the World's Fair site as guests of Mr. Richard H. Phillips, chief engineer.

Mr. Cornelius J. Horrigan, of Wilmington, Del., has received the appointment of state highway commissioner, of Delaware.

Mr. Rudolph Hering, of New York City, has been retained as consulting sanitary engineer for the extensive sewerage work proposed for York, Pa.

Mr. Michael F. Buckley has been reappointed superintendent, and Mr. John Carpenter, engineer on the board of water commissioners of Rochester, N. Y.

Mr. Charles H. Smith, of Middletown, N. Y., has been named as engineer of Orange County and will have charge of the road improvements now in progress.

The announcement has been made of the retirement of Brig. Gen. Jared A. Smith, Corps of Engineers, U. S. A., at his own request, having served more than forty years.

Messrs. Maxcy & Anderson, Houston, Tex., will act as consulting engineers for the San Antonio Irrigation Co. in designing a system of sewage disposal for San Antonio, Tex.

Mr. Hector James Hughes has received an appointment at Harvard University as assistant professor of hydraulics and sanitary engineering, in the Lawrence Scientific School.

Mr. R. H. H. Stanger, 2 Broadway, Westminster, London, S. W., Eng., has succeeded to the practice of his father, the late W. H. Stanger, as an inspecting, testing and consulting engineer.

Mr. Alexander Potter, Assoc. M. Am. Soc. C. E., will remove his offices for the practice of consulting civil engineering, on May 1, to the Central Railroad Building, 143 Liberty St., New York City.

Mr. John I. Riegel has resigned as division engineer of the Delaware, Lackawanna & Western Railroad, and will act as consulting engineer for the Dunning Engineering Co., Mears Building, Scranton, Pa.

Professor E. B. Kay, of Cornell University, has been engaged by the commissioners of Greene, N. Y., to prepare plans and superintend the installation of a combined water-works and electric light plant for that village.

At a meeting of the mechanical section of the Engineers' Society of Western Pennsylvania, at Pittsburg, April 14, Mr. T. F. Webster, of the Link-Belt Engineering Co., of New York, read a paper on "Coal Handling Machinery."

Mr. W. B. Smith Whaley, president of a number of large cotton mills in South Carolina, delivered a lecture before the engineering students of Cornell University, April 17, on "The Mechanical Applications of Electricity in Mills."

Mr. Charles C. Schneider, vice-president Am. Soc. C. E., has resigned as vice-president in charge of engineering work of the American Bridge Co., but, at the request of the management, will remain in the service of the company in a consulting capacity.

Mr. A. A. Knudson, at a convention of the American Electro-Chemical Society in New York City last week, read a paper on "Corrosion of Metals by Electrolysis," pertaining principally to the effects of stray trolley currents in Manhattan and Brooklyn.

Mr. Carl Link has resigned as assistant supervising architect of the new state house in Jackson, Miss., to act as supervisor during the construction of a large building in Philadelphia,

designed by his father, Mr. Theodore Link, and will be succeeded by Mr. Schmidt, of St. Louis.

Mr. J. W. Holman, recently of "The Engineering and Mining Journal," and Mr. G. W. Scott, recently of the "Mining and Scientific Press," have purchased the "Western Mining World" of Chicago, and after May 1 it will be known as the "Mining World."

The following water commissioners have been appointed in Colorado: District No. 1, Mr. Charles I. Colwell, of Snyder; No. 2, Mr. C. M. Jump, Platteville; No. 3, Mr. J. L. Armstrong, Fort Collins; No. 4, Mr. J. R. Anderson, Loveland; No. 5, Mr. A. L. Gibson, Longmont; No. 6, Mr. Moses Hoover, Boulder.

Mr. Elmer L. Corthell, M. Am. Soc. C. E., delivered an address, April 14, before the American Geographical Society at Mendelssohn Hall, New York, on "Argentina," where he has recently acted as consulting engineer to the ministry of public works. On April 28 at the American Museum of Natural History, New York, he will give the first of a series of lectures on the Argentine Republic, provided in a free course by the board of education.

The following orders for officers of the Corps of Engineers, U. S. A., have been reported: Lieut. Col. Charles W. Raymond to New York City; Maj. C. McD. Townsend to assume command of the Third Battalion of Engineers upon the arrival in the Philippines of Companies L and M, of which Captains Harry Taylor and H. M. Chittenden, respectively, will assume command; Maj. Edward Burr to assume command of the Second Battalion upon the arrival of Companies E and F at Washington Barracks; Capt. J. B. Cavanaugh to Montgomery, Ala.; Capt. R. R. Raymond and First Lieut. E. R. Stewart to Fort Leavenworth, Kan.; First Lieutenants W. D. Connor, H. B. Ferguson and J. A. Woodruff to West Point; First Lieutenants E. I. Brown, G. B. Pillsbury, C. W. Otwell and A. E. Waldron to Washington Barracks; First Lieutenants F. C. Boggs to the Philippines, William Kelly to New London, T. H. Jackson to the Philippines, J. R. Slattery to New York City, A. B. Putnam to Pittsburg, and F. A. Pope to San Francisco; Second Lieutenants G. R. Spalding and E. J. Dent to Washington Barracks, and W. L. Guthrie and J. F. Bell to the Philippines.

The following are among the recent railroad changes: Mr. James M. Gruber, formerly assistant general superintendent of the eastern district of the Great Northern Railway, succeeds Mr. H. S. Cable as general superintendent of the western district of the Chicago, Rock Island & Pacific Railway, with headquarters at Topeka, Kan. Mr. Cable will become general superintendent of the northern district of the same system with headquarters at Cedar Rapids, Ia., where he succeeds Mr. Robert Williams, resigned. Mr. E. L. Brown, general superintendent of the Montana Central Railway, will succeed Mr. Gruber. Mr. J. C. Patterson has been appointed principal assistant engineer of the Great Northern Railway with headquarters at St. Paul, and will be succeeded as resident engineer by Mr. W. P. Whitten. Mr. B. Haskell, superintendent of motive power of the Pere Marquette Railroad, has resigned. Mr. F. K. Zook has been promoted to be general superintendent and chief engineer of the California Northwestern Railway. Mr. E. E. Nichols has been appointed assistant superintendent of the Wisconsin division of the Chicago, St. Paul, Minneapolis & Omaha Railway, succeeding Mr. William Bennett. Mr. G. B. Owen, formerly with the Baltimore & Ohio Railroad as engineer of maintenance of way, has been appointed assistant to the vice-president and general manager of the Erie Railroad. Mr. Charles W. Galloway has been promoted to be superintendent of the Baltimore division of the Baltimore & Ohio Railroad. On the Northern Pacific Railway Mr. M. C. Kimberley has been promoted to be assistant general manager; Mr. F. W. Gilbert to be general superintendent; Mr. Newman E. Kline to be assistant general superintendent of the eastern district; Mr. E. J. Pearson, assistant general superintendent of the middle district; and Mr. W. C. Albee, superintendent of the Pacific division.

Obituary Notes.

Mr. William H. Barnes, who was city engineer of Topeka, Kan., from 1895 to 1900, died April 15, at his home at Easthampton, L. I., New York.

Mr. David Russell, general superintendent of the Brooks Locomotive Works at Dunkirk, N. Y., for thirty years prior to last May, died of paralysis April 14, at Fredonia, N. Y.

Mr. William B. Swan, for many years an assistant engineer in the New York City park department, died April 14, at his home in that city. He was appointed to that department in 1859 and at the time of his death was one of the oldest employes of that branch of the city government.

Captain J. E. Townsend, a well known architect and builder, died April 17 at Lake Forest, Ill., aged sixty years. Prior to the World's Fair, he, in association with Henry Ives Cobb, planned and erected several of the exposition structures, and many large buildings in Chicago were also designed by him.

Mr. John P. McGuire, M. Am. Soc. M. E. and general superintendent of the Variety Iron Works, Cleveland, O., died April 14, in Florence, Col., where he was sojourning for his health. He was born in Buffalo, N. Y., in 1856 and in early manhood entered the employ of the company with which he was still connected at the time of his death.

Colonel William R. Arthur, formerly president of the Illinois Central Railroad, died April 20 on his farm, near Urbana, Ill., at the age of eighty-two. He was an engineer of ability and occupied, at different times in his life, positions of considerable responsibility. Besides the one mentioned, which he held from 1858 to 1865, he was general manager of the St. Louis, Iron Mountain & Southern Railroad, from 1869 to 1873. After that time he became commissioner for all railroads south of the Ohio River with headquarters at St. Louis.

Mr. Edward Ludlow Gould, a civil engineer in the employ of the commissioners for securing an increased water supply for New York City, died at Yonkers, N. Y., April 16, from heart failure resulting from an attack of pneumonia. He was born in Yonkers in 1870, was a graduate of Columbia University, and has successively filled the positions of assistant to the chief engineer of the Union Bridge Co., assistant engineer in the Yonkers department of public works, assistant in the U. S. Engineer's office at Santiago, Cuba, and the position as previously mentioned, which he occupied at the time of his death.

Notes.

Trees Were Planted to the number of 2,600 in the District of Columbia during the year ending June 30, 1902, according to the annual report of Mr. Trueman Lanham, superintendent of parking. The varieties were elms, ginkgoes, lindens, Norway, silver and sugar maples, and pin and willow leaf oaks, the average total expenditure being $3 per tree on the street, boxed, staked, and strapped.

In Laying Out Residential Streets in Winchester, Mass., Mr. E. D. Fletcher, the town engineer, recommends that hereafter not over 17 feet be taken for the roadway of 40-foot streets, 11 feet for planting spaces, and 12 feet for the sidewalks. These streets have heretofore been laid out with not over 16 feet for sidewalks and borders, leaving 24 feet for roadway and gutters, in which weeds, grass, and dirt collect and have to be removed, at considerable expense to the town.

The Earth Dam of the Bonney irrigation reservoir, about 15 miles above Delta, Col., failed about 2 a. m. April 11, cause not reported. The area of the reservoir is said to be about 300 acres. The breach in the dam is over 100 feet long, and at this place the depth of water was 34 feet. A half-mile of Denver & Rio Grande Railway track, including a bridge, and a highway bridge were washed out, many cattle were drowned and much damage was done to farms in the Uncompahgre River valley. The dam was built about two years ago.

Liquid Air is delivered in Berlin two liters (0.528 gallon) at a time for about 35 cents. In a recent issue of "Energie" of that city it is stated that the receptacles are made of glass with double walls, the space between the walls being filled with an insulating material, the walls being silvered to prevent radiation of heat and the whole enveloped in an insulating material. They retain their temperature for 14 days. Several drops in a glass of water produce freezing, and it is intended for such uses as refreshing drinks and improving the condition of the air in sick rooms.

Highway Improvement Bonds to the amount of $50,000,000 were advocated at the fourth annual good roads convention of the boards of supervisors of the State of New York, held at Albany January 20 and 21. It was recommended that this amount be apportioned in the usual way in that state, 50, 35 and 15 per cent. to the state, counties, and towns, respectively. It was proposed to issue these bonds in sums not to exceed $5,000,000 in any one year, and that they should bear interest not to exceed 3 per cent. A resolution was also unanimously carried requesting the Governor and the Legislature to make an appropriation of $2,000,000 for 1903, as the state's share in the road improvement, the counties and towns having already appropriated $2,007,812 as their share.

The Cottancin System of steel cored brick and steel cored concrete is being extensively used in England and Europe for caissons for foundations of buildings and for large gas holder tanks and other structures, according to "The Journal of Gas Lighting," London. Soft steel wire is woven into both the brick and concrete so as to give continuous reinforcement. The walls and columns are built of brick, the former with inside and outside horizontal ribs, and the roofs are concrete arches. The caissons appear from the illustrations to be shallow concrete intersecting walls built in trenches in the soft ground and connected by a continuous monolithic concrete platform on their upper edges. The Paris Gas Company's tank at Alfortville was 95 feet in diameter and 23 feet deep inside, with a capacity of 2,200,000 gallons. The 11-foot masonry walls split their whole height, and as it had proved impossible to repair similar cracks in other walls, the tank was emptied and lined with a 2-inch coating of Cottancin steel cored cement which has proved entirely successful and makes the tank watertight.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 425, 29, 31, 32 and 34.

WATER.

Oakland, Cal.—The San Pablo & Oakland Arteslan Water Co. has been incorporated by W. B. Hellings, A. W. Craig, of San Francisco, and J. R. Little, of Berkeley, with a capital of $200,000, to bore wells and supply water in Oakland.

Colorado Springs, Colo.—Bids will be received May 4 by K. M. MacMillan, City Clk., for $409,000 water bonds.

Hartford, Conn.—The Bd. of Water Comrs. have voted to build a plant for the filtration of Connecticut River water, as a means of adding to the water supply of city.

Washington, D. C.—Bids will be received at office of Washington Aqueduct, May 22, for Venturi meters, sluice gates, pumping engines, etc., as advertised in The Engineering Record.

Hawkinsville, Ga.—T. J. Holder, City Clk., writes that it was voted Apr. 16 to issue $40,000 bonds for water works and a sewerage system.

Evanston, Ill.—M. Foley, of Evanston, has secured the contract for laying a system of water mains in 4 streets (bids opened Apr. 16) for $3,195.

Moline, Ill.—The City Council has adopted the plan recommended by Engr. Daniel W. Mead for the low lift pumping plant, and recommended that the Mayor and City Clk. be authorized to procure the license necessary to operate this plant, and to purchase the machinery recommended. Chas. G. Carlson, City Clk.

Elgin, Ill.—Bracy, Howard & Co., of Chicago, are stated to have secured the contract for the completion of the shaft and tunnel system at the pumping station.

Chicago, Ill.—Local press reports state that the 3 pumps which have supplied water from the station at Chicago Ave. and Lincoln Park Boule. are to be replaced, in a short time, with 3 triple expansion pumps, each with a capacity of 25,000,000 gals. a day.

Bloomfield, Ind.—E. H. Dugger & Co. have secured a franchise to construct water works here.

Loogootee, Ind.—See "Power Plants, Gas and Electricity."

Parnell, Ia.—The citizens are reported to have voted to construct water works.

Sioux City, Ia.—The Bd. of Trus. of City Water Works will extend plant, at a cost of $250,000. J. M. Lewis, City Engr.

Cedar Rapids, Ia.—The City Council is stated to have voted to purchase the plant of the Cedar Rapids Water Co. for $473,000. The citizens will vote on the approval of contract May 19.

Crowley, La.—See "Power Plants, Gas and Electricity."

Dexter, Me.—Bids will be received by the Water Comrs. until May 7 for laying about 6 miles of 6 to 12-in. pipe, and setting special castings, valves, hydrants, etc. Arthur P. Abbott, Chmn.

Williamsburg, Mass.—The citizens are stated to have voted on Apr. 14 to issue bonds to construct water works according to plans of committee. Henry W. Hill, Clk.

Falmouth, Mass.—Bruno & Milano, of Boston, have secured the contract for laying c. i. pipe at Falmouth, for $7,733.

Palmer, Mass.—The estimated cost of a system for fire protection at Palmer is reported to be $9,300.

Concord, Mass.—Walter A. Carr, Town Clk., writes that it is proposed to extend the water system. Engineer, W. D. Hubbard.

Onaway, Mich.—A bill is reported to have been signed authorizing the issue of $40,000 bonds for water works.

Minneapolis, Minn.—The House is stated to have passed a bill providing for the issue of $100,000 water bonds.

South Stillwater, Minn.—See "Power Plants, Gas and Electricity."

Redlake Falls, Minn.—The citizens are reported to have voted to grant a franchise for water works to the company making the best offer.

Kansas City, Mo.—Local press reports state that the Bd. of Pub. Wks. on Apr. 18 again rejected the bids received Apr. 15 for the pipe line from Quindaro Station to Kaw Point, and new bids will be received Apr. 30. Baxter Brown, Secy.

Gardiner, Mont.—See "Power Plants, Gas and Electricity."

Enfield, N. H.—The contract for laying about 5 miles of 4 to 12-in. pipe and setting about 35 hydrants, valves, etc., bids for which were received by Water Comrs. Apr. 17, is stated to have been awarded the Eglee-Bunting Co., Boston, Mass., for $6,509. E. B. Huss, Chmn. Bd.

Williamstown, N. J.—The Township Com. is stated to have granted permission to the Monroe Water Co. to lay mains in the Township.

Greenport, L. I., N. Y.—See "Power Plants, Gas and Electricity."

Buffalo, N. Y.—Mayor Knight has signed bills recently passed by Legislature authorizing Council to issue $500,000 bonds for the construction of new water works and $100,000 bonds for the enlargement of Grosvenor Library.

Syracuse, N. Y.—W. H. Jones, Clk. Bd. Contract & Supply, writes that the contract for furnishing and delivering 204 tons 6 to 24-in. c. i. pipe (bids opened Apr. 20) has been awarded to Donaldson Iron Co., of Emans, Pa., for $6,034.

Scarsdale, N. Y.—J. W. Ledoux, 112 N. Broad St., Philadelphia, Pa., writes that plans and specifications are not yet completed for proposed reservoir for Scarsdale.

New York, N. Y.—Bids will be received May 5 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing and delivering c. i. water pipes, branch pipes and special castings, double and single nozzle "New York" case hydrants, cocks, curb cocks, soldering nipples and hydrant nozzles, waste cocks and bridge for Boros. Manhattan and Bronx.

Greene, N. Y.—Bids will be received by the Village Bd. of Trus. until Apr. 29 for furnishing approximately 20,190 ft. of 4-in., 14,636 ft. of 6-in., and 7,705 ft. of 8-in. cast iron water pipe, and 6 tons of special castings. Meta L. Cowles, Clk. of Bd.; Edgar B. Kay, Engr., Ithaca, N. Y.

Winston-Salem, N. C.—The City Engr. is reported to have been instructed to make necessary surveys for securing an additional supply from Frazier Creek; probable cost of work, $18,625.

Vermillion, O.—The citizens are stated to have voted Apr. 6 to issue $35,000 bonds for water works.

Sandusky, O.—Henry Debmel, Jr., Secy. Bd. Water Wks., writes that the contract for furnishing 2,900 ft. 6 and 8-in. c. i. pipe (bids opened Apr. 20) has been awarded to J. B. Clow & Sons, of Chicago, Ill., at $30.95 per ton, standard weight.

Columbus, O.—Bids will be received Apr. 28 by John A. Connor, Clk. Bd. of Pub. Wks., for furnishing 13,000 ft ¾, 1, 1½ and 2-in. galvanized iron pipe, for the Water Dept.

Cleveland, O.—According to local press reports, City Engr. Carter states that a filtration system suitable to the needs of the city would cost about $5,000,000.

Wellsville, O.—The Water Works Trus. are reported to be preparing for the establishment of new water works for Wellsville.

Alva, Okla. Ter.—The proposition to issue $35,000 water bonds is reported to have carried at the election Apr. 7.

Union, Ore.—The City Council is stated to have decided to extend the water mains about 5,000 ft.

Dallas, Ore.—The citizens are stated to have voted Apr. 17 to put in a water plant under contract with H. B. Gates. Mr. Gates will at once make arrangements to put in a gravity system, to be completed this summer.

Corvallis, Ore.—Bids are wanted May 10 for a system of water works. Address E. P. Greffoz, Police Judge.

Adams, Ore.—Bids will be received by J. T. Lieualien, Chmn. Water Com., for $5,000 water bonds.

Steelton, Pa.—According to the estimate by Comrs. Mason and Pratt, water pipe can be laid to the new annex of Steelton for $12,453.

Allentown, Pa.—Jacob S. Reninger, Secy. Water Comrs., writes that the contract for a 10,000,000 gal. pumping engine, including foundation and all fittings, bids for which were received on Mar. 24, was awarded on Apr. 16 to the Holly Pump Co., of Lockport, N. Y., for $34,500.

Providence, R. I.—Local press reports state that the Dept. of Pub. Wks. is preparing estimates for constructing a pumping station, which will probably be placed in Pettaconset Station next year.

Harriman, Tenn.—F. J. Mauley, City Engr., writes that it is proposed to expend $10,000 for some pipe and a reservoir.

Clarksville, Tenn.—The Senate has passed the bill authorizing Clarksville to issue $28,000 water works bonds.

Pulaski, Tenn.—It is stated that the Pulaski Water Co. will extend its mains and build a new filter, at a cost of about $20,000.

Blooming Grove, Tex.—The citizens are reported to have voted on Apr. 7 to issue water works and school bonds.

Terrill, Tex.—The Council is reported to have decided to construct water works.

Richfield, Utah.—J. F. Meagher, of Salt Lake, representing the Utah branch office of the Crane Co., of Chicago, Ill., is stated to have secured the contract to supply the city with piping for the water works; the contract calls for 80,000 ft. of converse joint pipe and fitting.

Richmond, Va.—Bids are wanted May 15 for constructing a steel substructure and steel tank, substructure to be 120 ft. between base plate and tank; tank to be 30 ft. diameter and 30 ft. high, with metal hood; bids to include furnishing and erecting 16-in. c. i. flanged pipe and 8-in. waste pipe; entire cost not to exceed $12,000. Chas. E. Boiling, Supt. City Water Wks.

Walla Walla, Wash.—It is proposed to construct a reservoir of 30,000 gals. capacity. The question of issuing $100,000 water bonds is reported to have been postponed indefinitely.

Chehalis, Wash.—The Chehalis Water Co. is reported to be about to commence surveying for a new water supply.

Seattle, Wash.—The City Council is stated to have passed an ordinance providing for the laying of a water main on Rainier Ave., at a cost of $48,574.

Cle Elum, Wash.—G. P. Short, City Clk., writes that the citizens have voted to issue $10,000 bonds for constructing a gravity system of water works.

Martinsburg, W. Va.—Bids will be received by the Water Bd. until May 21 for constructing a pumping plant and improving the water supply. Wm. R. Kline, Chmn.

Tacoma, Wash.—The Risdon Iron Wks., of San Francisco, Cal., is stated to have secured the contract for 4,000,000 lbs. of steel pipe for the water works of the Pierce County Improv. Co. at Tacoma.

Bids will be received about May 20 for 1,400 6-in., 2,700 8-in. and 300 ft. 12-in. wood pipe for water mains, with specials and gate valves. N. L. Taylor, City Engr.

The Washington Pipe & Foundry Co. has secured the contract for wooden water mains as follows: 6,000 ft. 18-in. 90 lbs. pressure, $1.40 per ft.; 1,800 ft. 18-in., 130 lbs. pressure, $1.60, and 1,600 ft. 12-in., 130 lbs. pressure, 75 cts.—all delivered f. o. b. Tacoma, not laid.

Fairmont, W. Va.—The City Council is reported to have awarded the contract for the new reservoir and filter to Eldridge & Bartlett for $25,000.

Marinette, Wis.—A. B. Gifford, City Clk., writes that it was voted Apr. 7 to purchase the water works.

Juneau, Wis.—The citizens are stated to have voted Apr. 7 to issue $3,500 bonds for an extension to water works.

St. Boniface, Man.—See "Power Plants, Gas and Electricity."

Puebla, Mexico.—A concession for water works and a sewerage system has been granted to an American syndicate, represented by Stephen D. Sheppard, of New York, N. Y.

Regina, N. W. Ter.—See "Power Plants, Gas and Electricity."

Gananoque, Ont.—S. McCammon, Town Clk., writes that Willis Chipman has prepared plans for water works, to cost about $250,000. By-laws will be submitted to ratepayers.

St. Marys, Ont.—L. Harstone, Town Clk., writes that it was voted Apr. 17 to expend $26,000 for water and street improvements.

SEWERAGE AND SEWAGE DISPOSAL.

Los Angeles, Col.—Local press reports state that the City Clk. has been directed to secure bids to supply the city with 20,000,000 bricks and about 40,000 bbls. of cement, for the construction of the outfall sewer and the storm drains.

Manitou, Colo.—Chas. A. Grant, Recorder, writes that about $16,000 will be expended for proposed sewerage work, to be done by days' work. Engineer, E. A. Sawyer, of Colorado Springs.

Denver, Colo.—The Bd. of Pub. Wks. is stated to have passed a resolution recommending the City and County Council to pass a bill authorizing the construction of sub-districts 10 and 11 of Capitol hill storm sewer district No. 1.

New London, Conn.—Bids are wanted by Bd. Sewer Comrs. until May 7 for constructing a submerged 18-in. wooden outfall sewer. W. H. Richards, Engr., 181 State St.

Bridgeport, Conn.—The Pierce Mfg. Co., 89 Wall St., is stated to have secured the contract for constructing sewers in Thompson St. and Wheeler Ave., for $12,443.

New Haven, Conn.—Bids are wanted Apr. 27 for constructing a storm water overflow sewer in portions of Water St. C. W. Kelly, City Engr.

Washington, D. C.—Bids are wanted June 6 for the construction of Sections B and C of the B St. and New Jersey Ave. trunk sewer, as advertised in The Engineering Record.

Hawkinsville, Ga.—See "Water."

Lewiston, Idaho.—The following bids are reported to have been received on Apr. 9 for the Normal Hill sewer: Naylor & Norlin, Lewiston, $37,230 (awarded contract); L. H. Wilkerson & Co., Weiser, $38,495; Jas. C. Broad, Spokane, Wash., $37,800; Peter Costello, Spokane, Wash., $38,000; Chas. Hahn, Lewiston, $39,000, and W. H. Fife, Colfax, Wash., $41,000.

Rockford, Ill.—An ordinance is under consideration by City Council providing for the construction of a sewer on N. Main St. Edwin Main, City Engr.

Consulting Engr. D. W. Mead, of Chicago, is stated to have approved the plans of City Engr. Edwin Main, for the Kent Creek Sewer Dist., estimated to cost $54,000.

Urbana, Ill.—According to press reports the Improv. Bd. at Urbana has called for bids for the construction of a sanitary sewer, which will require 7,362 ft. of 18-in. sewer pipe and 1,700 ft. of 10-in.

Belleville, Ill.—Bids are wanted May 5 for constructing 4,600 ft. of brick sewer in W. Main St., estimated cost, $15,000. G. H. Belnecke, Secy. Bd. Local Improv.

Terre Haute, Ind.—The Bd. of Pub. Wks. is stated to have instructed the City Engr. to prepare plans for two pipe sewers, one in the vicinity of 19th and Warren Sts., the other on 8th St.

Indianapolis, Ind.—City Engr. Jas. Nelson has been asked to report to Bd. of Pub. Wks. on petition for a sewerage system for Indianapolis, west of White River.

The Bd. of Wks. has adopted the plans of City Engr. Nelson for the Irvington sanitary sewer system, to cost about $100,000.

Davenport, Ia.—J. W. B. McGee, City Clk., writes that the question of constructing a septic tank system of sewage disposal for North Davenport is being discussed; probable cost of work, $15,000. Thos. Murray, City Engr.

Coon Rapids, Ia.—Mayor Cooney is stated to have recommended to Council the construction of a sewerage system.

Clinton, Ia.—Chas. P. Chase is stated to have completed plans for a sewerage system.

New Orleans, La.—Acting Ch. Engr. Kirkland has submitted to the Sewerage & Water Bd. recommendations for the improvement of the drainage of the second section of the drainage system lying between Broad St., Carrollton Ave., and the New and Old Navigation Canals. The work proposed will cost about $277,000.

Quincy, Mass.—About $45,000 will be expended for improvements to the sewerage system. E. W. Branch, of Quincy, Engr. in Charge. Hamilton Flood, City Engr.

St. Paul, Minn.—See "Bridges."

St. Paul, Minn.—The Bd. of Pub. Wks. has decided to report favorably on the South Wabasha St. sewer system, which will cost about $19,207.

St. Paul, Minn.—Bids will be received Apr. 27 by the Bd. of Pub. Wks. for constructing a sewer in portion of Aurora Ave. A. L. Gorman, Clk.

Blackduck, Minn.—The question of constructing a sewerage system, to cost $7,000, is reported under consideration.

Red Lodge, Mont.—The Council is reported to be taking steps to construct a sewerage system.

Newark, N. J.—Bids will be received May 15 by W. L. Glorieux, Chmn. Com., 124 Market St., for constructing Section 5 of the joint outlet sewer for Newark, Irvington, South Orange, Summit, West Orange, Millburn, and Vailsburgh. Alex. Potter, Ch. Engr., 140 Nassau St., N. Y. City.

South Orange, N. J.—M. A. Fitzsimmons, Village Clk., writes that the contract for laying sewer pipes, connecting houses with local system, bids for which were received on Apr. 20, has been awarded to Ludwig Batt, South Orange, for $5,630, total length 16,000 ft.

Collingswood, N. J.—Boro. Council is stated to have decided to issue $120,000 bonds, to pay for street improvements and surface drainage.

East Syracuse, N. Y.—The Governor has signed the bill authorizing East Syracuse to expend $55,000 for sewer improvements.

Skoneateles, N. Y.—The estimated cost of a sewerage system for this village is reported to be $48,000.

Elmira, N. Y.—The Bd. of Pub. Wks. is stated to have decided to construct a new sewer on Main St. The City Engr. is also reported to be preparing plans for a system of sewerage in the vicinity of La France shops.

Whitesboro, N. Y.—The Senate has ordered to a third reading the bill authorizing Whitesboro to expend $5,000 in completing its sewerage system.

Baldwinsville, N. Y.—A press report states that a $50,000 sewer system is to be built in Baldwinsville. W. S. Farrington, of Syracuse, will prepare the plans.

Poughkeepsie, N. Y.—Local press reports state that bids will be received May 5 by Geo. E. Fowler, Supt. Water Wks., for constructing sewers in portions of 7 streets.

Ithaca, N. Y.—The Sewer Comn. is stated to have instructed its Supt., Henry L. Stewart, to make surveys of the proposed University Ave. sewer.

Brooklyn, N. Y.—Bids will be received Apr. 29 by J. Edw. Swanstrom, Boro. Pres., for constructing 62 sewer basins.

Long Island City, N. Y.—Bids will be received Apr. 30 by Jos. Cassidy, Pres. Queens Boro., for furnishing material for constructing sewers and appurtenances in portions of 13th Ave. and Lockwood St. Engineer's estimate, 2,509 lin. ft. 12 and 15-in. vitrified salt glazed sewer pipe, 18 manholes, etc.

Amsterdam, N. Y.—F. E. Crane, Supt. of Sewers, writes that all bids received Apr. 15 for constructing sewers on E. Main St. and Guy Park Ave., about 1,550 ft., have been rejected, and new bids will be received May 20.

Lestershire, N. Y.—The citizens are stated to have voted Apr. 15 to construct a sewerage system, to cost about $69,000.

Buffalo, N. Y.—Col. Ward, Comr. of Pub. Wks., is stated to have recommended the construction of sewers in Hopkins, Tifft and Germania Sts.

Cleveland, O.—It is stated that bids are wanted May 14 for constructing a sewer in Colgate St. C. P. Salen, Dir. Pub. Wks.

Columbus, O.—Julian Griggs, Ch. Engr., Dept. Pub. Improv., writes that the following bids were opened by the Bd. of Pub. Wks. Apr. 14 for sewers—*a*, brick; *b*, concrete; *c*, concrete and steel: C. T. McCracken & Co., of Cleveland, O., bid for the Beck St. relief sewer, *a*, $36,932; *b*, $35,892; *c*,* $35,577, and for the Central relief sewer, *a*, $79,016; *b*, $69,796; *c*,* $68,187. Adams Bros., of Zanesville, bid for Central relief sewer, *a*, $78,907; *b*, $84,980; *c*, $91,053. For West Side sanitary sewer, two bids were submitted as follows: Lee & Casey, Pittsburg, Pa.,* $31,737, and N. B. Abbott, Coinmbus, $31,982. Louis Lind, of Columbus, bid for Greenlawn Ave. sewer,* $2,064. (*Awarded contracts according to press reports.)

Bids will be received Apr. 28 by John A. Connor, Clk. Bd. Pub. Wks., for constructing sn 8 and 12-in. pipe sewer in portions of Granger and Bedford Alleys.

Bids will be received Apr. 30 by John A. Connor, Clk. Bd. of Pub. Wks., for constructing the main trunk sewers, known as the South Side main trunk sanitary sewer, and the Russell St. relief sewer.

Guthrie, Okla. Ter.—Local press reports state that bids will be received by the City Clk. until Apr. 30 for constructing lateral sewer No. 14.

Pendleton, Ore.—G. N. Miller is reported to be preparing preliminary plans for the proposed sewerage system, which will cost about $30,000.

Portland, Ore.—A plat of the system of sewers, designed for Southern Portland sewer district, has been about completed by City Engr. Elliott. This district includes Southern Portland, Fulton, Fulton Park, and the region extending from old Terwilliger Pl. south to Taylor Ferry Road, and from river to top of hills on the west.

Baker City, Ore.—W. H. Bentley, City Clk., writes that it was voted Apr. 13 to issue $12,000 bonds for sewers and $46,000 for a City Hall.

Sharon, Pa.—The Council is reported to have decided to vote on an issue of $80,000 bonds, for the extension of the sewerage system and to pave streets.

Berwick, Pa.—The Council has passed an ordinance appropriating $60,000 for the construction of sewers, erection of a town hall and for street improvements.

Hazleton, Pa.—A. Brooks Ceilax, City Engr., writes that contracts have been awarded as follows, bids opened Apr. 17: For 620 ft. stone sewer, 8 ft. x 6 ft. 6 in. in diameter, to Jacob Jacoby, of Hazleton, for $6,607, and for 880 ft. 15-in. pipe sewer to A. Ruth, of Hazleton, for $3,083.

York, Pa.—Rudolph Hering, of New York, N. Y., has been selected as engineer for the proposed sewerage work, for which $400,000 bonds have been authorized.

Pen Argyl, Pa.—The Council has passed an ordinance granting Milton Jordan the right to lay pipes for sewerage. Digory Radcliffe is Towa Clk.

Erie, Pa.—City Engr. Briggs is stated to have submitted to Council plans for a sewerage system in the district lying between 12th and 26th Sts. and Liberty and the western city line; entire length, 4,200 ft., and cost $18,900.

Providence, R. I.—The Bd. of Aldermen on Apr. 16 adopted a resolution providing for an additional appropriation of $100,000 for carrying on the work of building the improved sewerage system.

Bids are wanted Apr. 28 for constructing about 2,152 ft. 18, 20 and 24-in. and 400 ft. 50-in. brick sewer; also 10,237 ft. 8, 12 and 15-in. pipe sewer in portions of 12 streets. Robt. E. Smith, Comr. Dept. of Pub. Wks.

Harriman, Tenn.—It is stated that bids are wanted May 1 for constructing 7,220 ft. of 8 to 18-in. pipe sewer, 240 branches, 37 manholes, etc. F. J. Manley, City Engr.

Sweetwater, Tenn.—See "Paving and Roadmaking."

Austin, Tex.—John Fields, of Ft. Worth, has secured the contract for the construction of a storm water sewer on Congress Ave., for $19,339.

Houston, Tex.—Bids are wanted May 5 for constructing approximately $75,000 worth of brick and pipe sewers. Thos. H. Langham, Mayor.

Seattle, Wash.—The following bids are stated to have been opened by the Bd. of Pub. Wks. on Apr. 11 for the Madrona Pl. sewer system: F. McLellan & Co., $29,566; J. W. Fitts & Co., $29,937; T. Ryan & Co., $32,635; T. I. Peterson, $32,951, and Stirrat & Goetz, $31,450.

The City Council is stated to have passed an ordinance providing for the construction of sewers along Prospect Ave.; to cost $22,800.

Ballard, Wash.—The City Engr. is reported to be preparing plans for the construction of a complete system of sewerage.

Stevens Point, Wis.—Lamoreaux & Park, of Stevens Point, are the attorneys for a syndicate which proposes constructing a drainage system in Portage County. Chas. A. Lane is Co. Clk.

Winnipeg, Man.—Bids will be received May 7 by John A. Davidson, Provincial Treas., for $509,000 Dist. drainage bonds.

Puebla, Mexico.—See "Water."

Regina, N. W. Ter.—See "Power Plants, Gas and Electricity."

BRIDGES.

Brewton, Ala.—The Co. Comrs. have rejected all bids received for constructing a steel bridge across Conecuh River at McGowan's Ferry.

Birmingham, Ala.—It is stated that the Birmingham Railway, Light & Power Co. intends to build a viaduct over the railroad tracks at Bessemer for the new electric line which will connect Bessemer with Birmingham.

Little Rock, Ark.—Local press reports state that as soon as plans have been prepared and approved, the W. 3d St. viaduct will be built.

Oakland, Cal.—Bids will be received May 4 by John P. Cook, Co. Clk., for constructing a concrete bridge to replace old wooden bridge on San Ramon road in Eden Township.

Colorado Springs, Colo.—Press reports state that the Santa Fe R. R. Co. intends to make several changes in the bridges along its line in the vicinity of Colorado Springs, including the replacing of the present structure at Kiowa St. with an iron bridge and the building of a stone or steel bridge in the southern part of the city. A. F. Robinson, Bridge Engr., Topeka, Kan.

Rockford, Ill.—Local press reports state that an $8,000 bridge is to be built across Kishwaukee River.

Decatur, Ill.—The contract for constructing a bridge across Sangamon River, east of Decatur, is reported to have been secured by the Decatur Bridge Co., at $6,480.

Chicago, Ill.—Local press reports state that bascule bridges of the type used at State and Randolph Sts., will be constructed at Dearborn and 22d Sts. They are estimated to cost $200,000 each.

Winamac, Ind.—Bids will be received May 5 by the Bd. of Co. Comrs. for constructing a 2-span iron truss bridge, 221 ft. long and 16 ft. clear roadway, over Tippecanoe River at Tippecanoe Township. Ellis S. Rees, Co. Aud.

South Bend, Ind.—The Co. Comrs. have asked the Council to appropriate about $300,000 for building 2 bridges across the river in South Bend.

Peru, Ind.—The Comrs. of Miami and Wabash Counties are considering the building of a bridge across Eel River. Peru, County Seat of Miami Co.

Lafayette, Ind.—The Co. Comrs. have granted permission to the Monon Ry. Co. to build a steel and stone underground viaduct at the intersection of Brown St. and the old Wabash and Erie Canal. W. A. Wallace, Asst. Engr., Chicago, Ill.

Terre Haute, Ind.—Plans have been prepared for a bridge across Wabash River; 36 ft. roadway, 8 ft. sidewalks on each side, 870 ft. in length. Howe & Starbuck, Engrs. Ralph H. Sparks, City Engr.

Boonville, Ind.—Bids will be received May 4 by the Co. Comrs. for constructing an iron bridge in Pigeon Township. R. D. O. Moore, Co. Aud.

Sullivan, Ind.—Bids will be received May 8 by the Co. Comrs. for constructing 11 steel or concrete bridges. J. M. Lang, Co. Aud.

Salem, Ind.—Bids will be received May 4 by the Bd. Co. Comrs. for constructing a steel bridge; also stone abutments and approaches for a bridge, both across Lost River, in Vernon Township.

Ottumwa, Ia.—The Co. Comrs. have been petitioned to construct a bridge in the vicinity of Cliffland, at a probable cost of $20,000.

Lexington, Ky.—The Lexington & Eastern Ry. Co. has submitted to the Mayor plans for the proposed extension of its road to a point on Main St. These plans include the building of a steel bridge at Megowan St., 50 ft. wide, with a roadway for vehicles and a sidewalk on each side. J. R. Barr, Ch. Engr., Lexington.

Bangor, Me.—The City Engr. has been directed to make surveys for the new bridge across Kinderskeag Stream from Broad to Exchange Sts. Mayor Beal estimates the cost at from $40,000 to $45,000.

Hyde Park, Mass.—The town has adopted a resolution providing for the abolishment of grade crossings. This changing of grades will mean the raising of 4 streets and the construction of 4 bridges.

Palmer, Mass.—At the town meeting, Apr. 13, it was voted to construct a stone arch bridge at Thorndike, to cost $6,000, and a stone and iron bridge at Burleighs, to cost $5,000.

Jackson, Mich.—The Bd. of Pub. Wks. has recommended to the City Council that if a 2-span concrete and steel bridge be built at E. Main St., the bid of E. J. Tobin & Co. at $10,985 be accepted, but if a 1-span bridge is built, the bid and plan of R. Dunn, of Detroit, at $13,847 be accepted.

Grand Rapids, Mich.—The proposition to issue $30,000 bridge bonds carried at the recent election.

Grand Rapids, Mich.—Bids are wanted May 15 for the construction of a concrete, or concrete-steel arch bridge across Grand River at Bridge St., as advertised in The Engineering Record.

St. Paul, Minn.—A bill has been passed in the Senate authorizing St. Psul to issue $600,000 bonds for the construction of bridges, schoolhouses, municipal buildings and main sewers.

Carpentersville, N. J.—Governor Murphy has signed the bill authorizing the Warren Bridge Co. to construct a bridge across Delaware River at Carpentersville, and a bill authorizing the Northampton Bridge Co. to construct a bridge across Delaware River at Martins Creek.

Rochester, N. Y.—Press reports state that the bridges of the New York Central R. R. at Kent, Smith, and Oak Sts. are to be rebuilt in the near future. H. Fernstrom, Ch. Engr., New York, N. Y.

Troy, N. Y.—A bill has passed the Senate incorporating the Troy & Colonie Bridge Co. to construct and maintain a bridge across Hudson River from Hutton St., Troy, to Green Island.

Syracuse, N. Y.—A bill has passed the Assembly appropriating $9,500 as the State's share toward the building of a bridge at Willow St.

Allegheny, N. Y.—Chas. F. Norton, Town Clk., writes that it was voted Apr. 15 to issue $8,000 bonds for constructing a new bridge.

New York, N. Y.—Bridge Comr. Lindenthal is reported to have rejected all bids received Apr. 9 for constructing masonry pedestal towers for Manhattan Bridge (No. 3) over East River, and it is stated that new bids will be received Apr. 30.

Lillington, N. C.—Press reports state that bids will be received May 4 by the Bd. of Co. Comrs. for constructing a steel bridge at Aversasbero Ferry, on the Cape Fear River; probable cost, $10,000.

Hamilton, O.—Bids are wanted May 8 for repairing Main and High St. bridge over Great Miami River by repaving the roadway, constructing a cement sidewalk (including all necessary iron work), etc.; approximate estimate, 1,350 sq. yds. asphalt block paving (exclusive of R. R. portion), 11,660 sq. ft. cement paving, including iron work, etc. Estimated cost, $9,391. C. Pabst, Co. Aud.

Alliance, O.—The business men of Alliance have petitioned the Co. Comrs. to construct a new bridge on the county line.

Newcastle, O.—Local press reports state that about $80,000 is to be expended by the Baltimore & Ohio R. R. Co. for strengthening bridges on the line between Newcastle and Connellsville Junction, so that 100-ton locomotives can be run over them. J. M. Graham, Ch. Engr., Baltimore, Md.

Greensburg, Pa.—Bids are wanted May 14 for constructing substructure and superstructure of a steel bridge over Big Sewickley Creek at Gratztown Station. John H. Brown, Co. Compt.

Gettysburg, Pa.—Bids are wanted June 1 for furnishing material and constructing a steel bridge at Reynolds Ave. upon battlefield of Gettysburg. John P. Nicholson, Chmn. War Dept., Gettysburg Comn.

Philadelphia, Pa.—Local press reports state that Ch. Engr. Twining, of the Philadelphia Rapid Transit Co., has completed plans for the bridge across Schuylkill River at Market St., which the company will build to connect its elevated structure with the Subway.

Philadelphia, Pa.—See "Railroads."

Waverly, Tenn.—The Nashville Bridge & Construction Co. is reported to have received the contract for constructing a bridge across Duck River, near Waverly, at $13,000.

Houston, Tex.—City Engr. Dormant has submitted to the City Council plans and specifications for constructing a bridge connecting the 4th and 6th Wards, and estimates the cost at $91,000.

Tacoma, Wash.—Mayor Campbell has signed the ordinance appropriating $14,000 for the construction of a bridge across Puyallup River.

Montesano, Wash.—It is stated that bids are wanted May 4 by the Co. Comrs. for constructing a 50-ft. highway bridge across Cedar Creek; also for constructing a 200-ft. combination span highway bridge across Humptulups River. W. D. Campbell, Co. Aud.

PAVING AND ROADMAKING.

Birmingham, Ala.—The Bd. of Aldermen has passed an ordinance providing for the grading, macadamizing, guttering and sidewalking of portions of 22d and Sycamore Sts. and Palmetto Ave.; estimated cost, $18,000.

San Francisco, Cal.—The City Engr. recommends the repaving of portions of numerous streets at a total cost of $143,450, and the paving of portions of numerous other streets at a total cost of $378,340.

New Haven, Conn.—Bids are wanted May 4 for a crushed stone pavement with Belgian block gutters on portions of Cedar St. C. W. Kelly, City Engr.

Wilmington, Del.—The Park Comrs. are reported to be contemplating the building of a drive on the north side of the Brandywine River.

Boise, Idaho.—Wm. Harkins is reported to have submitted the lowest bid for paving with brick on a portion of 8th St., at $19,453.

Messrs. Kingsbury, Dunton, Hessing and Parnell have been appointed a committee to prepare plans and specifications for paving with either asphalt, vitrified brick or bituminous macadam on a portion of Main St.

Belleville, Ill.—City Engr. Graner is preparing plans and specifications for paving a portion of W. Main St.

Springfield, Ill.—Ordinances have been passed in the Council authorizing the paving of portions of No. 7th and Carpenter Sts. and No. Grand Ave. Brick may be used.

Freeport, Ill.—G. Moffioli, of Rockford, has secured the following contract: For 34,446 sq. yds. macadam, 40 cts. per sq. yd.; 25,302 cu. yds. excav., 25 cts. per cu. yd.; 12,410 lin. ft. cement curb and gutter, 50 cts. per ft., and 7,820 lin. ft. cement curb and gutter, 29½ cts. per ft.

Evanston, Ill.—The following bids were opened Apr. 16 for paving Dempster St., about 9,000 sq. yds. granite top macadam and 11,000 lin. ft. Berea sandstone curb: M. Foley, $15,580 (awarded contract) and John A. McGarry & Co., $16,700. M. Foley bid for macadam $1.01¼ per sq. yd. and 53 cts. per ft. for curb. J. H. Moore, Comr. Dept. Pub. Wks.

Chicago, Ill.—Bids will be received Apr. 29 by the Bd. of Local Omprov. for grading, curbing and paving with granite blocks, vitrified paving bricks, crushed limestone, crushed granite, asphalt, etc., on portions of numerous streets. Andrew M. Lynch, Pres.

Newman, Ill.—It is stated that over $8,000 will be expended this spring for concrete sidewalks.

Bluffton, Ind.—It is stated that bids are wanted by the Co. Comrs. until May 19 for constructing 56,592 ft. of gravel road.

Jasper, Ind.—It is stated that bids will be asked for the construction of 16 miles of rock road in Dubois Co. The estimated cost is $42,929.

Princeton, Ind.—Bids are wanted May 5 for constructing 9 gravel roads, comprising 24 miles. Jonathan W. Phillips, Chmn. Bd. of Comrs.

Laporte, Ind.—Local press reports state that bids will be received May 11 by the City Council for paving with brick and macadam on portions of 10 streets.

Williamsport, Ind.—The contract for building about 10 miles of gravel roads, bids for which were received on Apr. 6, has been awarded to Moore & Woodward, of Bloomington, Ind., for $25,975.

Terre Haute, Ind.—Plans have been submitted for paving with brick 4th St. and Lafayette Ave; total square yards, about 45,500. Ralph H. Sparks, City Engr.

South Bend, Ind.—Contracts for 16,000 lin. ft. cement curb and 80,000 sq. ft. cement walks on 8 streets have been awarded as follows: To H. N. Barnes, for 3 streets, $3,619; R. Z. Snell, 2 streets, $2,006; C. C. Shively, 2 streets, $5,574, and Siders Bros., 1 street, $2,411. Contractors all of South Bend.

Waterloo, Ia.—B. G. Stewart, City Clk., writes that the contract for 4,500 sq. yds. asphalt on 4th St. (bids opened Apr. 13) has been awarded to the Barber Asphalt Paving Co., at $1.96 per sq. yd.

Cedar Rapids, Ia.—Bids will be received May 1 by the Pub. Improv. Com. for paving with asphalt portions of 1st Ave. W. L. Cherry, Chmn.

Albia, Ia.—The McCarthy Stone Co. is stated to have received the contract for paving the principal business street of this city. Appropriation, $19,000.

Cedar Rapids, Ia.—The City Council has adopted a resolution authorizing the City Engr. to prepare plans and specifications for paving with brick on a portion of 5th Ave.

Ft. Scott, Kan.—Bids will be received May 5 by the Scott Township Road Comn. for constructing 7 macadam roads in Scott Township and the city of Ft. Scott. A. J. Sherman, Township Trus.

Louisville, Ky.—The Bd. of Pub. Wks. is preparing plans and specifications for paving with vitrified brick on portions of 10 streets. Probable cost, $90,000.

Lake Charles, La.—The property owners on Ryan St. have agreed to pave about a mile with brick or asphalt, the city to pay one-third and the property owners two-thirds.

Augusta, Me.—The city proposes to purchase a steam road roller this season. C. E. Purinton, Chmn. Com. on Highways and Sewers.

Baltimore, Md.—On Apr. 14 the following ordinances were passed in the 2d Branch of the City Council: Appropriating $25,700 for paving North Ave. from Broadway to Washington St. with asphalt blocks; $4,600 for repairing with vitrified brick Ensor St. from Harford Ave. to Chase St., and $37,500 to repave with asphalt blocks McCulloh St. from Lafayette to North Aves.

New Bedford, Mass.—See "Government Work."

Amesbury, Mass.—The Lane Construction Co., of Meriden, Conn., is reported to have secured the contract to construct a State highway on the Amesbury road, at $8,659.

Boston, Mass.—Local press reports state that the following bids were received by Jas. Donovan, Supt. of Streets, on Apr. 13, for furnishing the city with 500,000 paving blocks on the wharves and 300,000 gutter paving blocks delivered: Paving blocks—Commonwealth Granite Co., $62.90 per 1,000; Rockport Granite Co., $70.60; Pigeon Hill Granite Co., $71; Austin Ford & Son, $71.75; W. R. Harvey, $75.50. Gutter paving blocks—S. & R. Lombard, $54 delivered on wharves and $55 delivered on streets; John Fallon & Son, $54.35 on wharves; W. Shea & Son, $55 on streets in Dorchester; Austin Ford & Son, $56.50 on wharves; Rockport Granite Co., $61 on wharves.

Supt. of Streets Donovan on Apr. 16, according to local press reports, opened bids for paving with granite block on portions of Broad and Purchase Sts., the lowest received being from W. H. Ellis, at $11,109, for Broad St., and J. E. Burns & Co., at $12,968, on Purchase St.

Kalamazoo, Mich.—Bids are wanted Apr. 27 for paving with 22,829 yds. Trinidad Lake sheet asphalt portions of South and Park Sts. and Park Pl. John De Visser, City Clk.

Albion, Mich.—F. W. Culver, City Clk., writes that the citizens voted Apr. 6 to issue $25,000 bonds to pave Main St.

Battle Creek, Mich.—It is stated that the proposition to issue $11,000 paving bonds carried at the recent election.

St. Paul, Minn.—Bids will be received Apr. 27 by the Bd. of Pub. Wks. for paving portions of University Ave, with asphalt; estimated cost, $45,443; also portions of E. 3d St. with granite. R. L. Gorman, Clk.

Duluth, Minn.—Local press reports state that the Bd. of Pub. Wks. is about to receive bids for paving a portion of 2d Ave. W. at an estimated cost of $14,500.

St. Louis, Mo.—The proposition to build a stone road from Jerseyville to Fielden, a distance of about 10 miles, is reported to have carried at the election held recently in Jersey Township.

Kansas City, Mo.—The Co. Court has approved the Town Fork route for the proposed Swope Park Boulevard.

Ashland, N. H.—It is stated that bids are wanted May 1 for macadamizing certain streets. A. W. Dudley, Engr., Manchester.

Dover, N. H.—The State has appropriated $20,000 for Ocean Boule. in N. H. Engineer, Wm. C. Ogden, Dover.

Concord, N. H.—It is stated that $50,000 has been appropriated for highways in White Mountain Dist. Engineer, John W. Storrs, Concord.

Ocean City, N. J.—Dixey & Reilley, of Atlantic City, are reported to have secured the contract to pave the principal streets of the city, at a cost of $70,000.

Trenton, N. J.—Local press reports state that the following were the lowest bids received by the Bd. of Freeholders on Apr. 14 for constructing macadam roads in the county: Richard Newton, River Road, about 7 miles, $38,248; Wm. F. McGovern, Princeton Hill Road, from Delaware & Raritan Canal to Prospect St., Princeton, $8,400. John T. Carr & Co. submitted the lowest bid on the following roads: Extension of Harbourton Road, $12,281; Shabbakong Road, $10,600; extension of Scotch Road, $13,220, and Pennington-Centreville schoolhouse road, $9,940.

Morristown, N. J.—G. A. Becker, Dir. Bd. Chosen Freeholders, writes that contracts for macadamizing roads in Morris County, bids for which were received on Feb. 23, were awarded on Apr. 8 as follows: To J. B. & H. K. Salmon, Ledgewood, N. J., for Sussex and Newtown Turnpike, length 5,280 ft., $7,571; to Dickerson & Gill, Rockaway, N. J., for Morristown and Greenvillage Road, length 17,931 ft., $14,603, and to W. J. & Arthur G. Bunn, Singac, N. J., for Boonton and Beavertown Road, length 22,600 ft., $13,920.

Collingswood, N. J.—See "Sewerage and Sewage Disposal."

Jersey City, N. J.—Bids will be received Apr. 28 by the Bd. of St. and Water Comrs. for improving portions of 3 streets. Engineer's estimate, 4,760 cu. yds. earth excavation, 8,510 cu. yds. rock excavation, 6,620 sq. yds. Belgian paving, 8,230 lin. ft. curbstone, 30,350 sq. ft. flagging, etc.; also for furnishing and delivering 2,000 fire brick, 25,000 No. River hard burned brick, 150 bbls. American Portland Atlas cement, etc. Geo. T. Bouton, Clk.

Cohoes, N. Y.—On Apr. 11 the Common Council decided to make an additional issue of $20,000 bonds for the paving of Vliet St. extension. The work will be done this summer.

Schenectady, N. Y.—The building of a boulevard from McClellan St. to the Shakers in the town of Niskayuna, a distance of about 10 miles, is reported to be under consideration.

New York, N. Y.—Bids will be received Apr. 28 by Jacob A. Cantor, Boro. Pres., for regulating and repaving with asphalt on present pavement relaid as foundation portions of numerous streets. Engineer's estimate, 119,677 sq. yds. asphalt pavement, including binder course, 119,480 sq. yds. old stone pavement, relaid as foundation or in approaches, etc., 3,303 cu. yds. concrete, 57,270 lin. ft. new curbstone, furnished and set, etc.

Mayor Low has approved the ordinance providing for the issue of $3,150,000 repaving bonds.

Oswego, N. Y.—The Bd. of Superv. has passed resolutions authorizing the expenditure of $49,150 for building 3 roads in this county under the Higbie-Armstrong law. One in Hastings from Brewerton to Central Square, to cost $14,700, another from the south line of Oswego city to Minetto along the W. River road, to cost $20,900, and the other from the west city line to Fruit Valley, to cost $13,550.

Troy, N. Y.—Plans and specifications for improving under State direction 3.54 miles of the Nassau and Brainard road and 3.61 miles of the Averill Park and Crooked Lake road have been received by the Bd. Superv. from the State Engr. and the necessary resolutions adopted. The cost of construction is placed at $34,900 and $35,640 respectively.

Long Island City, L. I., N. Y.—The following bids were opened Apr. 16 by Jos. Cassidy, Pres. Queens Boro., for asphalt on concrete foundation—*a*, Barber Asph. Pavg. Co.; *b*, Uvalde Asph. Pavg. Co.; *c*, Continental Asph. Pavg. Co.:

Nott Ave.—Jackson to Van Alst Aves.

Bidders.	Asph., 9,700 s. yd.	Concr., 1,620 c. yd.	Blue curb, 2,900 ft.	Earth exc., 2,000 c. yd.	Fill, 2,000 c. yd.	Flags, 14,500 s. ft.
a	$1.04½	$5.75	$0.76	$0.22	$0.12	$0.26
b	1.30	5.00	.85	.25	.50	.28
c	1.15	5.25	.80	.70	.01	.26

9th St.—Pub. School to Vernon Ave.

Bidders.	Asph., 4,300 sq. yds.	Concrete, 725 cu. yds.	Blue. curb, 2,600 ft.	Filling, 3,500 cu. yds.
a	$1.07	$5.75	$0.76	$0.22
b	1.35	5.00	.90	.50
c	1.20	5.25	.80	.40

Goshen, N. Y.—The Bd. of Superv. has decided to build portions of 4 roads at the following estimated costs: Greenville-Port Jervis road, $62,800; Greenville-Slate Hill road, $57,600; West Point-Central Valley road, $86,600, and undergrade crossings, Central Valley-Turners road, $12,514.

Columbus, O.—Bids will be received Apr. 28 by John A. Connor, Clk. Bd. of Pub. Wks., for improving portions of Bellows Ave. by grading and paving with macadam or other substantial material, setting 5-in. curb and constructing necessary sub-drains and catch basins.

Toledo, O.—Bids will be received May 18 by the Bd. Pub. Service for furnishing material for grading, paving with blocks or Trinidad Pitch Lake asphalt on a 6-in. concrete, 8-in. sand foundations on portions of 7 streets. Chas. H. Nauts, City Clk.

Toledo, O.—H. G. Jennison, of Toledo, is reported to have secured the contract to pave on Starr Ave., 13,770 sq. yds., at $21,420. For detail bids see issue of The Engineering Record of Apr. 11.

Bowling Green, O.—Bids are wanted Apr. 27 for $100,000 road improvement bonds. B. C. Harding, Co. Aud.

Napoleon, O.—John Ryan, of Whitehouse, O., is reported to have secured 3 contracts for constructing stone and gravel roads in Henry Co. at a total cost of $50,749.

The Co. Comrs. have sold $62,000 road improvement bonds.

Findlay, O.—John W. Riegle, City Engr., writes that the lowest bid received on Apr. 18 for paving with block Defiance Ave., 3,360 sq. yds. paving and 1,870 ft. curb, including permanent foundations and filler, was that of C. B. Hall & Son, of Findlay, at 20 cts. per cu. yd. for excav., 36 cts. per ft. for curb and for block per sq. yd. as follows: Peebles, $1.27; Logan, $1.31; Hocking Valley, $1.23; Athens, $1.27; Nelsonville, $1.35, and Metropolitan, $1.22½.

Celina, O.—F. H. Kreusch, City Clk., writes that the following bids for paving about 10,270 sq. yds. of block or brick pavement were received on Apr. 7: Saml. Monroe, Portsmouth, $22,941; T. J. Mulligan, Lima, $23,852; G. H. Heffner, Celina, $21,216; Philip Hipkind, Wabash, Ind., $25,966; J. O. Shoup, Dayton, $23,682; Trask & Lally, Portland, Ind., $21,744; Henry Gantz, Bowling Green, $23,069; Kelly Bros., Portsmouth, $20,753.

Napoleon, O.—It is stated that bids are wanted May 4 for macadamizing Hadley Ave. N. Fisher, Clk.

Weston, O.—It is stated that bids are wanted May 11 for 6,540 sq. yds. of brick pavement and necessary drainage.

Norristown, Pa.—S. C. Corson, Boro. Engr., writes that contracts have been awarded as follows, for material required by Highway & Sewer Dept. during the year ending Mar., 1904 (bids opened Apr. 16): To the McAvoy Brick Co., of Philadelphia, for vitrified brick pavers, gutter brick and small brick, at $15, $14 and $13 per M. respectively; to Sigler, Smith & Yocum, Norristown, for cement at $2.25 per bbl.; to Lattimore & Fox, Norristown, for granite curb, 6x24 in., $1.10 per ft. set and granite curb, 6, 8 and 10-ft. radius, delivered $1.55 per ft. and to the Norristown Brick Co., Norristown, for No. 1 paving brick, No. 1 straight hard and No. 2 hard, at $10, $8.50 and $7 per M. respectively.

Ebensburg, Pa.—Bids will be received May 1 by Wm. Davis, Pres. of Council, for furnishing and delivering f. o. b. cars 1,200,000 paving bricks; also for grading and paving portions of 3 streets.

Harrisburg, Pa.—A bill has passed both the Senate and the House appropriating $6,500,000 for road and highway improvements in the State of Pennsylvania.

Berwick, Pa.—See "Sewerage and Sewage Disposal."

Williamsport, Pa.—Jas. F. Fisher, City Engr., writes that the following bids were opened by the Highway and Sewer Com. Apr. 16 for (*a*) 14,000 sq. yds. brick paving on 6 in. concrete found.; (*b*) 4 in. straight curb, per ft.; (*c*) reset curb, per ft., and (*d*) 4 in. circular curb, per ft.; Coryell Constr. Co., Williamsport, *a*, $1.94; *b*, 60 cts.; *c*, 20 cts.; *d*, $1.30. The Welteroth Co., Williamsport, *a*, $2.01; *b*, 70 cts.; *c*, 30 cts.; *d*, $1.50. J. U. Fritchey & Son, Lancaster, Pa., *a*, $2.15; *b*, 60 cts.; *c*, 25 cts.; *d*, $1.50.

Sharon, Pa.—See "Sewerage and Sewage Disposal."

Waynesburg, Pa.—Bids will be received May 20 by the Town Council for 19,696 sq. yds. brick paving, 11,960 lin. curbing, 9,000 cu. yds. grading, 1,000 yds. excavating on portions of 4 streets. Address S. M. Smith, Secy.

Wilkesbarre, Pa.—The State Legislature has passed a bill providing for the improvement of highways to the amount of $6,000,000 for the next 6 years.

Centerville, Tenn.—A bill has passed third reading in the Senate authorizing Hickman County to issue $100,000 road bonds.

Sweetwater, Tenn.—A bill has passed third reading in the Senate authorizing the amending of the charter of Sweetwater so as to allow the issuance of $40,000 street and sewer bonds.

Galveston, Tex.—Bids will be received Apr. 28 by the Bd. of City Comrs. for paving approximately 7,299 sq. yds. with vitrified brick on portions of 21st St. and Mechanic St. C. G. Wells, City Engr.

Dallas, Tex.—The Mayor has vetoed the ordinance passed by the Council appropriating a portion of the $25,000 bond issue for the improvement of streets.

Portsmouth, Va.—Press reports state that bids will be received Apr. 28 for $100,000 grading bonds.

Newport News, Va.—Press reports state that bids will be received May 4 for $56,000 paving bonds.

Tacoma, Wash.—City Engr. Taylor is preparing plans and specifications for about 25 miles of cement sidewalks.

Marinette, Wis.—Bids are wanted May 15 for paving with macadam and curbing with stone on portions of 5 streets; also paving with macadam and curbing with cement or concrete on portions of Riverside Ave. Dan J. Madagin, Chmn. Bd. of Pub. Wks.

St. Marys, Ont.—See "Water."

Montreal, Que.—John R. Barlow, City Surveyor, writes that on Apr. 14 the contract for an asphalt paving plant, bids for which were opened Feb. 26, was awarded to the Warren Bros. Co., of New York, N. Y., for $13,000.

POWER PLANTS, GAS AND ELECTRICITY.

New Decatur, Ala.—The gas and electric plants are stated to have been purchased by New York, Boston and Cincinnati parties; $50,000 will be expended in improving the plants. The new company will furnish electric power to factories and will build a cold storage and ice plant.

Berkeley, Cal.—The Town Trus. are stated to have granted to the Bay Counties Power Co. a franchise for 28 yrs. to maintain its poles and lines in Berkeley.

Ft. Rosecrans, Cal.—See "Government Work."

Oroville, Cal.—A press report states that the Valley Counties Power Co. is preparing to install a plant on French Creek above Oroville. The location of the plant will be on the north fork of Feather River.

Ft. Collins, Colo.—T. H. Garrett, City Clk., writes that it was voted Apr. 7 to grant a franchise for a gas plant.

Atlanta, Ga.—The Georgia Ry. & Electric Co. has secured the contract for lighting the city for 5 years at $75 per yr. for arc lights and $33.75 for incandescent lights.

Rexburg, Idaho.—The Snake River Electric Light & Power Co., Ltd., of Rexburg, has been incorporated, with a capital of $100,000, by Jas. H. Wilson, John H. Hendricks, and others.

Saybrook, Ill.—H. W. Dahl, Village Clk., writes that it is proposed to construct an electric light plant, to cost about $6,000; he also states that private parties are talking of putting in a plant. Nothing definite has been decided on.

Springfield, Ill.—The plants of the Springfield Gas Co., the Springfield Electric Light, Heat & Power Co., the Peoples Hot-Water Htg. & Electric Co., and the Consolidated Ry. Co. are reported about to be absorbed by an Eastern syndicate, which contemplates extensive improvements.

Centralia, Ill.—The Merchants' Light Co. is reported organized to construct an electric light plant.

Wabash, Ind.—The Council is stated to have received a proposition from the Wabash Electric Light Co., which franchise will expire on July 1, for a renewal of the electric lighting contract for 5 years. The company proposes to install 100 arc lights at $80 per yr. ea., with $70 per yr. for an additional 25 lights, or an average of $78 per yr. for the 125 lights.

Bluffton, Ind.—The Council has awarded to the Olds Constr. Co., of Ft. Wayne, the contract for a complete incandescent and street lighting plant, for $24,950.

Terre Haute, Ind.—The Citizens' Mutual Htg. Co. is having plans prepared for a complete heating plant. Address, John T. Beasley.

Anderson, Ind.—The Home Htg. Co. has employed Geo. Vincent, of Indianapolis, to prepare plans for a steam heating plant.

Elkhart, Ind.—C. H. Wright is reported interested in the construction of a heating plant in this city.

Loogootee, Ind.—The Town Council has taken steps toward the erection of an electric light and water works.

Indianapolis, Ind.—The Jones-Hogue Co. is reported incorporated, with a capital of $10,000, to establish electric power, lighting and heating plants. Arthur B. Hogue, of Greenwood, and Edw. E. Elliott, Indianapolis, are among the incorporators.

Hartford City, Ind.—It is reported that the Hartford City Gas Co. will construct a pumping station, at a cost of about $25,000.

Galva, Ia.—Chas. C. Millen, City Clk., writes that it is proposed to construct a gas plant, at a cost of $4,000.

Gowrie, Ia.—O. T. Blomgren, City Clk., writes that a petition is in circulation for the formation of a stock company to put in a gas plant.

Des Moines, Ia.—John McDonald is reported interested in the construction of a heating plant.

Grand Mound, Ia.—The Grand Mound Gas Light Co. is reported formed to install a plant. Directors: J. W. Reihman, W. R. Barber, and others.

Muscatine, Ia.—A company is about to be formed here by the business men, with a capital of $50,000, to construct an electric light plant.

Anita, Ia.—Edw. R. Richardson, City Clk., writes that the town will install a gasoline gas plant.

Ashland, Ky.—Bids will be received May 4 by R. C. Richardson, City Clk., for lighting the streets with 2,000 c.p. arc electric lights, for a term of 5 and 10 yrs.

Crowley, La.—Electric light and water works bonds amounting to $100,000 have been sold.

Manchester, Mass.—At a town meeting Apr. 13 it was voted to authorize the Selectmen to grant locations for an underground system of electric lighting to a corporation now forming, providing the corporation give the town an option to purchase the property at any time within 5 years.

Ipswich, Mass.—The citizens are stated to have voted Apr. 18 to appropriate $25,000 for the establishment of a municipal electric light plant.

Swanzy, Mich.—The I. Stephenson Co., of Marinette, Wis., is stated to have decided to develop the water power on Escanaba River, at Swanzy. About 1,100 H.-P. will be generated and transmitted to Ishpeming and Negaunee.

South Stillwater, Minn.—It is stated that bids are wanted May 5 for $23,000 water and light bonds.

Renville, Minn.—C. L. Tenney, of Chicago, Ill., is stated to have secured the contract to install a gas plant for about $8,000.

Winona, Minn.—The Winona Gaslight Co. is stated to have decided to lay new mains.

Lake Crystal, Minn.—C. D. Ott, Recorder, writes that it was voted Mar. 23 to issue $12,000 bonds for an electric light plant and power house.

Norborne, Mo.—The Norborne Electric Light & Power Co. has been incorporated to furnish light and power; capital, $10,000. Incorporators: J. L. Wilson, Jas. W. Cunningham, and others.

Joplin, Mo.—The ordinance granting a gas franchise to M. M. Sweetman was passed by Council on Apr. 10th.

Louisiana, Mo.—The Louisiana Gas & Electric Light Co. has been incorporated to furnish gas for heating and lighting; capital, $50,000. Timothy T. Beach, of Lincoln, Ill., is one of the incorporators.

Great Falls, Mont.—An ordinance has been passed by Council granting John D. Ryan a franchise for an electric light, heating and power plant.

Gardiner, Mont.—The Gardiner Electric Light & Water Co. has been incorporated, with a capital of $15,000, to establish and maintain an electric light plant and water system. Incorporators: J. C. McCartney, Lawrence Link, and others.

Lincoln, Neb.—Geo. L. Campen, City Engr., writes that the citizens voted Apr. 7 to issue $65,000 bonds for a municipal electric light plant. Bonds have been ordered for sale by Council. B. C. Fox, City Treas.

Osceola, Neb.—This town is reported to have voted for electric street lighting.

Manchester, N. H.—A contract with the Manchester Traction, Light & Power Co., for lighting of the city at $90 per arc light of 2,000 c. p., and to extend over a term of 5 yrs., was practically agreed upon on Apr. 14 by the Bd. of Mayor and Aldermen.

Hammonton, N. J.—The Town Council is stated to have granted the Hammontown & Egg Harbor City Gas Co. a franchise to lay gas mains through the streets, and construct a gas plant.

Schenectady, N. Y.—The Buckley Constr. Co. is stated to have secured the contract for constructing a power station for the General Electric Co. for about $90,000.

Binghamton, N. Y.—Arthur W. T. Back, Clk. Bd. Superv., writes that contracts for the county heating and lighting plant (bids opened Apr. 20) have been awarded as follows: Building, to Mason I. Ford. Binghamton, for $14,417; heating to Runyon & Ogden, for $2,800, and electricity, to G. & E. Electric Co., for $2,215.

Brocton, N. Y.—Bids will be received May 2 by G. C. Harmon, Village Clk., for $10,000 electric light bonds.

Greenport, L. I., N. Y.—The citizens are reported to have voted Apr. 16 to issue $20,000 bonds to enlarge and extend village electric light and power plant, and water works.

Greene, N. Y.—Edgar B. Kay, of the College of Civil Engineering, Ithaca, has been employed by Bd. of Water & Light Comrs. to prepare the plans and superintend the work of installing a combined water works and electric light plant, to cost $40,000.

Cooperstown, N. D.—The Northwestern Electric Co., of Fargo, is reported to have secured a franchise for a lighting plant.

Akron, O.—It is reported that Akron Gas Co. will expend $100,000 in enlarging its plant the coming summer.

Deshler, O.—The plant of the Deshler Electric Light Co. has been purchased by the Findlay Natl. Bank. It is reported that $8,000 will be expended in improving the plant.

Tillamook, Ore.—The City Council is stated to have granted C. E. Hadley a franchise to install an electric light system. It is proposed to get the power from north fork of Wilson River, and the plant will be put in this summer, at a cost of $10,000.

Berlin, Pa.—The citizens are stated to have voted to issue $15,000 bonds for an electric light plant.

Lebanon, Pa.—The Council has passed a resolution authorizing the Police and Lighting Com. to secure bids for street lighting for a term of 1, 5 or 10 years, for 150 or more arc lamps, each of 2,000 c.p.; also for 100 or more 24 c.p. incandescent lamps for alleys. The contract proposed will take effect Dec. 31, 1904.

Mt. Joy, Pa.—Dr. J. J. Newpher, representing the Mt. Joy Light, Heat & Power Co., is stated to have petitioned the Council for a franchise to lay gas pipes and to erect poles and string wires in the borough.

Shenandoah, Pa.—The Peoples Electric Light, Heat & Power Co. is reported incorporated, with a capital of $20,000.

Columbia, Tenn.—The Senate has passed the bill authorizing Columbia to issue $25,000 electric light bonds.

Alexandria, Va.—Fred. Russell is stated to have petitioned the City Council for a franchise for an electric light plant.

Marysville, Wash.—The Shingle Co. is stated to have petitioned for a franchise for an electric light plant.

Randolph, Wis.—Bonds to the amount of $5,000 are reported to have been voted for an electric light plant.

Rossland, B. C.—It is reported that the Inland Light & Power Co., of Rossland, incorporated with a capital of $15,000, will construct an electric plant on Wild Horse Creek. K. L. Burnet and J. S. Clute are among the incorporators.

St. Boniface, Man.—Theo. Bertand, City Secy., writes that the question of constructing water works to cost $100,000 and electric light plant to cost $15,000 is being considered.

Chihuahua, Mexico.—A company is reported organized to install an electric power plant to generate 3,000 H.-P. to be transmitted 80 miles from Conchas River to Chihuahua, Mex. Wm. Stanley, of Great Barrington, Mass., and John F. Kelly, of Pittsfield, Mass., are the engineers in charge.

Regina, N. W. Ter.—The City Council is stated to have decided to construct a system of water works, electric lighting and drainage. John Galt, of Toronto, Ont., will act as consulting engineer.

ELECTRIC RAILWAYS.

Monrovia, Cal.—The Pacific Electric Ry. Co. will extend its interurban line from Monrovia up into the mountains, a distance of several miles.

San Bernardino, Cal.—The old San Bernardino & Arrowhead R. R., running from San Bernardino to Harlem Springs and Highland, has been purchased by San Bernardino & Highland Electric Ry. The plan of the company is to equip the line with electricity.

San Mateo, Cal.—Chas. W. Clark and Francis W. Carolan are stated to have petitioned the Town Trus. for franchise and bids for same will be received June 1.

Los Angeles, Cal.—H. J. Leiande, City Clk., writes that the Pacific Electric Co. has secured a franchise, bids for which were opened Apr. 13.

Los Angeles, Cal.—L. C. Brand, of the Title Guaranty & Trust Co. proposes to build, at a cost of about $200,000, a standard-gauge electric railway from Los Angeles to Glendale, a distance of 10 miles. Power for the proposed line will be secured from the Pacific Light & Power Co.

Beulah, Colo.—Geo. Peck and Monroe Isor, of Cincinnati, O., and R. F. Lemon, of Providence, are reported to be making preliminary arrangements for building an electric railway from Pueblo to Beulah, a distance of 30 miles.

East St. Louis, Ill.—The St. Louis Transit Co. is reported to have in contemplation the erection of a power house here. C. A. Moreno, Ch. Engr., 3901 Park Ave., St. Louis, Mo.

Lincoln, Ill.—The Lincoln Electric R. R. Co. has been incorporated, with a capital of $6,000, to build an electric railway here. Incorporators: D. H. Harts, E. G. King and A. D. Cadwallader.

Carpentersville, Ill.—The Elgin, Aurora & Southern Traction Co. is planning an extension from Carpentersville to Crystal Lake.

Moline, Ill.—The Moline, East Moline & Watertown Ry. Co. has secured a franchise for the extension of its lines through Rock Island County.

Springfield, Ill.—See "Power Plants, Gas and Electricity."

Rock Falls, Ill.—The preliminary survey is being made for the line of the Rock River Traction Co. from Rock Falls to Prophetstown, Spring Hill, Geneseo, Moline and Rock Island. The power-house will be located in Prophetstown. E. E. Andrews, Vice-Pres.

Madison, Ind.—The Jefferson Co. Comrs. are stated to have granted a franchise to Hubbard, Yoder & Co., of Indianapolis, for an electric railway from Madison to Hanover.

Richmond, Ind.—Gus M. Hodges, of Richmond, is reported interested in the construction of an electric railway to parallel the Pennsylvania from Richmond to New Castle.

Laporte, Ind.—The Chicago & South Shore Ry. Co. will increase its capital from $300,000 to $1,000,000, to provide for the construction of a line from Laporte to South Bend.

Valparaiso, Ind.—The City Council has granted a franchise to the Union Traction Co. of Indiana. A. J. Black, Ch. Engr., Anderson.

Vincennes, Ind.—The Citizens St. Ry. Co. proposes to build a new power house this year.

New Castle, Ind.—The Council has granted a franchise to the Union Traction Co.

New Albany, Ind.—Victor W. Lyon, of Jeffersonville, is making a survey from New Albany to Corydon, for an electric railway, about 20 miles in length.

Terre Haute, Ind.—The City Council has granted a 30-year franchise to O. E. Adams and H. D. Falls, known as the Brazil Electric Co., for an electric railway.

Sioux City, Ia.—The plans for improving the property of the Sioux City Traction Co., at a cost of about $1,500,000, have been approved by the directors of the company. This includes the work of making the entire system standard gage, extending 5 city lines, double-tracking one line, tearing up another line and binding the Sioux City (Neb.) line to Crystal Lake, Neb., the enlarging of the power plant and the erection of a car house.

Chanute, Kan.—The City Council has granted a 25-yr. franchise to J. P. McGramm, of Galena.

Somerset, Ky.—A franchise for a line to enter this city has been sold to Judge Faulkner, of Lexington, who proposes to build an electric railway from Somerset to Monticello.

New Orleans, La.—Bids are wanted by the City Comptroller for the purchase of a street railway franchise in the 5th Dist. of city. T. W. Campbell, Clk. of Council.

Laurel, Md.—The Laurel Traction Co. has been incorporated to build a third line in Laurel and vicinity. Chas. J. Fox, of Philadelphia, Pa., and Edw. T. Benton, Jr., of Prince George County, Md., are interested.

Cumberland, Md.—The Cumberland Electric Ry. Co. has secured a 25-yr. franchise for the construction of a number of new lines here.

Whitinsville, Mass.—The Worcester & Blackstone Valley St. Ry. Co., of Millbury, proposes to extend its line from Whitinsville to East Douglas, through South Sutton.

Springfield, Mass.—The State R. R. Comrs. have approved an issue of $1,500,000 bonds by the Springfield St. Ry. Co. Of the proceeds $250,000 are to be used for improvements and betterments. Geo. W. Cook, Supt., Springfield.

Coopersville, Mich.—The Grand Rapids, Grand Haven & Muskegon Electric Ry. will, it is reported, build a branch from Coopersville to Ravenna, a distance of 12½ miles. Thos. F. Carroll, Vice-Pres., Grand Rapids.

Hopewell, N. J.—The Trenton, Pennington & Hopewell St. Ry. Co. has secured a franchise in Hopewell. P. E. Hurley, Supt., Trenton.

Burlington, N. J.—The Council has granted the People's Traction Co. a franchise to build a line on High St.

Jamestown, N. Y.—Contracts are about to be let by the Chautauqua Traction Co. for the construction and equipment of its proposed road between Lakewood and Mayville, a distance of 19 miles. Four 250-Kw. generators and six 200-H.-P. boilers will be required. A. N. Broadhead, of Jamestown, Pres.

Hoosick Falls, N. Y.—A charter has been granted by the Vermont Legislature for an electric railway from Bennington, Vt., to the Massachusetts State line at Williamstown, where a short extension of the Hoosac Valley St. Ry. would connect the line with North Adams and Pittsfield. Terminals will be at Great Barrington, Mass., and Bennington, a distance of 60 miles. Among the incorporators are: C. H. Cutting, H. H. Hanley, H. W. Clark and C. Q. Richmond, of North Adams, Mass.

Jamestown, N. Y.—The Council has granted a franchise to the Jamestown & Warren Traction Co. It will be 19 miles in length, passing through Ackley, Russell and North Warren. D. H. Siggins, Pres.

Hammondsport, N. Y.—F. J. Kilpatrick and John F. Tuerk, of New York, N. Y., are stated to have secured a franchise in Hammondsport. They have in contemplation the construction of an electric railway from Hammondsport to Bath.

Auburn, N. Y.—It is stated that arrangements have been made with the Knickerbocker Trust Co. of New York, to finance the proposed electric railway between Ithaca and Auburn. The road will pass through Portland, Ludlowville, Lake Ridge, King Ferry, Poplar Ridge and Auburn. Isaac P. Hazard, of Poplar Ridge, Pres.; Sherman Collins, of Ithaca, Secy.

Ceres, N. Y.—A survey is being made for an extension of the Olean St. Ry. from Ceres to Shingle House, a distance of about 4 miles. I. W. Miller, Supt., Olean.

Wapakoneta, O.—The Auglaize Co. Comrs. and the Town Council have granted franchises to the Sandusky-Southwestern Ry. Co. H. A. Sparks, Ch. Engr., Wapakoneta.

Bucyrus, O.—The Crawford Co. Comrs. have granted a franchise to C. A. Linn and others for an electric railway from Marion to Bucyrus.

Columbus, O.—The Columbus, Delaware & Marion Ry. Co. will expend a large amount of money in improving both the railway and lighting systems. Lee D. Fisher, Mgr., Delaware.

The Columbus, Marysville & Bellefontaine Ry. Co. has been incorporated, with a capital of $25,000, by W. H. Luchtenberg, M. B. Earnhart and others, to construct an electric railway between Columbus, Marysville and Bellefontaine.

Coshocton, O.—It is reported that Tucker, Anthony & Co., of Boston, Mass., have secured control of a water power near Coshocton, and will erect a power house there for the proposed line from New Philadelphia to Newark.

Maumee, O.—The Council has granted a 25-year franchise to the Toledo Urban & Interurban Ry. Co., which is promoted by Thos. H. King, H. E. Riggs, of Toledo, and others.

Washington C. H., O.—The Columbus & Washington Ry. Co. has been incorporated, with a capital of $10,000, by Richard Emory, Otto Ehring and others. This is an Appleyard proposition and contemplates the extension of the Columbus, Grove City & Southwestern line to Washington C. H.

Marysville, O.—The Co. Comrs. have granted a franchise through the county to the Toledo, Columbus, Springfield & Cincinnati Traction Co.

Dayton, O.—The Oakwood St. Ry. will extend its line to Salem Hill and the City Ry. Co. will extend its Green Line and build a new line on Bway. to West Dayton View.

The Union Traction Co. has been incorporated, with a capital of $5,000, by W. H. Clapper and others, to build a union freight station with a loop line.

Nanticoke, Pa.—It is proposed to extend the Peoples' St. Ry. to Berwick, 20 miles from Nanticoke.

Lenape, Pa.—The West Chester St. Ry. Co. has completed arrangements for a new power house at Lenape, on the West Chester-Kennett extension. The building will be of brick, 60x80 ft., and 2 stories in height. The stack will be of terra cotta brick, 6 ft. in internal diameter and 125 ft. high. The equipment will consist in part of four 250-H.-P. boilers, 2 engines and two 300-Kw. generators. The Baker Engineering & Machine Co., of Philadelphia, is doing the architectural planning.

La Anna, Pa.—A charter has been granted to the Mt. Pocoro, La Anna & Newfoundland Ry. Co. for an electric railway between Mt. Pocoro and La Anna, a distance of 12 miles. John B. Williams, Pres.

Beaver Falls, Pa.—Charters have been granted to the Beaver Falls Electric St. Ry. Co. and the Beaver & Bridgewater Electric Ry. Co., to construct an electric railway connecting the boroughs of Beaver, Bridgewater and Beaver Falls. John Warren, of Beaver Falls; Wm. A. Park, of Beaver, are among the directors.

Freedom, Pa.—The Boro. Council has passed an ordinance granting a franchise to the North Rochester Electric St. Ry. Co.

Greenville, S. C.—Dr. Geo. E. Coughlin, of Indianapolis, Ind., is interested in the construction of an electric railway from Greenville to Anderson.

Seattle, Wash.—Jas. McMurray, of Chicago, Ill., is reported interested in the construction of an electric railway between Seattle and Everett. Geo. A. Yuille, of Chicago, will superintend its conatruction.

New Martinsville, W. Va.—The Wetzel & Tyler R. R. Co. has been incorporated to build an electric railway from New Martinsville to Sistersville; capital, $250,000. Incorporators: Thos. A. Watkins, John P. Gangwisch, Jr., of Pittsburg, Pa., and others.

Keystone, W. Va.—The Keystone Traction Co. has been incorporated to construct an electric railway from Sand Lick to Maybeury; capital, $25,000. Incorporators: O. J. Evans, Northfork, W. Va.; M. Goldstein, Keystone, and others.

Janesville, Wis.—The Council has granted the Janesville Traction Co. a franchise to run a line through the city.

Wausau, Wis.—The City Council has granted a 35-yr. street railway franchise to the Wisconsin Valley Ry. & Power Co. Company has now secured the same rights in each town between Wausau and Stevens Point.

RAILROADS.

Attalla, Ala.—The Bd. of Mayor and Aldermen are stated to have granted to the Louisville & Nashville R. R. Co. a franchise through the city. R. Montfort, Ch. Engr., Louisville, Ky.

Fayetteville, Ark.—The Ozark & Cherokee Central R. R. Co. is stated to have decided to extend its line from Fayetteville east to Jasper, a distance of about 100 miles. E. W. Boynton, Ch. Engr., Weiser, Idaho.

Marion, Ark.—The Memphis & New Orleans R. R. Co. has been incorporated, with a capital of $6,265,000, by B. L. Winchell, of St. Louis, Mo.; C. H. Trimble, of Memphis, Tenn., and others, to build a railroad from a connection with the Kansas City, Fort Scott & Memphis, at or near the town of Marion, through the counties of Crittenden, St. Francis, Lee, Phillips, Monroe, Arkansas, Desha and Chicot, to a point west of the Mississippi River, a distance of 179 miles. Principal office to be at Marion.

Hot Springs, Ark.—The Garland Western R. R. Co., of Hot Springs, has been incorporated, with a capital of $1,000,000, to build a railway from the southern boundary of Hot Springs to a point near the center of Montgomery County, a distance of about 51 miles. Directors: Ed. H. Johnson, S. W. C. Smith, and others, all of Hot Springs.

Rochelle, Ill.—McIntosh Bros., Milwaukee, Wis., are stated to have secured the contract for the construction of 40 miles of railroad for the Rochelle Southern R. R. from Rochelle, Ill., to Ladd, Ill.

Kankakee, Ill.—The Chicago & Great Western Ry. Co. has been incorporated, with a capital of $25,000, to construct a line from the north line of Cook Co. to the south boundary of Kankakee County. Incorporators: John T. Evans, Herbert T. Duncombe, David Plummer, and others, all of Chicago.

Greenfield, Ill.—The Burlington R. R. Co. is stated to have decided to build a line from Greenfield to Winterset and Norwalk. W. L. Breckinridge, Ch. Engr., Chicago.

Clyde, Ill.—The Chicago, Burlington & Quincy R. R. Co. is about to increase facilities in its Hawthorne yards at Clyde, involving an expenditure of probably $300,000. The plans include a round house and a 30-stall engine house. W. L. Breckinridge, Ch. Engr., Chicago.

Indianapolis, Ind.—The Union Ry. Co. has employed Thos. H. Johnson, of Pittsburg, Pa., to prepare plans for a general system of track elevation of all the railroads entering this city.

Pella, Ia.—The Iowa Ry. Co. has been incorporated, with a capital of $135,000, to construct a short line, about 4 miles in length, from Pella south to Howell, to connect with the Wabash. Incorporators: Liston McMillen, T. J. Price, and others. Principal office to be at Oskaloosa.

Syracuse, Neb.—A preliminary survey is being made by the Santa Fe through Beaver County, Okla., on the proposed line from Syracuse, Kan., to a point south of Albuquerque, N. M. W. B. Storey, Ch. Engr., Topeka, Kan.

Philadelphia, Pa.—Press reports state that the Phila. & Reading Ry. Co. has prepared plans to elevate its 9th St. tracks. The general plans, according to Vice-Pres. Theo. Voorhees, of Philadelphia, provide for a solid roadway between retaining walls as far as Girard Ave., with steel bridges over the intersecting streets. North of Girard Ave. the right of way extends from house line to house line, and at city's suggestion plans call for an open steel elevated arructure as far as Jefferson St. Beyond that point and as far as Cumberland St. the elevated will again be a solid roadbed between retaining walls, the entire width of company's right of way.

Glen Loch, Pa.—Contracts for constructing sections of the double track road for the Pennsylvania R. R. Co. from Thorndale to Glen Loch are stated to have been awarded as follows: Glen Loch, Section No. 4—About 80,000 cu. yds. excav., masonry for 4 undergrade bridges; masonry for one overhead road bridge; operation 7,000 ft. long; to Reiter, Curtis & Hill. Bradford Hills, Section No. 7—450,000 cu. yds. excav., masonry for 3 undergrade bridges; about 8,500 ft. in length; to P. F. Brendlinger, of Philadelphia. Thorndale, Section No. 10—170,000 cu. yds. excav, masonry for 6 undergrade bridges; length 8,500 ft.; to P. McManus, Philadelphia.

Hillsdale, Pa.—J. C. McAtee, of Clearfield, and J. D. Ake, of Hillsdale, will build a railroad from Gypsy to Hillsdale. The line will be called the Hooverhurst & Southwestern R. R.

Aiken, S. C.—Artic Legare, Jas. G. Guingnard, and other engineers, are reported to be making a preliminary survey for a railroad from Columbia to Aiken, a distance of about 47 miles.

PUBLIC BUILDINGS.

Little Rock, Ark.—Plans and specifications will be received May 12 by the Bd. of Trus. of State Charitable Instit. for erecting 2 annexes at the Arkansas State Lunatic Asylum, Little Rock, to cost not exceeding $140,000. John H. Page, Secy.

Fresno, Cal.—It is stated that bids are wanted May 4 for erecting a fire engine building on Block 2, Fishers Addition. J. B. Johnson, City Clk.

Tenleytown, D. C.—Bids are wanted Apr. 30 for erecting a substation building for the Police Dept. on Tenleytown road. John Biddle, Comr., D. C.

Athens, Ga.—The contract for the erection of the city hall is stated not to have been awarded as the bids were in excess of the $40,000 appropriation. W. J. Beelan, of Macon, is reported to have submitted the lowest bid, $46,374.

Washington, Ga.—Bids will be received by the Co. Comrs. of Roads & Revenues until May 12 for erecting a court house according to plans prepared by Frank P. Milburn, Archt., Columbia, S. C. R. D. Callaway, Chmn.

Boise City, Idaho.—Bishop Funsten is reported to be having plans prepared for an addition to St. Luke's Hospital, to cost $50,000.

Lincoln, Ill.—Press reports state that bids will be received May 11 by the Co. Comrs. for erecting a court house. J. M. Deal, Archt.

Lafayette, Ind.—The Bd. of Trus. of Lafayette Soldiers' Home will soon receive bids for the installation of a heating plant, to cost $35,000.

Liberty, Ind.—Rev. J. J. Wade writes that all bids received Apr. 15 for erecting the R. C. Church have been rejected, and new bids will be received June 1.

Paris, Ky.—Press reports state that bids will be received by the Co. Comrs. May 15 for $150,000 court house bonds.

Louisville, Ky.—The following contracts are stated to have been awarded for the superstructure of the jail to be erected here: Structural iron work, Snead Architectural Iron Works, 710 14th St., $34,450; brick work, Fred Hoertz, 1322 Beechwood Ave., $19,017; plumbing and drainage, M. J. Duffy, 527 W. Market St., $16,149; electric work, Jos. McWilliams & Co., $3,663.

Boston, Mass.—Bids will be received until Apr. 27 by the Park Comrs. for erecting 3 stone sanitary buildings and a brick storehouse. Chas. E. Stratton, Chmn.

Boston, Mass.—Hollis French and Allen Hubbard, Engrs., write that the contract for a heating system in the Boston Insane Hospital (bids opened Mar. 28) has been awarded to A. A. Sanborn, 18 P. O. Sq., Boston, for $44,399.

The following bids have been received for the erection of a boiler house for the new prison at Deer Island, Boston Harbor: Mack & Moore, 22 Chapman Pl., $59,900, and Henry McGahey, $55,865.

St. Paul, Minn.—See "Bridges."

Rochester, Minn.—F. A. Graves, of Minneapolis, is stated to have received the contract for the erection of the addition to St. Mary's Hospital, for $46,845.

St. Louis, Mo.—The following bids were opened on Apr. 15 by the Missouri Comn. for the erection of the Missouri Bldg. on World's Fair site: Strehlow & Phelps, $105,480 (awarded contract); Goldie Construction Co., $109,000; Smith & Eastman Co., $115,403; Caldwell & Drake, $122,067; John J. Dunnavant & Co., $123,543; Althaus-Helm Bldg. & Constr'n Co.; $135,598; R. W. Morrison Construction Co., $141,991; Henry W. Schlueter, $161,000.

The contract for the construction of Jerusalem, one of the great concessions of the La. Purchase Expos., has been awarded by the Jerusalem Exhibit Co. to John J. Dunnavant & Co.; contract price, $500,000.

Red Lodge, Mont.—Bids will be received Apr. 28 by the Co. Bd. for erecting a jail; also for a heating plant for the court house, jail and sheriff's residence.

Nashua, N. H.—It is reported that the Church of the Immaculate Conception has plans for a new edifice, and is calling for bids for same. Address Rev. Mr. Buckle.

Concord, N. H.—Bids will be received Apr. 28 by the Com. of Trus. of the N. H. State Hospital for furnishing material and erecting wings to the Rumford and Chandler buildings; bids will also be received for constructing 5 iron-proof stairways. Wm. M. Butterfield, Archt., Manchester. J. A. Spalding, Chmn.

Jersey City, N. J.—Bids will be received by the Bd. of Finance until Apr. 29 for erecting public baths on Coles St.; work to include plumbing, electric wiring, gasfitting, ventilating and heating. Oliver H. Perry, Chmn.

Rochester, N. Y.—Bids will be received May 6 by the State Comn. in Lunacy at the Capitol, Albany, for installing engines, generators, electric wiring and fixtures, etc., for the reception, infirmary, kitchen and chronic buildings, connecting corridors and power house at the Rochester State Hospital. G. L. Heins, State Archt., Albany. E. H. Howard, Supt.

Buffalo, N. Y.—See "Water."

Long Island City, L. I., N. Y.—The following bids were opened Apr. 17 by Thos. Sturgis, Fire Comr., N. Y. City, for a building for Hook & Ladder Co. 66, Jackson Ave. and Kouwenhoven St.: Tolmie & Kerr, 205 W. 30th St., N. Y. City, $26,687; Thos. B. Leahy, $27,750; H. F. Lippe & Bro., $28,398; Geo. Hildebrand, $29,480; Wm. Horne, $29,750; James A. Stevenson, $44,999.

Plans are stated to have been filed for the erection of the 65th Precinct Station House at Vernon Ave. and 4th St.; probable cost, $90,000. Thos. Short, Archt., 3 W. 29th St., N. Y. City.

Brooklyn, N. Y.—The following bids were opened Apr. 17 by Thos. Sturgis, Fire Comr., N. Y. City, for a building for Engine Co. 124, Hicks St., near Joralemon St.: Geo. Hildebrand, $36,350; Tolmie & Kerr, 205 W. 30th St., N. Y., $31,287; Wm. Horne, $36,798.

Bids will be received Apr. 29 by Thos. Sturgis, Fire Comr., N. Y. City, for furnishing material for erecting new buildings for Engine Co. No. 146 and 145, Boro. Brooklyn.

New York, N. Y.—The following bids were opened Apr. 17 by E. J. Lederle, Pres. Bd. of Health, for erecting a nurses' home at the Riverside Hospital, North Brother Isl.: John R. Sheehan & Co., Inc., 160 5th Ave., $47,740; J. E. Butterworth, $49,287; J. C. Vreeland Bldg. Co., $54,436; G. L. Walker, $57,790; John J. Tucker & Sons, $58,000; Herman F. Lippe & Bro., $67,500.

Bids will be received May 4 by Francis V. Greene, Police Comr., for furnishing material for making and completing the repairs and alterations to the station houses of 17 precincts and the Central Dept. Bldg.

The lowest bid received Apr. 22 for erecting a male servant's dormitory at City Hospital, Blackwells Island, was submitted by Jos. E. Butterworth, 2070 Ryer Ave., at $39,597. J. McKee Borden, Secy. Dept. of Charities.

Bids will be received May 15 by the Bd. of Estimate and Apportionment for furnishing material and doing interior marble work in the Hall of Records. Horgan & Slattery, Archts., No. 1 Madison Ave. Seth Low (Mayor), Chmn.

Bids will be received May 5 by the Dept. of Bd. of Health for furnishing material to complete the foundations for the scarlet fever pavilion at the Willard Parker Hospital, E. 16th St. Ernst J. Lederle, Ph. D., Pres.

Napoleon, N. D.—Bids will be received July 8 by the Bd. of Co. Comrs. for erecting a jail. Sam Brand, Co. Aud.

Langdon, N. D.—It is stated that bids are wanted Apr. 29 for erecting a brick church for St. Alphonsus Parish. Address Rev. M. Dougherty, Box 56.

Baker City, Ore.—See "Sewerage and Sewage Disposal."

Philadelphia, Pa.—The Senate is stated to have passed a bill providing for an appropriation of $50,000 for the erection of a building for the Eastern Pennsylvania Inst. for Feeble Minded and Epileptics.

Williamsport, Pa.—Bids will be received May 9 by the Co. Comrs. for furnishing material for erecting an annex to the Lycoming Co. court house. Truman P. Reitmeyer, Archt., Masonic Temple. Saml. Bastian, Chmn.

Berwick, Pa.—See "Sewerage and Sewage Disposal."

Fenelton, Pa.—It is stated that plans are being prepared by Sidney F. Heckert, 341 6th Ave., Pittsburg, for Father Hickey's Memorial Church, to be erected here at a cost of $60,000.

Providence, R. I.—Bids will be received Apr. 29 by the Comn. on State Sanitorium for consumptives for erecting a sanitorium in Burrillville Township. C. Alvin Potter, Chmn.

Memphis, Tenn.—Bids will be received by the Co. Court until May 12 for furnishing and installing 2 boilers and a heating plant in the court house. T. B. Haynes, Chmn.

Bids will be received May 6 by J. Edw. Swanstrom, Boro. Pres., for furnishing material for erecting an interior public bath building on Montrose Ave.

Newport News, Va.—The House of Delegates is stated to have passed a bill authorizing the issue of $100,000 bonds for the erection of a municipal building.

Spokane, Wash.—Julian & Williams, of Spokane, have prepared plans for a $75,000 R. C. Church to be erected in this city.

Moundsville, W. Va.—C. E. Haddon, Warden, writes that the contract for a stone and cement addition to North Hall of the W. Va. Penitentiary (bids opened Apr. 14) has been awarded to Diskeson & Beardsley, of Marietta, O., for $20,615. The Van Dorn Iron Works Co., of Cleveland, O., has the contract for the steel cell work for $58,890.

Berlin, Ont.—Bids will be received until Apr. 27 by Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, for erecting additions to the Post Office at Berlin.

Libraries.—Andrew Carnegie is stated to have offered the following cities libraries: Oberlin, O., $125,000; Bayonne, N. J., $50,000.

BUSINESS BUILDINGS AND DWELLINGS.

Mobile, Ala.—A correspondent writes that Christ Church will erect a 4-story business building on Commerce St.

San Francisco, Cal.—It is reported that Scott & Van Arsdale will erect an 8-story brick fireproof building at Mission and Jessie Sts., to cost $215,000.

Colorado Springs, Colo.—The Colorado Springs & Interurban Ry. Co. will erect a car house here, to cost $25,000.

Waterbury, Conn.—Architects Bowditch & Stratton, of Boston, Mass., and Griggs & Hunt, of Waterbury, are preparing plans for a new hotel; estimated cost, $250,000.

New Britain, Conn.—Bids are wanted Apr. 27 for the erection of a 5-story business building, 50x100 ft., for John A. Andrews; cost, about $30,000.

Washington, D. C.—It is stated that the Royal Arcanum is preparing to erect in this city a building, probably 7 stories, to cost about $250,000.

Chicago, Ill.—It is stated that Hillman & Co. will erect a warehouse at 1917 Clark St. The structure will be 4 stories, 50x135 ft., and cost $40,000.

Clyde, Ill.—See "Railroads."

Chicago, Ill.—See "Schools."

Chicago, Ill.—Plans are stated to have been completed for the erection of the club house for the Union League at Jackson Boule. and Custom House Court; approximate cost, $100,000.

It is stated that Henry Stanger will erect a 3-story building at W. Madison and Sangamon Sts., at a cost of $45,000.

Louisville, Ky.—The Kentucky Malt & Grain Co. has taken out a permit to build a brick addition to its plant at 13th and Maple Sts.; cost, $20,000.

The Kentucky Tobacco Product Co. will build a warehouse at 9th and York Sts.; cost, $20,000.

Holyoke, Mass.—W. B. Reid, 280 High St., has prepared plans for a 3-story brick building, 41x90 ft., for the Holyoke Telegram.

Kansas City, Mo.—The following brick apartments will be erected: For Henry Deloy, at 2408 Troost Ave., cost $25,000; for A. W. Mason, at 1401 Troost Ave., $25,000; for Mrs. A. Gray, at 202 W. 36th St., $15,000; for C. R. Manger, at 2100 E. 8th St., $15,000, and for I. J. Hedrick, at 3220 E. 10th, $16,000.

Schenectady, N. Y.—Press reports state that the contract will soon be let for the 600x150-ft. machine shop to be erected here.

Auburn, N. Y.—The Syracuse & Auburn Ry. Co. is having plans prepared for a car shed and repair shop to be erected on Franklin St. The structure will be 1 story, 17x200-ft.

Brooklyn, N. Y.—Peter W. Rouss is stated to have purchased a site at Prospect Park West and Garfield Pl. for the erection of a residence, to cost $100,000.

Wrightsville, N. C.—It is stated that a hotel will be erected at Wrightsville Beach, to cost $50,000.

Springfield, O.—The Columbus, London & Springfield Ry. Co. (C. A. Alderman, Ch. Engr., Columbus) is preparing to erect a car house and repair shop here.

Lancaster, O.—Bids are wanted Apr. 28 for furnishing material and erecting a 3-story business block, 75x80 ft., at Columbus and Chestnut Sts., including plumbing, electric wiring, etc. John B. Price, Archt., Rm. 30, Martens Blk.

Dayton, O.—See "Electric Railways."

Pittsburg, Pa.—The Baltimore & Ohio R. R. Co. (J. E. Greiner, Engr. Bldgs., Baltimore) is reported to be having plans prepared for warehouses to be erected at Ross and Brewery Sts.; probable cost, $800,000.

Erie, Pa.—The Lake Shore Lodge of Odd Fellows are stated to have decided to erect a building at 11th and Peach Sts., to cost $50,000.

Grove City, Pa.—Plans are stated to have been approved for the erection of a building for the Odd Fellows of Western Pennsylvania and Eastern Ohio; estimated cost, $50,000.

Richmond, Va.—Clinton & Russell, 32 Nassau St., New York, N. Y., is reported preparing plans for an office building for the Mutual Assurance Society of Va. E. A. Palmer, Principal Agent, Richmond.

Petersburg, Va.—John K. Peebles, of Norfolk, Va., is preparing plans for the Randolph Hotel, to be erected on Sycamore St. for Jos. W. and Simon Seward; cost about $50,000.

Milwaukee, Wis.—Herman Nunnemacher is reported to be having plans prepared for a flat, to be erected on Terrace Ave., at a cost of $75,000.

La Crosse, Wis.—The Park Store is reported destroyed by fire Apr. 21.

NEW YORK, N. Y.

Cannon and Stanton Sts, 7-story br loft bldg; c, $35,000; o, Marcus Schiff; a, Ebeling & Meyer.

188 Chrystie St, 6-story br tenemt and stores; c, $52,000; o, Friedman & Feinberg; a, Bernstein & Bernstein.

Hester and Mulberry Sts, 6-story br tenemt and stores; c, $35,000; o, David Baum; a, Horenburger & Straub.

Houston and Greene Sts, 9-story br loft and stores; c, $100,000; o & a, W G Piqueron.

50 Macdougal St, 6-story br tenemt and store; c, $25,000; o & b, Chas I Weinstein; a, G F Pelham.

Ave B and 3d St, 6-story br tenemt; c, $40,000; o, Sami Barkin; a, Alfred E Badt.

Ave C and 9th St, 6-story br tenemt and stores; c, $50,000; o, Julius Weinstein; a, Bernstein & Bernstein.

Ave D and 5th St, 6-story br tenemt; c, $70,000; o, M Jacobs; a, Alfred E Badt.

3 E 17th St, 9-story br offices and stores; c, $120,000; o, Gabay Construction Co; a, Fred C. Zobel.

22d St. and 6th Ave, 6-story br offices and stores; c, $30,000; o, Mrs Wm B Hoffman; a, Parrish & Schroeder.

31st St and 3d Ave, 6-story br tenemt; c, $40,000; o, John Roth; a, Gillespie & Carrel.

50th St and 2d Ave, 6-story br tenemt; c, $50,000; o, Wolf Fish; a, Sass & Smallheiser; b, Rosenberg & Aaronson.

51st St and Madison Ave, 3 5-story br dwells; total c, $135,000; o, The Joseph A Farley Constr. Co.; a, C C & M C Thaln.

Madison Ave and 26th St, 10-story br tenemt; c, $320,000; o, The Wyllys Co; a, Howells & Stokes; b, Thompson-Starrett Co.

32 E 22d St, alterations to 5-story br dwell; c, $65,000; o, Stern & Marks; a, Louis C Albro.

BROOKLYN, N. Y.

Clinton and Greene Ave, 3-story br dwell; c, $45,000; o, H. Batterman; a, A. Ulrich.

Sackett and Van Brunt Sts, 5-story br tenemt; total c, $30,000; o, A Castruccio; a, C H Richter, Jr.

3d Ave and 45th St, 3-story br factory; c, $20,000; o, M Kurzrock; a, Pohlman & Patrick.

SCHOOLS.

Pasadena, Cal.—J. F. Atkinson, of Los Angeles, is stated to have secured the contract for erecting the high school, for $74,777.

Washington, D. C.—It is stated that contracts will soon be let for the plumbing of various schools; probable cost, $20,000.

Quincy, Ill.—Bids are wanted Apr. 30 for erecting the Webster School on Maine St. Dickerson McAfee, Chmn. Joint Com. of the Finance and Bldgs. and Grounds Com. Bd. of Educ.

Chicago, Ill.—R. C. Berlin, 131 La Salle St., is stated to have completed plans for a parochial school, rectory, boiler house, and heating plant to be erected at Leavitt and 18th St.; probable cost of all, $125,000.

Chicago, Ill.—Bids will be received May 1 by the Com. on Bldgs. and Grounds, Bd. of Educ., for the Luma addition on Sacramento Ave., including ventilating, steam heating, plumbing, gas fitting, sewerage, electrical work, fireproofing, etc.; also for erecting a Parental School Hospital on St. Louis Ave., including plumbing, gas fitting, sewerage, and electrical wiring. W. B. Mundie, Archt. of Bd. T. J. Waters, Ch. Engr.

Young America, Ind.—Bids are wanted May 2 for erecting a school. J. A. Gray, Trus.

Bluffton, Ind.—Bids are wanted May 4 for erecting a school in Dist. No. 10, Nottingham Township. A. W. Sours, Trus.

Goshen, Ind.—Geo. W. Wehmeyer, 221 N. 6th St., has received the contract for erecting the high school here, for $42,556.

Anderson, Ind.—T. H. Jones, of Alexandria, is stated to have submitted the lowest bid for erecting the high school and the American Warming and Ventilating Co., of Chicago, for installing the steam heating plant, for $22,647 and $5,280 respectively.

Terre Haute, Ind.—The Trus. of Indiana Normal School will soon receive bids for erecting the Mannal Training School; estimated cost, $50,000.

Centerville, Ia.—Bids are wanted May 4 for erecting a school in Taylor Sub-Dist. No. 4. Address J. E. Callen.

Ledyard, Ia.—Bids are wanted May 9 for erecting a school. J. E. B. Worden, Pres. Dist. No. 3.

Ames, Ia.—Bids will be received May 6 (readvertisement) by the Bd. of Trus. of the Iowa State College for erecting a 4-story stone central building, to cost about $300,000. Prondfoot & Bird, Archts., Des Moines.

Kansas City, Kan.—Bids will be received May 4 by the Bd. of Educ. for erecting a 6-room addition to the London Heights School. Address, W. E. Barnhart, Pres.

Topeka, Kan.—Plans will be received May 4 by J. E. Steward, Clk. Bd. of Educ., for a 6 and 8-room ward school; also on May 11 for a 12-room ward school; plans are also wanted for a high school.

Madisonville, Ky.—The citizens are stated to have voted to erect a school, to cost $25,000.

Orono, Me.—The Trus. of the Univ. of Maine have accepted the plans of Thomas & Crowell, of Bangor, for a new shop for the mechanical and electrical departments, for which $35,000 was voted by last Legislature.

Baltimore, Md.—Ordinances are stated to have been passed providing for the appropriation of $30,000 for the erection of a school at Ramsay and Smallwood Sts., and $40,000 for a school at Hollins St. and Fulton Ave.

Peabody, Mass.—A. E. Wells, Chmn. Bldg. Com., writes that contracts for a brick high school (bids opened Apr. 20) have been awarded as follows: Masonry, D. F. O'Connell, Boston, $31,923; carpenter work, J. W. Balcomb, Salem, $36,530; heating, Aetna Eng. Co., Springfield, $7,480, and plumbing, M. E. Lynch, Peabody, $3,179.

New Bedford, Mass.—Geo. W. Parker, Mayor's Secy., writes that the following bids were opened on Apr. 15 by Mayor Ashley for erecting a high school: Henry T. Bulman, New Bedford, $679,225; Zebina B. Davis, New Bedford, $787,407; The B. F. Smith Co., Pawtucket, R. I., $740,790; R. L. Fosburg & Sons, Boston, $715,000; The J. W. Bishop Co., Worcester, $723,936; P. H. Jackson, Brockton, $692,-901.25; Morrill & Whiton Constr. Co., Boston, $724,-708, and Beattie & Cornell, Fall River, $715,494.

Saginaw, Mich.—W. R. Burt is reported to have offered this city $150,000 toward the erection of a Mannal Training School.

River Rouge, Mich.—Bids are wanted May 8 for erecting a 9-room school in Dist. No. 4 Ecorse Township. Edw. C. Van Leyen, Archt., Detroit. H. E. Visger, Dir. Bd. of School Trus.

St. Paul, Minn.—See "Bridges."

Dillon, Mont.—Bids are wanted Apr. 29 for erecting an addition to the dormitory at the State Normal College. C. S. Haire, Archt., Helena; A. L. Stone, Secy. Executive Bd.

Kalispell, Mont.—Local press reports state that bids will be received until Apr. 30 by the Bd. of Trus. for erecting a high school according to plans prepared by Gibson & Shanley, Kalispell.

Concord, N. H.—Perley F. Gilbert, of Lowell, Mass., is preparing plans for an annex to the high school.

Ft. Wadsworth, N. Y.—Bids will be received May 4 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures and electric bell system in School No. 34, Boro. Richmond.

New York, N. Y.—The following contracts have been awarded, bids for which were opened on Apr. 20 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City: To Jas. Fay, 205 E. 51st St., for sanitary work of addition to and alteration in School No. 92, Boro. of Manhattan, for $6,248; to M. B. Foster, 171 W. 71st St., for installing electric light fixtures, etc., in School 190, Boro. of Manhattan, for $4,262, and to John W. Moore, 307 Kingsland Ave., Brooklyn, for completing School No. 5, Boro. of Queens, for $24,700.

Andrew Carnegie is stated to have offered $250,000 to the General Society of Mechanics and Tradesmen of this city for the enlargement of their buildings.

The following bids were opened on Apr. 20 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for (*a*) general construction of Public School 84, Boro. of Queens, and (*b*) for general construction of addition to and alterations in Truant School, Boro. of Manhattan: Geo. Hildebrand, 1368 Bwny, *a*, $198,390 (awarded contract); *b*, $92,000. P. J. Walsh, *a*, $205,000. Thos. Cockerill & Son, *a*, $214,900; *b*, $98,500. F. J. Kelly's Sons, *a*, $204,368. Myron C. Bush, *a*, $204,997; *b*, $97,969. Aug. Braeunig, *b*, $89,600.

Bids were opened at the same time and place for (*a*) installing, ventilating and heating apparatus in School 190, Boro. of Manhattan, and (*b*) installing, ventilating and heating apparatus in New P. S. 6 (65), Boro. of Bronx: Frank Dobson, *a*, $20,300; *b*, $20,500; Jas. Curran Mfg. Co., *a*, $21,000; *b*, $21,500. Williams & Gerstle, *a*, $20,760. Wm. N. Tobin, *a*, $20,916; *b*, $20,491. John Hankin & Bro., *a*, $23,667; *b*, $26,097. Blake & Williams, *a*, $20,994; *b*, $20,720. E. Rutzler, 178 Centre St., *a*, $19,568 (awarded contract); *b*, $20,278 (awarded contract). John Neal's Sons, *a*, $21,438; *b*, $21,918. United Htg. Co., *b*, $20,617.

Bids will be received May 4 by C. B. J. Snyder, Supt. of School Bldgs., for alterations and repairs to Schools Nos. 1, 27, 20, 55, 59, 109 and 137; also for installing electric light wiring, fixtures and electric bell system in School No. 183.

Brooklyn, N. Y.—Bids will be received May 4 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric light wiring and fixtures in School No. 19.

Cleveland, O.—Bids are wanted May 8 for erecting a school on Down St. Starr Cadwallader, School Dir. Bd. of Educ.

It is stated that bids are wanted May 11 for completing the Doan St. school. Starr Cadwallader, Dir.

Frankford, Pa.—The Bd. of Educ. is stated to be having plans prepared for an 8-room school to be erected at Oxford and Hedge Sts., to cost $35,000.

Mercersburg, Pa.—Jos. M. Huston. Witherspoon Bldg., Philadelphia, is reported to be preparing plans for a 3-story dormitory for the Mercersburg Academy, to cost $30,000.

Lawndale, Pa.—The Bd. of Educ. is stated to be having plans prepared for a 6-room school to be erected here, to cost $30,000.

Blooming Grove, Tex.—See "Water."

Lexington, Va.—Theo. C. Link, of St. Louis, Mo., is preparing plans for a building for the Physical and Engineering Dept. of Washington and Lee Univ.; cost, $30,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Oakland, Cal.—The Pacific Incinerating Co. has been incorporated, with a capital of $35,000, by A. S. Lilley, W. W. Thurston, and others. The company is reported to have recently obtained from City Council a franchise for the erection of a garbage crematory at 26th and Magnolia Sts., which the residents of 2d Ward are now fighting in courts.

Sacramento, Cal.—Mayor Clark in his annual address states that the construction of a garbage crematory is within the possibilities of an annual tax levy, and recommends that steps be taken to prevent perpetuation of existing nuisance.

Jacksonville, Fla.—Judge A. O. Wright is stated to have made a proposition to the city to establish a garbage plant.

Indianapolis, Ind.—E. F. Harris, Clk. Bd. Pub. Wks., writes that Kennington Bros. secured the contract for sprinkling the streets of the city at $18.70 for each 10,000 ft. of surface, sprinkled twice a day and an additional dollar if sprinkled 3 times a day (bids opened Apr. 15).

Shreveport, La.—Bids are wanted May 18 for the erection of a garbage crematory, as advertised in The Engineering Record.

Brooklyn, N. Y.—Bids will be received Apr. 30 by the Bd. of Park Comrs. for furnishing and delivering 12 sprinkling trucks. Wm. R. Willcox, Chmn.

Dallas, Tex.—Local press reports state that bids will probably be received May 1 for street cleaning. I. A. Moore, City Secy.

Seattle, Wash.—The Council has passed an ordinance granting P. G. Yaw a 30-year franchise for the collection and cremation of garbage. He will construct a crematory.

GOVERNMENT WORK.

Ft. Morgan, Ala.—Bids are wanted May 25 for an extension to and alterations in Guard House, as advertised in The Engineering Record.

Ft. Rosecrans, Cal.—Bids are wanted May 16 for an electric plant at this post. Capt. Edgar Jadwin, Corps Engrs., U. S. A., Los Angeles.

Washington, D. C.—The following bids were opened Apr. 16 for high pressure steam boilers at National Bureau of Standards Bldg., Washington: Babcock & Waters Co., New York, N. Y., $9,264; Heine Safety Boiler Co., Philadelphia, Pa., $8,884, and Oil City Boiler Wks., New York, N. Y., $10,500.

Washington, D. C.—Bids are wanted May 11 for furnishing brass and iron castings during the fiscal year commencing July 1, 1903. Wm. M. Meredith, Dir. Bur. of Engraving & Printing, Treas. Dept., Washington.

Bids will be received May 11 at the Office of Pub. Bldgs. & Grounds for furnishing iron pipe and plumbers' supplies, cement, brick, etc., during year ending June 30, 1904. Address Col. Theo. A. Bingham.

Leavenworth, Kan.—Contracts for headquarters building and combination barracks, bids for which were received by W. W. Martin, Treas. Western Branch, N. H. D. V. S., at National Military Home, Kan., on Apr. 17 have been awarded to the Miller-Banfield Bldg. Co., 405 Kemper Bldg., Kansas City, Mo., at $16,840 and $38,612 respectively. No bids were received for erecting the Chaplain's quarters.

Portland, Me.—Robt. Hamilton, Chebeague, Me., and Smith D. Sawyer, Yarmouthville, Me., bid for dredging Camden Harbor, Me., 26,600 cu. yds. and removing boulders (bids opened Apr. 14 by Maj. S. W. Roessler, Corps Engrs., U. S. A.) 26¼ cts. per cu. yd. and $10 per ton respectively.

Local press reports state that the following bids have been received by Capt. A. W. Yates, Q. M., U. S. A., for the construction of a pier at Diamond Island: Philip H. Doyen, Knightville, $22,853; Wm. L. Miller, Boston, Mass., $29,843 and $25,974; Jas. H. Ferguson, Dorchester, Mass., $36,666, and Mannix Bros., Portland, $53,000.

Ft. Washington, Md.—Capt. Geo. H. McManus, Q. M., U. S. A., writes that the contract for constructing cement sidewalks at Ft. Hunt, Va., and Ft. Washington (bids opened Apr. 16) has been awarded to Lyons Bros., of Brookland, D. C., at $1.32 per sq. yd.

New Bedford, Mass.—Capt. Thos. H. Slavens, Corps Engrs., U. S. A., of Newport, R. I., writes that the contract for constructing granolithic walks and macadam roads at Ft. Rodman (bids opened Apr. 6) has been awarded to W. A. Murtfeldt Co., 31 Milk St., Boston, for $3,756.

Boston, Mass.—Bids are wanted May 26 for rock excavation in Boston Harbor, Mass., as advertised in The Engineering Record.

The following bids for dredging in (*a*) Beverly Harbor, 18,000 cu. yds., and (*b*) Manchester Harbor were received by Capt. Harry Taylor, Corps Engrs., U. S. A., Apr. 20; price given per cu yd.: Chas. H. Souther, *a*, 33¾ cts.; *b*, 38⅛ cts. Bay State Dredging Co., *a*, 34¼ cts.; Eastern Dredging Co., *a* and *b*, 39 and 38½ cts.; bidders all of Boston.

Minneapolis, Minn.—The H. N. Leighton Co., of Minneapolis, is stated to have secured the contract for enlarging the federal building for $224,735.

New York, N. Y.—Col. Amos Stickney, Corps Engrs., U. S. A., writes that bids were opened as follows for dredging on Apr. 15 (price given per cu. yd.): John P. Randerson, 62 Quay St., Albany, N. Y., bid 28 cts. for dredging Port Jefferson Harbor; R. G. Packard Co., 130 Pearl St., Jersey City, N. J., bid 37⅛ cts. for dredging in Flushing Bay, and John and Jos. McSpirit, 118 Wayne St., Jersey City, N. J., submitted the following bids for dredging: Portchester Harbor, 21 cts.; Mamaroneck Harbor, 27 cts.; Bronx River, 95 cts. and East Chester Creek, 45 cts.

The following bids were received at the same time for constructing stone breakwater at Glencove Harbor, price given per ton: John A. Bouker, 21 State St., N. Y. City, $1.50; O'Brien Bros., 54 South St., N. Y. City, $1.83, and Smith & Robinson, 100 William St., N. Y. City, 78½ cts.

New York, N. Y.—The following bids for dredging in (*a*) Buttermilk Channel and (*b*) Gowanus Creek, N. Y. Harbor, were received by Maj. W. L. Marshall, Corps Engrs., U. S. A., Apr. 20 (price given per cu. yd.): Wm. H. Taylor, 24 Emery St., Jersey City, *a*, 26 cts.; *b*, 19¾ cts. W. H. Beard Dredging Co., Bridge St., *a*, 36 cts.; *b*, 22½ cts. R. G. Packard Co., 130 Pearl St., *a*, 39 cts.; *b*, 32 cts. Morris & Cummings Dredging Co., 24 State St., *a*, 32½ cts. Inter. Contracting Co., 95 Broad St., *a*, 36 cts.; *b*, 30 cts.

The following bids for dredging in Passaic River, N. J., were received by Lieut. Col. C. W. Raymond, Corps Engrs., U. S. A., Apr. 22; price given per cu. yd., scow meas.: Morris & Cumings Dredging Co., 17 State St., 34¾ cts., and The International Contr. Co., 95 Broad St., 28¾ cts.

Philadelphia, Pa.—Bids are wanted May 22 for removing rock, etc., in Delaware River at Schooner Ledge, as advertised in The Engineering Record.

Charleston, S. C.—Bids will be received May 23 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a 3-story brick and steel building for equipment at the Navy Yard, Charleston. Limit of cost, $125,000.

The contract for constructing a railway for Charleston Navy Yard (bids opened Apr. 18) has been awarded to the New York Continental Jewel Filtration Co., New York, N. Y., for $32,000.

The Clark Constr. Co., of Chicago, Ill., is stated to have secured the contract for building the machine shops at the Charleston Navy Yard, for $290,001.

Johnson City, Tenn.—Bids will be received at the office of the Natl. Home for D. V. S., 346 Bway, New York, N. Y., on May 14 for the construction of 4 barrack buildings near Johnson City, as advertised in The Engineering Record.

Hampton Roads, Va.—The following bids were opened Apr. 15 by Lieut.-Col. Jas. B. Quinn, Corps Engrs., U. S. A., at Norfolk, Va., for dredging at Hampton Roads—*a*, amount of material to be removed at price bid; *b*, price per cu. yd. (amount available, $202,500): Norfolk Dredging Co., Norfolk, Va., *a*, 1,723,404; *b*, 11.75 cts. Atlantic Gulf & Pacific Co., New York, N. Y., *a*, 1,273,856; *b*, 15.9 cts. Virginia Dredging Co., Richmond, Va., *a*, 1,387,328; *b*, 14.6 cts. Norris & Cumings Dredging Co., New York, N. Y., *a*, 1,602,482; *b*, 12.7 cts. Coastwise Dredging Co., Baltimore, Md., *a*, 2,250,000; *b*, 9 cts.

Cape Charles City, Va.—The following bids were opened Apr. 11 at Norfolk, Va., by Lieut.-Col. Jas. B. Quinn, Corps Engrs., U. S. A., for dredging harbor at Cape Charles City—*a*, price per cu. yd.; *b*, number of cu. yds. to be removed at price bid (amount available, $18,000): Coastwise Dredging Co., Baltimore, Md., *a*, 32¾ cts.; *b*, 54,961. McLean Contr. Co., Baltimore, Md., *a*, 32 cts.; *b*, 56,250. Norfolk Dredging Co., Norfolk, Va., *a*, 33 cts.; *b*, 54,545.

Norfolk, Va.—Bids will be received May 23 by Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a 1-story steel storage building at the Navy Yard, Norfolk. Appropriation, $27,500.

Port Townsend, Wash.—The following bids were opened on Apr. 8 by Capt. Geo. H. Penrose, Q. M., U. S. A., for the construction of buildings, including plumbing, heating and wiring, at (*a*) Ft. Casey, Wash., and (*b*) Ft. Worden, Wash.: Hastie & Dougan, Spokane, *a*, $74,500; *b*, $71,058. W. H. Nichols & Co., Tacoma, *a*, $75,505; *b*, $74,135. Alfred W. Burrell, Oakland, Cal., *a*, $70,862; *b*, $73,255. S. E. Boeker, Whatcom, *a*, $74,532; *b*, $74,032. R. M. Henningsen & Co., Seattle, *a*, $69,000; *b*, $79,950. Cawsey & Carney, Seattle, *a*, $76,573; *b*, $76,573, and Andrew Stegerwald, Port Townsend, *b*, $71,750. Separate bids for work on said buildings were received as follows: Jos. A. Hurley, St. Paul, Minn., bid for plumbing and heating, *a* and *b*, $14,286 each, and R. Daziel, Jr., of San Francisco, for plumbing and heating, *a* and *b*, $11,750 each. Harris & Alger, Camden, N. J., bid for heating alone, *a* and *b*, $5,436 each, and W. O. Nelson, Seattle, bid for plumbing alone, *a* and *b*, each $7,382.

Wheeling, W. Va.—Bids are wanted May 21 for furnishing and delivering irons for lock for Dam No. 18, Ohio River. Maj. Geo. A. Zinn, Corps Engrs., U. S. A.

Sitka, Alaska.—Bids are wanted June 8 for furnishing material for constructing 1 set officers' quarters at marine barracks, Sitka. Col. F. L. Denny, Q. M., U. S. Marine Corps, Washington, D. C.

NEW INDUSTRIAL PLANTS.

The Oshkosh, Wis., Logging Tool Co. is having plans drawn for a new factory, but will, at present, erect only a 2-story and basement, 158x65-ft. woodworking building.

Geo. I. Edgerton, Jr., Rock Stream, N. Y., is interested in the erection of a 3-story cold storage building about 76x80 ft., to have a capacity of 20,000 bbls.

The Illinois Steel Co., Chicago, will erect a cement plant, to have a daily capacity of 4,000 bbls., near Indiana Harbor, Ind. The buildings will include a 180x130-ft. raw material mill, a 120x240-ft. burner building, a 70x240-ft. finishing mill, two 120x350-ft. storage warehouses with a capacity of 400,000 bbls., machine shop, etc.

MISCELLANEOUS.

Rochester, Ind.—The contract for constructing the Mud Creek ditch is stated to have been awarded to John Boyer, of North Manchester, for $10,623.

Lafayette, Ind.—It is stated that bids are wanted Apr. 30 for constructing about 8,210 ft. of ditch. H. H. Cheney, Co. Aud.

Sioux City, Ia.—County Surveyor Martin Holmvig estimates the cost of cleaning and straightening Hedges-Garretson ditch at $42,000.

St. Paul, Minn.—The House has passed the bill authorizing the issuance of $50,000 bonds to enable the Park Bd. to acquire additional land for park purposes.

Jersey City, N. J.—The St. and Water Bd. is stated to have awarded to the Cement Paving & Constr. Co. the contract for improving the Lafayette Park site at Van Horne and Lafayette Sts., for about $19,000.

New York, N. Y.—The following bids were opened Apr. 17 by McDougall Hawkes, Comr. Dock Dept., for building a rip-rap embankment on easterly side of Riker's Island (100,000 cu. yds.): O'Brien Bros., 54 South St., 73 cts.; J. S. Miller, 89 cts.; De Witt C. Bonker, $1.25. (All bids rejected.)

Bids will be received Apr. 30 by the Bd. of Park Comrs. for furnishing and delivering 500 bbls. Portland cement and 200 cu. yds. Cow Bay sand for parks, Boro. Bronx. Wm. R. Willcox, Chmn.

The following bids were opened Apr. 21 by McDougall Hawkes, Comr. Docks, for dredging the East and Harlem Rivers; International Constr. Co., 44 cts. per cu. yd.; H. G. Packard Co., 42 cts.; W. H. Beard Dredging Co., 10 Bridge St., 33 cts.

Bids will be received May 5 by McDougall Hawkes, Comr. of Docks, for furnishing material for dredging the North River between the Battery and W. 159th St.; amount of bond required, $36,000; also for furnishing, delivering and putting in place small cobble and riprap stone.

Brooklyn, N. Y.—An ordinance has been adopted by Bd. of Aldermen authorizing the laying out of a public park, having as boundaries 73d St. and Ft. Hamilton and 7th Aves., Brooklyn.

New Rochelle, N. Y.—Bids will be received May 5 by Chas. Kammermeyer, City Clk., for constructing a stone dock in Hudson Park.

Philadelphia, Pa.—Bids will be received Apr. 30 by the Comrs. of Fairmount Park, for river wall, stone wall around Peter's Island, and a stone arch bridge over Wissahickon Creek at Hermit Lane. Jesse T. Vogdes, Ch. Engr. and Supt.

Milwaukee, Wis.—C. J. Poetsch, City Engr., writes that the contract for dredging the several rivers and canals in the city, bids for which were received on Apr. 20, has been awarded to Adolph F. Buss, of Milwaukee, at 9 cts. per cu. yd.

Riviere au Renard, Que.—Bids will be received May 8 by Fred. Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont., for extending the wharf at Riviere au Renard.

BUSINESS NOTES.

Gilbert Wilkes & Co., Denver, Colo., engineers and contractors, have removed their offices and salesrooms to 435 Seventeenth St.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Washington, Pa., Electric Light & Power Co., two 400-H.-P. engines; Franklin, Pa., Electric Light Co., a 150-H.-P. engine.

The Burt Mfg. Co., Akron, O., reports the following among recent orders: A large oil filter for the B. F. Goodrich Co., Akron, O.; 16th order for exhaust heads for the Baldwin Locomotive Works; oil filter for Pittsburg Steamship Co.; third order for exhaust heads from Edison Phonograph Works, Orange, N. J.; two large oil filters, making 114 now in use, for the U. S. Steel Corporation.

Dodge & Day, engineers, of Philadelphia, are installing a new shop management system in the works of the Link-Belt Engineering Co.

The Stanley Electric Mfg. Co. has sold thirty-two 38-H.-P. and twenty 50-H.-P. street railway motors to the Sheboygan, Wis., Light, Power & Railway Co. A sale has also recently been made of a 750-Kw. engine type railway generator to the Trenton St. Ry. Co.

The Plunger Elevator Co., Worcester, Mass., reports the following among its recent sales: Two passenger elevators with a travel of 103 ft. and one freight elevator with a travel of 114 ft. for the Victoria Hotel, New York; four elevators, car travel 114 ft., for the State Mutual Life Insurance Bldg., Worcester; six elevators with a travel of 125 ft. for the new building of the State Mutual Life Insurance Co. of Boston; and a car lift with a travel of 25 ft. and a capacity of 60,000 lbs. for the car barn of the Worcester Consolidated St. Ry. Co.

Westinghouse, Church, Kerr & Co. recently received an order for the entire mechanical equipment of a new smelter to be shortly erected in the vicinity of Butte, Mont. The equipment comprises: Two 160-H.-P. Westinghouse compound engines driving Connersville blowers, one 85-H.-P. Westinghouse compound engine driving a 45-Kw. direct current 125-volt generator, with switchboard; two Westinghouse standard engines; four Roney mechanical stokers for four 250-H.-P. Babcock & Wilcox boilers. The company has also received an order from the Rome, N. Y., Brass & Copper Co. for a steam turbine power equipment for a new rolling mill, consisting of a Westinghouse steam turbine direct connected to a 400-Kw. Westinghouse three-phase generator, designed especially for turbine driving. It is probable that the turbine will operate under 150 lbs. steam pressure, 26 or 28 in. vacuum, and possibly a moderate amount of superheat. The generator will furnish current at 440 volts and 60 cycles, which will be used at this voltage upon the motors driving the rolls in the mill, which will be independently driven by a Westinghouse induction motor.

At the meeting of the Board of Directors of the Allis-Chalmers Co., held in New York April 15, the regular quarterly dividend of 1¾% was declared on preferred stock. The volume of business on the books of the company far exceeds that of any time since the organization of the company, notwithstanding the fact that the output of the plants has been increased to a large extent.

The Westinghouse Machine Co., Pittsburg, Pa., recently shipped two 1,000-Kw. Westinghouse turbine generating units for light and power service in the De Beers mines, at Kimberly, South Africa. Steam turbine equipments have also within the last month been shipped as follows: The B. F. Goodrich Co., Akron, O., one 400-Kw. unit for supplying light and power; the Johnson Harvester Co., Batavia, N. Y., one 400-Kw. unit for furnishing power; the Consolidated Railways, Light & Power Co., Wilmington, N. C., one 400-Kw. unit for railway and lighting service; the Nassau Light & Power Co., Roslyn, L. I., one 400-Kw. unit for local lighting; S. D. Warren & Co., Cumberland Mills, Me., one 400-Kw. unit for light and power; the Sherwin-Williams Co., Cleveland, O., a steam turbine direct connected to a 400-Kw. two-phase turbo-generator, the current being generated at 400 volts and 60 cycles, used for general power and lighting purposes.

The Nernst Lamp Co., of Pittsburg, Pa., through the H. C. Roberts Electric Supply Co., of Philadelphia, has secured the contract for lighting the new Roberts Hall, Haverford College, Haverford, Pa., with two, three and six-glower Nernst lamps. The main auditorium of the college is also to be lighted by Nernst lamps. The Westinghouse Trust Co. building, of Washington, Pa., has been fitted throughout with two and three-glower Nernst lamps.

The General Fireproofing Co., Youngstown, O., has let contract for an office building of cementine (exterior concrete) on herringbone expanded steel lath construction and with vault and all steel filing equipment.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Apr. 28.	Columbus, O.	Apr. 25
Apr. 29.	Greene, N. Y.	Apr. 25
Apr. 30.	Kansas City, Mo.	Apr. 25
Apr. 30.	Strathroy, Ont.	Apr. 11
May 1.	Chinook, Mont.	Feb. 7
May 2.	Ft. D. A. Russell, Wyo.	Apr. 4
May 5.	Atlantic City, N. J., Adv. Apr. 18, 25.	Apr. 11
May 5.	New York, N. Y.	Apr. 25
May 7.	Dexter, Me.	Apr. 25
May 7.	Newark, N. J.	Apr. 4
May 10.	Corvallis, Ore.	Apr. 25
May 11.	Pipe, etc., Holyoke, Mass. Adv. Apr. 25.	Apr. 25
May 12.	Toronto, Ont.	Mar. 21
May 15.	Richmond, Va.	Apr. 25
May 18.	Sterling, Colo., Adv. Apr. 25.	Apr. 25
May 19.	New Bremen, O., Adv. Apr. 25.	Apr. 25
May 20.	Pipe, Tacoma, Wash.	Apr. 25
May 21.	Martinsburg, W. Va.	Apr. 25
May 22.	Washington, D. C., Adv. Apr. 25.	Apr. 25
Aug. 1.	Allegheny, Pa.	Apr. 4
———	Quincy, Mass.	Mar. 28
———	Lonaconing, Md.	Mar. 28
	SEWERAGE AND SEWAGE DISPOSAL.	
Apr. 27.	St. Paul, Minn.	Apr. 25
Apr. 27.	New Haven, Conn.	Apr. 25
Apr. 28.	Columbus, O.	Apr. 25
Apr. 28.	Providence, R. I.	Apr. 25
Apr. 28.	St. Louis, Mo.	Apr. 11
Apr. 28.	Cape May, N. J.	Mar. 28
Apr. 29.	Brooklyn, N. Y.	Apr. 25
Apr. 30.	Nashville, Tenn.	Apr. 18
Apr. 30.	Long Island City, N. Y.	Apr. 25
Apr. 30.	Guthrie, Okla. Ter.	Apr. 25
Apr. —	Crookston, Minn.	Feb. 21
Apr. 30.	Columbus, O.	Apr. 25
May 1.	Harriman, Tenn.	Apr. 25
May 1.	Aberdeen, S. D.	Apr. 18
May 1.	Canneraville, Ind., Adv. Apr. 18, 25.	Apr. 18
May 1.	Ft. D. A. Russell, Wyo.	Apr. 4
May 2.	Crookston, Minn.	Apr. 4
May 4.	Lockport, N. Y.	Apr. 18
May 4.	Glenville, O.	Apr. 18
May 4.	Ft. Missoula, Mont.	Apr. 11
May 4.	Ardmore, Pa., Apr. 11 to 25.	Apr. 11
May 5.	Ponghkeepsie, N. Y.	Apr. 25
May 5.	Honston, Tex.	Apr. 25
May 5.	Belleville, Ill.	Apr. 25
May 5.	Beaumont, Tex.	Apr. 18
May 5.	Allentown, Pa.	Apr. 18
May 5.	Olathe, Kan.	Apr. 11
May 7.	New London, Conn.	Apr. 25
May 9.	Bowling Green, O.	Apr. 18
May 12.	Beaumont, Tex., Adv. Apr. 11.	Apr. 11
May 14.	Cleveland, O.	Apr. 25
May 15.	Newark, N. J.	Apr. 25
May 15.	Tonah, Wis.	Apr. 4
May 20.	Amsterdam, N. Y.	Apr. 25
Jun. 6.	Washington, D. C., Adv. Apr. 25.	Apr. 25
	BRIDGES.	
Apr. 28.	Peoria, Ill.	Apr. 18
Apr. 28.	Tacoma, Wash.	Apr. 18
Apr. 29.	South Bend, Ind.	Apr. 11
Apr. 30.	New York, N. Y.	Apr. 25
May 1.	Indianapolis, Ind.	Apr. 11
May 4.	Corning, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 4.	Quincy, Cal.	Mar. 28
May 4.	Boonville, Ind.	Apr. 25
May 4.	Oakland, Cal.	Apr. 25
May 4.	Lillington, N. C.	Apr. 25
May 4.	Montesano, Wash.	Apr. 25
May 4.	Salem, Ind.	Apr. 25
May 5.	Astoria, Ore.	Apr. 18
May 5.	Harrisburg, Pa.	Apr. 18
May 5.	Atlantic City, N. J.	Apr. 11
May 5.	Winamac, Ind.	Apr. 25
May 6.	Frankford, Ind.	Apr. 18
May 7.	Columbus, O.	Apr. 11
May 8.	Sullivan, Ind.	Apr. 25
May 8.	Hamilton, Ind.	Apr. 25
May 9.	Bay City, Mich., Adv. Apr. 25.	Apr. 25
May 14.	Greensburg, Pa.	Apr. 25
May 15.	Grand Rapids, Mich., Adv. Apr. 25.	Apr. 25
May 18.	Fredericton, N. B.	Apr. 4
May 19.	Milwaukee, Wis.	Apr. 18
Jun. 1.	Gettysburg, Pa.	Apr. 25
	PAVING AND ROADMAKING.	
Apr. 27.	New York, N. Y.	Apr. 18
Apr. 27.	St. Paul, Minn.	Apr. 25
Apr. 27.	Kalamazoo, Mich.	Apr. 25
Apr. 28.	Cape May, N. J.	Mar. 28
Apr. 28.	Jersey City, N. J.	Apr. 25
Apr. 28.	Columbus, O.	Apr. 25
Apr. 28.	Galveston, Tex.	Apr. 25
Apr. 28.	New York, N. Y.	Apr. 25
Apr. 29.	Chicago, Ill.	Apr. 25
Apr. 29.	Brooklyn, N. Y.	Apr. 18
Apr. 30.	Nashville, Tenn.	Apr. 18
May 1.	Opelousas, La.	Apr. 18
May 1.	Watertown, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 1.	Cincinnati, O.	Apr. 11
May 1.	Cedar Rapids, Ia.	Apr. 25
May 1.	Ebensburg, Pa.	Apr. 25
May 1.	Ashland, N. H.	Apr. 25
May 4.	Napoleon, O.	Apr. 25
May 4.	New Haven, Conn.	Apr. 25
May 4.	Atchison, Kan.	Apr. 18
May 4.	Morristown, N. J.	Apr. 18
May 4.	Glenville, O.	Apr. 18
May 4.	Newton, N. J.	Apr. 11
May 4.	Johnstown, N. Y.	Apr. 11
May 5.	Princeton, Ind.	Apr. 25
May 5.	Beaumont, Tex.	Apr. 18
May 5.	Lisbon, O.	Apr. 11
May 5.	Marion, Ind.	Apr. 4
May 5.	Versailles, Ind.	Apr. 18
May 5.	Ft. Scott, Kan.	Apr. 25
May 9.	St. Joseph, Mo.	Apr. 18
May 9.	Evansville, Ill.	Apr. 18
May 11.	Weston, O.	Apr. 25
May 11.	Laporte, Ind.	Apr. 25
May 12.	Alexandria, La.	Apr. 18
May 14.	Norfolk, Pa., Adv. Apr. 11, 18.	Apr. 11
May 15.	Marinette, Wis.	Apr. 25
May 18.	Toledo, O.	Apr. 25
May 19.	Bluffton, Ind.	Apr. 25
May 20.	Waynesburg, Pa.	Apr. 25
———	Muncie, Ind., Adv. Mar. 21	Mar. 21
	POWER, GAS AND ELECTRICITY.	
May 2.	Brocton, N. Y.	Apr. 25
May 4.	Ashland, Ky.	Apr. 25
May 11.	Toronto, Ont., Adv. Apr. 4 to 25.	Apr. 4
May 12.	Copenhagen, Denmark	Apr. 4
Jun. —	North Yamkill, Ore.	Apr. 4
Jun. 1.	San Diego, Cal.	Apr. 18
Jun. 18.	Portland, Ore., Adv. Apr. 18, 25.	Apr. 18
	GOVERNMENT WORK.	
Apr. 28.	Denver, Colo., Adv. Mar. 28 to Apr. 18.	Mar. 28
Apr. 29.	Grand Junction, Colo.	Apr. 11
Apr. 30.	Ft. Lincoln, N. D.	Apr. 18
Apr. 30.	Tongue River Agency, Mont.	Apr. 11
Apr. 30.	Portland, Ore.	Mar. 28
Apr. 30.	Washington Barracks, D. C. Adv. Apr. 4 to 25.	Apr. 4
Apr. 30.	Kalamazoo, Mich., Adv., Apr. 4.	Apr. 4
Apr. 30.	Norfolk, Va., Adv. Apr. 11, 25.	Apr. 4
May 1.	Ft. Ringgold, Tex.	Apr. 18
May 1.	Rapid City, S. D.	Apr. 11
May 1.	West Point, N. Y., Adv. Apr. 4 to 25.	Apr. 4
May 1.	Boston, Mass.	Apr. 4
May 4.	Ft. Douglas, Utah.	Apr. 18
May 4.	Washington, D. C.	Apr. 18
May 4.	Ft. Brady, Mich.	Apr. 11
May 4.	Catlettsburg, Ky., Adv. Apr. 4 to 25.	Apr. 4
May 4.	Memphis, Tenn.	Apr. 4
May 5.	Denver, Colo., Adv. Apr. 18, 25.	Apr. 18
May 5.	Greensboro, N. C., Adv. Apr. 4, 11.	Apr. 4
May 6.	Flandreau, S. D.	Apr. 18
May 6.	Grand Rapids, Mich. Apr. 11 to 25.	Apr. 11
May 6.	Norwich, Conn.	Apr. 4
May 8.	Ft. D. A. Russell, Wyo.	Apr. 18
May 11.	Elmira, N. Y.	Apr. 18
May 11.	Washington, D. C.	Apr. 25
May 12.	New Orleans, La.	Apr. 11
May 12.	Beaumont, Tex., Adv. Apr. 11, 18.	Apr. 11
May 13.	Merrill, Pa., Adv. Apr. 25.	Apr. 25
May 14.	Barracks, Johnson City, Tenn. Adv. Apr. 28.	Apr. 25
May 14.	Hartford, Conn.	Apr. 18
May 15.	Des Moines, Ia., Adv. Apr. 18, 25.	Apr. 18
May 15.	New York, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 15.	New London, Conn., Adv. Apr. 18, 25.	Apr. 18
May 16.	Ft. Rosecrans, Cal.	Apr. 25
May 18.	Zanesville, O., Adv. Apr. 18, 25.	Apr. 18
May 20.	Ft. Greble, R. I., Adv. Apr. 25.	Apr. 25
May 21.	Wheeling, W. Va.	Apr. 25
May 22.	Philadelphia, Pa., Adv. Apr. 25.	Apr. 25
May 23.	Charleston, S. C.	Apr. 25
May 23.	Norfolk, Va.	Apr. 25
May 25.	New York, N. Y., Adv. Apr. 25.	Apr. 25
May 25.	Ft. Morgan, Ala., Adv. Apr. 25.	Apr. 25
May 25.	Lockport, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 26.	Boston, Mass., Adv. Apr. 25.	Apr. 25
Jun. 1.	Sitka, Alaska	Mar. 21
Jun 8.	Sitka, Alaska	Apr. 25
Jun. 15.	Manila, P. I., Adv. Mar. 14 to Apr. 25.	Mar. 14
	BUILDINGS.	
Apr. 27.	Bus. Bldg., New Britain, Conn.	Apr. 25
Apr. 28.	Hospital, Concord, N. H.	Apr. 25
Apr. 27.	Court House, Berlin, Ont.	Apr. 25
Apr. 27.	Park Bldgs., Boston, Mass.	Apr. 25
Apr. 28.	Pub. Bldg., Milwaukee, Wis.	Apr. 18
Apr. 28.	Bus. Bldg., Tyrone, Pa.	Apr. 18
Apr. 28.	Library, Flora, Ill.	Apr. 18
Apr. 28.	Library, Cleveland, O.	Apr. 11
Apr. 28.	Jail, etc., Red Lodge, Mont.	Apr. 25
Apr. 28.	Hospital, Concord, N. H.	Apr. 25
Apr. 28.	Bus. Bldg., Lancaster, O.	Apr. 25
Apr. 29.	Pub. Bldg., St. Louis, Mo.	Apr. 11
Apr. 29.	Engine House, Brooklyn, N. Y.	Apr. 25
Apr. 29.	Bathe, Jersey City, N. J.	Apr. 25
Apr. 29.	Church, Langdon, N. D.	Apr. 25
Apr. 29.	School, Dillon, Mont.	Apr. 25
Apr. 29.	Sanitorium, Providence, R. I.	Apr. 25
Apr. 30.	School, Kallspell, Mont.	Apr. 25
Apr. 30.	School, Deseronto, Ont.	Apr. 11
Apr. 30.	School, Quincy, Ill.	Apr. 25
Apr. 30.	Substation, Tenleytown, D. C.	Apr. 25
May 1.	Htg. Court House, Memphis, Tenn.	Apr. 25
May 1.	Schools, Chicago, Ill.	Apr. 25
May 1.	Bank, Litchville, N. D.	Apr. 18
May 1.	Church, New Decatur, Ala.	Apr. 18
May 1.	Hospital, Toledo, O.	Apr. 11
May 1.	Pub. Bldg., Springfield, O.	Apr. 11
May 1.	Bus. Bldg., Newcastle, N. B.	Apr. 11
May 1.	School, Le Sueur, Minn.	Apr. 11
May 1.	School, Hamilton, O.	Apr. 4
May 1.	Library, Des Moines, Ia.	Apr. 25
May 2.	School, Young America, Ind.	Apr. 25
May 2.	School, Arthur, Ia.	Apr. 18
May 2.	School, Rome, Ia.	Apr. 11
May 4.	Court house, Newport, Ky.	Apr. 18
May 4.	School, Montezuma, Ia.	Apr. 18
May 4.	Court house, Albany, Ga.	Apr. 11
May 4.	Court house, Abbeville, Ga.	Mar. 21
May 4.	School, Brooklyn, N. Y.	Apr. 25
May 4.	School, Centerville, Ia.	Apr. 25
May 4.	Station Houses, New York, N. Y.	Apr. 25
May 4.	Engine House, Fresno, Cal.	Apr. 25
May 4.	School, Kansas City, Kan.	Apr. 25
May 4.	Schools, New York, N. Y.	Apr. 25
May 4.	School, Topeka, Kan.	Apr. 25
May 4.	School, Bluffton, Ind.	Apr. 25
May 4.	School, Ft. Wadsworth, N. Y.	Apr. 25
May 5.	Hospital, New York, N. Y.	Apr. 25
May 5.	Pub. Bldg., St. Paul, Minn.	Apr. 18
May 5.	Hospital, Jamestown, N. D.	Apr. 18
May 6.	Hospital, Rochester, N. Y.	Apr. 25
May 6.	Bath, Brooklyn, N. Y.	Apr. 25
May 6.	School, Milwaukee, Wis.	Apr. 18
May 6.	Pub. Bldg., Topeka, Kan.	Apr. 18
May 6.	School, Ames, Ia.	Apr. 25
May 7.	Library, Cleveland, O.	Apr. 18
May 8.	School, Grand Rapids, Minn.	Apr. 18
May 8.	Htg. Court house, Shakopee, Minn.	Mar. 28
May 8.	School, Cleveland, O.	Apr. 25
May 8.	School, River Rouge, Mich.	Apr. 25
May 9.	Pub. Bldg., Columbus, O.	Apr. 18
May 9.	School, Ledyard, Ia.	Apr. 25
May 9.	Pub. Bldg., Williamsport, Pa.	Apr. 25
May 10.	Bus. Bldg., Rochester, N. Y.	Apr. 18
May 11.	Court House, Lincoln, Ill.	Apr. 25
May 11.	School, Cleveland, O.	Apr. 25
May 12.	Asylum, Little Rock, Ark.	Apr. 25
May 12.	Court House, Washington, Ga.	Apr. 25
May 14.	Library, Johnson City, Tenn. Adv. Apr. 18, 25.	Apr. 18
May 15.	Pub. Bldg., New York, N. Y.	Apr. 25
May 15.	Church, Carrollton, Ky.	Apr. 18
May 19.	Jail, Elizabethtown, N. C.	Apr. 18
Jun. 1.	Church, Liberty, Ind.	Apr. 25
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21 to Apr. 4.	Mar. 21
	MISCELLANEOUS.	
Apr. 29.	Signs, Brooklyn, N. Y.	Apr. 18
Apr. 30.	Dredging, Honolulu, H. I.	Mar. 28
Apr. 30.	Stone Wall, etc., Philadelphia, Pa.	Apr. 25
Apr. 30.	Ditch, Lafayette, Ind.	Apr. 25
Apr. 30.	Sprinkling trucks, Brooklyn, N. Y.	Apr. 25
Apr. 30.	Cement, etc., New York, N. Y.	Apr. 25
May 1.	St. Cleaning, Dallas, Tex.	Apr. 25
May 1.	Dam, Hartford, Vt.	Apr. 11
May 1.	St. Cleaning, etc., Washington, D. C. Adv. Apr. 4 to 25.	Apr. 4
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21
May 4.	St. Ry. franchise, Los Angeles, Cal.	Apr. 18
May 5.	Wharf, New Rochelle, N. Y.	Apr. 25
May 5.	Dredging, etc., New York, N. Y.	Apr. 25
May 8.	Wharf, Riviere au Renard, Que.	Apr. 25
May 10.	R. R. Work, Des Moines, Ia.	Apr. 18
May 18.	Garbage Plant, Shreveport, La. Adv. Apr. 18, 25.	Apr. 18
May 20.	Dredging, Falmouth, Jamaica	Apr. 11
Jun. 1.	El. Ry. franchise, Redwood City, Cal.	Apr. 18
Jun. 1.	El. Ry. franchise, San Mateo, Cal.	Apr. 25
———	El. Ry. franchise, New Orleans, La.	Apr. 25

PROPOSALS.

IMPROVEMENT OF DELAWARE RIVER.—U. S. Engineer Office, Philadelphia, Pa., April 21, 1903.—Sealed proposals for removing rock and overlying and adjacent material in Delaware River at Schooner Ledge will be received here until 12 o'clock noon, May 22, 1903, and then publicly opened. Information furnished on application. C. W. RAYMOND, Lieut. Col., Engrs.

SEALED PROPOSALS WILL BE RECEIVED at the office of the National Home for Disabled Volunteer Soldiers, 346 Broadway, New York, N. Y., until 12 o'clock M., Thursday, May 14, 1903, and then opened, for furnishing materials, labor, etc., for the construction of four barrack buildings at the Mountain Branch, N. H. D. V. S., near Johnson City, Tennessee. Plans may be seen, and copies of instructions and specifications together with blank proposals and other information had upon application to the architect, J. H. Freedlander, 244 Fifth Avenue, New York, N. Y.; to the Superintendent of Construction, Mountain Branch, Johnson City, Tenn.; and to MOSES HARRIS, General Treasurer, 346 Broadway, New York, N. Y.

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The Discharge of Sewage into Harbors and Lakes.

The self-purification of streams after receiving sewage has been sufficiently well studied, and, although no absolute conclusions of universal application have been reached, yet well-informed engineers having to deal with problems of this class have much to aid them in the treatment of a specific case. While much has been written concerning the effect of sewage upon streams, less has been recorded about the discharge into ocean inlets and large bodies of fresh water. One or two noteworthy projects for the discharge of sewage into seaboard harbors, and the serious pollution of water supplies at places on the Great Lakes give prominence to the matter at this time.

The principal objections to the disposal of sewage in harbors are the menace to health, in fresh water by the pollution of domestic supplies and in salt water by the contamination to shellfish used for food; offence to sight and smell; and the defilement of the shores. Very little is now heard in engineering circles of the wastefulness of this practice of throwing away the "enormous value" of fertilizers in the sewage; magazine and newspaper writers, however, still occasionally resuscitate this defunct issue. It is doubtless true that there is large manurial value in sewage—and there is gold in sea water; but until some discovery is made of a profitable method for recovering these values they will have to remain unappropriated so long as business judgment opposes expenditures of dollars for returns in cents. Sewage must be gotten rid of, and naturally the least expensive method will generally be adopted; but very rarely can the operation be so managed as to even repay costs. For communities on the Great Lakes and the ocean the most obvious disposal is the discharge into the neighboring body of water. In all such cases the sewage should at least be screened to remove floating solid matter. The effects of currents and winds must be carefully studied and their conditions complied with. The outfall should be located at some distance from habitations, and in some cases where large quantity of sewage must be discharged, better results will be obtained by having several outlets; for it has been observed under some circumstances that the area polluted by the discharge increases more rapidly than the discharge. There are places situated on large inlets from ocean or lake where the direct discharge of untreated sewage is inadmissible either because, for lack of current, the sewage is not carried rapidly away, or because the directions of the currents are such as to convey the sewage into places where it becomes a nuisance. In such instances either the sewage must be at least partially purified, or else it must be conducted at considerable expense to a distant and suitable outlet.

Furthermore, along the Lakes, the correlation of sewer outfalls and water-supply intakes must be kept in mind, for, in most places, the lake is regarded as both the most convenient dumping place for the sewage and the natural source of water supply. Consequently, as the sewage is most easily discharged at numerous points close to shore, the water intakes have been forced farther and farther out, in the endeavor to get beyond the pollution. This endeavor has not been wholly successful, as is shown in a measure by the large number of cases of sickness and death attributable to the use of polluted water, in some of these communities. As a general proposition, the treatment of sewage is more troublesome and less satisfactory than the filtration of water; hence, as the ultimate protection to public health is less certain by the former, filtration of the water supplies seems to be the most satisfactory, if not, indeed, the only safe solution of this two-fold problem.

There are places on the seaboard, however, where the direct discharge of sewage may be practiced with impunity. For example, the tidal flow of New York Harbor is so great, estimated at billions of cubic feet per day, and the direction of the currents are such that, if the sewage be screened, a very large quantity may be carried off without offence. Engineers who have studied this case have concluded that the sewage of 30,000,000 people could be put into the Bay from properly located outlets without becoming objectionably apparent. Large volumes and areas of water are not aloue adequate to prevent nuisance; the directions, velocities and volumes of surface currents and the action of wind are also controlling elements. Experience has taught that if locations for outlets can be found where the currents are always favorable, it is better to discharge the fresh sewage continuously, rather than to store it in tanks for intermittent discharge, although the latter practice is sometimes necessitated by the unfavorable directions of currents at certain times.

A few years ago the State Board of Health of Massachusetts studied the discharge of sewage into Boston Harbor and arrived at some conclusions of more or less general application. The discharge of sewage into frequented waters should be so made that the sewage will be quickly lost to the senses and even to chemical tests, which may be accomplished by discharging into quick currents of large volumes where the dispersion will be rapid and the dilution great. It was found that the sewage being of less density than the sea water tended to float, spreading out with but slight depth. At a surface outlet the sewage mingled with the sea water in a small area so as to be detected at depths of 4 or 5 feet, but over a much larger area the depth at which it could be plainly detected was only about 2 feet, beyond which the depth diminished gradually towards the borders of the area affected, where the sewage formed merely a surface film which gave to the water an oily appearance. Analyses of samples taken from the area covered by the film and from the discolored area showed that the portion of the sewage tract which contained a considerable amount of organic matter was substantially identical with the area of discoloration, and that the amount of organic matter in the film is so minute as not to be a source of offence. The discoloration on a comparatively calm day, was objectionable to the sight over only about two-thirds of the area, and the offensive odors were confined to a relatively small portion.

If the sewage is discharged below the surface the tendency of the light particles to rise will cause a more rapid dispersion and disappearance of color than when discharged at the surface. The deeper the submergence of the outlet, the more thorough is the dispersion. Where, in addition, a strong current prevails comparatively large quantities of sewage could be thus discharged without even becoming noticeable at the surface of the water. One of the outlets in Boston Harbor is under about 10 feet of water at high tide, and another, which is being constructed, will be at a depth of more than 30 feet. The present temporary outlet of the Honolulu sewer system is in 30 feet of water and is to be extended into water 100 feet deep, because there are no suitable strong currents in the harbor. The proposed Passaic Valley trunk sewer, in New Jersey, is to discharge into New York Bay at a depth of 40 feet. Discharge under a considerable depth, wherever feasible, seems to possess decided advantages.

Repairs to Asphalt Pavements in Columbus, O., are stated in the 1901 report of City Engineer Julian Griggs to be necessary for the greater part not on account of heavy traffic, but because of a disintegration of the paving material due to moisture in the gutters. Sixty-three per cent. of all repairs during 1901 were to strips 4 feet wide adjoining the curbs. A further examination indicates that 30.7 per cent. of the total length of gutters was patched at an expense which would have paid for brick gutters to cover 4 feet in width for a little more than the same length. The practice of paving the gutters of asphalt pavements with brick would therefore seem to find abundant justification. The age of the asphalt streets repaired varied from 6.1 to 14.2 years, averaging 11.64 years. All were originally laid under a 5-year guarantee, so that the average period of maintenance by the city was 6.64 years, during which time, owing to lack of funds, there were little or no repairs. It is thought that this failure to make repairs when needed has had a tendency to increase the cost. On the asphalt repairs 20 per cent. of the cost has been paid from the street repair fund, and the balance was assessed against the abutting property. During 1901 $27,771 was expended in these repairs, which is nearly equal to the total amount expended for repairs from 1894 to 1900 inclusive. Mr. F. J. Immel, director of public improvements, favors a vehicle tax as a means to secure funds for street repairs.

Difficult Supports for Underpinning.

The 25-story bank of the State of New York which was described in The Engineering Record of September 13, 1902, is built on quicksand which threatened great danger to the adjacent buildings when the excavation for its cellar was made below their foundations. This has necessitated difficult and elaborate systems of underpinning on three sides of the lot. It has been done on the principle of supporting the walls so that they could be lifted to correspond to the settlement caused by the quicksand and so as to allow the old footings to be removed and new ones to be carried down not to rock, but to a depth equal to that of the new excavation, and loaded after all excavation had been completed. On the east and west sides of the lot, special methods of supporting the walls without obstructing the sites of the adjacent caissons and of repeated transfers of the weight between needle beams and wall girders were illustrated in The Engineering Record of September 27 and November 1.

Entirely different methods were adopted for supporting the two buildings on the north side of the lot. At the northeast corner of the lot the building has 11 stories and a basement and the wall is about 130 feet high with an estimated weight of 21 tons per linear foot. It is built of excellent masonry made of hard brick in Dyckerhoff cement mortar and is 12 inches thick at the top and 42 inches thick at the bottom, with an offset base 8 feet wide seated on a 10-foot concrete footing 4 feet deep. This wall was underpinned by the Breuchaud method with four cast iron cylinders 36 inches in diameter and about 40 feet long sunk on the center line of the wall in the manner which has frequently been described in these columns. The recesses were about 10 feet high, 8 feet deep at the bottom and 4 feet wide and the cement was so hard that it was extremely slow and difficult work cutting them, besides the building was occupied as a bank and the men were not permitted to work at them during business hours, so that it required fully a month to cut one recess with a steam drill and chisels. After the recesses were finished the cylinders were easily sunk with pneumatic pressure and one, under the corner of the building, was loaded with 1,000,000 pounds.

The other building on the north side of the lot was ten stories high above the basement, and its wall, about 45 feet long, was carried temporarily on needle beams, supported in an unusual manner. It is 3 feet thick at the bottom and has an 8-foot concrete footing 6 feet deep with the upper side just below the level of the basement floor and the lower side several feet above the final excavation for the bank building. At one end there is a tall and heavy chimney and in the face are two piers built integral with the brick work and projecting like pilasters on both sides. At the feet of these piers brick arches are sprung across the basement to a parallel wall to carry a partition wall above, and the piers support the ends of heavy girders in an upper story.

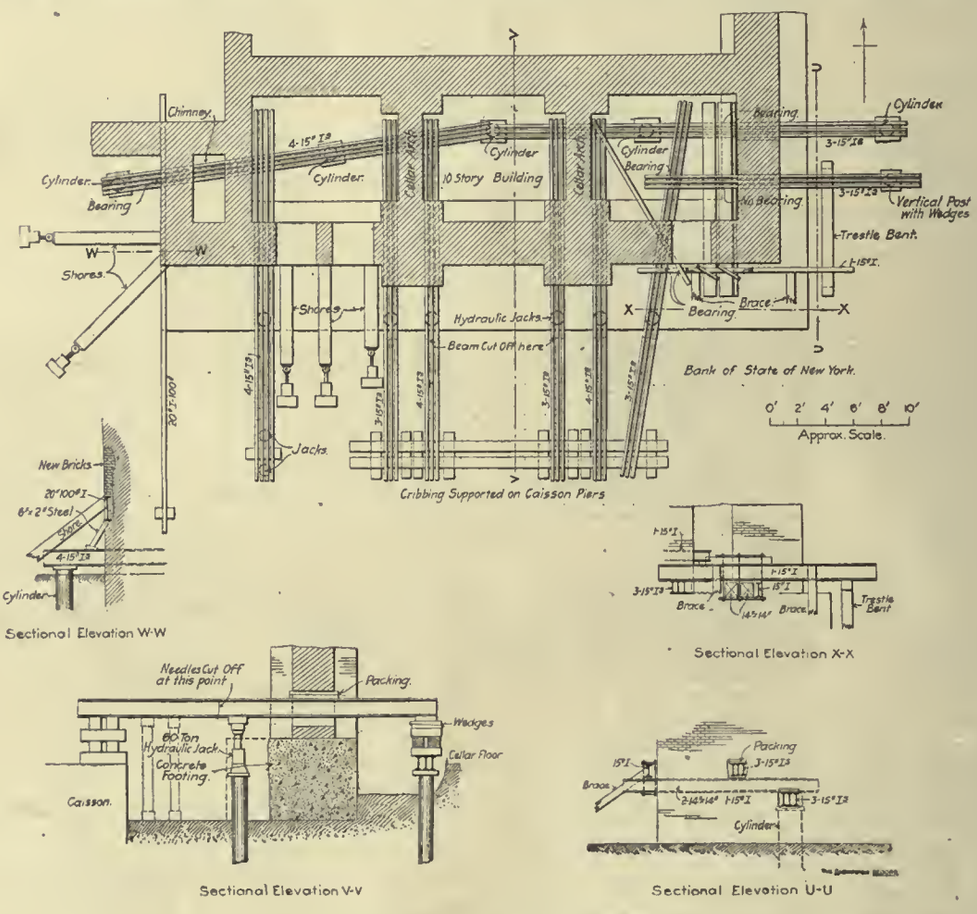
Holes were cut through the wall just above the footing, and through them were set groups of 15-inch 60-pound I-beams 28 feet long. The outer ends of the needles were supported on cribbing resting on the concrete piers which had been built in caissons for the columns of the bank building. The other ends were carried on a line of three 15-inch I-beams set on the caps of 16-inch concrete filled steel pipes sunk 36 feet below the basement floor to hard pan. Both ends of the needles being thus supported from the solid rock there was no possibility of settlement for the wall and after the loads were transferred to them with jack screws they were wedged up and the screws were removed. The holes were cut a few inches into each side of the piers so that the needles supported them directly.

At one corner of the building it was not permissible to make a support for the needle beams in the bank lot, so the outer end of the two 14x14-inch timbers and the 15-inch I-beam which were used as needles there were suspended from a 15-inch horizontal girder parallel and close to the outer face of the wall where it would clear the caissons which were afterwards sunk close to it. This girder was supported at one end on a trestle bent, and at the other on a group of diagonal needles which also carried a part of the wall. Its web was held tight against the wall by wooden braces, slightly inclined and abutting against the pier caissons.

All of the wall was weak and poor, especially the chimney, and it was difficult to support the latter as it was not thought that the brickwork was strong enough to stand if much of its section was cut out. Finally a shallow slot was cut in the outside of it to receive part of a 20-inch needle girder 30 feet long which had its web packed up tight against the brickwork and braced there by an inclined strut from an adjacent building. The girder was supported at the outer end from a caisson pier, and had a thick steel bar slightly inclined from the vertical, wedged between its lower flange and the longitudinal beams on the cylinders. The opposite wall of the chimney was carried by a regular group of needle beams and both walls were wedged up from the longitudinal cylinder beams. Unusual care was exercised in cutting the holes for the needles; as fast as the bricks were removed from a small space a jack screw was set there to take the load and leave the least possible part of the wall unsupported.

The needle beams projected so far into the bank lot that they obstructed subsequent operations there and new supports were provided for them, close to the wall, and their loads transferred to them while they were in service. The outside of the old footing was cut away under the needles and 16-inch steel pipe cylinders were sunk there to hard pan by jacking and jetting, using the needle beams themselves for reactions. They were afterwards filled with concrete and wedged up against the beams, and the latter were cut off close to the cylinders with pneumatic chisels and the spaces between the wall and the caissons left unobstructed.

The lower part of the chimney was bricked up solid to strengthen it and distribute the strains and where the 20-inch I-beam flanges were gained into it the face bricks were removed for some distance above and were replaced by new ones carefully bonded and laid in the best cement mortar. An arch in the base of the chimney was also bricked up solid above the longitudinal I-beams, and where the latter passed under it and under the partition arches in the basement they were packed or wedged up solid against the soffit in such a manner as to distribute the pressure over a considerable length of brickwork. After the excavations in the bank lot were entirely completed the new footings were built and loaded and the needles removed, abandoning the cylinders. The underpinning was in charge of Mr. A. E. Riendeau, superintendent for the George A. Fuller Company, contractors.



Underpinning of Bank of State of New York.

The Completion of the Triangulation of the City of New York jointly by the city and the United States Geological Survey is at present being arranged for.

The Output of the Mines of British Columbia for 1902 is given in an unofficial estimate accompanying Bulletin No. 7 of the Bureau of Provincial Information as follows: Total from metalliferous mines, 980,000 tons, representing a value of $12,310,000; coal and coke returns, 1,800,000 tons, or a valuation of $6,500,000.

Types and Details of Bridge Construction.—IV.

By Frank W. Skinner, C. E.

SPANDREL-BRACED ARCHES, CONTINUED.

The wrought iron highway deck bridge across the Mississippi River at Lake Street, Minneapolis, includes two 456-foot channel spans about 125 feet high above the water. Each span has two three-hinge spandrel-braced arch trusses, of about 95 feet rise, in vertical planes 19 feet apart. They are connected by lateral systems in the top and bottom chord planes and by from one to three panels of sway bracing in the planes of the vertical posts. The top and bottom chords are made of pairs of built channels latticed; in the top chord the channel flanges are turned inwards, and in the bottom chords they are turned outwards, but they are vertical in both cases. The principal web members of the trusses are zig-zag diagonals at different angles, which reach over one or two panels and are pin-connected to the chords. Vertical members from the ends of these web members and from the middles of the two-panel members divide the trusses into twenty-four panels of uniform length. The verticals and diagonals have I-shaped cross sections made with pairs of angles riveted together back to back and latticed, and all their connections are field-riveted to web-connection plates, except at the ends of the main diagonals. The sub-verticals are connected to the top chords with 3-inch pins and are field-riveted to the top flanges of the bottom chords with bent plates. Special care was taken to make the top chords discontinuous at the center and ends of the spans, and they were inclined downwards to bearings on the lower chord pins at the crown hinge. The lower chords have clearance between their half-hole bearings on the crown hinge pin, but the semi-trusses are locked together there by the full holes in the jaw plates on the ends of the vertical and diagonal members.

The top laterals are square rods with loop eyes connected to vertical pins through tie plates in the top chords. At the center point of the span the ends of the diagonals are connected to horizontal pins through the double vertical end plates of the lower lateral diagonal struts, between which the rods pass. The lower laterals are I-shaped struts field-riveted to horizontal connection plates on the inner flanges of the bottom chords. They are cut to clear at intersections where they are riveted to flange connection plates on the continuous transverse struts. Near the center of the span the top lateral diagonal rods have screw ends with their nuts bearing on the ends of pairs of horizontal angles, between which they pass and which are riveted to the top chord flange tie plates. The sway brace diagonal rods have bent eyes engaging the bottom chord pins and straight eyes engaging longitudinal pins through the transverse struts and through pairs of angle clips riveted to the bottom flanges of the floor-beams. The bridge was assembled on pile and trestle falsework erected from the ice, and was remarkable for the manner of assembling and connecting up the arch trusses from one skewback continuously to the other instead of from both skewbacks to the crown simultaneously. This method was successful, but involved special diagonal braces in the falsework.

The single track viaduct across the Viaur River, on the road from Carmaux to Rodez, France, is about 1,345 feet long between abutments and 380½ feet high from water level to track. The 721½-feet center span is a three-hinge spandrel-braced steel arch of 176¼ feet rise with horizontal top chord and polygonal bottom chord divided into 41.8-feet panels by posts perpendicular to the top chords, and has diagonals in one direction only. The battered trusses, 109½ feet apart at the skewbacks and 19½ feet apart at the roadway level, are connected together by the floor system, by diagonals and by horizontal transverse struts between the bottom chords. The pairs of perpendicular posts are also connected by horizontal and diagonal sway bracing members. All members are made to resist compression and have riveted connections. At each skewback there is a 5-inch bolt 20 feet long, bisecting the angle between the lower chord and the post and anchoring the truss to a grillage of plate girders built into the pier masonry and accessible through an inspection tunnel. The arch trusses are continuous beyond the skewbacks to form cantilever arms resembling semi-arches. Each cantilever truss is 226½ feet long, and from its extremity is suspended one end of an 85-foot Pratt truss, the opposite end of which rests on the masonry approach.

The top chords are about 43 inches wide, and their depths diminish from about 2½ feet at the skewbacks to about 1½ feet at the crown of the arch. They are made with a cover plate, two web plates and four angles each. At each panel point there are special sections of web plates spliced in which project below the line of the lower flange angles to form gusset plates for the connections of the web members of the trusses. The chords are stiffened at intervals by diaphragms formed of four solid web knee brace plates. The bottom chords decrease in depth and sectional area from the skewbacks to the crown and the ends of the cantilever arms, and are similar to the top chords except that at the panel points the edges of the web plates are cut to curves of 33 feet radius, so as to connect the tangent with the angles.

The shorter perpendicular truss posts have I-shaped cross sections with plate or latticed webs, four flange angles and two or more cover plates. The longer posts have rectangular cross sections with four angles latticed on each side, and interior diaphragm frames made of angles. The diagonal web members are similar to the long posts and both of them are of uniform width from end to end in the transverse planes, but are tapered from the middle to both ends in the longitudinal plane. The sway bracing consists of from one to four panels of X bracing in each bent. Where the depth of the trusses is least, the sway bracing consists of two inclined channel or plate-and-angle struts reaching from the ends of the lower chord horizontal transverse strut to the middle of the lower flange of the floor beam. Elsewhere the struts and diagonals all have I-shaped or rectangular cross sections, built up of four angles each, latticed, the rectangular ones having interior transverse stiffening plates. All truss members are latticed with small angles. The tops of each pair of perpendicular truss posts are connected by a double-web plate-girder floor beam about 45 inches deep, from the middle of which is suspended by two vertical and two inclined struts a light inspection platform, with a narrow gauge car track running from end to end of the bridge, accessible by iron ladders on the truss posts and a stair with hand rail in each lower arch chord. The solid floor has transverse rectangular floor triangles with longitudinal fascia plates at the ends to retain the ballast.

At the skewbacks, the ends of the arch and cantilever lower chords and the perpendicular posts are riveted together on large, heavy gusset connection plates, to which are riveted the

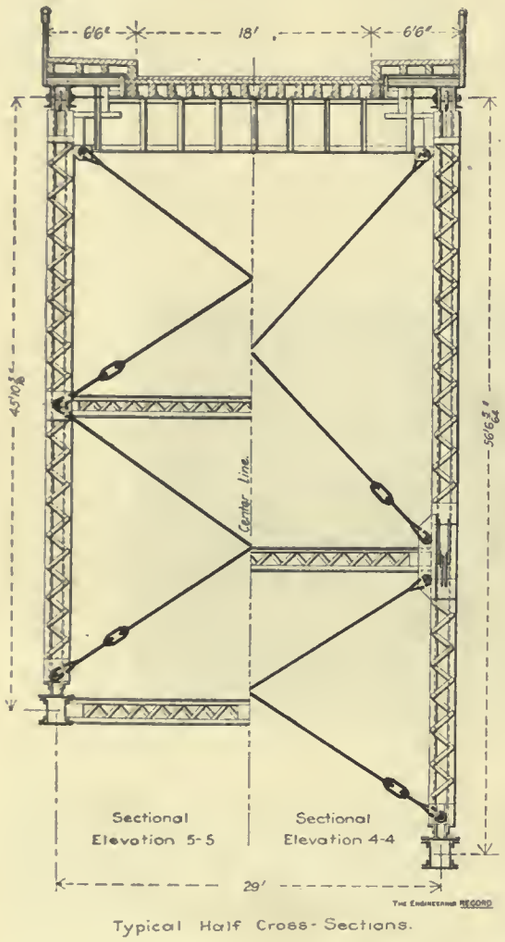


LAKE STREET BRIDGE, MINNEAPOLIS.

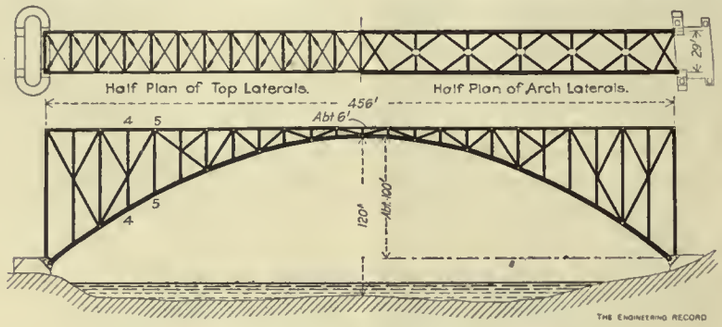
webs of special reinforcement plates tapering from a thin upper edge to a very thick forged angle flange taking bearing on the base plate riveted to it. The 5-inch main anchor bolt apparently has a forged head seated on an oblique bearing riveted to the outside of the chord. The base plate is normal to the maximum skewback reaction, and is inclined 25 degrees transversely, and 30 degrees longitudinally. It is fastened by four 1½-inch bolts to the top of the upper cast-steel hinge piece, which has a bearing surface of about 4x5½ feet, enclosing a 3/16-inch lead plate, on which the arch takes bearing. The hinge casting has transverse and longitudinal webs connecting the 24-inch top plate and the convex hinge surface, which is a segment of a cylinder, with a 15-foot radius and its axis perpendicular to a vertical plane through the axis of the bridge. The lower hinge casting is similar to the upper one and has a 6½x5¼-foot base plate 2¾ inches thick. Its concave hinge surface has a radius of 1.18 feet, and is connected to that of the upper casting by two bolts in slotted holes which allow limited radial motion, but prevent transverse motion. The lower hinge casting is seated in the recessed top of a 6x7-foot cast-steel base plate 2 inches thick, with longitudinal ribs on the under side, which fit recesses in the top of pedestal and prevent transverse displacement.

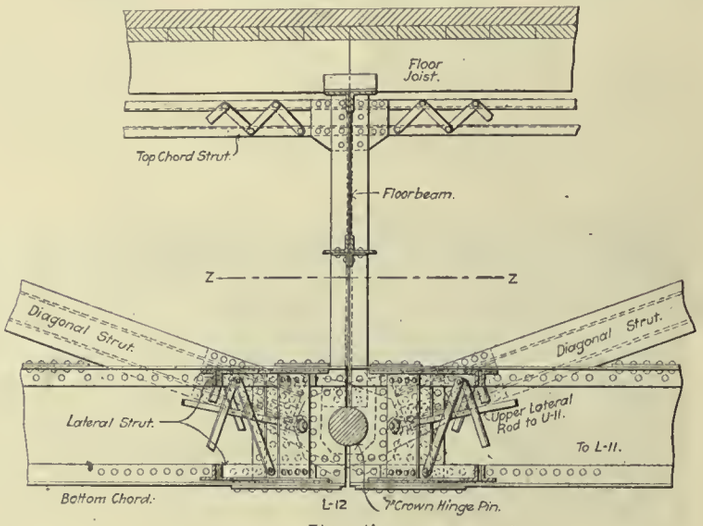
The base plate rests on the horizontal top of a cast-iron pedestal, 8½ feet square and 18 inches high, seated on a ⅜-inch sheet of lead and fastened to the masonry by six 2-inch holding-down bolts and one long oblique anchor bolt connected to reaction beams built into the masonry. All the sliding surfaces are machined, and there is a hole through all the castings with clearance for the main anchor bolt from the arch trusses. The bearing between the base plate and pedestal is made with six wedges providing an inch or more adjustment. The base plate is fixed transversely by wedges between its edges and the flange of the pedestal.

The ends of the arch trusses have solid reinforced webs at the crown, where they are about

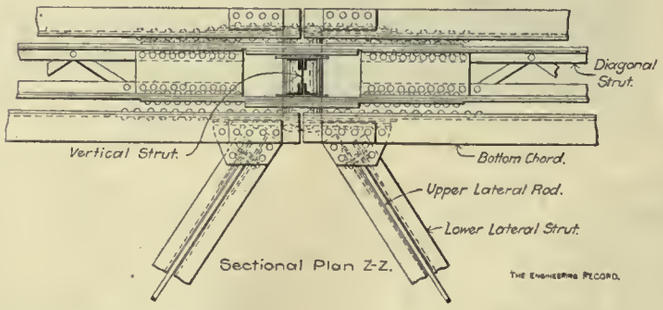


Typical Half Cross-Sections.



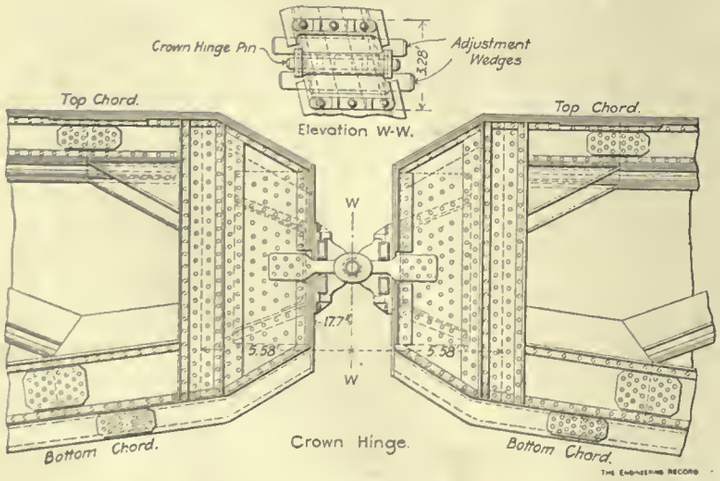


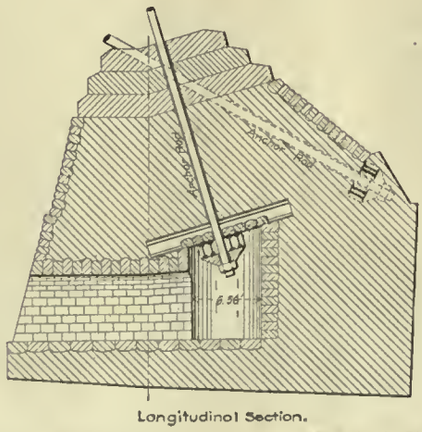
Elevation.

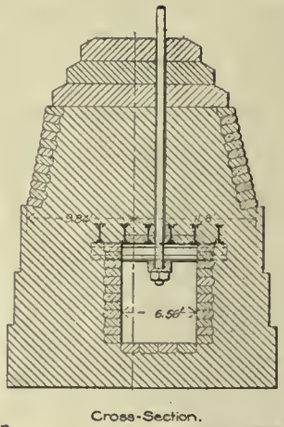


Connections at Crown.

LAKE STREET BRIDGE, MINNEAPOLIS.





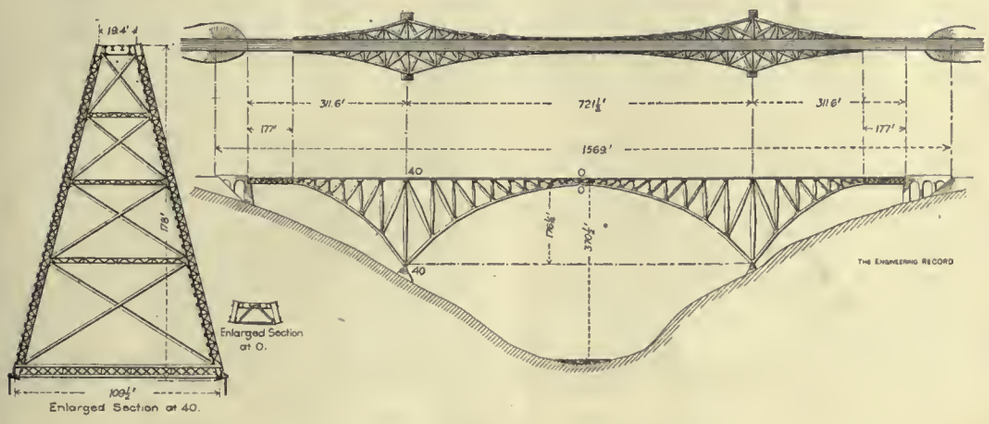


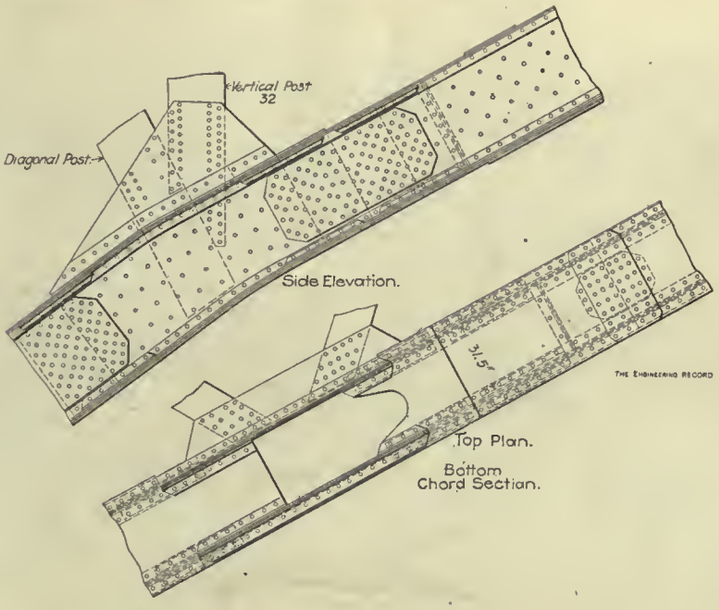
VIAUR VIADUCT, FRANCE.

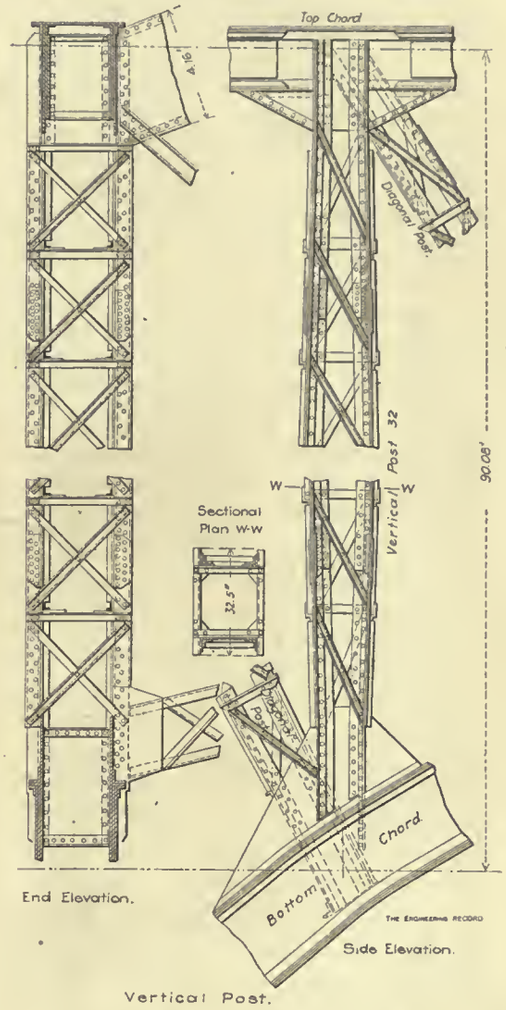
10¾ feet deep, with a clearance of 35 inches between the vertical faces, which are 49 inches wide at the bottom and 43 inches wide at the top. On the middle of each is bolted a vertical cast bed plate about 39 inches high and 48 inches wide with horizontal top and bottom ribs forming guides for the hinge casting. The hinge casting takes bearing on the face of the bed plate with two single horizontal transverse adjustment wedges, and has a semi-circular bearing for the 8-inch horizontal cast-steel pin. The pin has a collar at each end which engages the casting, and beyond each collar it is prolonged to receive two short horizontal eye bars, one of which is riveted at the opposite end to the web of each semi-arch truss.

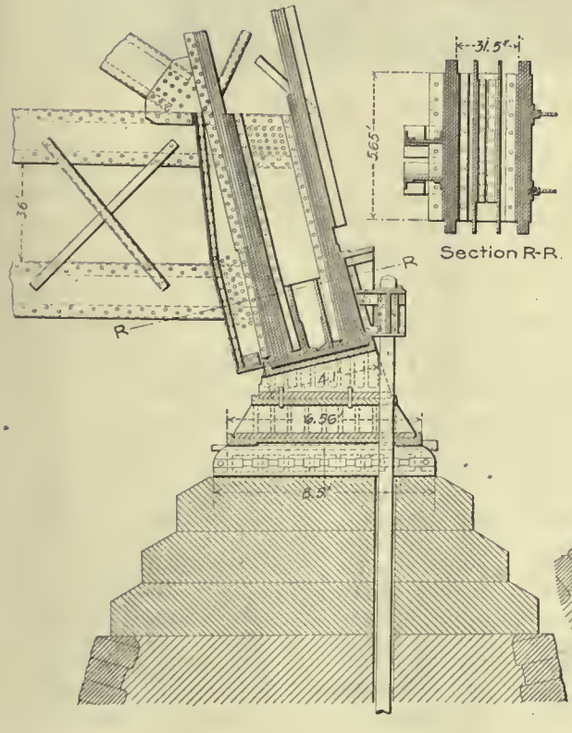
The bridge was illustrated in "The Revue Industrielle," September 16, 1899.

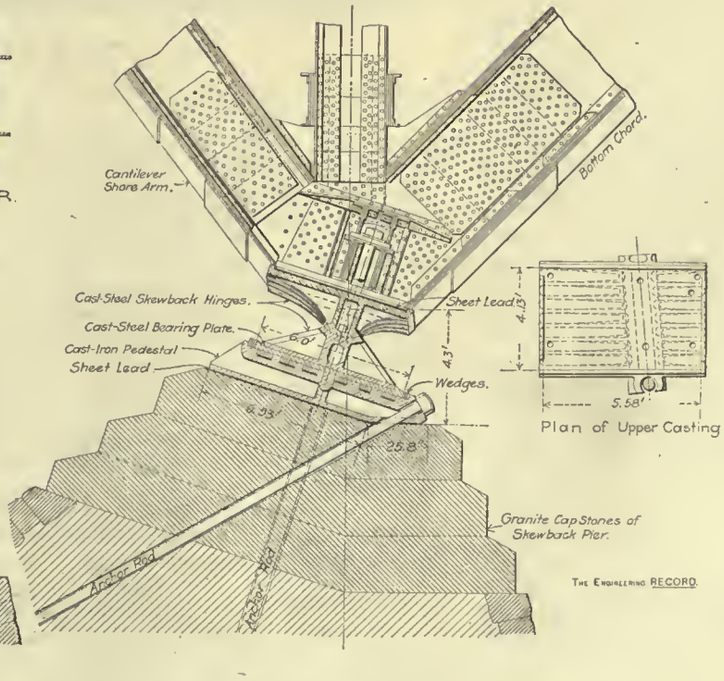
The Beautifying and Development of New York City along scientific and artistic lines is now being seriously considered. A public hearing was held April 27 on a proposed ordinance authorizing the appointment by the mayor of a commission to prepare a comprehensive plan for this work, all speakers being decidedly in favor of the ordinance. The value of appearances is becoming more widely recognized.

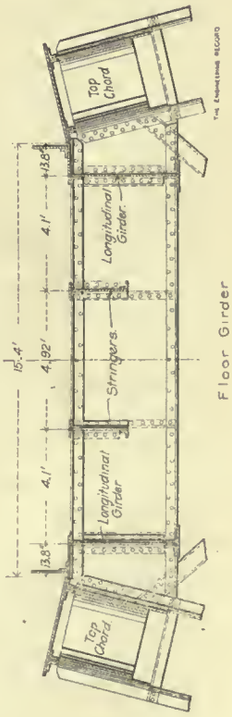












VIAUR VIADUCT, FRANCE.

The Cascade Water Power Plant.

By W. G. McConnon, Engineer in Charge of Construction

The recently completed plant of the Cascade Water, Power and Light Company is situated at Cascade, B.C., and owned by the London and British Columbia Goldfields Company, Limited, representing an investment, in round numbers, of $500,000. Cascade is a small town on the Kettle River, 12 miles east of the town of Grand Forks, and about 30 miles directly west from Rossland, B. C. Flowing from the west, the Kettle River descends 120 feet in passing through a half mile of narrow rocky gorge in a series of rapids and falls. For the utilization of this natural power, the Cascade Water, Power and Light Company has built a large dam, waterway, pipe line, power-house, and transmission line from Cascade to Phoenix, where the largest and most productive copper mines in the "Boundary District" are situated.

The dam, placed just above the entrance to the gorge, is of timber cribwork, with a 40-foot base and 24-foot top. The mid-section is 50 feet high, tapering to 25 feet at the sides, while the total length is 400 feet. This is built on a solid rock bed, to which the foundation timbers are bolted, and filled with 10,000 cubic yards of rock This dam raises the water 36 feet above the natural level, giving an effective head at low water of 156 feet. The permanent water level is 10 feet below the top of the dam, being controlled during high water by twelve sluiceways which can be opened to 12 feet below the natural river level, giving a passway of about 2,000 square feet. These sluices are closed by means of 12x12-inch squared timbers in grooves, operated by a traveling winch running on a track over the top of the dam.

From dam to power-house the water first passes through a 225-foot open rock cut from which it enters a tunnel driven through 410 feet of solid rock, passing under the track of the Canadian Pacific Railway, and then into another open rock cut 500 feet in length, at the end of which the bulkheads and controlling gates are located. These cuts and tunnel, representing an excavation of about 35,000 cubic yards of rock, are of dimensions liberal enough to avoid appreciable loss of head.

From the gates the water is conveyed for about 1,400 feet through a 7-foot pipe, constructed of Oregon fir tongued and grooved staves 2¾x7 inches, cut in circular segments and machined to the radius of the pipe. The staves are hooped at 12-inch intervals, with ¾-inch round steel bands, having cast-iron connecting shoes for clamping. Provisions have been made at the bulkhead and in the width of the cuts for the installation of a similar additional pipe. The stave pipe is followed by 250 feet of 7-foot circular steel pipe, resting on concrete piers and anchored into solid rock to avoid end thrust. Where this pipe passes alongside of the power-house, three 4-foot pipes and one 2-foot pipe are taken off below the floor level of the power-house to supply three 36-inch turbines for generators and two 12-inch turbines for exciters. A view of the power-house herewith shows also the stand-pipe at the junction of the stave and steel pipes, which relieves the pipe line from excessive water-ram strains, and incidentally voids any air taken into the pipes.

About 10,000 cubic yards of rock were removed for the site of the power-house, in a natural bay at the foot of the falls. This building is of substantial fire-proof construction, 150x50 feet, with stone foundation 22 feet deep on the lower side, and brick walls 30 feet above floor level, the height to peak of roof being 45 feet. It has been designed with a view to lengthening it when required. A second illustration shows the interior of the power-house, and the generating plant. The three generators are standard, three-phase, two-bearing, direct-coupled, 2,200-volt, 750-kilowatt, at 80 per cent. power factor, or 940 kilowatts at 100 per cent. power factor, 60 cycles per second, 300 revolutions per minute. The two exciters, each capable of exciting all three generators at one time, are 45-kilowatt, 120-volt, shunt wound dynamos, self-contained, two-bearing type, direct coupled to independent turbines, running at 500 revolutions per minute. The turbines are S. Morgan Smith wheels made at York, Pa., and the governors of Escher, Wyss & Company's make, from Switzerland.

There are nine standard, self-cooling, oil-insulated transformers in banks of three, having a capacity of 250-kilowatts at 80 per cent. power factor, or 312½ kilowatts at 100 per cent. power factor, "Star" connection, and wound for a ratio of 2,000 to 20,000 volts, on both high and low tension windings, with full load efficiency of 97.6 per cent. As the taps are brought out near the neutral point, which is grounded, it is impossible to maintain a dangerous voltage in the auxiliary circuit. The current from the high tension side of the transformers is carried to a row of high tension fused circuit-breakers, situated alongside of the building behind the main switchboard. These switches are placed on independent marble slabs, with marble barriers between. The current leaving these switches enters a high tension bus and is carried to the line switches at the rear of the building. These line switches are grouped switches opening all three wires at the same time. Each switch is furnished with a time limit tripping device, and reversed current tripping coils, so that overloads can be carried for a period of from one to ten seconds, as the local conditions call for, or either line can be cut out automatically in case of trouble.

The switchboard for the low pressure side consists of seven panels of blue Vermont marble, one panel for each generator, one for the two exciters, and a feeder panel for each group of transformers. The six lightning arresters, located just above the switches in the gable of the roof, are the "low equivalent" style, giving protection against lightning discharges for transmission at 20,000 volts. The electric apparatus was furnished by the Westinghouse Electric and Manufacturing Company.

A right of way 132 feet wide is cleared, and transmission lines erected from Cascade via Grand Forks to Phoenix, a distance slightly over 21 miles. The high tension circuit consists of two separate three-phase transmission lines, each carrying three No. 3 B. & S. copper wires, with room on each line for another circuit. Throughout it is one of the most substantial and well constructed lines in the Dominion. The poles are heavy cedar, and on tangents are spaced not over 100 feet apart, on curves at less distances, in some cases as low as 50 feet. No angles are turned, but all changes in direction of line made with easy curves. No side or head guys have been used except at extra heavy spans across rivers, and in similar places. The work on this line, as well as all construction of the plant, is a decided credit to the company's local engineer, Mr. Wm. Anderson, who has designed and executed the work.

A 3-mile feeder is taken off at Grand Forks, 12 miles from Cascade, to the Granby Smelter of the Granby Mining and Smelting Company, where current is used for driving Westinghouse induction motors of sizes ranging from 3 to 700 horse-power, and of an aggregate capacity of 2,400 horse-power.



CASCADE POWER HOUSE AND PIPE LINE.

The sub-station at Phoenix is located at an altitude of about 3,500 feet above the power-house. The building is of brick, with one end left for future extension, and contains the transformers, line switches, fused circuit breakers, switchboards, etc., substantially duplicating those at the power-house. This sub-station, for the immediate present, will be called upon to supply current for two 700-horse-power, Westinghouse, type "C" motors for driving two large compressors, a 100-horse-power motor for stone crusher, and a 150-horse-power motor for hoist, as well as furnishing the current for lighting the town of Phoenix.

The Cascade Water, Power and Light Company estimates that it will have a supply, at low water, for about 6,200 horse-power. This will enable the doubling of the present output. All the plans were made and carried out with the view of extending the plant to its full capacity, and from present indications it would

seem that the company will have a demand for all the power it can furnish.

Improved Maintenance of Earth Roads.

By Henry P. Morrison, M. Am. Soc. C. E.

Substantial progress toward a betterment of our country's highways is annually being made. Skill and intelligence are gradually being employed to supervise the expenditure of road improvement funds. The value of good roads, as an important factor in securing and maintaining national prosperity, is recognized to the extent that certain states have divided the cost of road construction with the localities directly benefited. Thousands confidently expect that the national appropriation for the same work will be so increased as to carry its good offices beyond the present advisory work of the Department of Agriculture. Yet when one thinks of the mileage of unimproved highway, of the poverty of the localities that must at least aid in the burden of paying for the road improvement, of the conservatism which spreads the narrow gospel that "What was good enough for father is good enough for me," and of the limitations to appropriation, whether national or state, the unwelcome truth that the vehicular traffic of this country must, for many years to come, perform its service largely on unimproved roads, is brought to notice.



GENERATING UNITS, CASCADE POWER HOUSE.

The economical improvement and maintenance of those earth roads, until such time as their substantial improvement is a financial possibility, becomes a matter of importance for the road engineer, who has learned much from the old-fashioned maker and mender of roads, even though he frequently turned in from his scraper and shovel material that should not have found place in the body of a road. It is quite improbable that any engineer will, in the future, be called upon to construct and maintain any extended highway system without having, at the same time, placed in his charge for maintenance, a certain mileage of earth roads. It is well that the highway commissioner has been brought to tell the secrets of his craft. Even though much of his information was scarcely such as could be extensively used, yet when coupled with the exact knowledge of the road engineer, the introduction of the money system, and the use of the level, it gives assurance for the improvement and maintenance of the earth roads of the country, which means that progress and prosperity will settle in new localities, even though those same localities have not stoned their roads. A few years ago, a road engineer would have been surprised had he been consulted concerning the best methods for maintaining earth roads, and the suggestion that a competent engineer would give valuable advice in the economical maintenance of an unimproved system would have been equally surprising to boards of supervisors or town officials. To-day the road engineer appreciates the fact that an opportunity to perform a great public service lies in the possession of knowledge which will increase the utility and lessen the expense of transportation on earth roads.

His investigation will naturally follow somewhat in this way: First, is there a mileage of roads in the system which travels over hills, that might be avoided? Is there a circuitous route which might be replaced by a straight one? Is there a swampy unmaintainable mile, which, without outraging the demands for directness and desirable grade, could be elsewhere located on firmer foundation? This matter of relocation, or in the case of new roads, the selection of route, is a work which, if well performed, will result in great good for the locality affected.

Next, the attention of the investigator will be directed toward the local supply of natural road making material, if any exists within reasonable haul, and the convincing, which is not infrequently the difficult task, of the local authorities that, whenever possible within the limits of the authorized annual expenditure for road improvement, it should be used upon the road. If the absence of available road material is unfortunately the condition, then the investigation should reach out so as to find what desirable combination could be affected from the local sands, clays or otherwise useless shales. Some luck and some judgment may result in developing a section of road which will not require turnpiking each year, and may be taken from the list of roads so treated.

The diverting of small water courses which make unnecessary junctures with the road system, and the provision of adequate culvert capacity, results in a permanent betterment of the road system and is a money saving operation. If the community, for whom the engineer is acting, is not in possession of a plant for earth road improvement, another opportunity presents itself in which he can perform great public service. When turnpiking the roads, he will get the greatest possible amount of his rounding material from the summits, and to the extent of financial ability, help the grade at low points. This annual helping of grade means that something is taken from the cost of everything that is brought into the locality, and increases the margin of profit on everything sold from the community; and further, that when you come to permanently improve the highway, a considerable amount of the necessary excavation has been made and paid for. This method of securing your rounding material aids in avoiding the incorporation of objectionable matter in the wearing surface of the new road. It also aids in securing the least possible disturbance of the sod of the side wings, which is an important feature in avoiding storm water scour.

The blades of the road scraper, under engineering supervision, will be permitted to disturb the wing sod very little, and the man with the scythe will successfully deal with the tall grass and weeds which are calculated to interfere with the flow of water on the wings. This leaves a valuable sod. The writer, for a number of years, successfully used a mowing machine on the dirt wings of improved roads. The supervising engineer will frequently find that a wet, slow and disagreeable half mile is caused by a hedge of tall bushes, which prevent the direct rays of the sun from drying out the slough. He cuts down the bushes, keeping in mind that the sun's rays are to be courted for the low flat sections of unimproved roads, and generally avoided for improved roads. Another section of the road the engineer improves by tiling or stone draining a spring that has been a nuisance for years. Again he finds his road in bad condition because it traverses a clay pocket which is maintaining a swamp. This may be impracticable or too expensive to drain by ordinary methods, and, as the writer frequently has, he will accomplish the task by cutting through the clay formation and reaching a stratum which will give a subterranean conduit for the troublesome swamp water, being careful to roughly sheath up the sides of his cesspool above the conducting stratum.

Under the engineer's supervision, surface and subsoil drainage for earth roads accomplish results which ordinarily would not be looked for short of a permanent improvement. But after all, the one great thing which will be accomplished by the engineer will be the power which he will exercise in defeating the practice which requires that the funds raised for road maintenance purposes shall all be spent at one season of the year, and that in a few weeks, and the roads left without attention for the balance of the year. Within the writer's experience in the maintenance of earth and improved roads, extending over a quarter of a century, there is no calling in which the "stitch in time" is so calculated to save nine, as it is in road maintenance. There comes to mind one small illustration of the value of the ability to spend appropriations when required, the possibility of rolling your principal dirt roads after a wet spell and before the frost transforms the ridges into instruments of torture to the animal and ruin to the vehicle which passes over the roads.

With the constantly growing mileage of improved highways and the better understanding of methods which lengthen the months of profitable usefulness for unimproved earth roads, comes the assurance that the isolation of country life is being reduced, the opportunity for profit to the farmer is increased, and urban pleasure travel is offered extended opportunity.

Asphalt Experiments at Washington.

The results of some interesting investigations on asphalt for paving purposes are given in the report of the engineer department of the District of Columbia for the year ending June 30, 1902. These investigations were conducted by Mr. A. W. Dow, inspector of asphalts and cements, an abstract of whose report on the subject follows.

There is strong evidence to show that the Trinidad lake and land asphalts are of common origin, and that the latter is either the result of an overflow of asphalt from the lake or that it is being forced up through crevices in the earth; or it may be that these deposits are a result of a combination of the two conditions. Whatever the origin, the lake is, as a rule, appreciably the softer, as this deposit, being so extensive in bulk, has lost less of the lighter oils and has been less subjected to molecular changes than has the asphalt from the land deposits; but granting this and that for this reason the lake requires less flux to soften it into a paving cement, it does not follow that the lake is superior. The accompanying laboratory examination shows that the two are very similar in all respects. Where one excels in one property, the other excels in another:

Table I.—Examination of Refined Asphalts.

	Lake.	Land.
Bitumen sol. in carbon bisul., per cent.	55.74	54.20
Organic matter not bitumen	7.88	7.83
Mineral matter, per cent	36.38	38.07
Bitumen soluble in naphtha, per cent.	62.90	59.40
Bitumen insol. in naphtha, per cent..	37.10	40.60
Parts residuum oil to flux 100 parts refined asphalt	17	22

The two refined asphalts shown in the first table were fluxed into paving cements having the same consistency at 77 degrees, Fahr., by the addition of the same residuum to each, and then gave the results shown in the second table. The appearance of the lake asphalt after 48 hours immersion in water showed it to be badly attacked, while that of the land asphalt showed it to be only slightly attacked.

Table II.—Examination of Asphalt Cements.

	Lake.	Land.
Bitumen soluble in carbon bisulphide, per cent.	62.4	62.6
Penetration at 77° F. (100 gms. 5 seconds, No. 2 needle)	40	39
Heat test (samples heated in open tins in air bath)—		
Loss on heating at 325° F. for 24 hours, per cent	1.53	1.06
Penetration before heating	40	39
Penetration after heating	19	24
Susceptibility to changes in temperature—		
Penetration at 32° F. (200 gms. 1 minute, No. 2 needle)	12	12
Penetration at 77° F. (100 gms. 5 seconds, No. 2 needle)	40	39
Penetration at 100° F. (50 gms. 5 seconds, No. 2 needle)	90	75
Penetration at 115° F. (50 gms. 5 seconds, No. 2 needle)	195	171
Ductility, inches to which drawn before breaking	13	11

From this examination it is seen that the lake asphalt cement is inferior to the land in that it is slightly more altered by heat, is more susceptible to changes in temperature, and is more readily acted upon by water. The land asphalt cement is inferior to the lake in being less ductile at 77 degrees Fahr. After a careful examination into the facts Mr. Dow believes that there is little or no foundation for the claim that for paving purposes lake asphalt is superior to land asphalt. The reasons given for the superiority of the lake asphalt is that it contains a larger quantity of light oils, which are superior to any oil that can be added to the asphalt, and that the bitumen is more cementitious. On examination the asphalt cement is found to be slightly more cementitious at the ordinary temperatures, between 50 and 90 degrees Fahr., but in practical use asphalt pavements are subject to much lower and much higher temperatures, and as the lake cement is more susceptible to changes, it is doubtful whether it is superior at the extremes. It is claimed that as a rule the pavements laid with land asphalt have been inferior to those laid with lake; but this is easily accounted for by the fact that in the early days of the industry all the most experienced paving companies, controlling practically all the trained men, were induced to use lake asphalt, so that the land asphalt pavements were laid by incompetent and inexperienced men.

A practical demonstration tending to prove that the importance placed on the presence of the light oils in lake asphalt is much overestimated, is that one of the best pavements in the country was made with Gilsonite, which is considerably harder than land asphalt, softened into a paving cement by the addition of an oxidized petroleum residuum. The cement used in this pavement is entirely lacking in natural light oils and is less cementitious at ordinary temperatures than is even a cement made from land asphalt. Two cargoes of refined land asphalt were received during the year, from which four samples were taken and gave on analysis the following per cent. bitumen: 54.1, 51.8, 53.8, 50.7. Judging from the quantity of residuum oil used in each still to flux this asphalt into a paving cement, it was very uniform in consistency. In the first three streets where residuum oil was alone used as a flux, the proportion varied from 25 to 26½ parts to 100 parts of asphalt, and the penetration of the cement varied from 33 to 41 at 77 degrees Fahr. This same uniformity was noticeable during the entire year, thus demonstrating that although this asphalt is not quite as uniform as that from the Trinidad lake, it is far more so than Bermudez asphalt.

Cuban Asphalt.—During the year ending June 30, 1902, the Brennan Construction Company, of Washington, used in about 5,000 square yards of sheet asphalt pavement a cement made of Cuban asphalt fluxed with California maltha. This asphalt is mined at Bejucal, about 20 miles from Havana. The flux used was manufactured by the Sunset Refining Company, of Los Angeles, Cal. An examination of the crude Bejucal asphalt showed it to contain 3.61 per cent. of water and light oils volatile at 225 degrees Fahr. A further analysis after drying at 225 degrees for 18 hours showed it to contain 71.64 per cent. of bitumen soluble in carbon bisulphide, 4.20 per cent. of organic matter insoluble in carbon bisulphide, and 24.20 per cent. of mineral matter (clay, sand and some limestone). An examination of the bitumen soluble in carbon bisulphide showed 50 per cent. of it to be soluble in naptha and 50 per cent. to be insoluble. This asphalt is too hard in its natural state to be suitable to use as a paving cement. Three samples of the crude Cuban asphalt were examined during the year, and were found to contain 71.64, 72.22, and 72.78 per cent. of bitumen soluble in carbon bisulphide. Judging from the amount of flux used in oiling each still, it showed a remarkable uniformity in quality.

After fluxing in the proportion of 100 parts of crude Cuban asphalt to 65 parts of the Sunset Refining Company's asphaltic oil flux, an analysis of the resulting cement showed it to be practically like that of a Bermudez cement made of the best quality of Bermudez asphalt fluxed with 13 parts of Constable Hook (N. J.) residuum. A comparison of these two cements is given in the third table. Neither of them showed the slightest signs of the action of water after two weeks' immersion in distilled water.

The great objection to Trinidad asphalt is the rapidity with which it disintegrates under the action of water, owing to the presence of soluble salts left after refining. As the removal of these salts is very desirable, Mr. Dow visited the works of the Maryland Paving Company, at Baltimore, where a plant was in operation for washing asphalt. The process consisted in first grinding the crude asphalt in a Denmead disintegrator of 10 tons per hour capacity, and then conveying it to a large circular vat, where it was washed in water, being agitated by revolving paddles. After being agitated for half an hour the paddles were stopped, the asphalt allowed to subside and the water drawn off. After a second washing in the same way, the asphalt was run off into the stills and refined. It is claimed that the asphalt is more easily refined after having been washed. The washing plant appeared so practical and

Table III.—Comparison of Cuban and Bermudez Asphalts.

	Cuban.	Bermudez.
Penetration at 77° Fahr.	53	51
Bitumen soluble in carbon bisulphide, per cent.	84.60	95.80
Heat test—		
Loss on heating for 18 hours at 325° F., per cent.	5.20	3.20
Penetration at 77° F., after above heating, per cent.	18	21
Hardened by heating, per cent.	290	240
Test for susceptibility to changes in temperature—		
Penetration at 52° F. (200 gms. 1 minute, No. 2 needle)	17.5	15
Penetration at 77° F. (100 gms. 5 seconds, No. 2 needle)	53	51
Penetration at 100° F. (50 gms. 5 seconds, No. 2 needle)	115	113
Penetration at 115° F. (50 gms. 5 seconds, No. 2 needle)	218	232
Ductility, inches to which drawn at 77° F.	24	22

inexpensive, and the asphalt was so much improved by the process, that it was thought advisable to insert the following clause in the specifications for sheet asphalt and asphalt blocks in Washington: "The asphalt cement must be either naturally or through artificial treatment of such character as to be unaffected by the action of water when tested as follows: The asphalt cement shall be tested by coating on a piece of glass and immersing this coated glass in distilled water at a temperature between 70 and 90 degrees, Fahrenheit. The surface of the asphalt cement must remain bright and show no corrosion or discoloration after immersion for a period of seven days."

Clermont-Ferrand Power Plant.

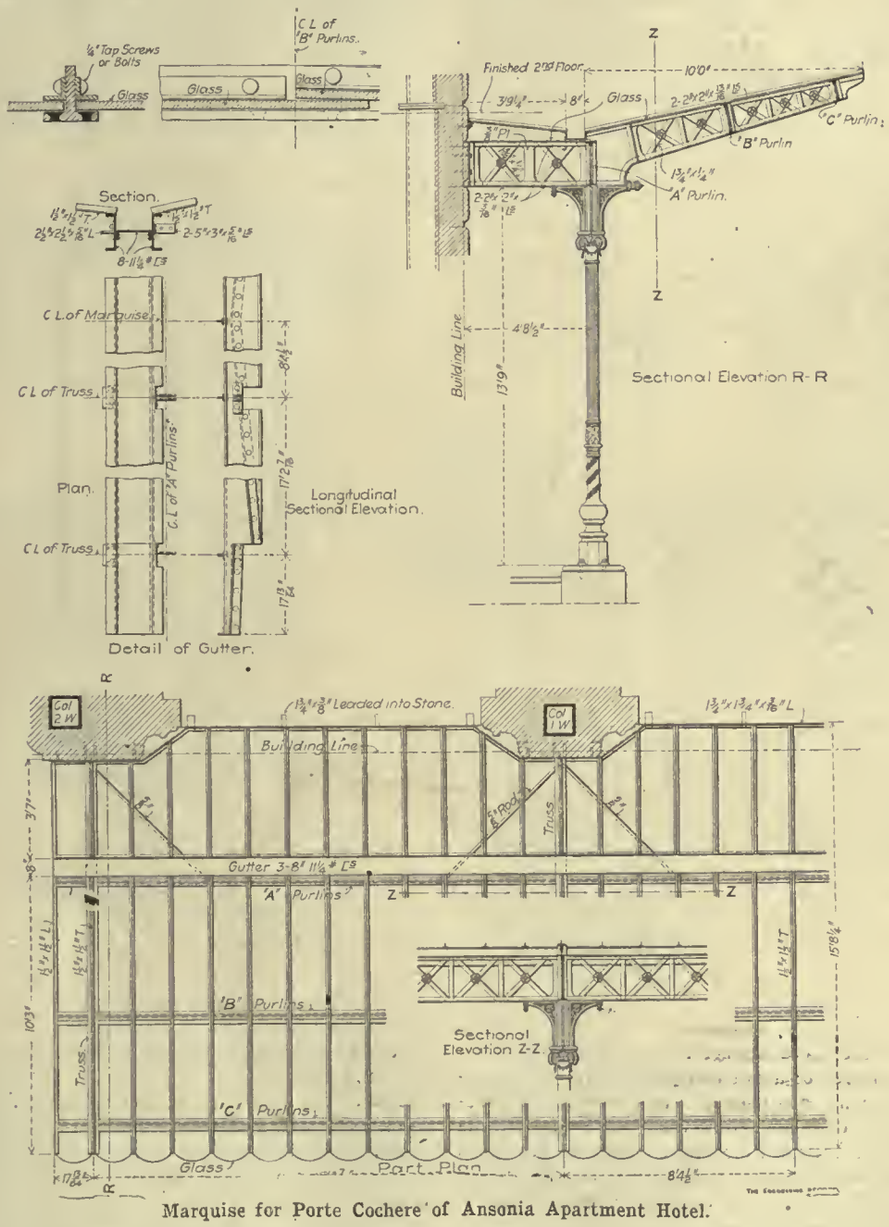
Clermont-Ferrand is a city of somewhat more than fifty thousand people situated in central France about midway between Limoges and Lyon, and is the center for a large rubber trade. The gas company is increasing its electrical plant by a hydro-electric installation, the new works being situated on either side of the Sioule River. Just above the works is a large dam forming a reservoir of 250 acres area, about 4 miles long and 390 feet in average width. The equipment in the power plant includes six 1,000-horse-power, horizontal shaft Francis turbines, direct-connected to 800-kilowatt, 1,000-volt three-phase Westinghouse alternators running at 333 revolutions per minute. Excitation is accomplished by two 37.5-kilowatt dynamos driven by small auxiliary turbines. The turbines are supplied by independent pipe lines conveying water from the reservoir. The voltage will be increased to 20,000 by means of monophase transformers in groups of three, and the current transmitted 30 miles on double overhead transmission lines for lighting and power purposes. The cross-arms for the wire are boiled in paraffin and coated with tar. The construction and installation of the mechanical plant are being performed by the Société Anonyme Westinghouse, of Havre.

The Preparation of a City Map based on an accurate triangulation system is recommended in the last annual report of Mr. Charles M. Slocum, city engineer of Springfield, Mass., who states that the need of such a map is felt in all the city departments as well as in general business.

Structural Steelwork in the Ansonia Apartment Hotel, New York.—V.

Steel and Glass Marquise.

The Seventy-third Street porte-cochere of the Ansonia building has a light and graceful steel and glass Marquise designed by Mr. Edward Raqué in imitation of one at Versailles. It consists of a slender ornamental framework carrying a roof which reaches from the main entrance to the curb. It has a length of about 53 feet and a width of 18 feet, and is supported on four cast iron columns, with fluted shafts and ornamental bases and rafters, which are seated on the pavement about 4½ feet beyond the building line. The top of each column serves as the fulcrum for a lattice-girder cantilever about 14½ feet long, which has the end of its short arm anchored to the masonry in the face of the main wall.



Marquise for Porte Cochere of Ansonia Apartment Hotel.

The cantilevers are of a peculiar shape with the long arms inclined upwards and having ornamental cast iron rosettes and knee braces. They are connected by three lines of longitudinal purlins which carry transverse T-bars supporting the glass roof. To avoid the possibility of drip at the curb, the roof is made concave so as to pitch from both edges toward an inside gutter which is formed, as shown in the cross-section, by three longitudinal channels riveted together to have a trough-shaped cross-section and supported over the tops of the columns. The roof is braced laterally by screw ended diagonal rods, like knee braces, which extend from the anchorages of the cantilevers to the intermediate points on the main purlin girders.

Ribbed glass ¼-inch thick is set in panes 16 inches wide and about 5 feet long with overlapping ends and ¾-inch angle stops, as shown in the detail. Where the roof joins the moulded faces of the stone pilasters, which enclose the columns and the main wall, the joint is made with cast iron plates carefully fitted to the curve of the mouldings, anchored to the stone and riveted to the horizontal angle, which receives the inner ends of the roof bars and is firmly anchored to the masonry with leaded flaps.

Mr. Paul E. Duboy was the architect; Mr. Philip E. Raqué the consulting engineer, and Mr. Edward Raqué the engineer in charge for Mr. W. E. D. Stokes, the owner and builder. The structural steel work was built and erected by Messrs. J. B. and J. M. Cornell, with Mr. C. J. Wolfe, engineer in charge of the draughting department. The copper and skylight work was done by Messrs. A. J. Ellis & Company.

Harrisburg, Pa., Water Consumption for 1902 was 151 gallons per capita per day, of which 80 gallons are estimated as domestic consumption and 71 gallons were used for public and manufacturing purposes.

Afforestation of a Watershed.

Forestry on the watershed of the Higby Mountain reservoir, Middletown, Conn., is being carried on along scientific lines, according to the 1902 report of the water commissioners. State Forester Walter Mulford, who visited the watershed early last spring, made a proposition leading to a written agreement between the Connecticut Agricultural Experiment Station at New Haven and the Board of Water Commissioners of Middletown, by which a careful study of the lands owned by the city and not at present wooded will be made, and a planting plan for the afforestation of these lands prepared. Detailed plans for the management on forestry principles of the Higby Mountain watershed will also be made. In return for this work on the part of the experiment station, the city agrees to expend $200 annually for a term of five years beginning January 1, 1903, in execution of the planting plan; and also to pay the board and traveling expenses to and from New Haven of one man while engaged in this work. Mr. Mulford has undertaken the work contemplated in the agreement (which was ratified by the Common Council on May 5, 1902) and has investigated the existing conditions on the various tracts of land. Steps have also been taken to improve the forest growth by thinning out some of the trees on certain tracts. In pursuance of the proposed planting plan, nurseries have been established, where there are already under cultivation 30,000 plants of white pine and a considerable number of black walnut, red oak, shagbark hickory, and catalpa trees. There have been obtained for planting this spring several bushels of acorns of the red and yellow oaks and a quantity of seed of the white ash and the tulip. It was desired to obtain a supply of chestnut and white oak seed, but this was not done, as the seed crop of those trees was a failure.

Examinations for Civil Engineers in the Navy.

On June 8 examinations will be held at the Navy Yard, New York, for two civil engineers and three assistant civil engineers in the Navy. Appointees to the grade of civil engineer will enter the corps with the rank of junior lieutenant, and pay of $2,700 per annum. At the end of five years the pay will be increased to $3,000 and at the end of ten years to $3,500. Appointees to the grade of assistant civil engineer will enter with the rank of junior lieutenant, and pay of $1,800, increasing to $2,100 at the end of five years. Further particulars were given in The Engineering Record January 31 and April 11, 1903.

No person shall be appointed a civil engineer who is less than 28 or more than 35 years of age. No person shall be appointed an assistant civil engineer who is less than 23 or more than 28 years of age.

Application for permits to be examined must be made to the Secretary of the Navy, and must be accompanied by testimonials as to character, evidence of American citizenship and evidence of having received a degree in the civil engineering course of some professional institution of good repute.

The Annual Meter Rental of $2, charged by the Water Department of Cambridge, Mass., has been discontinued, thereby making the net minimum charge for metered water $5. This change, which went into effect April 1, is especially for the benefit of small consumers, and the price is less than the minimum charge for ordinary domestic use under schedule rates. Mr. E. C. Brooks is the superintendent.

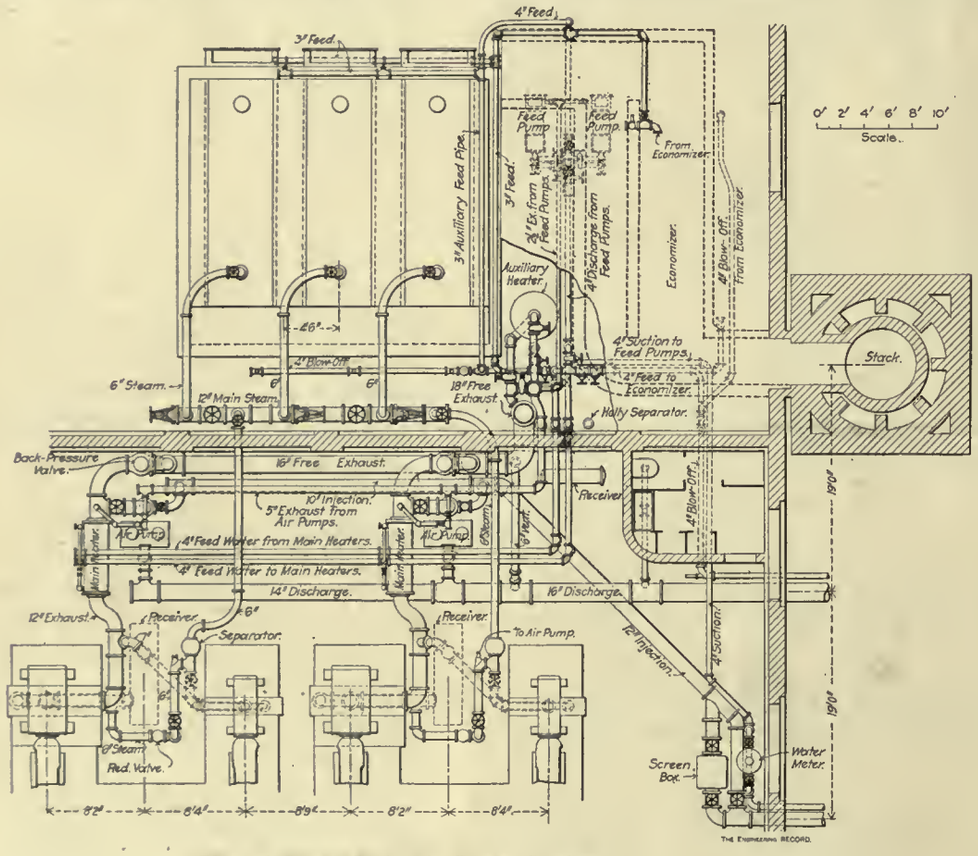
Power Plant of the Worcester & Blackstone Valley Street Railway Company.

The Worcester & Blackstone Valley Street Railway, now operated by the Worcester Suburban Street Railway Company, erected in Worcester some time ago a power plant which is another of those that may be recorded as a good example of modern practice in power plant work. It is equipped with compound condensing engines with feed-water heaters inserted in the exhaust from the engines and a feed-water heater to utilize the heat of the exhaust steam from the auxiliaries of the plant. The jet system of condensing is employed and fresh water has constantly to be delivered to the boilers and in addition to the feed heaters, the water is passed through a fuel economizer in the smoke passage. The boiler plant consists of horizontal tubular boilers.

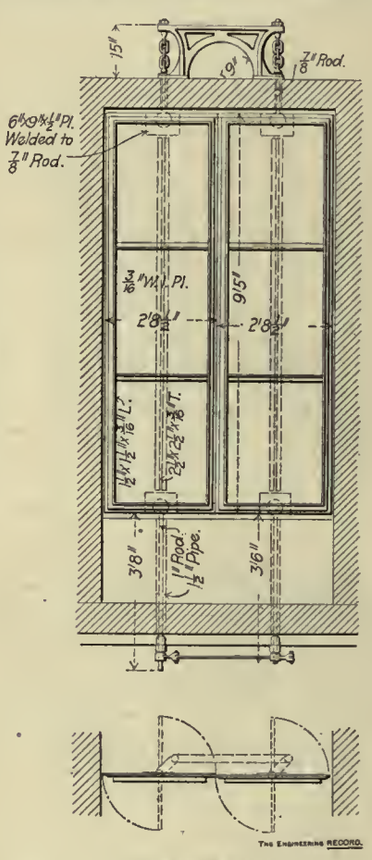
The power house is a brick structure with an iron truss roof, of the class in which engine and boiler rooms are side by side, that is, the engines and boilers back to back. It is about square in plan, being 101 feet 4 inches by 106 feet 8 inches in outside dimensions, and is built with 16-inch brick walls with a 12-inch partition wall between engine and boiler rooms. The boiler room is 50.5 feet wide in inside measurement and the engine room 1 foot wider. Each room is spanned by its own roof trusses and has a monitor. The roof is of 2-inch planking covered with tar and gravel. The boiler room is 26½ feet in clear height to the under side of the roof trusses and contains the feed pumps and auxiliary feed-water heater, the economizer and a setting of three horizontal tubular boilers of an aggregate capacity of 600 horsepower with ample space for another setting of three similar boilers. An interesting feature of the arrangement in the boiler room is the location of the economizer at an elevated position with the auxiliary apparatus underneath it. In the engine room, the roof trusses are level with those of the boiler room, and the usual basement has been provided; the engine room has a clear height to the lower chords of the trusses of 19 feet and the basement a clear height of 11 feet. As usual the main heaters, the engine connections, condensers and piping generally are in the basement. The engine room is spanned by a 10-ton Whiting Foundry and Machine Company's hand-power traveling crane. The engine room contains besides the switchboard two 325-kilowatt generating units with space reserved for doubling the capacity.

The boilers were built by the Stewart Boiler Works, of Worcester, Mass., and the three were erected in one setting. Each is about 21½ feet long and 6 feet in diameter and contains 90 4-inch tubes. They are hand fired from a firing space about 20 feet wide. The smoke breeching, which is made of 3/16-inch plate stiffened with angle irons, extends across the front of the boilers to the economizer setting and is suspended from the lower flanges of the roof trusses by four rods, ¾ inch in diameter, fitted with turnbuckles. It is built large enough to accommodate the future installation of boilers, and at the economizer setting has a cross-sectional area of about 38 square feet. The economizer was furnished by the Green Fuel Economizer Company, was installed in a passage 5 feet 5 inches wide and consists of 144 tubes in sections 6 tubes wide, across the passage, and 10 feet 2 inches high. The economizer chamber is provided with double, pivoted dampers at each end; the economizer by-pass, which has an area of about 38 square feet, has a single vertically pivoted damper; and there is a large damper set diagonally across the smoke connection into the chimney. A drawing has been made showing the method of suspending the dampers. They are operated at the bottom, twisting at the top the short length of chain by which each is held from a hanger above the brickwork of the smoke passage. The chimney is of the radial brick type built by Adam Weber Sons, of New York. It is 150 feet in height and 6 feet in inside diameter. It rises immediately outside, but independent of the building.

The steam, which is generated at a pressure of 150 pounds per square inch, is conducted from each boiler in a 6-inch pipe which has a horizontal bend at the boiler and then a vertical downward bend to the steam main. This is supported above the floor of the boiler room, back of the boilers and against the partition wall, so that the operating valves are under ready control from the passageway at the back of the boiler setting. The steam main is 12 inches in diameter, large enough for the future boiler installation. Each boiler supply pipe is, as usual, fitted with two valves, one set vertically at the boiler outlet and the other horizontal, at the steam main. The main is divisible into three sections corresponding to the three boilers by vertical gate valves. The steam main is drained of condensation at points immediately below the entrance of the boiler supply pipes, and the water together with the clean drainage from all high-pressure sources is led to a Holly receiver in the engine-room basement and returned to the boilers automatically by this system, the separator of which is indicated in the upper part of the cross-section drawing of the station.



Plan of Steam Piping in Power Station.



Damper Details.

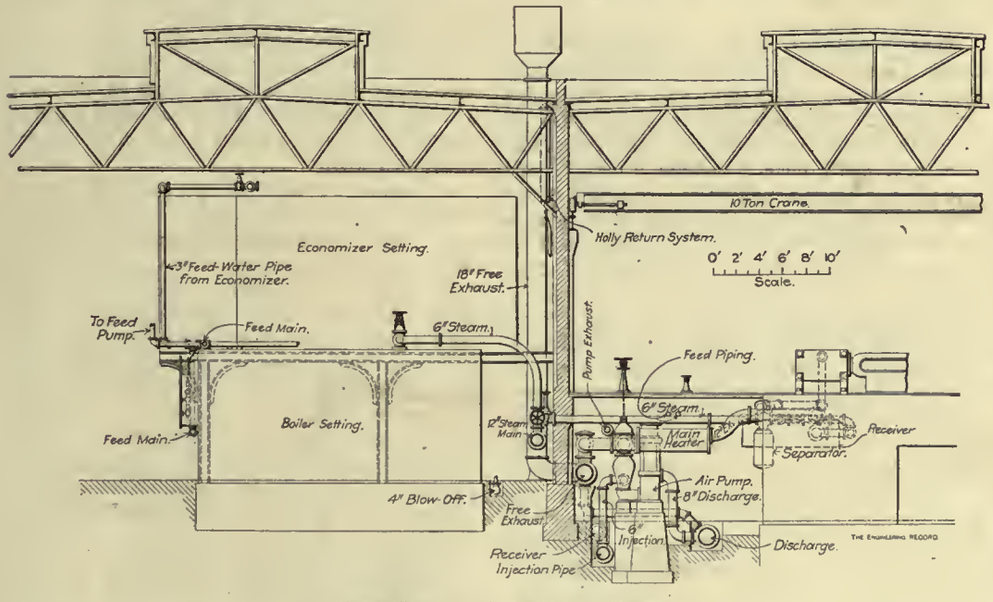
The steam supply to each engine is 6 inches in diameter and starts from the top of the steam main, where it has a valve, and runs into the basement of the engine room to a Cochrane separator. Beyond this the live steam may go to either or both of the two cylinders of the engine, which is of the cross compound type, the branch to the low-pressure cylinder having a reducing valve, to reduce the working pressure in the larger cylinder. The steam distribution is similar to that frequently obtaining in plants employing cross-compound condensing engines. The exhaust from the high-pressure cylinder is ordinarily discharged into a receiver, which, in this case, is seven times larger in volume than the high-pressure cylinder, and the supply to the low-pressure cylinder is taken from the receiver; but each cylinder may receive the steam direct from the boilers, and exhaust together into the exhaust pipe.

The exhaust pipe for each engine is 12 inches

in diameter and the exhaust must first pass through the main heater and then either to the condenser or into the free exhaust main through a back-pressure or relief valve. The heater is of the American type made by the Whitlock Coil Pipe Company, of Hartford. The condensers are of the Blake vertical twin type, with 9x18x12-inch air pumps. They receive their steam supply from the steam connections at the main engine cylinders, that is, beyond the steam separator, and may exhaust into an auxiliary system of exhaust mains or into the exhaust from the engines, and thus operate condensing. The condensing water is drawn from the river through a 12-inch injection pipe, provided with a screen box at its entrance into the station, and is discharged through a 16-inch discharge pipe. The condensing water conduits, which are laid underneath the floor of the basement, and the exhaust systems are of large enough size to serve the completed power installation. The main exhaust pipe is run into the boiler room, and rises above the roof, as indicated, with an exhaust head at its top. The exhaust steam from the air pumps and from the feed pumps in the boiler room is collected at a point near the main exhaust riser, and the steam can either be passed through the auxiliary feed-water heater or directed into the free exhaust riser, as a by-pass around the heater. The heater is also of the American type.

The feed water is delivered by the feed pumps through the main heaters, the auxiliary heater and the economizer, in turn. The feed pumps are installed in duplicate, one of the Blake type and the other of the Worthington, and are located, as stated, beneath the economizer setting. Any of the heaters and the economizer can be by-passed and the water is delivered to the boilers through either of two feed mains. One of these mains extends across the fronts of the boilers underneath the ends of the overhanging boiler sheils, and the other runs above the front ends of the boilers. Opposite each boiler a tap connection is made with each main, that from the lower main passing upward and that from the upper main dropping and the two uniting in a single pipe which passes into the boiler. The necessary valves are inserted for controlling the flow from the main line desired. The live and exhaust steam piping throughout is of wrought iron, except the main exhaust line, which is of cast iron. The feed piping, from the source of supply to the main heaters is of wrought iron, from the heaters to economizers it is of cast-iron and from the economizers it is of brass; the auxiliary feed main, which forms the line carrying water when the heating apparatus is largely by-passed, is of wrought iron. The feed piping is 4 inches in diameter throughout except the mains at the boiler, including the discharge from the economizers, which is 3 inches in size. The condensing water mains are, of course, cast iron.

The plant was designed by Messrs. Sheaff & Jaastad, of Boston, Mass. The main engines are Hamilton Corliss engines, 16 and 30x42 inches in cylinder sizes, built by the Hooven, Owens, Rentschler Company. It will be noticed that the cylinder ratio is 1 to 3½. They drive 325-kilowatt Westinghouse generators, direct-connected, at a speed of 100 revolutions per minute. The electric distribution is by means of direct current.



Cross-Section of the Power Plant.

Test of an Oil Separator in the Exhaust of a Condensing Engine.

It has become a common practice of the present day to install an oil separator in the exhaust of a non-condensing engine plant where it is desired to use the steam for heating purposes and finally return the condensation to the boilers, but it is the exception rather than the rule, in a condensing plant, to make any attempt to remove grease contamination and save the condensed steam for boiler feed. The report of the test as given herewith will therefore be of interest as it is believed to be the first record of satisfactory results attained by inserting an oil separator in the exhaust pipe between an engine and a condenser. The test was made March 24, at the Brooklyn Navy Yard, by Professor F. R. Hutton, secretary of the American Society of Mechanical Engineers. The separator used was of the "Utility" type, as manufactured by the Standard Steam Specialty Company, 542 West Broadway, New York City, and was placed in the 12-inch exhaust pipe of a 250-horse-power condensing Ball engine. It consists of a horizontal drum, 40 inches in diameter and 96 inches long, with the interior of the upper cylindrical portion between the inlet and outlet nozzles, occupied by a series of vertical baffle plates through which the steam passes. The baffle plates are placed close together and are formed of iron chains suspended so as to fill the space within their semi-circular supporting frames. The oil and water intercepted by the chains, drips to the lower part of the drum and is removed automatically to the sewer through the agency of a pump and governor. The following is taken from Professor Hutton's report of the test:

Two tests were made. In the first, a half pint of oil, or .484 pound, was sent through the lubricator of the engine during an hour's run, and in the second test a pint, or twice the amount of oil used in the first test, was passed through the engine in the same time. The separator was connected on a 12-inch exhaust pipe, between the engine and a surface condenser, and by means of pumps samples of water containing the oil separated from the exhaust steam were taken from the separator and samples of the condensed water were taken from the condenser after the separation of the oil. These two samples have been analyzed by a competent chemist and the quantity of oil ascertained in each sample. By comparing the amount of oil in the sample with the amount of oil which passed through the engine, and the total weight of steam condensed, and water withdrawn from the separator, the result shows that, in the first test, 90 per cent. of the oil was caught in the separator and that of the mixture of water and oil issuing from the condenser only .0008 per cent. was oil. That is, the amount of oil in the condensed water, delivered by the condenser after separation, had only eight parts of oil in it to the million parts of water by weight. An analysis of the discharge from the separator, showed that it had the balance of the oil fed to the engine with the exception of a small and negligible loss, due, doubtless, to adhesion of oil to metallic surfaces which the steam, by its motion, could not remove. The second test, with twice the weight of oil fed to the engine, gave the same result or proportion of oil in the condensed water, indicating that the increased feed of oil did not make any difference in the effectiveness of the separation.

European Tramway Practice.

Mr. Richard McCulloch gave an address before the Western Society of Engineers, on April 15, on European tramway practice, embodying the results of his general observations as engineer engaged in the examination, construction and operation of tramways in continental Europe. He called attention to the backwardness of the tramway systems, due not only to the conservativeness of the people, but also to the peculiar conditions existing in the cities, and to the fact that Glasgow, with a population of nearly 800,000 inhabitants, had but 100 miles of track, whereas American cities of about the same size possessed from three to four times as many miles. The chief reason for this is that most European cities were located for defensive reasons; but American cities for commercial reasons, and the streets have been laid out accordingly. One of the attractions in the location of an American city was accessibility. In the European city the very reason for the location was the difficulty of approach. The narrow and crooked streets prevent the construction of tramways, other than the single tracks with turn-outs, as it is usually impossible to find parallel adjacent streets on which the mate for a double track can be built. As a consequence, these tramways do not give the service nor offer the accommodation of the American tramway, which takes a man up at his door and deposits him at his place of business. In some cities, furthermore, it is impossible to cross the old and congested districts in the center.

The obtaining of a concession is a long and tedious process, accompanied by much red tape. In England, the conditions as a rule are so onerous as to discourage private enterprises, whereas on the continent, long-term franchises are freely given on favorable terms, the state reserving the right to purchase the tramway after a certain period of operation. As all locations and designs have to be carefully worked out in advance, before receiving the approval of the authorities, it often happens that the tramway is three or four years behind the times when construction is begun. The electrical equipment at present installed, in many cases resembles that used in America, the two large American manufacturers of electrical apparatus

being closely allied to companies in all of the European countries, who follow the American models. The cars, however, are quite different, although American cars have been lately introduced and are now serving as models for European builders. The service is different, inasmuch as conditions are so radically dissimilar, both as regards hours of work, and the fact that workmen usually live in the neighborhood of the factories. It is poor, considered from the American standpoint. The rates of fare, as compared with those in American cities, are rather high, the distance traveled for one fare being limited, although the impression prevails that such is not the case.

Canadian Portland Cement Tests.

Report of Special Committee of Canadian Society of Civil Engineers.

At the last annual meeting of the Canadian Society of Civil Engineers a report was submitted by the committee on standard specifications and tests for Portland cement. This report differs in several respects from that of the committee of the American Society of Civil Engineers, an abstract of which appeared in The Engineering Record of January 31. For example, the Canadian committee recommends a mechanical sifter with no weights in the sieve for the fineness tests, whereas the American committee recommends hand sifting with a small quantity of large shot in the sieve. Extracts from the Canadian report follow.

All experiments shall be carried on, as nearly as possible, at a uniform temperature of 65 degrees, Fahr., except when tests are being made for the purpose of ascertaining the comparative strength of cements required for winter use. All proportions shall be determined by weight. A maximum residue of 10 per cent. shall be retained on a sieve of 10,000 meshes to the square inch, and the whole of the cement shall pass through a sieve of 2,500 meshes to the square inch. A mechanical sifter, working automatically by jig motion, is recommended. In the case both of hand and mechanical sifting, the process shall occupy a definite time, depending upon the weight to be sifted, and the diameter of the sieve. For example, with a weight of 10 ounces of cement and sieves 8 inches in diameter, the sifting shall be continued 2½ minutes on No. 120 sieve, 1 minute on No. 100, ¾ minute on No. 80 and ½ minute on No. 50. The introduction of small weights into the cement, while being sifted, is to be deprecated, as they tend to push an undue proportion of the cement through the mesh, to stretch the wires and to increase the grinding. The sand for standard tests shall be quartz, crushed so that the whole can pass through a sieve of 400 meshes to the square inch, but sufficiently coarse to allow of the whole being retained by a sieve of 900 meshes.

The specific gravity test is to determine the degree of calcination with certainty, and is, therefore, of great importance. The specific gravity of a Portland cement shall be at least 3.09, and shall not exceed 3.25 for fresh cements, by "fresh" meaning cements not more than two months old. The gravimetric system is recommended. Portland cement improves with age, provided it is properly stored and kept in air-tight bags or barrels. Specifications, therefore, should not prescribe only fresh cement.

The hot bath test for detecting free lime, etc., shall be carried out in the following manner: Mortar pats, prepared of neat cement and thoroughly worked, shall be troweled upon ground glass plates (carefully cleaned, preferably with acid) about 5 by 2½ inches, and ¼-inch thick. The pats shall be about ½-inch thick in the center, and worked off to sharp edges on the four sides of the plate. They shall then be covered with a damp cloth and allowed to remain in the air until set, after which they shall be placed in vapor in the Faija bath tank, in which the water is to be heated to a temperature of about 130 degrees Fahrenheit. After remaining in the vapor for 6 hours, including the time taken to set in air, they are to be immersed in hot water for 18 hours. Upon their removal from the bath, the samples should not be curled up, should not have fine hair cracks nor be distorted, and should not have large expansion cracks. The samples should break with a sharp crisp ring. Cements when very finely ground, even if slightly overlimed, are not so liable to blow.

The time of setting shall be determined by noting the time required for a sample to bear a needle of 1/12 inch diameter loaded with one-fourth of a pound, and 1/24 of an inch diameter loaded with one pound, the mortar under test being of the consistency of rather stiff plaster. The percentage of water used shall be stated in the report. For more accurate determination, a brass or rubber mould, 10 centimeters in diameter and 4 centimeters high, is filled with neat cement, mixed to such a plastic consistency that a plunger of 1 centimeter diameter and loaded with 300 grammes, penetrates to a point 6 millimeters from the bottom. Setting commences when a needle, of 1 square millimeter section, first refuses to sink entirely through "the mould." Setting is complete when the needle rests upon without penetrating the surface.

Tensile and compressive tests of neat cement, except where fineness, specific gravity and hot bath blowing tests are also made, are misleading. Briquettes of neat cement, in which these characteristics have been found satisfactory, shall bear a tensile stress of 250 pounds per square inch at the end of 3 days; 400 pounds at the end of 7 days, and 500 pounds at the end of 28 days. All briquettes shall be one day in damp air, and submerged in clean water for the remainder of the time. Any cement which shows a decrease in strength on or before the twenty-eighth day is to be rejected. The decisive tests shall be considered as the average of five briquettes, although for ordinary practice two or more briquettes may be sufficient and, in the latter case, only the highest test of the group is to be taken as the strength of the cement. In determining the tensile strength, the area of the broken surface shall be measured with great accuracy, as errors exceeding 10 per cent. are otherwise possible.

In sand tests, the sand and cement must be thoroughly mixed dry. After the water has been added, either for neat or sand tests, the mortar shall be thoroughly mixed for a uniform time; suitable periods being 2 minutes for machine mixing and 5 minutes for hand mixing. Briquettes made of one part cement and three parts sand shall bear a tensile stress of 125 pounds per square inch after submersion for 6 days and 200 pounds after 27 days. At the end of the same period the minimum compressive strength of a mixture of one part cement to three parts sand shall be 2,000 pounds per square inch. The tensile strength of briquettes, mixed in the proportion of three to one, or of other sand briquettes, shall not show a decrease either on the twenty-eighth day or subsequently. In every case the quantity of water used in mixing shall be stated in the report. The quantity of water to be used in neat tests, varies with the kind of cement, fineness, etc., the correct method being to bring all mortars to the same degree of plasticity. An apparatus, similar to Vicat's, and consisting of a needle having an area of 0.4 square inches, weighted to about 11 ounces may be used.

A simpler method for determining the standard consistency for neat cement tests is to mould a ball of mortar in the hands to a plastic state and drop the same about 20 inches on to the table. If the ball neither flattens appreciably nor cracks, the consistency is satisfactory. This process corresponds practically with the previous method. The water for standard consistency of three to one briquettes shall ordinarily be 10 per cent. of the sand and cement by weight. If the amount of water for standard consistency of neat cement of any particular brand be less than 20 per cent., then the amount of water for standard consistency of three to one briquettes for this particular brand shall be one-half of the amount used in neat tests.

In preparing the neat briquettes by hand the mixture of cement and water shall be thoroughly worked together (preferably in a Faija's mixer) for five minutes. The moulds shall then be filled well above the rim, so that the mortar presents a convex surface. With an iron trowel the mixture shall then be patted, commencing at the side, first gently and then harder until it becomes elastic and water appears upon its surface. No after addition of the mixture shall be allowed. The superfluous cement shall then be removed and the surface smoothed by means of a knife or sharp-edged trowel. The briquettes shall then be placed in a damp chamber (zinc lined) furnished with a lid (also zinc lined) to prevent the irregular drying of the briquettes. After 24 hours the briquettes shall be laid in water and kept completely submerged during the whole period of hardening. In preparing the sand specimens five pieces of blotting paper, soaked in water, shall be laid upon a metal or glass plate, and upon each piece of paper there shall be placed a mould, also moistened with water.

If possible, briquettes, prepared as above, shall be subjected to a uniform specified pressure (say, for example, 20 pounds per square inch) by means of a ram of the same gauge as the moulds, or, a Bohmé apparatus may be used. In this case the moulds shall be filled with about .4 pound of mortar, and shall be placed in the machine; 150 strokes shall then be applied to the core with a hammer of about 4.4 pounds in weight. After removing the mould and the core the briquettes shall be smoothed off, taken off the subjacent plate and treated as if hand-made. Doubtful cases should be invariably decided by machine made briquettes.

Testing machines shall be of the positive lever automatic type, so arranged as to apply the loads quietly and uniformly at the rate of 200 pounds per minute. Clips with adjustable rubber or paper composition rollers are found to work satisfactorily and should be used.

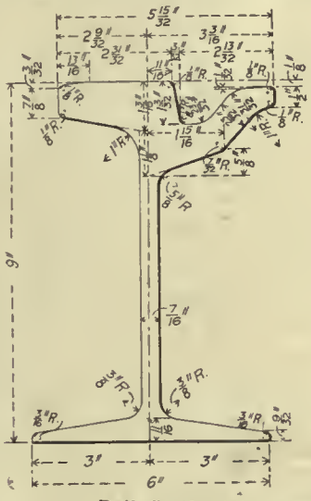
Chemical tests and full quantitative analyses are strongly recommended and preference will be given to cements, of which analyses are furnished by the manufacturers. Any cement containing adulteration shall not be accepted as a Portland cement. If there is found to be more than 2 per cent. of sulphuric acid, or 3 per cent. of magnesia, the cement should be rejected. The Silica cements are in a class by themselves and need special specifications.

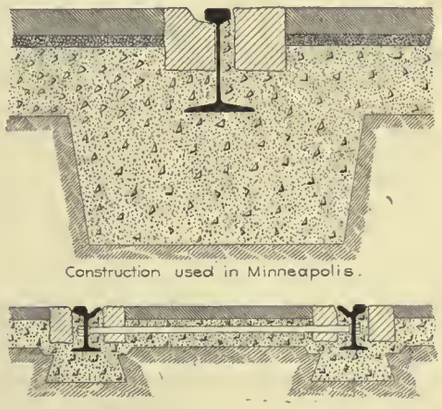
The net amount of cement, deducting the weight of the package, shall be 350 pounds per barrel. The manufacturer shall give a written certificate with each shipment of cement, stating (1) the date of manufacture; (2) the tests and analyses which have been obtained at the manufacturer's laboratory for cement taken from the day's grinding, of which the shipment forms a part; (3) that the cement does not contain any adulteration.

Types of Car Tracks for City Streets.

In connection with the description of the subway system for Chicago, recommended by Mr. Bion J. Arnold, published in The Engineering Record of February 21, brief mention was made of the types of rail suggested for various conditions of street and traffic. This is a matter that interests municipal officers as well as managers of street railways throughout the country; and so it is thought that an abstract of this portion of Mr. Arnold's report will be of value.

The design of rail that would be practicable in a well-maintained street paved with asphalt or dressed granite, would not be practicable in outlying streets cheaply paved and poorly maintained. This statement is made not from the street railway company's standpoint, but from the standpoint of the citizen who uses these streets with vehicles. In the absence of well paved and well maintained streets it would be a great hardship on the whole vehicular traffic of the city to demand the installation of a rail which would deprive vehicles of the roadway furnished by the girder tram rail now in use. The free movement of wheeled vehicles throughout a large proportion of the city would be materially retarded by the adoption of the girder grooved rail, and such change should be made only as new and permanent pavement is laid. In the outlying districts, where the time between cars is long, the grooved rail would frequently become clogged with ice in winter, preventing the operation until the ice was removed. This would not occur on streets where cars are run at short enough intervals to clear the groove by the passage of the wheel flanges.





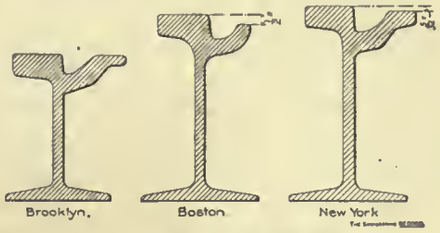
Rail Section and Construction Recommended for Chicago.

From the standpoint of the street railway company the design of the rail is generally a compromise between the demands of the several department heads, the demands of team traffic, and the ordinances of the city. The superintendent of motive power demands a rail that will offer the least resistance to the movement of the car and will be kept absolutely clean under all conditions, so that a continuous contact with the wheel can be assured, both of which conditions materially affect his monthly statement. He is convinced that the only rail that should be used is the ordinary steam railroad T-rail, laid well above the surface of the pavement. The superintendent of transportation is satisfied with this rail until the pavement immediately adjoining the rail becomes so badly rutted that the cars are constantly delayed by the slow progress of teams. Then he demands that a place be provided on the rail for the accommodation of vehicles. The superintendent of maintenance of way, charged with the maintenance of the pavement between the rails, demands that they be of the girder type, not less than 7 inches in height, so that sufficient foundation can be laid between the paving and the top of the tie; and he is equally insistent that a place be provided on the rail for wagon wheels, so that they will not wear out the pavement. The owners of vehicles, of course, want rails which will accommodate them, or else pavements equally good. The general manager of the company, in his endeavor to meet the requirements of all, adopted the present girder tram rail, which, till recently was considered ideal, and which has been specified in a number of franchises granted to Chicago companies.

There has grown up among drivers a habit of running the wheels on one side of their wagons in the outside car track, while the other wheels run on the paving, which soon leads to a depression in the surface of the paving, destroying its appearance and life. On account of this wear on the pavement, and from a desire to secure car tracks that can be easily crossed at any point on the street, there has arisen the demand for the full-grooved rail. In this the flange of the rail is brought up flush with the head and is the ideal rail from the viewpoint of having the surface of the street present an unbroken surface. Such a rail, however, cannot be cleaned by the passage of the wheel flange—the dirt will pack down in the groove until the cars run off the track. The compromise is to lower the flange on the rail and grade the incline from the bottom of the groove to the top of the flange at such an angle that the dirt can be forced up the incline and over the edge of the flange. If the flange is lowered too much a guiding shoulder for wagon wheels is created by the head of the rail and vehicles will follow the rail as much as they do the present tram rail, but an advantage is gained in that the wheels can climb the inclined flange and leave the track easily.

In Philadelphia the street railway company is charged with the entire cost of maintenance of the paving from curb to curb on all streets on which it has tracks, some 500 miles. It is reasonable to suppose that where the company is thus responsible for the condition of the entire pavement, the design of rail finally adopted would be that calculated to give the best results from all points of view. It certainly was not adopted to cheapen the construction of tracks, for the section chosen is the heaviest girder grooved rail ever rolled, weighing 135 pounds per yard. The great weight and strength of this rail will be of material assistance in the production of a rigid and unyielding track. The increased breadth of tread with the slight bevel toward the back of the rail is a very important improvement for two reasons. First, it provides for the use of car wheels with broad treads which will present a greater surface for frictional resistance to brake shoes, thus reducing the wear of brake shoes and of the wheels. Second, the beveled surface at the back of the tread will prevent the wheel from crushing or wearing the pavement where it comes in contact with the rail head. The web of this rail is almost directly under the bearing point of the head, which is a desirable feature where traffic is very heavy.

With the Philadelphia rail as a basis, Mr. Arnold has designed a rail for use in Chicago on streets that are paved with asphalt, brick, or dressed granite, when such pavement is kept cleaned and well maintained. The most important differences between this and the Philadelphia section are that the flange is only 5/32 inch below the head of the rail, instead of twice that amount, and the base is 6 inches instead of 7 inches wide.



Typical Rail Sections.

Mr. Arnold is of the opinion that where the street surface is asphalt there should be a well-dressed ribbon of granite between the rails and the asphalt. In warm weather the steel absorbs more heat and retains it longer than the granite; and the asphalt mastic, if placed next to the rail, is softened, and permanent distortion of the pavement next to the rail takes place. In laying block paving next to tracks, the old practice of having the blocks project above the rail is sometimes followed when an unyielding concrete foundation is used, with the result that the blocks do not settle as they did with the more yielding foundation and a rut is worn in the pavement along each line of rails, the bottom of which is on a level with the rail head.

Small-scale sections are given showing types of rails used in several large cities. That given as used in New York city is installed only on well paved and well kept streets. On this, the flange is only 5/32 inch below the head. The section marked Boston is used on paved streets, and is known as the half-grooved rail, the flange being ½ inch below the head. Considerable temptation to vehicles to follow the tracks is extended by this rail. A section of the standard type of track construction used in Minneapolis and St. Paul is also given. This consists of ordinary T-rails laid on concrete beams, with ribbons of dressed granite along each side of the rails, the blocks next to the gauge side of the rails being dressed to form a groove for the flanges of the car wheels. Mr. Arnold believes that under moderately heavy vehicular traffic this type of track will give excellent service, and the officers of a leading asphalt pavement company have stated that the most satisfactory results have been obtained in streets where the Minneapolis type of construction has been installed. With the present operation of 25-ton motor cars it is considered a necessity

Cost of Track Recommended for Chicago.

Excavation and hauling, 2,000 cubic yards.	$2,000.00
Concrete beams, 800 cubic yards	4,800.00
Steel rails, 120 lbs. per yd., 188.57 tons	7,731.37
Hauling rails, at $1	188.57
Tie rods, 700	175.00
Cast welded joints, 176	880.00
Cross bonding	10.00
Track laying, cleaning street, etc	1,501.44
Special track work per mile of single track	4,500.00
Engineering, supervision, etc	2,178.63
Total cost, exclusive of paving	$23,965.01
If paved with asphalt	36,845.01
If paved with granite	42,365.01
If paved with brick	36,615.01

for Chicago, because of the nature of the soil, to lay concrete road beds. An advance in the use of concrete construction has been made in dispensing with wooden cross ties altogether, burying the rail in concrete to the under side of the paving material, the rails being kept to gauge by tie rods placed in the track at frequent intervals. The type of construction recommended is presented herewith. The cost of laying 1 mile of this construction with the grooved girder rail recommended is given in the accompanying table.

Municipal Accounting.

The eleventh National Conference for Good City Government and the ninth annual meeting of the National Municipal League, were held in Detroit on the 22nd and 23rd, and at Ann Arbor on the 24th of April. Of the subjects presented, municipal accounting is, without doubt, of greatest interest to readers of The Engineering Record. Mr. Charles Richardson, of Philadelphia, vice-president of the National Municipal League, presided at the meetings. Mr. Clinton R. Woodruff, in a report entitled "The Year's Work," reviewed all phases of the advance of municipal reform.

Mr. J. Horace MacFarland, of Harrisburg, Pa., argued for "The Federation of Civic Forces, City, State and National," remarking that there are some forty known general organizations dealing with civics in several forms—ethical, administrative, philanthropic, artistic, political—and presenting a plan of alliance for civic bodies, which was thoroughly discussed. As a result of this discussion the following resolution was adopted: Resolved, that the League approve the suggestion of the civic alliance, and that the Executive Committee of the League be authorized to take such steps as may, in its judgment, be desirable and necessary to carry the plan into execution. In a paper entitled "Municipal Situation in the Philippines," Dr. Paul S. Reinsch, of the University of Wisconsin, stated that the conditions are such that the establishment of municipal institutions closely modeled upon those of the United States, would be inadvisable, although, it is in the municipalities that the natives will have to receive their first lessons in self government.

The report of the committee on "Uniform Municipal Accounting" was presented by Dr. M. Hartwell, city statistician, of Boston. He deplored the fact that statistics in general as published at the present are not of great value, made a strong plea for better statistics in every department, and stated it to be his belief that municipal statistics should begin at home; that they should relate to the object and needs of local administration and be prepared with the primary purpose of enlightening a local public opinion and of serving local authorities as the basis of intelligent action. So long as a city does not know itself it cannot know other cities, nor compare itself with them, nor profit largely by their experience. The sooner our leading cities are led to insist upon having simple and intelligible financial and statistical reports furnished by their own servants for home use, the sooner will the public and official mind become responsive to demands for the adoption of more modern and scientific methods of bookkeeping and housekeeping by all cities; and the sooner will it become possible for the student of municipal affairs and for state and national officials and bureaus to secure from city officials and publications, such information as is usually unattainable now. The immediate prospects for gathering strictly comparable data throughout the wide range of activities common to cities is not brilliant.

Frederick A. Cleveland, Ph.D., of the University of Pennsylvania, outlined the "Chicago Accounting Reform" in part as follows: Within fifty years Chicago grew from a village to a municipality of 2,000,000; it began with a small town organization; as its population and territorial jurisdiction spread, these town governments were incorporated by consolidation rather than by readjustment and reorganization. The city finally came to include more than twenty separate taxing jurisdictions, over which it had little control and between which there was no well defined method co-operation. The financial side of the administration became unmanageable and the government in all its activity was crippled.

In the first place, court judgments had accumulated against the corporation until on January 1, 1900, they were known to amount to $3,000,000; second, it was found that the funded debt of the city was much larger than represented upon the books; third, it was discovered by the controller that previous administrations had been using trust funds to cover running expenses; fourth, the methods of accounting showed that the amount of school tax funds was uncertain.

Investigations lasting several months were made, and the report showed: That the accounts with different departments, on the books of the controller, in many instances, did not agree with the same accounts on the books kept by the departments; that there was no adequate system of audit and no way of bringing the various accounts into harmony; that the controller lacked authority, in many instances, to compel a uniform method, and to inspect or audit before authorizing disbursement; that there was such variety in the methods of disbursements as to make auditing and verification difficult, even if adequate authority were given; that in the records of receipts and disbursements both ordinary and extraordinary receipts were accredited to the general funds, and subsequently distributed so that the general accounts in many instances did not furnish an intelligent statement of operating expense, as distinct from construction and other permanent accounts; that all warrants drawn on the treasurer were paid by him by means of his own private check, and these were not a part of the public records; that the special assessment books were regularly destroyed at the end of each administration, thus leaving a large amount of trust funds without books of original entry; and that several other graver irregularities existed in the system of accounting.

In reference to the revenue system, it was shown that no adequate provision was made for the meeting of the current expenses. The taxes for the current year were levied on April 1, and were not payable until December. In order to utilize taxes assessed but not collected, therefore, as available resources, the city was required to borrow in anticipation of taxes to be collected during about ten months of the year, and to pay on an average about 4 per cent. for these advancements. Similar arrangements had been made for the meeting of current expenses of the water department. Totally inadequate methods for levying and collecting taxes, and the extensive frauds resulting, caused the city very considerable financial losses. The real estate record was so inaccurate and so poorly kept that the city had allowed many of its rights to lapse, and had accordingly suffered loss on this account.

It became evident that municipal reform must begin with the accounts, in order to reduce them to such order as to make the data available as a basis for political action and administrative control. This report having been laid before the mayor, an ordinance was drafted and passed authorizing the accounting firm of Haskins & Sell to install a new system of accounts and to supervise its operation during the first year after installation. The features of the new system as set forth by the official report of the controller are as follows:

Uniformity in accounting methods.

Concentration of the accounting in the controller's office.

Collection of all revenues by the city collector.

Daily remittances.

Monthly reports and balances between the controller and all departments.

Monthly financial report of the controller.

Organization of an auditing bureau and of a methodical plan of auditing by officers retained specially for that purpose and independent of all departments.

Accruement of all revenues on the general books of the city, where they will always be evident as obligations due the city and unpaid.

Approval of all contracts and requisitions for supplies by the controller to prevent departments from incurring liabilities in excess of appropriation.

The issuance of all fiscal stationary, forms and receipts, consecutively numbered by the controller, and holding the departments responsible for their use or cancellation.

The use of graduated stubs or carbon receipts to check the collection of money.

The establishment of a complete chain of accounting from the inception of revenue or expense throughout the various branches of the city to the controller's office, where all the accounting is finally centralized.

The financial operations of the city are summarized in the monthly report compiled in the controller's office not later than the 20th of each month, for the preceding month. This report shows: (1) Balance sheet—the financial condition of the city at the end of the month as compared with the same month of the previous year and the resultant increases and decreases during the year. The balance sheet is so classified as to show the financial conditions of the municipality in its relation to the city corporate, the trust funds, the water works, the schools and the library. Schedules supporting the balance sheet, show the necessary details. (2) The revenue and expenses for the month compared with the same month of the previous year and of the elapsed period of the current fiscal year, compared with the corresponding period of the previous year. (3) The expenditures authorized by the appropriation ordinance remaining unexpended, and the percentage of the appropriations expended. The revenue, expenses and appropriations are shown in detail segregated, first, as between city corporate, the trust funds, the water works, the schools and the library; and, second, between ordinary revenue and expenses and extraordinary revenue and expenses. Ordinary revenue represents the income from taxation, licenses, fees, etc. Extraordinary revenue represents income which creates liability to be liquidated at some future date; as, for example, bonds or water certificates sold, or income which is derived from a decrease in the fixed assets of the city, such as the sale of buildings, lands, etc. Ordinary expenses represent the amounts expended in conducting the city government, maintenance, repairs, operation, etc. Extraordinary expenses represent the amount expended to increase the fixed assets, such as the purchase of lands, erection of new buildings, construction of additional sewers, etc.

All departments have been operating under this new system during the past year. The change from the old to the new was accomplished without confusion or detriment to the conduct of public business, and the detailed workings of the new system have progressed without friction. It is now evident that the system has proved an advantage to the city government; has improved the efficiency of individual employes, and promoted an intelligent

and interested direction of their efforts by departmental heads. The total of decreased expense and increased revenues seem to be close to a million dollars. From the point of view of municipal reform, the new system has laid the foundation for effective administration, and the reports based on this system give to the citizens a well classified digest of financial results, supplemented by schedules in sufficient detail to furnish a comprehensive knowledge of the affairs of the municipality. Taking the new system of accounting as a whole, it is a masterly piece of work; it may be said that Chicago has taken an advanced position worthy of emulation.

Mr. Harvey S. Chase discussed the progress of uniform municipal accounting in Ohio, outlining the steps taken to secure the passage by the Legislature of an act which created a "Bureau of Inspection and Supervision of Public Offices" under the Department of the Auditor of State. In laying out the system the Bureau was compelled to consider primarily the requirement of the Ohio Uniform Accounting Law for the publication, by the Bureau annually, of comparative statistics of cities, villages, townships, school districts and other taxing bodies, respectively, as state documents. Having considered the general nature and form for these statistical reports—in which it is intended to set before the people comprehensive tables of comparisons of the financial results in all taxing bodies of the same class, so that any citizen can see for himself what these results are in his own municipality, and compare them with results from other municipalities—it was then considered what requirements should be laid by the Bureau upon the accounting officers of the cities, in order to furnish the information needed by the Bureau to make up the comparative statistical tables. The bureau has had no precedent to guide it, for this is the first time that an entire state bookkeeping, including the accounts of large cities, has been overhauled and systematized.

Mr. Chase called attention to several important features of the National League's system, which had been incorporated by the state. The favorable reception which has been given to the bureau's schedule by the officials throughout Ohio has been very gratifying. The reports of the five largest cities of Ohio—Cleveland, Cincinnati, Columbus, Toledo and Dayton, for the fiscal year 1902, are now nearly completed upon the new schedules. It must be recognized and remembered that the proposition before the bureau in Ohio is a vast one. It comprises not only the reorganization of the accounting and reporting in the cities, but likewise also for villages, townships, counties, school districts, and in fact for every taxing body in the state.

The results accomplished in the unification of accounts for quasi-public corporations were referred to in a brief manner, in a paper by Mr. M. N. Baker, of the "Engineering News." Uniform accounting systems have been adopted by national organizations devoted to the gas lighting, electric lighting and street railways. A uniform summary of statistics for the reports of water works is in use by some municipal water departments. The latter covers physical as well as financial statistics, but does no more in the way of accounting than to suggest a uniform system. The outline for water works statistics was adopted by the New England Water Works Association in June, 1885, thus making that organization a pioneer in the movement for uniform municipal statistics. The schedule has recently been endorsed by the American Water Works Association, the Central States Water Works Association, and the American Society of Municipal Improvements.

In August, 1899, as a result of co-operation between the Street Railway Accountants' Association of America, the Association of American Accounting Officers, and the National Convention of (State) Railroad Commissioners, a detailed accounting system for street railways was adopted by the latter body, after having been previously approved by the other two organizations. The schedule is printed in full in the report of the Connecticut Railroad Commission for 1899. It was adopted for use by street railway companies in making up their reports to the Connecticut Railroad Commission for 1899, and since June 30, 1900, has been used in making up the regular reports. In May, 1901, the National Electric Light Association adopted a committee report which included a uniform system of accounting for electric lighting plants, the schedules for which are included in the proceedings of the convention for that year. In October, 1902, the American Gaslight Association adopted the report of this committee on final accounting, which included a detailed system of accounts.

The Friday sessions of the League were held in Ann Arbor, at which further papers on municipal experiences were read and discussed. In the evening the convention closed with a banquet at the Cadillac Hotel, Detroit.

Road Construction in the Eastern States.

In the preceding issue were given abstracts of the highway laws of several states, and in connection therewith a summary of the methods of construction is not out of place. Such a summary as regards Connecticut, Massachusetts, New Jersey and New York is very concisely given in "City Roads and Pavements," by Wm. Pierson Judson, M. Am. Soc. C. E. (reviewed in The Engineering Record of September 27, 1902). As this information could hardly be presented in more convenient form, with the author's permission, the following extracts are given, with slight corrections. In explanation of the table it should be stated that in all four cases the thickness of the compacted lower course is 4 inches, and that of the upper course 2 inches. The screenings for the surface course range from dust to ½ inch in size in all but New Jersey, where the upper limit is ¾ inch. In Connecticut the surface course is 1 inch thick after rolling and in New York ⅜ inch, in the other states being simply rolled to a smooth surface. In New York, ½ to 1-inch stone is spread on the subgrade as one-third of the base course.

In New Jersey, after the lower course of broken stone has been rolled until compacted, trap rock screenings ½-inch to dust, free from loam or clay, are spread over the lower course in a uniform layer and the course is again rolled until the stones cease to sink or creep in front of the roller; water being applied in advance of the roller if required. The same treatment is given to the top course. This is then covered with a mixture in equal parts of ¾-inch crushed trap and of ½-inch trap screenings, properly mixed and spread in sufficient thickness to make a smooth and uniform surface which is rolled until hard. Sandy loam is used with good results upon some New Jersey roads.

In Connecticut, after each of the two courses has been rolled until solid, dry trap rock screenings not larger than ½-inch are scattered over the surface so as to fill all interstices, being rolled to shake in the dust. The sprinkler is then used to wash in the screenings; more screenings are added, rolled dry and sprinkled, and these processes are repeated for each course until all interstices are completely filled. When the top course has thus been made firm and smooth, it is covered with 1 inch of screenings to form the wearing surface.

Sizes of Stone in State Road Construction.

State.	Lower course. Inches.	Upper course. Inches.
New Jersey	2 —3	1 —2
Connecticut	¾—2	1 —1½
Massachusetts	1¼—2½	½—1¼
New York	1½—3	1 —2

In Massachusetts the lower course is thoroughly compacted by rolling, but no screenings or filler are spread upon it. After the top course has also been thoroughly compacted by rolling, screenings of the same kind of stone are laid on in just sufficient quantity to cover the stone and are watered and rolled until the mud flushes to the surface. The screenings are not treated as a part of the wearing surface but are used simply to hold the larger stones in place, using as little as possible.

In New York the screenings used as filler are usually limestone when the road material is brought from a distance, but are often the product of the local crushed stone when local rock is fit for use. Sometimes local rock and its screenings are used for the lower course only. In some cases, when local granite rocks are used, the screenings for the top course are caused to bind properly by mixing an equal amount of limestone screenings with the granitic. In other cases good results have been obtained by mixing an equal amount of clean sand with the granitic screenings. Trap, granite and quartzite screenings are limited to a maximum of ½ inch, but those of softer rocks are limited to ¾-inch. After the first course of broken stone has been rolled until the stones do not creep or wave ahead of the roller, the dry screenings are spread uniformly to a depth of ½-inch, rolled dry and swept with brooms of steel or rattan until the screenings disappear among the stones, when the process is repeated until no more will go in while dry; the surface is then wet with a sprinkler (unless the subgrade is of clay), using water freely until all voids are filled, leaving the surface of the stones free from screenings. The top course is then treated in the same manner in sections of about 300 feet length, water being freely used and the rolling continued until a grout has been formed of the stone-dust and water and a wave of the grout is pushed before the roller. After this screenings are spread and rolled, leaving ⅜-inch depth for a wearing surface. After 48 hours, or when the surface has dried, the road is again rolled and sprinkled. It is then opened to traffic, being sprinkled daily for 30 days.

An Intercontinental Railroad.

The recent appropriation by Congress of $2,500 and the donation by individuals of several thousands more to defray the expense of sending a competent agent to Central and South America to study the commercial and traffic possibilities of the various countries has again attracted the attention of the technical and daily press to the scheme for a trunk railroad connecting New York with Buenos Ayres. About 1890 extended investigations were undertaken and a large body of valuable data collected by a commission, which was one of the results of the first Pan-American conference. The total distance between the termini just mentioned would be about 10,200 miles, and less than half the distance can now be traveled by rail. The total cost of constructing the connecting portions of the line is estimated, or rather guessed, to be about $200,000,000. Great physical, financial and, possibly, some political difficulties will have to be overcome in both the construction and maintenance of the missing portions of the road.

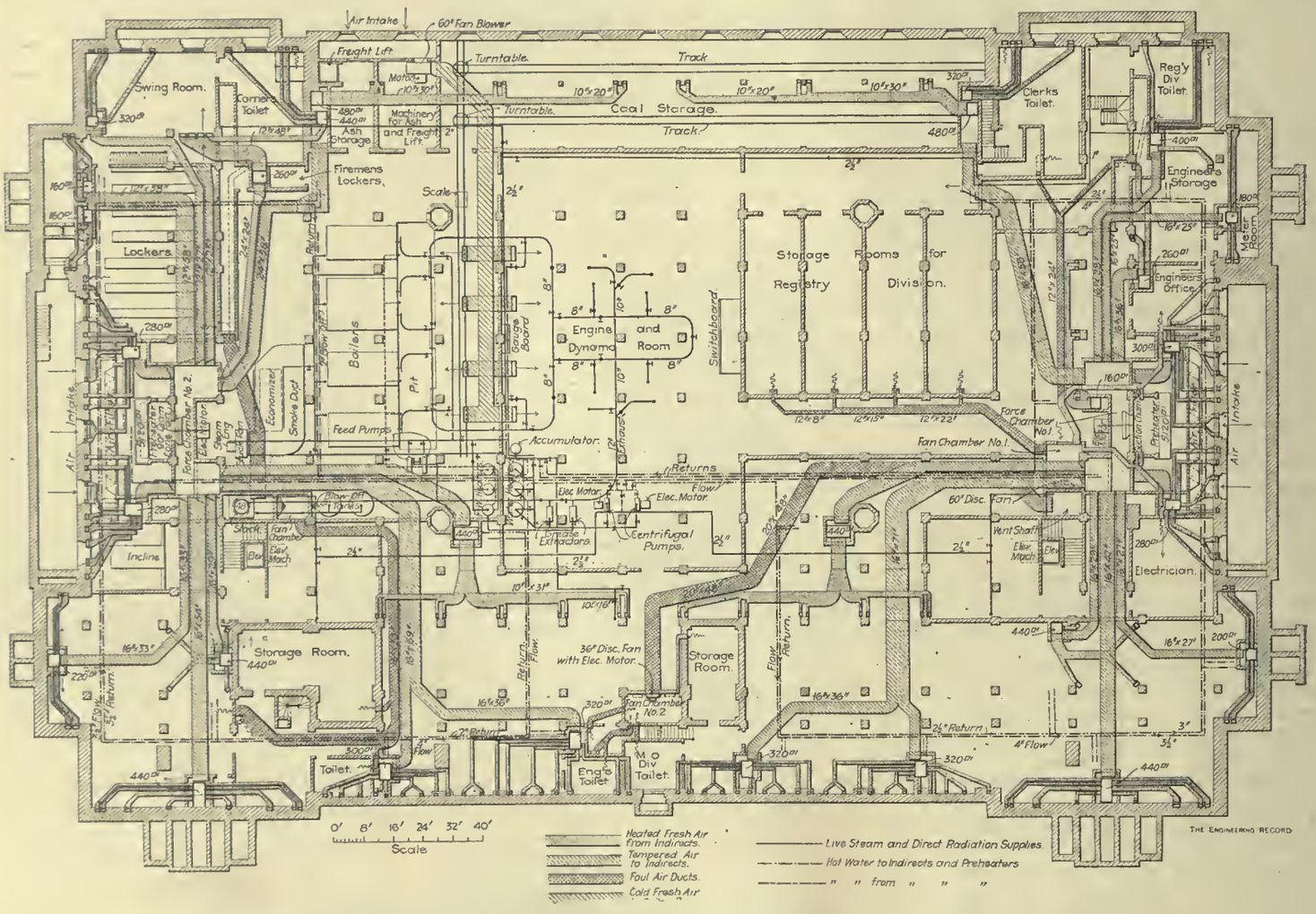
Ventilation and Heating in the New Government Building at San Francisco.

The description of the power plant of the new government building at San Francisco, as given in The Engineering Record for April 18, was confined to the treatment of the apparatus in the boiler and engine rooms only. In the main the heating is accomplished in combination with the ventilation, the air for the latter being introduced at a temperature slightly above that required for the room to compensate for the heat lost through the walls, windows and doors. In certain locations which could not be conveniently reached with air supply ducts, direct radiators are used. These direct radiators and the indirect radiators employed for the heating of the air supply are furnished with hot water, circulated continuously by means of centrifugal pumps and restored to its original temperature at the end of each round in water heaters using exhaust steam from the engine plant.

The air circulation is positive in both directions, since the fresh air is supplied by plenum fans and the foul air is removed by exhaust fans. The distribution of air is effected through three separate systems, as may be seen on the accompanying plan of the basement. Two of equal size and capacity with symmetrical arrangement of ducts each supply one-half of the building, and the engine and boiler rooms have a third distinct equipment. The apparatus is essentially the same in the two main systems, the only points of difference being minor details concerning the location or direction of parts of the distributing system; therefore, while the following description deals with the equipment of one-half of the building only, it may be taken to apply equally to the other.

The cold fresh air for each system is drawn in through three middle windows in the nearer end wall of the basement and passes through an air filter of light rough serge or cheviot supported on the usual zigzag type of frame and affording a total filter area of 396 square feet. The skeleton frame consists of tee, channel, angle and plate iron with the several sections secured to one another by latches so as to be easily dismembered. Beyond the filter the bulk of the air comes in contact with a preheater coil containing 5,120 linear feet of 1-inch pipe in eight sections of sixteen pipes each, built up in banks of horizontal rows, while the remainder of the air is by-passed over the coil into the brick chamber on the suction side of the fan. The amount of cold air passed is governed by a damper controlled by a thermostat in the force chamber beyond the fan so as to maintain the temperature of the mixture in the suction chamber at 70 degrees. To confine the necessary cold air dilution to reasonable limits the temperature of the hot air may be reduced by cutting out one or more sections of the heater.

From the suction chamber, an American Blower Company's cone fan with an inlet 63 inches in diameter forces the pre-heated air into a plenum chamber from which the main distributing ducts are taken, the amount of air withdrawn through them being regulated by volume dampers near the chamber, which will be set permanently after their proper adjustment. The fan has a 90-inch wheel and is capable of discharging 18,000 cubic feet of air per minute when driven at 250 revolutions by the direct-connected McWilliams motor. The distributing ducts emanating from the force chamber lead to fourteen auxiliary heating chambers arranged and located so that each will serve a group of individual supply ducts and allow for convenient and advantageous connections. The chambers are walled with brick and contain cast-iron man-hole doors and frames affording access to the interior for cleaning, inspecting or repairing. The indirect stacks are of cast iron made up of sections of the three-barrel loop pattern as manufactured by the American Radiator Company. They are suspended from the ceiling of the chambers, and are encased in No. 16 galvanized iron with by-pass provisions so that mixing dampers controlled by thermostats in the rooms affected will allow just the right amount of additional heat to be imparted to the passing air. The air pressure for the operation of the mixing dampers by thermostatic control is obtained from an air compressor in the engine room, which delivers the air at a pressure of 15 pounds into a steel pressure tank of 4 cubic feet capacity.

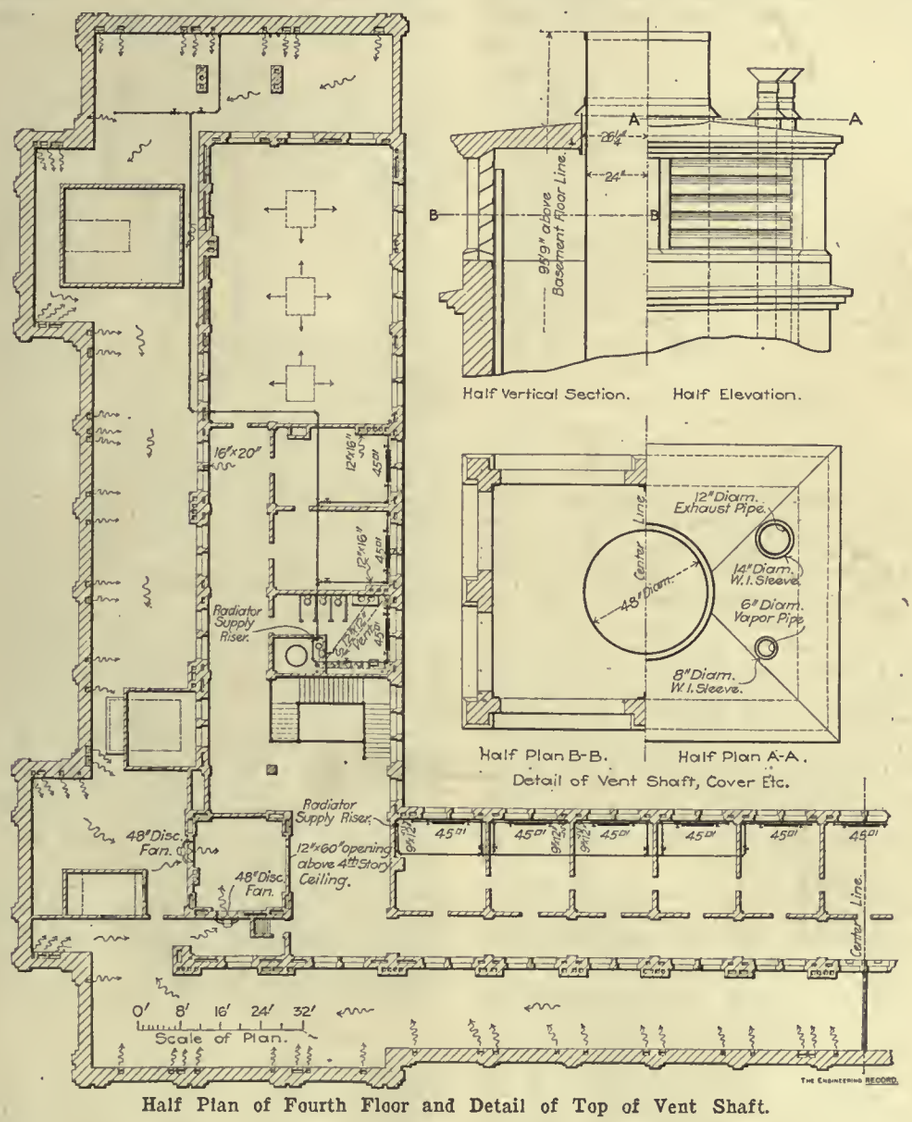


BASEMENT PLAN, SAN FRANCISCO POST OFFICE AND COURT HOUSE.

In general the ducts of any one group all supply either one room or superimposed rooms where the conditions are nearly equal and the temperature required by one is approximately the same as required by all. The branch ducts also contain a volume damper inserted near the foot of the uptake to adjust the amount of air to that demanded for proper ventilation. It will be seen that this method of preliminary tempering will produce a greater uniformity in the air as it reaches the rooms and avoid such excessive fluctuations as might result were the mixture adjusted with cold air at the start of the individual ducts. For certain rooms in the basement where the air is wanted for ventila-

tion only, it is taken in its tempered condition from the main distributing ducts without being passed through auxiliary heating chambers.

A noticeable feature is the use of many comparatively small registers rather than a few large ones, the result being a very thorough and uniform distribution. The distances of the auxiliary heaters from the rooms supplied through them are usually quite short, hence it was possible to have a separate flue for each register without an extravagant use of duct material. In general the area of the fresh air register openings are about one and two-thirds times larger than the areas of the corresponding flues, and the same is usually true of the vent openings. In some cases the total area of the vent outlets in a room is less than the total air inlet area, such provisions being made



Half Plan of Fourth Floor and Detail of Top of Vent Shaft.

contents passed through a duct to one of the vent shafts just mentioned, by means of a 36-inch disk fan of the same make driven at 550 revolutions. On all floors the toilets adjoining these shafts are vented into them, and to prevent back-draft, have the top and bottom registers, which they contain, connected on the back into flues extending up in the shaft to the next floor above. The toilet and locker rooms in the basement, a few rooms on the first floor and all of the rooms on the floors above, except the toilets mentioned, are vented by flues discharging into the space under the Mansard roof along the front and end walls, as shown on the half-plan of the fourth floor. These spaces are exhausted by four A. B. C. 48-inch disk fans driven at 400 revolutions per minute, and arranged in pairs to discharge into vent

for the purpose of forcing fresh air to adjoining smaller rooms, such as toilets, which have no fresh air registers, but are abundantly provided with vent outlets. The large post office room on the first floor has a very plentiful supply of fresh air since it depends on the pressure of the incoming air for the removal of the vitiated air through the vent outlets located in the ceiling and opening into the court above.

The foul air from the majority of the rooms in the basement and first floor is collected in ducts and conveyed to three foul air gathering chambers, shown on the basement plan. Two of these chambers are located at the bases of two vent shafts and the contents of each is expelled into the shaft by an A. B. C. 60-inch disk fan driven at 330 revolutions per minute by a McWilliams motor. The third chamber has its chambers with louvres above the roof. These chambers also receive the air discharged into the roof spaces above the rooms on the fourth floor with the exception of those over the two large court rooms in the wings, which have only natural ventilation.

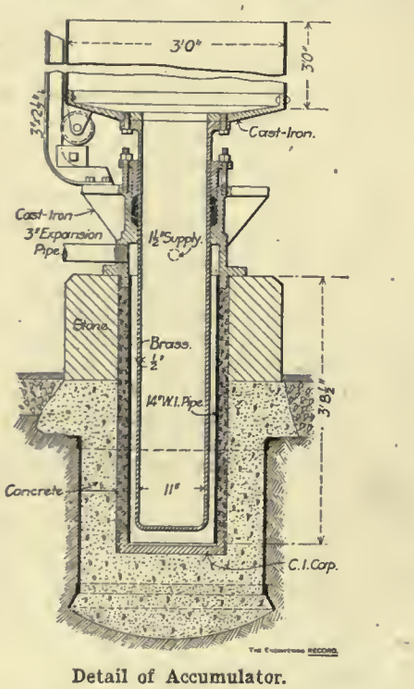
The engine and boiler rooms are supplied with fresh air taken in through two windows at the rear of the basement and passed without heating by an A. B. C. 60-inch blower fan having a capacity of 10,000 cubic feet of air per minute when driven at 330 revolutions by a direct-connected McWilliams motor. From the discharge of the blower a 24x48-inch duct is carried overhead to and through the boiler room along the wall adjoining the engine room. The part within the boiler room is divided by horizontal partitions making four superimposed ducts, which terminate successively from bottom to top in tees of equal cross section, branching to either side for the supply of the two rooms. The openings in the ends of the branches are turned upward and contain 18x48-inch gratings. The removal of the warm air at the ceiling of the boiler and engine rooms is accomplished in common with that of the rest of the basement through the two suction chambers at the foot of the two ventilating shafts.

All of the motors driving fans are wound for 220 volts direct current and run normally at the speeds which have been given. In addition, however, they are equipped with controllers making them capable of operating at four different speeds within the following ranges: For the 90-inch cone fans, 125 to 250 revolutions per minute; for the 60-inch blower and 60-inch disk fans, 165 to 330 revolutions; for the 48-inch disk fans, 200 to 400 revolutions; and for the 36-inch disk fans, 275 to 550 revolutions. The ventilating flues in the basement not located in walls, the horizontal hot air and ventilating ducts, and the sleeves for riser and auxiliary stack connections are constructed of galvanized iron of thicknesses as follows: Sleeves for piping, etc., No. 24 gauge iron; all flues, individual hot air ducts from auxiliary chambers and ventilating ducts not exposed in the basement, No. 24 gauge iron, with surfaces 20 inches wide and over stiffened with 1x1x⅛-inch angle iron spaced not over 30 inches apart; all other ducts are of No. 20 iron with longitudinal angles at the four corners, flanges at the joints and lateral stiffeners at least every 30 inches, all of 1¼x1¼x3/16-inch angle iron. All ducts in the basement are supported by wrought iron hangers, spaced not over 10 feet apart. Those for the larger ducts each consist of a 5/16x2-inch bar suspended at the ends by ⅜-inch rods secured to the ceiling beams with clamps, and those for the smaller ducts are correspondingly smaller.

The hot water as heating medium for the direct and indirect radiation is heated in either or as many of the three water heaters provided for the purpose as may be needed. The heaters are constructed of flange steel, the shells being ⅜-inch thick, 3 feet in diameter and 5½ feet high with ¾-inch cast steel water heads. Within the heater there are ninety-one 2-inch vertical tubes of charcoal iron secured between ½-inch tube sheets, 4 feet 10 inches apart, affording a total heating surface of 238 square feet. The water is passed upward through the tubes, while the space surrounding them is filled with exhaust steam from the engines. The steam space is relieved by an automatic air valve and the water space by an automatic water valve wasting to the blow-off tank or sewer. The water outlets of the three heaters are connected in a main leading to the suction header of the two centrifugal pumps that maintain the forced circulation. The pumps are of the Gould's Manufacturing Company's make with double suction inlets. Each has a capacity of 750 gallons per minute, and is capable of maintaining a velocity of not less than 4 feet per second in the main circuits under the pressure carried therein. The pumps are driven by direct-coupled McWilliams motors, capable of operating from 25 per cent. below to 25 per cent. above normal speed.

The discharges of the pumps are combined in a header which supplies the five distinct circuits of the heating apparatus. Two of these circuits, each 4 inches in diameter, are run in trenches under the basement floor to the air pre-heaters in the two fan suction chambers; two more, of the same size and run in the same manner, supply the auxiliary heaters in the

east and west halves of the building respectively, including all told about 9,100 square feet of indirect radiator surface; and the fifth starting as a 3-inch main branches to either side into 2½-inch lines carried overhead to the bases of the four risers that supply all the direct radiation above the first floor, a total of some 2,840 square feet of surface and found almost entirely along the walls adjoining the court. Two of these risers are run up in the vent shafts nearly to the ceiling of the fourth floor, and there supply the various falling risers in the two wings of the building. The other risers for the supply of the direct radiators in the rear of the main part of the building are run up to the ceiling of the fourth floor near the inner corners of the court and thence supply the different falling risers. All of the falling risers are continuous lines back to the return gathering mains, the radiators being connected to them by shunt connections. To insure a positive circulation through each radiator when the valves are opened, the connections to and from the risers are made with "O. S." pattern partition tee fittings. The direct radiators are all of American Radiator Company's Peerless pattern, and are set in



Detail of Accumulator.

the ordinary manner, except in the corridor on the third floor, where they are placed behind screens. The few direct radiators which are used on the first floor are connected to the circuits which supply the indirect stacks in the auxiliary heaters. All radiators, air heaters and risers are provided at their highest points with positive acting air valves operated by hand.

The return mains from all circuits are of the same size as the flow mains and are collected in a similar manner into a header, which is connected to the bottoms of the three water heaters and also to an accumulator. The latter is a special piece of apparatus which not only serves the function of an expansion tank, but also automatically relieves the system of any superabnndance of water and feeds it when there is a deficiency. The construction of the accumulator is indicated in an accompanying detail. Briefly, it consists of a weighted plunger 12 inches in diameter working within a cylinder formed of a piece of 14-inch standard wrought iron pipe with the bottom closed by a cast iron screw cap, and the whole imbedded in concrete in an outer casing of ¼-inch iron. The plunger is of hollow brass, ½-inch thick and is filled with lead to a height sufficient to create a static head of water throughout the system of at least 5 feet above the highest piece of apparatus. When it is desired to circulate the water at a higher velocity the load on the plunger may be increased by placing additional weights in a box carried on the top of the plunger.

The up and down movement of the plunger is guided by a pair of grooved wheels rolling between tee bar guides, the lower ends of which are secured to the top of the casing and the upper ends to the framing of the ceiling construction. For the automatic admission or expulsion of water there is a device connected to the accumulator for operating a three-way cock in such a way that the rise and fall of the plunger at the upper 12 inches of its travel will open and close a connection from the casing with the drainage system allowing the surplus to waste, while the fall and rise of the lower 12 inches of its travel will open and close a connection with the feed water system of the boilers, compensating for any loss.

The building was designed in the office of the supervising architect of the Treasury Department at Washington, Mr. James Knox Taylor. The mechanical plant and all of the heating and ventilating equipment are due to the chief mechanical and electrical engineer of the department, Mr. J. E. Powell, and his staff.

Letters to the Editor.

Standards for Sewer Pipe.

Sir:—The efforts of the New England Water Works Association in adopting standards for cast iron water pipe should be followed in the adoption of standards for sewer pipe manufacture, which will be acceptable as well to the needs of the engineers as to the convenience of the manufacturers. The usual practice of furnishing pipe in 2-foot lengths has much to condemn it from every point of view except ease in manufacture. A percentage of the capacity of the sewer varying with the personal equation of the constructing engineer (not the designer) from 5 per cent. to 50 per cent. is necessary to provide for the ground water filtration. With the general adoption of a 3-foot standard the percentage of leakage can be reduced by one-third.

The objection of the manufacturer to the general adoption of a 3-foot standard is based largely on some irrational requirements of engineers' specifications. The manufacture of the smaller sizes of pipes, say, 8, 10 and 12-inch, cannot be accomplished without considerable warping, and the usual requirement that pipes designed to be "straight" shall not exhibit any material deviation from a straight line, would, if strictly interpreted, immediately transform half the output of the kiln to "seconds."

The increase in the carrying capacity of the sewer due to the reduction of the number of joints, and consequently the amount of leakage, will offset many times the slightly lessened velocity due to any irregularities or reasonable warpings in a 3-foot length. The depth of socket and the width of the annular space in the manufacturer's "standard" is too small to secure proper joints at all times, and the engineer desiring a deeper joint, although the same can be manufactured without any additional cost whatever, or a wider joint than the present standard, finds himself legislated against to the extent of 10 per cent. on the cost of the pipe.

The field of discussion is large. Is it possible to specify with precision what defects are sufficient to condemn a length of pipe? How much or how little shall the bell be broken to cause rejection? How uniform must the vitrification be? The writer's viewpoint is that while his specifications are liberal as to what constitutes acceptable pipe, he receives no offsetting advantage because prices are also standardized, and are fixed to make a profit upon the most rigid and arbitrary inspection and interpretation. The writer ventures to send a copy of the pipe specifications used by him with the hope that your readers, both engineers and manufacturers, will criticise them and with the further hope that a discussion might ultimately bring about some agreement between engineers and manufacturers mutually satisfactory. Yours truly,

Alexander Potter.

New York City, April 18, 1903.

[The following specification for pipe is taken from complete specifications for a joint outlet sewer for several municipalities in New Jersey.]

Sewer Pipe.

In the following specifications straight sections will be termed "pipe," and branches, bends, reducers, etc., will be called "specials."

Pipes and specials shall be constructed of the best quality of salt glazed, vitrified, stoneware sewer pipe.

The dimensions of the pipe required shall be substantially as follows:

Caliber.	Thickness.	Weight.	Depth of socket.	Annular space.	Length.
24	1¾	150	4"	⅝	2½ to 3
22	1⅝	125	4"	⅝	2½ to 3
20	1½	100	3¾"	⅝	3
18	1¼	78	3½"	⅝	3
15	1⅛	70	3¼"	⅝	3
12	1	48	3"	⅝	3
10	⅞	35	2½"	⅝	3
8	¾	25	2½"	⅝	3

In specifying these dimensions it is not the intention to bar any manufacturer whose dies may vary slightly from the dimensions named. These weights and dimensions are intended to secure deep socket pipe.

All pipes shall be so truly cylindrical that the hubs or sockets will freely receive the spigot end of the next following pipe or special without any clipping whatever of either; pipes and specials which cannot be thus freely fitted into each other shall be rejected.

The body and bell of the pipe shall be hard and burned thoroughly. Fire cracks, blisters, and iron pimples shall not necessarily cause rejection. The engineer shall be the final arbiter as to what pipes shall be rejected from these causes.

All pipes having transportation, cooling, frost or other cracks, not fire cracks, shall be immediately rejected.

Pipes with bells partly broken by a clear fracture, as opposed to a crack, or with a spigot chipped will not be rejected if in the opinion of the engineer such chippings do not injure the pipes when laid.

For the better adherence of the cement to the pipe in laying, it is desirable to omit the salt glaze from about two inches of the outside of the spigot end. This can be secured by replacing the pipes in the kiln, bell end down. This is advisory but not mandatory. Pipes with corrugations on spigot end are preferred.

All pipes and specials which are designed to be straight shall not exhibit any material deviation from a straight line. Special curves or bends shall substantially conform to the degree of curvature and general dimensions that may be required.

The interior of the pipes and specials shall be smooth and thoroughly glazed.

The pipes and specials as they are taken from the car by the sewer contractor shall be carefully inspected and culled by the contractor for the purpose of determining whether the pipes required by the foregoing specifications have been delivered by the manufacturer. All pipes failing to pass this inspection will be destroyed or moved to a yard, there to remain until the completion of the entire shipment of pipe.

The pipe shall be further inspected by the engineer immediately before it is used in the work.

Reporting Prices for Paving.

Sir:—It is to be hoped that at no distant day the methods for reporting prices for paving work, from different localities, may be standardized sufficiently to make possible intelligent comparison. Some bids as given in the journals include grading and some do not. How can the prices reported from various places be compared unless one knows whether the grading and other items of work are included in the bid? All these points should be stated, if possible, as otherwise one can merely guess.

Yours truly,

T. E. Petrie, City Engineer.

Marion, Ind., April 25, 1903.

[The Engineering Record intends to publish in each case reported to it as complete a statement of what is included in the prices bid as can be obtained from the information sent. If its friends in reporting prices bid for such work will be careful to state just what is included, the value of the information will certainly be much increased.]

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

Personal Notes.

City Engineer Briggs, of Erie, Pa., has been re-elected.

Mr. J. E. Hill has been elected city engineer of St. Cloud, Minn.

Mr. H. F. Lincoln has been elected city engineer of St. Albans, Vt.

Mr. E. W. Case has been chosen city engineer of Colorado Springs, Col.

Mr. George Turner has been reappointed city engineer of Bay City, Mich.

Mr. Elmer Folsom has been re-elected city engineer of Bloomington, Ill.

Mr. Frank H. Oldershaw has been appointed city engineer of New Britain, Conn.

Mr. L. A. Francisco has been re-elected city engineer of Easton, Pa., for a term of three years.

Mr. W. W. Wells has been appointed superintendent of sewers and water commissioner of Boulder, Col.

Mr. Harry F. Bascom, of Messrs. Lehr & Bascom, Allentown, Pa., has been made city engineer of that place.

Mr. Charles H. Smith, of Middletown, N. Y., has been appointed county engineer of Orange County, New York.

City Engineer Poetsch, of Milwaukee, Wis., has been elected president of the board of public works of that city.

Mr. C. S. Sims, general superintendent of the Baltimore & Ohio Railroad, has been promoted to be general manager.

Mr. J. E. Carroll, formerly of the city engineer's department of Minneapolis, has been elected city engineer of Crookston, Minn.

Professor C. R. Van Hise, who has held the chair of geology in the University of Wisconsin since 1892, was recently elected president of the university.

Mr. W. H. Kennedy, of Philadelphia, has been appointed assistant division engineer on the Illinois Central Railroad, with headquarters at Dubuque, Ia.

Mr. Henry C. Smith has been appointed division engineer of the Philadelphia & Reading Railway, at Philadelphia, succeeding Mr. J. S. Caldwell resigned.

Mr. P. S. Austin, an electrical engineer from Fresno, Cal., has accepted the position of superintendent of water system for the Chino (Cal.) Land and Water Co.

Mr. Charles Varrelmann has been reappointed as street commissioner of St. Louis, Mo. He has been connected with the street department for the past twenty-eight years.

Mr. G. M. Parce, for several years connected with the engineering department of the New York Central Railroad at Syracuse, has resigned to take service with a firm of engineers in that city.

Mr. Benj. C. Adkins, who has been connected with the water department of St. Louis, Mo., since 1885 and is at present engineer in charge of the distribution system, has been appointed water commissioner of that city.

Mr. J. N. Barr, M. Am. Soc. C. E., M. Am. Soc. M. E., has been made vice-president of the Chicago, Milwaukee & St. Paul Railroad, and after May 1 will have entire charge of motive power and rolling stock with headquarters at Chicago.

Mr. S. Waters Fox, assistant engineer in the government service, has retired on furlough and will engage in private practice as a consulting engineer. He will be succeeded as supervising engineer at Sioux City, Ia., by Lieut. E. D. Vincent.

Mr. W. H. Knowlton has resigned as assistant chief engineer of the Chicago Great Western Railway to accept the position of principal assistant engineer of the western district of the New York Central Railroad, with headquarters at Syracuse.

Messrs. D. B. Johnson and Paul Jones, engineers of maintenance of way on the southwest division of the Pennsylvania lines west of Pittsburg, have been transferred; Mr. Johnson goes from Indianapolis to Louisville and Mr. Jones from Louisville to Indianapolis.

Mr. Burdett Moody, M. Am. Soc. C. E., for the past thirteen years engineer for the Homestake Mining Co., of the Black Hills, S. Dak., has resigned and formed a partnership with Mr. Henry Schnitzel, M. E., under the firm name of Schnitzel & Moody, civil and mining engineers, Lead, S. Dak.

At a meeting of the Municipal Engineers of the City of New York, held April 22, the following were chosen as the first officers of this newly organized society: President, Mr. Nelson P. Lewis; first vice-president, Mr. O. F. Nichols; second vice-president, Mr. S. C. Thompson; secretary, Mr. Wisner Martin; and treasurer, Mr. Arthur S. Tuttle.

The origin of the John Fritz medal and the conditions governing its award are explained in The Enginering Record for November 8, 1902. Recently a corporation has been formed for the control of the fund, the directors for which have been chosen from among the members of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers, and are as follows: Messrs. J. J. R. Croes, Alfred Noble, C. W. Hunt, E. E. Olcott, E. G. Spilsbury, James Douglas and C. Kirchoff, of New York City; Robert Moore, of St. Louis; Gaetano Lanza, of Boston; John E. Sweet, of Syracuse; Robert W. Hunt, of Chicago; S. T. Wellman, of Cleveland; Arthur E. Kennelly, of Cambridge, Mass.; Carl Hering, of Philadelphia; Charles P. Steinmetz, of Schenectady; and Charles F. Scott, of Pittsburg.

Obituary Notes.

Mr. William August Fiedler, F. Am. Inst. Arch., former architect for the board of education of Chicago, died at his home in that city, April 22, at the age of 60 years. He was born in Elbin, Germany, and came to this country about 32 years ago. He supervised the construction of about fifty-eight school buildings in Chicago, among them the Franklin, the Kosminski, the Jackson, the Von Humboldt and the John Worthy.

Victor M. Clement, M. Am. Inst. Min. Eng., a mining expert of international reputation, died at Saltillo, Mex., April 26, as the result of an unsuccessful surgical operation. He conducted many important mining operations in various parts of the world, being at one time connected with the Empire Gold Co., of Grass Valley, Cal., later with the Barnato Bros. in Johanneshurg, South Africa, where he was associated with Mr. John Hays Hammond, and still later with the De Lamar Co., in Salt Lake City, Utah. While in the Transvaal he was regarded by the Boers as involved in the Jameson raid, which lead to his imprisonment and would have resulted in his execution but for the intervention of England and the United States.

Mr. Irving Murray Scott, past vice-president of the American Society of Mechanical Engineers and for many years vice-president and general manager of the Union Iron Works of San Francisco, died at his home in that city, April 28. He was widely known as the builder of the "San Francisco," "Monterey," "Olympia" and "Oregon.' The performance of the "Oregon" secured international fame for Mr. Scott resulting in his being called into consultation at various times by Russia and other European governments. He was born in 1837, at Hebron Hills, Baltimore County, Md., and received his early education in the public schools, Milton, Md., Academy and the Baltimore Mechanics' Institute. With a humble start as a draughtsman with the Union Iron Works in 1860, he in seven years became a member of the firm and its general manager, which position he still occupied at the time of his death. Outside of mechanical circles he was prominent as president of the Art Association of San Francisco, of the Mechanics' Institute, as regent of the University of California, as trustee of the Leland Stanford, Jr., University, and of the Free Library.

Trade Publications.

Cementine, a type of exterior concrete construction on herringbone expanded steel lath, is illustrated and explained in a pamphlet from the General Fireproofing Co., Youngstown, O.

The Rinald Bros., 1142 N. Hancock St., Philadelphia, are issuing a circular recounting three remarkable instances of enduring and protective qualities of their Bessemer paint for iron and steel.

Catalogue No. 032 from the C. W. Hunt Co., West New Brighton, New York, is a leaflet descriptive of foundry ladle cars for the transportation of molten metal.

A catalogue revised to April 1 has been issued by the American Radiator Co., Lake and Dearborn Sts., Chicago, listing with tables of sizes, etc., an extensive line of valves and elbows; steam and hot water boilers, sectional and ordinary; heaters; tanks; traps; and general steam

specialties. Many items of information useful to the heating engineer are given. The same matter, slightly abridged, is contained in a pocket edition of the new catalogue.

General catalogue No. 42, from the Flint & Walling Mfg. Co., Kendallville, Ind., is an attractive illustrated book of some 250 pages, containing a complete statement of its wind mills, water tanks and towers for their support, and all appurtenances commonly associated with the use of wind power. A feature of the book is its illustration of details of the construction of parts and the manner of erecting the towers.

Another of its interesting descriptions of storage battery installations is given in bulletin No. 76 from the Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia, which pertains to the "Chloride Accumulators" used by the Edison Electric Illuminating Co., of Brooklyn.

The Star safety water tube boiler for power, and steam and hot water heating is described in a new pamphlet recently received from the A. D. Granger Co., 95 Liberty St., New York. It is a boiler of the self-contained type and is especially adapted for use in limited space.

The Keystone Blue Paper Co., 910 Filbert St., Philadelphia, is distributing a circular describing a new photographic printing machine. The apparatus will accommodate eight 11x14-inch negatives at a time, uses a 12½-ampere enclosed arc lamp and is stated to produce prints in from one-third to one-half the time required by the brightest sunlight.

The American Steel Scraper Co., Sidney, O., has issued an illustrated catalogue describing in detail drag, wheeled, and other scrapers, road plows, wheelbarrows, etc.

Road Machines, elevating graders, dump wagons, scrapers, rock crushers, and other forms of road machinery are described in a pamphlet issued by the Austin & Western Co., Ltd., 307 Dearborn St., Chicago.

A small pamphlet describing the advantages of the Watson dumping wagons, for carrying asphalt, ashes, garbage, etc., or for general contract work is furnished by the Watson Wagon Co., Canastota, N. Y.

The Acme Road Machinery Co., Frankfort, N. Y., presents a comprehensive catalogue of road machines, rock crushers with or without folding elevators, stone bins, dumping wagons, steam and horse rollers, street sprinkling and cleaning machinery and other implements for use on streets and highways.

The Indiana road grader is described in detail in the catalogue of the Indiana Road Machine Co., Ft. Wayne, Ind., as well as stone crushers and elevators, horse rollers and other forms of road machinery.

The General Pneumatic Tool Co., Montour Falls, N. Y., in bulletin No. 53, describe a portable riveting machine with which columns composed of channels with the flanges turned inward may be riveted as readily and rapidly as any class of work. The machine is also adapted for general riveting.

A pamphlet on power transmission appliances in general and oil-cooled gasoline engines in particular has been received from the Ferodowill Mfg. Co., St. Paul, Minn.

A folder from the Goheen Mfg. Co., Canton, O., tells where and how to use carbonizing coating, a preservative for structural steel, and galvanum, a paint which will adhere to galvanized iron.

Cuts of a number of highway bridges of various types, as manufactured by the Joliet Bridge & Iron Co., Joliet Ill., together with brief items concerning them have been collected in an attractive pamphlet now being distributed by that company.

Those whose work involves the marking of surveyor's stakes or lumber in any form will appreciate a booklet on pencils designed for that work, published by the Joseph Dixon Crucible Co., Jersey City, N. J.

The Ransome system of concrete-steel construction in its many forms as employed by the Turner Construction Co., 11 Broadway, New York, is beautifully presented with cuts and text in a catalogue of about 60 pages, recently issued.

"Modern labor saving appliances for assayers and chemists," is the significant title of a catalogue from the F. W. Braun Co., Los Angeles, Cal.; a claim well substantiated by the matter offered in its 100 pages.

The Coffin Valve Co., Neponset, Boston, Mass., in bulletin No. 6 are distributing a catalogue illustrating and describing sluice valves and devices for their operation. The book is replete with instructive matter concerning the flow of water through the valves, their general construction and practical application and tables giving the principal dimensions.

The Dobbie Foundry and Machine Co., Niagara Falls, N. Y., manufacturers of contractors' and quarrymen's machinery, in its 200-page illustrated catalogue No. 10, lists an extensive line of concrete mixers, steam hoisting engines, derricks, boilers, tanks, rooter plows, horse and hand power hoisting machinery, etc.

A publication so artistic as almost to deserve classification as an album rather than a catalogue has been issued by the Virginia Portland Cement Co., Craigsville, Va., to advertise its "Old Dominion" brand of cement, showing works in which this cement has been employed.

Notes.

The Coolgardie Goldfields Water-Supply system has been put into successful operation. This plant, notable for having the longest water-pipe line in the world, 328 miles, was described in The Engineering Record, February 24, 1900. The total cost of the works has been $13,500,000; the capacity is 5,000,000 gallons per day.

The Gold and Coal Region of Curry County, Oregon, is shown on four topographic and geologic maps, soon to be issued as the Port Orford, Oregon, folio No. 89 by the United States Geological Survey. Folio No. 87, of the Camp Clark Quadrangle, Nebraska, embracing a region crossed by the North Platte River, will likewise be ready soon.

Harbor Works costing about $2,500,000 are being undertaken at Adelaide, South Australia, a local firm, Messrs. Waring & Rowden, having been awarded the contract. The work includes dredging a channel 33 feet deep, 400 feet wide, and 1,000 feet long, with a swinging berth of the same depth, 1,000 by 2,000 feet in area. An area of 3,200 by 2,600 feet will be reclaimed by filling in with the dredged material. On the inner side of the channel a revetment mound of random stone 7,000 feet long and 1 foot above high water mark is to be constructed in order to train the tidal current so as to maintain the channel at the proper depth. Consular Agent C. A. Murphy, of Adelaide, states that it was expected to begin operations in April.

Percolating Sewage Filters have been constructed in Harrogate, England, by supporting the bottom layer of cinders on sheets of expanded metal resting on small concrete piers, as described in "The Surveyor" recently. Mr. E. W. Dixon, the engineer in charge, states that the use of expanded metal, woven wire, or parallel bars, has the advantage over cast perforated grids or plates in that besides being cheaper, the under surface of the bed is exposed in a much more efficient manner, air currents are not prevented from having free play over the bottom of the bed, the purification is accelerated, and any solid sediment drops clear of the bed instead of much of it being kept in contact with the bottom of the cinders, and clogging up the perforations more or less. The results obtained from this construction have been very satisfactory.

The Coal Consumption Record of the plant of the British Xylonite Company, whose engine, built by Easton & Company, Ltd., of London, developed 239 indicated horse-power at the rate of 9 pounds of superheated steam per horse-power per hour, has been compared with a so-called standard coal. As stated in the report of the test in the issue of March 21, 1.41 pounds of coal were used per indicated horse-power hour, composed of two kinds of coal, one of 13,300 British thermal units calorific value and the other of 11,900 thermal units. Prof. Ewing finds that the mean calorific power of the fuel, calculated from the proportions of each kind supplied, is 12,970 thermal units per pound, so that the coal consumption is equivalent to 1.22 pounds of a standard coal having a calorific power of 15,000 thermal units per pound.

The Morehead Steam Trap has recently been improved by some radical changes in its form and construction. A cast iron base has been substituted for the wooden platform previously used. The drum or tank is now counter balanced by a lever and weight having a fulcrum attached to the base. The weight of the water now has a greater leverage in starting the tank to tilt over, and vice versa, the counter balancing weight has a more powerful leverage to bring the tank back to its normal condition when the water is discharged, than in the old movement. The slight change made in the construction of the vent to the trap has overcome the necessity for the equalizing pipe formerly on the outside of the drum. The seat and disc of the steam valve have been improved so as to reduce the possibility of destruction and wear. The trap now presents a neater appearance while preserving its simple adjustments.

Regulating and Reversing Controllers for direct-current motors operating cranes, hoists and appliances requiring variations in speed and frequent stops and reversals, have been placed on the market by the Westinghouse Electric & Manufacturing Co. The necessary resistance is mounted inside of a cast-iron frame, on the outside of which is attached the commutator, or contact dial for regulating the amount of resistance in circuit and for reversing the motor. In the smaller sizes the resistance is of the ventilated cell type, as used in the Westinghouse standard railway controller resistance. The resistance in the larger sizes consists of cast-iron grids capable of withstanding severe use. The contact dial is made up of copper contacts which are fastened to the periphery of a circular stone, affording a firm support and giving insulation for the parts. The contacts are simple and so made that they may be easily renewed when injured by wear or any possible arcing. Their total allows for a correspondingly large number of steps of resistance, giving a gradual regulation to the motor. The brush-holder is fitted with four contact arms, which, when the circuit is opened, divide the arc into four breaks. Each contact arm is provided with a blow-out magnet to reduce the arcing to a minimum.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 25, 28, 29 and 38.

WATER.

Phoenix, Ariz.—Chas. D. Wolcott, Dir. of U. S. Geol. Survey, has completed a tour of inspection of the Tonto Reservoir Site, on Salt River, and has assured the citizens that the Government will build the dam and work would start in a short time. W. A. Farish, City Engr.

Tucson, Ariz.—Bids will be received by the Mayor and Common Council until May 20 for furnishing f. o. b. Tucson, 1 cross compound, crank and fly wheel, high-duty pumping engine, with a capacity of 4,000,000 gal. in 24 hours, pumping against 90 lbs. per sq. in., with 100 lbs. steam pressure. Pumping engine must have a guaranteed duty of 115,000,000 ft. lbs., for 1,000,000 lbs. of steam. C. F. Schumacher, Mayor.

Marianna, Ark.—A bill is reported to have been passed in Legislature empowering Water Improv. Dist. No. 1 to complete its water works.

Madrone, Cal.—Martin Hobin, who owns a fruit ranch on Coyote River, about 2 miles east of Madrone, is reported to be preparing to construct and operate an irrigating plant in that section.

Anaheim, Cal.—J. W. Duckworth and C. W. Marden, are reported interested in the construction of a pumping plant for irrigation purposes.

San Jacinto, Cal.—R. J. Waters, of Los Angeles, is reported to have offered to construct water works at San Jacinto.

Ft. Lupton, Colo.—The Fulton Irrigation Co. has filed plans for a reservoir at Ft. Lupton with the State Engr. They show a basin with a capacity of 155,727,000 cu. ft. It will be supplied with water from the Platte through Fulton ditch. Emil J. Riethmann, Pres. Engineer, D. L. Thompson.

New Britain, Conn.—The Bd. of Water Comrs. will sell at once $75,000 bonds, to pay for the construction of the retaining reservoir at Wolcott. Bids for its construction will soon be asked.

Louisville, Ga.—See "Power Plants, Gas and Electricity."

Atlanta, Ga.—The citizens voted Apr. 22 to issue $400,000 for the improvement and better equipment of water works and for extension and improvement of the sewerage system.

Pocatello, Idaho.—Press reports state that Greene & Higson have secured the contract for laying about 3½ miles of water main extensions for the Pocatello Water Co. The company will furnish the material. Probable cost of work reported to be $40,000.

Chicago, Ill.—The City Council on Apr. 20 authorized the Mayor and Controller to issue water certificates to the amount of $3,500,000, to be used on intercepting sewer work and for extension of water system.

Frank Murphy, Contract Clk., writes that the contract for furnishing 1,600 tons of 36-in. c. i. pipe (bids opened Apr. 21) has been awarded to U. S. Cast Iron Pipe & Fdy. Co., of Chicago, at $32.80 per ton.

Bids will be received May 7 by the Bd. of Local Improv. for constructing and laying water supply pipes in portions of 11 streets. Andrew M. Lynch, Pres.

Antioch, Ill.—J. C. James, Jr., Village Clk., writes that on April 21 the trustees in favor of water works were elected, and steps will probably soon be taken to construct same.

Shelbyville, Ind.—See "Power Plants, Gas and Electricity."

Anderson, Ind.—The City Council is stated to have received a proposition from the Continental Jewell Co., of New York, N. Y., for the erection of an alum filtration plant. The company proposes to furnish a plant with an initial capacity of 5,000,000 gals. and ultimately of 8,000,000 for $85,000.

Centerville, Ia.—Local press reports state that the bondholders of Centerville Water Co. will expend about $30,000 on improvements.

Marshalltown, Ia.—It is reported that the city will construct a reservoir at a cost of $25,000.

Fayette, Ia.—Bids are wanted May 20 for constructing a water works system, consisting of a steel tower and wooden tank, furnishing and laying pipe, hydrants and gates; brick pumping station, about 1½ miles mains, with hydrants, etc.; 80-H.-P. boiler with stack, 700,000-gal. duplex high pressure pump, 80-H.-P. steam engine, 1 water heater and feed pump. E. B. Scobey, City Clk.

Latonia, Ky.—The Aldermen have concurred in the action of Council and adopted the resolution ordering the Water Wks. Trus. to enter into a contract with the Kenton Water Co. to furnish water for a period of 12 yrs. at 10 cts. per 1,000 gals.

Dexter, Me.—R. D. Wood & Co., of Philadelphia, Pa., are stated to have secured the contract for applying water pipe at $32.80 per ton.

Standish, Mich.—See "Power Plants, Gas and Electricity."

Houghton, Mich.—The Legislature is stated to have passed the bill authorizing the issue of $100,000 bonds, which will include improvements to the water works and the paving of Sheldon St.

Agricultural College, Mich.—The State Agricultural Bd. is stated to have awarded the contract for water works at the college to Brooks & Sons, of Jackson, for $60,000.

Truman, Minn.—Engr. M. B. Haynes, of Mankato, writes that the following bids for water works were received by Village of Truman on Apr. 21: W. D. Lovell, Des Moines, Ia., $7,580; Fairbanks, Morse & Co., St. Paul, $7,943; Allen, Black & Co., St. Paul, $7,895; W. I. Gray & Co., Minneapolis, $8,075; Dunnegan & Sykes, $7,960; Des Moines Iron & Bridge Co., Des Moines, Ia., $7,932, and National Constr. Co., So. Bend, Ind. (compressed air system), $6,000 (awarded contract).

Kiester, Minn.—Bids will be received May 4 by C. W. Tuebner, Village Recorder, for boring an 8-in. well for a water supply.

Duluth, Minn.—See "Power Plants, Gas and Electricity."

Carthage, Mo.—The citizens are stated to have voted Apr. 21 to grant to J. T. Lynn, of New York, N. Y., a franchise for water works.

Desoto, Mo.—It is reported that the Council contemplates installing a water works and a sewerage system. Ward Cunningham, Secy.

Kansas City, Mo.—The contract for a smokestack at Turkey Creek pumping station is stated to have been awarded to A. M. Blodgett, of Kansas City, for $6,500.

Belgrade, Mont.—See "Power Plants, Gas and Electricity."

Lima, Mont.—The Lima Irrigation & Reservoir Co. is reported organized to construct and maintain an irrigating ditch in Madison and Beaverhead Counties, which is to furnish water sufficient to irrigate more than 100,000 acres of land in Beaverhead County. J. J. Cusick is the chief promoter.

Jersey City, N. J.—Bids will be received May 5 by the Bd. of Street and Water Comrs. for furnishing and delivering special castings. Geo. T. Bouton, Clk.

Manasquon, N. J.—The question of constructing water works, at a cost of $35,000, is reported under consideration.

Port Jefferson, L. I., N. Y.—The Port Jefferson Water Co. is stated to have secured the contract for furnishing water for 10 yrs. It will lay about ½ mile of new mains.

Gouverneur, N. Y.—Robt. E. McLear, Village Clk., writes that bids are wanted June 1 for the erection of a standpipe for the water works; probable cost, $3,500.

Rome, N. Y.—The Governor has signed the bill providing for the completion of the water system.

Corning, N. Y.—The Governor has signed the bill authorizing this city to expend $10,000 to enlarge water works, $40,000 to complete a sewerage system, and $15,000 for highway improvements.

Medina, N. Y.—The citizens are stated to have voted to authorize the Council to investigate the question of securing a water supply south of the village for municipal control.

Wayland, N. Y.—F. Allen DeGraw, Village Clk., writes that proposed water works will probably cost about $25,000. No engineer in charge as yet, and date of securing bids not yet decided upon.

Glens Falls, N. Y.—Geo. P. Slade, Village Engr., writes that it is proposed to purchase about 3,500 ft. of 6-in. water pipe, about 390 lbs. per length, and about 2 tons of lead. Address F. P. Shippy.

Schenectady, N. Y.—The Bd. of Water Comrs. on Apr. 20 are stated to have awarded the following contracts: To Miller & Co., of Utica, for furnishing pipe at $20,000; to Jos. Clements, for laying water mains at $6,588; the Rensselaer Mfg. Co., of Troy, for valves and stop gates and the Ludlow Co., Troy, for hydrants.

Fillmore, N. Y.—Articles of incorporation are being prepared for the Fillmore Water Works Co., which proposes to supply Fillmore and Hume with water from springs on Ayres farm.

New York, N. Y.—Bids will be received by Edw. M. Grout, Comptroller, May 12 for the purchase of the following bonds: $500,000 for the new aqueduct; $1,000,000 for the construction of the Rapid Transit R. R., $500,000 for the Dept. of Docks and Ferries, $500,000 for schools and sites, and $500,000 for the repaving of streets.

Buffalo, N. Y.—The Governor has signed the bill authorizing the city to issue $500,000 bonds toward the construction of water works.

Cleveland, O.—The Cleveland Steam Boiler Co. is stated to have secured the contract for iron pipe for the Kirtland pumping station, for $8,380.

Wellsville, O.—Contracts for the proposed water works, amounting to about $42,000, are stated to have been awarded as follows: To the Stirling Boiler Co., Barberton, O., for two 200-H.-P. tube boilers; to J. E. Fassett of Wellsville, for 1 steel self-supporting stack 54 in. in diameter by 110 ft. in height; to Cleveland Crane & Car Co., Wickcliffe, for 1 20-ton traveling crane, and to the Deane Steam Pump Co., Holyoke, Mass., 2 steam pumps of 3,000,000 gals. capacity and 2 feed pumps and necessary pipe for engine room and pit.

Milford, O.—Mayor J. K. Buckingham writes that the proposed water works will cost about $27,000. N. E. Scott is Cor. Secy.

Albany, Ore.—See "Power Plants, Gas and Electricity."

Reading, Pa.—Bids will be received May 5 by the Bd. of Water Comrs. for furnishing c. i. pipes and specials. Lincoln S. Ramsey, Secy.

Meadville, Pa.—The city has purchased 30 acres of land in Vernon Township upon which to place pumps, wells, etc., for the new water supply. The tests show an abundance of clear cold water. W. A. Doane, City Engr.

Ambridge, Pa.—Ott Bros., of Pittsburg, have secured the contract for laying the water and gas lines at the new town of Ambridge. I. A. Gasteiger, 323 Rosedale Ave., Pittsburg, Engr. in Charge.

Lancaster, Pa.—Ervin Lyndall, John S. Kyle, and Wm. H. Roth, of Philadelphia, are about to apply to the State Dept. for Charters for 3 companies to supply water to the public or for the supply, storage or transportation of water and water power for commercial and manufacturing purposes. The Conestoga and Octorara Creeks will furnish the water.

Pittsburg, Pa.—Press reports state that W. A. Shoemaker, representing a New York syndicate, is in Pittsburg with a proposition to lease the water works for 50 years. It is proposed to provide Pittsburg with distilled water, install meters and pay the city at least $500,000 a year for operating the water system.

St. Marys, Pa.—The Horton Water Co., of Horton Township, has been incorporated, with a capital of $15,000, by D. F. Maroncy, H. S. Hastings, and others, all of St. Marys.

Indiana, Pa.—The Chymer Water Co., of White Township, has been incorporated, with a capital of $5,000. W. B. Kline, J. H. Hill, F. Sansom and H. M. Bell, of Indiana, are the incorporators.

Spencer, S. D.—It is stated that the Town Bd. will be asked to call an election to vote on the issue of bonds for the construction of water works.

Parker, S. D.—The citizens are stated to have voted to issue $10,000 bonds for improving the water works.

Tullahoma, Tenn.—A bill has been passed in Legislature authorizing an issue of $5,000 bonds to improve and perfect water works.

Jellico, Tenn.—The citizens will petition the Council to construct water works and a sewerage system.

Dyersburg, Tenn.—Water bonds amounting to $33,000 are reported sold.

Floresville, Tex.—See "Power Plants, Gas and Electricity."

Bristol, Va.—The City Council is stated to have voted to issue $15,000 bonds for completing the water works.

Seattle, Wash.—The Council on Apr. 13 ordered the construction of Rainier Ave. water-main system, to cost $48,524.

New Martinsville, W. Va.—See "Power Plants, Gas and Electricity."

Moundsville, W. Va.—Geo. Bauer, of Pomeroy, O., is stated to have secured the contract for constructing the reservoir for the Water Co., at about $15,000.

Benwood, W. Va.—The Benwood Water Co. will construct the proposed reservoir (bids for which were opened Apr. 17) by day labor under Elmer Shanefelt as foreman, and under general supervision of Chopin & Knowles, Consulting Engrs.

La Crosse, Wis.—H. J. Beckwith, Pres. Bd. Pub. Wks., writes that the only bid received on Apr. 25 for furnishing material and laying a 6-in. water main, was that of Thill & Lapitz, 512 State St., La Crosse, for $6,660.

Regina, Assa., N. W. Ter.—See "Power Plants, Gas and Electricity."

SEWERAGE AND SEWAGE DISPOSAL.

Marysville, Cal.—Engineer Marsden Manson, City Hall, San Francisco, in his report to City Council estimates the cost of constructing a sewerage system and pumping plant for Marysville, at $67,000.

Healdsburg, Cal.—The City Trus. are stated to be considering the question of constructing a sewerage system.

San Francisco, Cal.—Local press reports state that the following bids were opened by the Bd. of Pub. Wks. Apr. 15 for the 6th St. Sewer: The City St. Improv. Co., $53,236 (awarded contract); O. D. Vincent, $55,302; Williams, Beiser & Co., $55,676, and C. S. Harney, $57,133.

Colorado Springs, Colo.—City Engr. Case is stated to have completed surveys for sewer extensions for the coming year. About 5 miles of tile sewer will be constructed, at a cost of $16,000.

Rockville, Conn.—The Council is stated to have adopted a resolution for the appointment of a committee of 5, with the Mayor as Chmn., to examine one or more filter beds now in use, and report the estimated cost and a practical location of beds for the city sewer, together with the expense of running same.

Naugatuck, Conn.—The Council on Apr. 21 authorized the Clk. to secure bids for sewers in 4 streets.

Atlanta, Ga.—See "Water."

Chicago, Ill.—See "Water."

It is stated that bids are wanted by the Bd. of Local Improv. until May 6 for constructing sewers in various streets. A. M. Lynch, Pres.

Rockford, Ill.—The contract for sewers on portions of 4 avenues (bids opened Apr. 23) has been awarded to G. Maffioli, of Rockford, Ill.; probable cost, $8,000.

Contracts for Railroad Ave., 11th St. and Tenth Ave. sewers have been awarded to F. Bairstow, W. J. Allen and H. O. Foley, of Waukegan, Ill. Edwin Main, City Engr.

Noblesville, Ind.—Local press reports state that plans for the Baker sewer, as prepared by City Engr., have been accepted by Council, and bids for constructing a sewer on Edwards St. will be received on May 11.

Richmond, Ind.—It is stated that an appropriation of $18,005 has been made to construct a septic sewerage system at Eastern Hospital.

Rushville, Ind.—The City Council has adopted a resolution ordering a survey, plans and specifications for a sewerage ayatem.

Elkhart, Ind.—The Council is reported to have authorized the issue of $5,000 sewer bonds.

Des Moines, Ia.—Bids are wanted by the Bd. of Pub. Wks. until May 18 for constructing 12 and 15-in. pipe sewers in portions of 4 streets, requiring in all about 2,041 lin. ft. B. O. Hanger, Chmn.

Sioux City, Ia.—N. Jennes, Co. Aud., writes that it is proposed to construct a drainage ditch in Woodbury County, to cost about $50,000. Engineer, J. M. Lewis.

Onawa, Ia.—A press report states that a ditch about 26 miles in length will probably be constructed in Monona and Woodbury Counties; probable cost of work, $100,000. Mr. Ellis, of Onawa, is Aud. of Monona Co.

Estherville, Ia.—Bids will be received May 25 by Roy J. Ridley, Co. Aud., for digging and constructing a ditch known as public drain No. 8 in Ellsworth Township.

Abilene, Kan.—The Council has passed the ordinance providing for the construction of Sewer Dist. No. 2. S. R. Cowan, Mayor.

Abilene, Kan.—The City Council is stated to have voted to build a second sewerage system, covering the residence portion of town west of Mud Creek.

South Hadley Falls, Mass.—Snow & Barber, of Boston, are reported to be here making surveys for the proposed sewerage system.

Brockton, Mass.—The Council is stated to have appropriated $10,000 for drainage work and $20,000 for work on highways.

Quincy, Mass.—The City Council Apr. 27 voted $70,000 for sewer extensions and $6,000 for house connections. H. Flood, City Engr.

Worcester, Mass.—Local press reports state that Sewer Com. will present an ordinance to Council providing for the construction of 3 pumping stations and the laying of sewers in Lake View, the sewer to cost about $70,000.

Hudson, Mass.—The citizens are stated to have voted Apr. 22 to construct a sewerage system, at a cost of about $100,000.

Albert Lea, Minn.—Engr. Wolf, of St. Paul, estimates the cost of constructing a brick sewer from Spring Lake Park, a distance of about 2,000 ft., at $14,490.

St. Paul, Minn.—The Bd. of Pub. Wks. has reported favorably on the construction of sewer for E. 5th St., to cost about $7,217.

Bids will be received May 4 by the Bd. of Pub. Wks. for constructing a sewer in portions of Minnehaha St. R. L. Gorman, Clk. of Bd.

The Bd. of Aldermen has adopted an ordinance providing for the construction of the Stryker Ave. sewer, to cost about $19,000.

Newark, N. J.—The Bd. of Pub. Wks. is stated to have voted to lay a 10-in. pipe sewer in 14th Ave. and a 12-in. sewer in Plane St.

Madison, N. J.—The Boro. Council is reported to be considering the question of constructing a sewerage disposal plant.

Guttenberg, N. J.—The citizens on Apr. 25 are stated to have voted to construct an outlet sewer, to cost about $40,000. Harry Prosser, Town Engr.

Canajoharie, N. Y.—Jobial Vaughn, of Stamford, N. Y., is stated to have secured the contract for constructing the sewerage system, for $34,400.

Saratoga Springs, N. Y.—The Governor has signed the bill providing for the issue of $130,000 bonds for for the construction of a sewerage system.

Bids will be received May 5 by the Sewer, Water and Street Comn. for furnishing material and constructing an 8 and 10-in. sewer in portions of 3 streets. H. F. Thomas, Clk.

Corning, N. Y.—See "Water."

Binghamton, N. Y.—The Council has adopted a resolution providing for sewers on Sturges and Gaylord Sts.

Cuba, N. Y.—The citizens are stated to have voted Apr. 22 to construct a sewerage system, to cost from $36,000 to $41,000.

Penn Yan, N. Y.—It is stated that plans for the construction of a sewerage system have been completed and sent to State Bd. of Health. If constructed it will be 12⅛ miles in length, and cost about $75,000.

Gloversville, N. Y.—The Governor has signed the bill authorizing Gloversville to expend $250,000 for a sewage disposal system.

Albany, N. Y.—The Council on Apr. 20 passed ordinances providing for the construction of sewers in 1st Ave. and Charles St. It also noticed for passage ordinances for sewers in Liberty and S. Pearl Sts.

St. Bernard, O.—Engr. Stewart is stated to have presented to Council plans for the sewerage system; probable cost, $75,000.

Dayton, O.—It is reported that plans for sanitary sewers in Dist. No. 5 have been completed. Total length of sewers to be built about 5 miles.

Bond Hill, O.—Bids will be received May 20 by A. J. Kiphart, Village Clk., for furnishing material for constructing sewers. Earnshaw & Punshaw, Village Engrs., Cincinnati.

Oregon City, Ore.—Bids will be received May 14 by the Com. on Sts. and Pub. Property for furnishing material and constructing sewers in Sewer Dist. No. 3. Wm. Sheahan, Chmn.

Springgrove, Pa.—Engineer McKennon is reported to have made a survey for a sewerage system.

South Bethlehem, Pa.—Local press reports state that Nagle & Son, of Allentown, have secured contracts for sewers (bids opened Mar. 3) as follows: Linden St. sewer, $23,956; Elm St., $17,157; Northampton Ave., $4,286; Bway. sewer, $60,419 and Bway. house sewer, $4,450.

Johnson City, Tenn.—A press report states that the Bd. of Mgrs. of the Natl. Home for D. V. S. have decided to construct a sewage disposal plant. Moses Harris, Gen. Treas., 346 Bway., New York, N. Y.

Memphis, Tenn.—The Legislative Council at a recent meeting included in the annual budget $60,000 for sewer construction and $150,000 for streets and bridges.

Jellico, Tenn.—See "Water."

Ballard, Wash.—The Council is stated to have adopted ordinances for the construction of sewers on Ship, 2d Ave. and Bway., at an estimated cost of $38,916.

Seattle, Wash.—The City Council on Apr. 13 ordered the construction of Prospect St. sewer system, to cost $22,800.

Milwaukee, Wis.—C. J. Poetsch, City Engr., writes that contracts for sewers (bids opened Apr. 23) have been awarded as follows: To Geo. E. Zimmerman, for 814 ft. of 30 and 60-in. brick sewer, $7.73 per ft.; W. T. Werner, for 1,524 ft. pipe sewer, $1.46; Herman Hohensee, 1,529 ft. pipe sewer, $1.47; and to F. H. Naklelski, 50 ft. 30-in. brick sewer, $4.80, and 983 ft. pipe sewer, $1.98. Contractors all of Milwaukee.

Regina, Assa., N. W. Ter.—See "Power Plants, Gas and Electricity."

BRIDGES.

Birmingham, Ala.—Bids are wanted May 23 for constructing 3 steel bridges; also for abutments of 2d class masonry. A. J. Tarrant, Pres. Co. Bd. of Revenue.

San Jose, Cal.—J. G. McMillan, Co. Surv., writes that the Bd. of Superv. have adopted plans for a steel bridge over Coyote River, 1 100-ft. span and 1 70-ft. span, to cost about $8,000. Bids for constructing same will be received by the Clk. of Bd. May 18.

Dycrville, Cal.—The Santa Fe R. R. Co. is reported to be contemplating the building of a steel bridge across Eel River. R. B. Burns, Ch. Engr., Los Angeles, Cal.

Los Gatos, Cal.—It is stated that a steel or concrete bridge may replace the present wood structure at Main St.

Pueblo, Colo.—The city has voted, according to press reports, to issue $120,000 viaduct bonds.

New Haven, Conn.—The Bd. of Aldermen has voted in favor of a 15-ft. stationary bridge at Kimberly Ave.

Atlanta, Ga.—The building of a viaduct to connect Washington and Courtland Sts. is reported under consideration. R. M. Clayton, City Engr.

Joliet, Ill.—Bids will be received May 12 by the Joint Bridge Com. of Will and Grudy Counties for furnishing material and constructing the stone abutments and piers and steel superstructure, etc., of a 5-span highway bridge over Kankakee River; estimated cost, $25,000. Henry H. Stassen, Chmn.

Sterling, Ill.—Injunctions against the building of steel bridges across the canal feeder having been set aside, Capt. L. L. Wheeler is reported as having stated that he will immediately begin the construction of said bridge.

Pekin, Ill.—Plans have been submitted for a wagon bridge, estimated to cost $25,000.

Petersburg, Ind.—Bids will be received by the Bd. of Co. Comrs. May 5 for constructing a concrete arch bridge over the State ditch on the Morgan Ferry Road. T. W. Basinger, Co. Aud.

Indianapolis, Ind.—Co. Engr. Klausman has completed plans for a 3-span stone bridge to be erected over Fall Creek at College Ave. Bids for construction will soon be advertised. Address C. Comrs.

La Orange, Ind.—Bids are wanted May 5 for constructing 2 iron bridges over Pigeon River—1 90 ft., the other 120 ft.; also bids for stone abutments. V. D. Weaver, Co. Aud.

Neodesha, Kan.—Bids will be received May 8 by the Township Trus. for constructing a 110-ft. steel bridge and approaches over Fall River, in Neodesha Township. A. H. Black, Township Clk.

Oak Ridge, La.—Plans and specifications will be received June 3 by Co. Comrs. at Bastrop for constructing a 150-ft. steel bridge. Address J. S. Rolfe, Oak Ridge.

Lewiston, Me.—Press reports state that the Maine Central R. R. Co. intends rebuilding 3 bridges in this city. T. L. Dunn, Ch. Engr., Portland.

Cumberland, Md.—See "Electric Railways."

Hagerstown, Md.—Bids will be received May 15 by the Bd. of Co. Comrs. for furnishing material and constructing a metal and stone bridge over Beaver Creek; substructure and superstructure to be bid on separately. John E. Wagaman, Clk. of Bd.

Springfield, Mass.—Local press reports state that the Bd. of Superv. is about to request bids for raising the South End bridge according to specifications of the War Dept., which require that the 4th span be raised 15 ft. The cost is estimated at about $10,000.

Salem, Mass.—The building of a bridge across Danvers River between Salem and Beverly is being considered. Probable cost, $100,000.

Jackson, Mich.—R. Dunn, of Detroit, is reported to have secured the contract to construct a 1-span bridge at Main St., for $13,935.

St. Paul, Minn.—Bids are wanted May 5 for furnishing material and constructing substructure of Grand Ave. bridge. Estimated cost, according to local press reports, $15,000. Matt Jensen, City Clk.

Windom, Minn.—Bids will be received May 7 by the Bd. of Co. Comrs. for constructing a steel bridge over Des Moines River in Southbrook Township. John A. Brown, Co. Aud.

Livingston, Mont.—It is stated that bids are wanted by the Co. Comrs. until June 3 for constructing Shields River Bridge.

Paterson, N. J.—Bids will be received May 4 by the Com. of the Co. Bd. of Chosen Freeholders for constructing a concrete or steel beam bridge at Summer St. with brownstone or concrete abutments, granite sidewalks and brick paved roadway. John Blauvelt, Chmn.

Newark, N. J.—The Joint Com. of the Boards of Essex and Hudson Counties has instructed the engineers employed by the two counties to prepare plans immediately for a new draw for the Bridge St. bridge.

Syracuse, N. Y.—See "Miscellaneous."

Durhamville, N. Y.—A bill has passed the Legislature appropriating $57,000 for a canal culvert to be built across Oneida Creek at Durhamville.

Williston, N. D.—Bids will be received May 11 by the Bd. of Co. Comrs. for constructing a 40-ft. steel bridge over Stony Creek. E. M. Atterberry, Co. Aud.

Langdon, N. D.—Bids will be received May 19 by the Co. Comrs. for furnishing material and constructing a 60-ft. steel bridge about 1 mile northwest of Milton. Itobt. Work, Co. Aud.

Niles, O.—The Osborn Engineering Co. is preparing plans for a steel Co. highway bridge with concrete-steel floor, to be erected at Niles, O. The span is 75 ft., width of roadway 36 ft., and 2 sidewalks 5 ft. 6 in. wide.

Cleveland, O.—See "Railroads."

Mt. Vernon, O.—It is stated that bids will be received by the Bd. of Co. Comrs. until May 16 for a 100-ft. span superstructure for Banning Bridge in Morris Township. A. C. Collins, Co. Aud.

Eugene, Ore.—It is stated that bids are wanted May 6 for building a bridge over Coast Fork River at Cottage Grove. It is to be a Howe truss structure having an 87-ft. span and an 18-ft. roadway. C. M. Collier, Co. Surv.

Bath, Pa.—Co. Engr. Cooper has been instructed to prepare plans and specifications for a bridge to be built at Main St., this city.

Johnstown, Pa.—Press reports state that the Johnstown Passenger Ry. Co. intends to build a bridge across the river.

Woonsocket, S. D.—Bids will be received May 19 by the Bd. of Co. Comrs. for furnishing material for completing a steel county bridge over Red Stone Creek. Address Daniel Hoy, Co. Aud.

Parker, S. D.—Bids will be received May 12 by the Co. Comrs. for constructing a 70-ft. steel bridge over Vermillion River, Monroe Township. Jos. J. Waltner, Jr., Co. Aud.

Castlewood, S. D.—Bids will received July 10 by L. H. Forde, Co. Aud., for constructing a 50-ft. steel bridge, with 16-ft. roadway.

Carthage, Tenn.—Local press reports state that the city of Carthage is negotiating the sale of $60,000 bridge bonds.

Memphis, Tenn.—See "Sewerage and Sewage Disposal."

Tacoma, Wash.—Geo. Milton Savage is reported to have secured the contract to build the 34th St. bridge, at $7,250.

Parkersburg, W. Va.—The Parkersburg Bridge & Terminal R. R. Co. has filed with the Secretary of War specifications and plans for a railroad bridge to be built across the Ohio River, a mile above the mouth of the Little Hocking River, Ohio. J. T. Blair, Pres.

Niagara, Wis.—Press reports state that the Senate and Assembly of the Wisconsin Legislature has passed a bill providing for the building of a bridge between Niagara and Marinette.

Milwaukee, Wis.—The City Engr. has been directed to prepare plans and specifications for the Washington Ave. viaduct.

Trempeleau, Wis.—According to press reports the bridge on the Chicago, Burlington & Quincy R. R. across Black River near Trempeleau has been destroyed by fire. Loss reported at $100,000. C. H. Cartledge, Bridge Engr., Chicago, Ill.

Surrey, B. C.—It is stated that bids are wanted May 10 for constructing a draw bridge across Serpentine River on Mud Bay Road. Daniel Johnson, Reeve, of Surrey, Mud Bay, B. C.

Brompton, Ont.—It is stated that bids are wanted May 9 for building abutments and superstructure for bridge across River Credit in Streetsville. The bridge is to be of steel and to have a 120-ft. span and 14-ft. roadway. John McCauley, Chmn. Com.

Plympton, Ont.—It is stated that bids are wanted May 9 for constructing an iron bridge, 65-ft. span, on stone or concrete abutments. Hugh Montgomery, Reeve, Wyoming, Ont.

PAVING AND ROADMAKING.

Montgomery, Ala.—The citizens have, according to reports, voted to issue $12,000 street improvement bonds.

Brooklyn, Conn.—Bids will be received May 7 by the Bd. of Selectmen for constructing a macadam and telford road. John C. Williams, Chmn.

Glencoe, Ill.—Bids will be received by the Village Bd. of Local Improv. until May 9 for grading, draining and macadamizing parts of South, Hawthorne, Hazel and Greenleaf Aves., requiring in all about 10,650 sq. yds. of slag and stone macadam, 7,000 cu. yds. of excavation, 9,330 lin. ft. of 4 to 12-in. drain, 28 concrete end curbs, 35 catch basins, etc. Frank A. Windes, Engr., Winnetka, Ill.

Paris, Ill.—Bids will be received until May 6 by Z. T. Baum, Pres. Bd. Local Improv., for 13,776 sq. yds. of brick pavement on concrete foundation. D. H. Sawyer, City Engr.

Decatur, Ill.—Geo. V. Loring, City Engr., writes that the only bid received on Apr. 25 for paving E. Main and Water Sts. was from the Barber Asphalt Co. of Chicago, Ill., as follows: For resurfacing with brick over ½ mile, $1.25 per sq. yd.; 2,540 ft. new streets, asphalt and excav., $1.65, and for combined curb and gutter on new streets, 60 cts. per lin. ft.

Danville, Ill.—Bids are wanted May 7 (readvertise ment) for 15,000 yds. paving; 5,000 ft. stone curb and 3,300 ft. 8-in. sewer. W. H. Martin, City Engr.

Moline, Ill.—The City Council has ordered the paving of portions of 5 streets with brick and asphalt, at a total estimated cost of $25,000.

Streator, Ill.—The City Council has passed ordinances to pave portions of La Rue and Lundy Sts., estimated to cost $5,999 and $4,217 respectively.

Rock Island, Ill.—The cost of paving with vitrified brick on 17th St. from 9th to 18th Ave. is estimated at $23,033.

Marion, Ind.—T. E. Petrie, City Engr., writes that the following bids were received Apr. 14 for paving (1) 37th St., (2) 38th St., (3) Alley bet. 4th and 5th with (*a*) Metropolitan blk., (*b*) Athens, (*c*) Poston, (*d*) Canton wire cut, and (*e*) Logan, price given per lin. ft.: Philip Hipskin & Son,* Wabash (1) *a*, $9.18; *b*, $8.98; *c*, $8.88; (2*) *a*, $9.69; *b*, $9.49; *c**, $9.39; (3) *a*, $3.31; *b*, $3.26; *c*, $3.21. W. W. Hatch & Son,* Goshen (1*), *a*, $9.25; *b* and *d*, $9.17; *c**, $8.89; *e*, $9.01; (2) *a*, $9.95; *b* and *d*, $9.87; *c*, $9.59; *e*, $9.71; (3) *c*, $3.59. F. M. Benner*, Marion (3*) *c**, $2.87. Lora Lillard, Marion (3) *a* and *e*, $3.25; *c*, $3.16. These bids include furnishing all labor and material, excavation of roadway and sidewalks and completing same. *Awarded contracts according to local press reports.

New Albany, Ind.—The City Council has ordered 13 miles of streets paved with asphalt.

Anderson, Ind.—Press reports state that at the election held Apr. 14 the question of issuing $25,000 street improvement bonds carried.

Linton, Ind.—W. D. Norton & Co., of Terre Haute, are stated to have secured the contract for paving about 2 miles of streets with vitrified brick, at a cost of $76,478.

New Albany, Ind.—Resolutions have been adopted by the City Council to improve portions of numerous streets.

Owensville, Ind.—At the special election held Apr. 20 it was voted to construct rock roads in Montgomery Township.

Michigan City, Ind.—Plans and specifications have been approved for the paving with brick or bituminous macadam of Pine, 8th, 4th, Ohio, Detroit and Greene Sts., about 25,000 yds. H. M. Miles, City Engr.

Warsaw, Ind.—G. W. Dresser, City Clk., writes in regard to paving work contemplated that the Council has not yet decided on material to be used but favor brick.

Michigan City, Ind.—Bids will be received May 18 by Edw. J. Heise, City Clk., for improving by paving with brick and bituminous macadam 6 streets; also for constructing a macadam roadway of limestone on Krueger Ave.

Madison, Ind.—Bids are wanted May 7 for improving portions of Mulberry St. with vitrified brick. Geo. F. Harper, City Clk.

Lafayette, Ind.—G. H. Stevenson, City Engr., writes that the Western Constr. Co., of Lafayette, secured the contract for paving 5 streets with asphalt about 12,000 sq. yds., at $2.17 per sq. yd., including found.; total, $37,540. The Barber Asphalt Co., of Cincinnati, O., bid $2.17, including foundation (bids opened Apr. 27).

Frankfort, Ind.—Chas. E. Cheney, City Engr., writes that bids are wanted May 18 for paving 3 streets about 22,000 yds. with brick or Warren's bituminous macadam.

Des Moines, Ia.—See "Government Work."

Des Moines, Ia.—Bids will be received until May 18 for paving with vitrified brick on a concrete foundation portions of W. 15th and W. 16th Sts., requiring in all about 5,089 sq. yds. B. O. Hanger, Chmn.

Marshalltown, Ia.—The City Council has ordered about 15,500 sq. yds. of asphalt paving and about 8,500 lin. ft. combined curb and gutter, bids for same to be received on May 18. Wm. Brenner, City Engr.

Louisville, Ky.—The Bd. of Pub. Wks. on Apr. 23 authorized the paving with vitrified block on portions of 6 streets.

Annapolis, Md.—See "Government Work."

Boston, Mass.—Bids will be received May 4 by Jas. Donovan, Supt. of Streets, for conatructing a telford-macadam roadway on portions of Columbia Road.

Brockton, Mass.—See "Sewerage and Sewage Disposal."

So. Hadley, Mass.—Colea & Childs, of Amherst, are reported to have secured the contract to build a section of the state road from Granby Road to Stony Brook bridge, for $14,000.

Lansing, Mich.—H. A. Collar, City Engr., writes that all bids received Apr. 13 for paving Franklin St. with brick on a gravel foundation have been rejected. The lowest bid amounted to $11,750.

Marquette, Mich.—The Northern Land Co. is reported to be contemplating the building of a boulevard, and paving same with macadam, at a probable cost of $9,000.

Delray, Mich.—The paving of River St. probably with brick is being considered.

Houghton, Mich.—See "Water."

Minneapolis, Minn.—Bids will be received May 4 by the Bd. of Co. Comrs. for furnishing a power road roller, rock crusher, reversible road machine and a sprinkling wagon. Hugh R. Scott, Co. Aud.

St. Paul, Minn.—A bill has passed both the Senate and Assembly authorizing the issue of $30,000 bonds as a part of the cost of macadamizing W. 7th St. from Tuscarora St. to Ft. Snelling.

The Bd. of Pub. Wks. has authorized the paving with asphalt on a portion of Jackson St., at estimated cost of $6,916; also has reported favorably the paving of 10 blocks on Mississippi Ave. with brick, at an estimated cost of $14,231.

The Barber Asphalt Paving Co. is reported to have secured the contract to repair about 4,000 sq. yds. of asphalt pavement on 6th St. at $1.65 per sq. yd.

Bids are wanted by the City Council until May 5 for repairing asphalt pavement on 6th St. Matt Jensen, City Clk.

Columbia, Mo.—The City Council is reported to have adopted a resolution to pave with brick on a portion of Bway.

St. Joseph, Mo.—The macadamizing of about 1½ miles on Amazonia Road is contemplated; probable cost, $10,000.

Camden, N. J.—Bids will be received by the Camden Co. Stone Road Com. of the Camden Co. Bd. of Chosen Freeholders until May 11 for conatructing a macadam road a distance of about 2 miles. J. J. Albertson, Co. Engr.

Belvidere, N. J.—Bids will be received by the Co. Bd. of Chosen Freeholders until May 9 for macadamizing 10 miles of Warren Co. roads. A. W. Cutler, Dir., Hackettstown.

Newark, N. J.—Bids will be received May 7 by the Bd. of Street and Water Comrs. for grading, curbing, flagging and paving portions of 4 streets, requiring in all about 34,900 sq. yds. oblong granite block and 2,900 sq. yds. sheet asphalt or paving brick. J. Crowell Mundy, Gen. Supt. of Works.

Edgewater, N. J.—Bids will be received May 5 by E. H. Speer, Boro. Clk., for regrading, curbing, guttering and constructing catch basins on Undercliff Ave., a distance of about 3,150 lin. ft. Willard Cass, Boro. Engr., Englewood.

Long Branch, N. J.—Press reports state that a survey has been made by Engr. Wm. H. Denise for the proposed Monmouth Speedway. The cost, including land, will amount to about $15,000.

Jersey City, N. J.—Local press reports state that Jas. Mannix has secured the contract to improve Belleville Turnpike, at $44,583. For detail bids ace issue of The Engineering Record of Apr. 18.

Union, N. J.—Bids will be received May 11 by the Town Bd. of Council for curbing, flagging, and paving with specification block on a sand foundation portions of 3 streets. Emil Bautz, Jr., Town Clk.

Camden, N. J.—The city is having ordinances prepared to expend about $100,000 on asphalt and stone block pavements.

Brooklyn, N. Y.—The following bids for repaving with wood block pavement on concrete founda. Clinton Ave., from Park to Flushing Aves., etc., were received by J. Edw. Swanstrom, Boro. Pres., Apr. 29—*a*. U. S. Wood Preserving Co., 29 Bway., N. Y. City; *b*, Eppinger & Russell Co., 66 Broad St., N. Y. City:

Bidders.	Wood blk., 10,040 s. yd.	Relay 120 s. yd.	Concrete, 1,790 c. yd.	New curb, 4,620 ft.	Old curb, 1,060 ft.	M. covers, 27.	Total.
a.....	$2.20	$0.35	$5.95	$0.95	$0.40	$18.	$38,079.50
b.....	2.20	.25	6.65	.92	.42	18.	39,203.10

Brooklyn, N. Y.—The following bids for grading and paving with asphalt on concrete founda. Linden Ave., from Flatbush to Rogers Aves., were received by J. Edw. Swanstrom, Boro. Pres., Apr. 29—*a*, Cranford Co.; *b*, Uvalde Asph. Pavg. Co.; *c*, Bklyn. Alcatraz Asph. Co.:

Bidders.	Asphalt, 8,200 s. yd.	Concrete, 1,140 c. yd.	Excav., 4,440 c. yd.	Conc. curb, 3,466 ft.	Cem. walk, 960 s. ft.	Total.
a.....	$1.31	$5.75	$0.45	$0.60	$0.22	$21,587.60
b.....	1.25	4.75	.30	.50	.18	18,904.00
c.....	1.35	6.00	.45	.70	.25	22,576.00

Brooklyn, N. Y.—The following bids for grading, curbing, etc., on Nichols Ave. from Jamaica to Atlantic Aves. were received by J. Edw. Swanstrom, Boro. Pres., Apr. 29—*a*, J. Chas. Weschler; *b*, Mangieri Co.; *c*, Daniel Douglass, 122 Logan St.; *d*, Dennis Norton:

Bidders.	3,400 c. yds. excav.	10,500 c. yds. embank.	5,780 c. yds. conc. curb.	27,550 sq. ft. cem. walks.	Totsl.
a.....	$0.40	$0.70	$0.50	$0.19	$16,834.50
b.....	.45	1.25	.60	.22	24,184.00
c.....	.40	.60	.58	.20	16,522.40
d.....	.55	.98	.69	.26	23,311.20

New York, N. Y.—The following were among the bids opened Apr. 28 by J. A. Cantor, Pres. Manhattan Boro., for asphalt pavement on present pavement relaid as foundation—*a*, Barber Asph. Pavg. Co.; *b*, Continental Asph. Pavg. Co.; *c*, Uvalde Asph. Pavg. Co.; *d*, Asphalt Constr. Co.:

42d St.—7th to 10th Aves.

Bidders.	10,600 s. yd.	Relay, 10,660 s. yd.	Concrete, 240 cu. yd.	New curb, 4,520 ft.	Old curb, 210 ft.	Manhole covers, 22.
a.....	$1.65	$0.42	$5.48	$0.89	$0.38	$20.
b.....	1.40	.35	6.00	.85	.30	20.
c.....	1.50	.40	5.00	.85	.35	20.

Amsterdam Ave.—141st to 155th Sts.

	16,170	*16,200*	*402*	*6,170*	*610*	*12*
a.....	$1.12	$0.40	$5.48	$0.89	$0.38	$20.
b.....	1.17	.33	5.60	.88	.40	20.
d.....	1.12	.30	5.50	.90	.30	20.

New York, N. Y.—See "Water."

Brooklyn, N. Y.—The following bids were opened Apr. 29 by J. Edw. Swanstrom, Boro. Pres., for asphalt pavt. on concrete found. on Prospect Ave. from Ft. Hamilton Ave. to Vanderbilt St.—*a*, Uvalde Asph. Pavg. Co.; *b*, B'klyn Alcatraz Asph. Co.; c, Cranford Co.:

	a	*b*	*c*
Asphalt, 7,690 sq. yds....	$1.25	$1.30	$1.35
Concrete, 1,070 cu. yds...	5.00	5.50	5.75
Totals	14,963	15,882	16,534

Buffalo, N. Y.—The following streets have been ordered paved or repaved: Roberts and Normal Aves., Lutheran, Larkin, Pascal, Gilbert and 16th Sts. and Ripley Pl.

Cohoes, N. Y.—On Apr. 21 the Common Council ordered the issue of $39,000 bonds for the paving of Saratoga St.

Bids will be received May 9 by the City Chamberlain for $39,000 public improvement bonds.

Solvay, N. Y.—Sidewalk bonds, amounting to $50,000, are reported to have been sold.

Corning, N. Y.—See "Water."

Brooklyn, N. Y.—Bids will be received May 7 by the Bd. of Park Comrs. for paving with macadam portions of Plaza St. Wm. H. Wilcox, Chmn., N. Y. City.

Albany, N. Y.—A bill has passed the Legislature authorizing the incurring of a State debt for $50,000,000 for the improvement of roads.

Buffalo, N. Y.—Bids are wanted May 8 for furnishing material and paving portions of 3 streets. Francis G. Ward, Comr. Dept. Pub. Wks.

Massillon, O.—Harold Howald, City Engr., writes that the following bids for curbing and paving with brick on So. Erie St. were received Apr. 21; estimated quantities, 21,593 sq. yds. paving, 2,200 ft. old curb reset, 1,000 ft. new curb and 450 cu. yds. extra grading—*a*, Massillon block; *b*, Metropolitan block; *c*, Canton shale; *d*, Davis wire cut; *e*, Malvern; *f*, new curb; *g*, old curb; *h*, extra grading: Welbie, Schott & Vogt,* Massillon, *a**, *b*, *c*, $1.24; *f*, 40 cts.; *g*, 15 cts.; *h*, 20 cts. J. B. Snyder, Massillon, *a*, $1.34; *e*, $1.35½; *f*, 95 cts.; *g*, 25 cts.; *h*, 90 cts. H. C. Schneider, Massillon, *a*, $1.50; *b*, $1.35; *f*, 90 cts.; *g*, 20 cts.; *h*, 30 cts. Cori & Shekels, Canton, *a*, $1.93; *b*, $1.26; *d*, $1.22; *f*, 97 cts.; *g*, 24 cts.; *h*, 30 cts. (*contract awarded).

Salem, O.—Local press reports state that the following bids were received Apr. 18 for paving with asphalt block—*a*, New Garden St.; *b*, E. Bway.; *c*, Howard St.: H. B. Chase, *a*, $33,008; *b*, $15,172. Geo. B. Smith & Bro., *a*, $33,827; *b*, $14,291, and *c*, $10,472. Chas. J. Deckman, Cleveland, *c*, $11,126.

Payne, O.—It is stated that bids are wanted May 18 for paving with brick on Main and Merrin Sts. D. McCormick, Clk. of Council.

Springfield, O.—Bids are wanted May 5 for paving with brick on a portion of St. Louis St. and with macadam on a portion of Dollison St. Geo. W. Collier, City Engr.

Cincinnati, O.—Bids are wanted May 5 for improving by grading, curbing, and paving with brick portions of Witter St. Robt. Allison, Pres. Bd. of Pub. Service.

Portland, Ore.—The Trinidad Asphalt Paving Co. is reported to have bid $27,459 for paving on Alder St. and Giebisch & Joplin are reported to have submitted the lowest bid for paving on E. Salmon St., at $21,021.

Grove City, Pa.—Bids will be received May 15 by the Boro. Council for grading, curbing and paving N. Broad St. J. W. Russell, Jr., Secy.

Wilkinsburg, Pa.—Bids are wanted May 5 for grading, curbing and paving with Ligonier block stone portions of Penn and Kelly Aves.; approximate estimate, 8,500 cu. yds. grading, 5,900 sq. yds. paving, 3,092 ft. curb, etc.; also for furnishing f. o. b. cars 6 side and 6 corner sewer drops. Frease & Sperling, Boro. Engrs., Carl Bldg.

Harrisburg, Pa.—Gov. Pennypacker has signed the bill appropriating $6,500,000 to be spent in 6 years for highway improvements throughout the State.

Providence, R. I.—The General Assembly has passed a bill appropriating $100,000 for the construction, maintenance and improvement of the highways of the State.

Anderson, S. C.—It is stated that the proposition to issue $25,000 street improvement bonds carried at the recent election.

Union, S. C.—Bids will be received by W. D. Arthur, City Clk., for 3,500 sq. yds. of concrete paving.

Sevierville, Tenn.—The Co. Court has appropriated $16,000 with which to repair the pike road from this city to the Knox Co. line.

Memphis, Tenn.—See "Sewerage and Sewage Disposal."

Ft. Hunt, Va.—See "Government Work."

Seattle, Wash.—The City Council has ordered the paving of First Ave. S., at an estimated cost of $54,800.

Tacoma, Wash.—Geo. M. Savage & Co., Tacoma, have secured the contract for work in Local Improv. Dist. No. 56, including 4,970 sq. yds. concrete sidewalks, 1,180 cu. yds. fill., 1,100 ft. hand rail, etc., for $10,186, and for work in Local Improv. Dist. No. 52, including 13,763 sq. yds. cement walks, 1,560 cu. yds. fill., etc., for $25,998. N. L. Taylor, City Engr.

Seattle, Wash.—The St. Com. will recommend to the City Council the paving with brick and asphalt on a portion of Bway., at an estimated cost of $16,000.

Watertown, Wis.—Henry Bleber, City Clk., writes that bids are wanted May 9 for paving N. 1st and N. 3d Sts.; probable cost of work, $30,000. G. H. Blanchfield, City Engr.

Waukesha, Wis.—Bids are wanted May 8 for furnishing material and macadamizing portions of Wisconsin St. and Arcadian Ave. John P. Dey, Chmn. Bd. Pub. Wks.

Racine, Wis.—The Bd. of Aldermen has authorized the Bd. of Pub. Wks. to prepare plans, specifications and an estimate of the cost of paving a portion of 5th St.

Lake Geneva, Wis.—Press reports state that the building of a driveway around the lake, a distance of about 27 miles, is contemplated. Chicago summer residents are reported interested.

Oshkosh, Wis.—The City Council has decided to pave with asphalt on Main and Jackson Sts. and Franklin Ave. and with macadam on Nebraska St.

Honolulu, H. I.—Bids will be received May 20 by Henry E. Cooper, Supt. of Pub. Wks., for furnishing f. o. b. wharf 5 and 7-ton steam road rollers, with sufficient H.-P. to operate stone crusher of 8 to 12 tons per hour.

POWER PLANTS, GAS AND ELECTRICITY.

Stockton, Cal.—The City Council has passed an ordinance providing for an election May 28 to vote on the question of issuing $160,000 bonds for the installation of an electric light plant. G. A. Athertou, City Engr.

San Francisco, Cal.—The American River Electric Co. has been incorporated, with a capital of $2,500,000, by H. H. Ferns, H. A. Cooke, and others, of San Francisco, and Hugh Goodfellow, of Oakland, for the manufacture, transmission and sale of electricity, electrical current and electric light, heat, power, and gas.

New Windsor, Colo.—The Bd. of Trus. have granted E. I. Raymond and H. C. Branch a franchise to construct and maintain an electric light and power system in the town of Windsor.

Washington, D. C.—Local press reports state that the Great Falls Power Co. will be ready within a few weeks to let contracts for its plant which will cost about $2,500,000. A corps of engineers under Ch. Engr. Sheriffs are reported to have completed the preliminary work. Allen L. McDermott, Pres. Washington Ry. & Electric Co., and other stockholders of this road are reported interested.

Walter C. Allen, Electrical Engr., writes that the contract for lighting with Welsbach or other high c. p. lights (bids to be opened Mar. 28) has been awarded to the American Lighting Co., of Baltimore, Md., at $25.75 per lamp per yr.

Louisville, Ga.—The citizens are stated to have voted Apr. 23 to issue $20,000 bonds for an electric light plant and water works.

Eastpoint, Ga.—Judge R. F. Thompson is reported to be on the committee to investigate the cost of electric lights for the town.

Belvidere, Ill.—The citizens are stated to have voted to issue $25,000 bonds for a municipal lighting plant.

Quincy, Ill.—The Independent Electric Light & Power Co., which recently secured a franchise, has purchased property, and will soon erect a power house covering a space of 100x125 ft.

Greentown, Ind.—The Indiana Tumbler & Goblet Wks. Co., of this city, will erect a $35,000 artificial gas plant.

Guthrie Center, Ia.—Luther L. Pennock, City Clk., writes that the citizens voted Apr. 20 to grant the Guthrie Center Electric Light Co. a franchise for an electric light plant.

Odebolt, Ia.—The Gas Co. is stated to have secured a site for the construction of a power plant.

Oakland, Me.—The Oakland Electric Co., of Oakland, is reported to have reorganized, increased its capital from $10,000 to $200,000, and purchased from the Messalonskee Electric Co. its property in Oakland, including water power privileges. The purchasers will at once proceed with the development of the power. W. M. Ayer, of Oakland, and W. S. Wyman, of Waterville, are among the directors.

Hudson, Mass.—The citizens are stated to have voted Apr. 22 to appropriate $13,000 for an engine and generator for the municipal light plant.

Standish, Mich.—E. M. Knight, Village Clk., writes that it was voted Apr. 20 to issue $20,000 bonds for water works and an electric light plant, and bids for the bonds will be received May 12.

River Rouge, Mich.—The Special Com. are stated to have reported to Council that a municipal electric light plant would cost $28,800.

Mt. Clemens, Mich.—Henry M. Wisler, of Chicago, Ill., and Chas. Flowers, of Detroit, are stated to have petitioned the Council for a heating and lighting plant.

Owosso, Mich.—The Owosso & Corunna Electric Co. is stated to have secured the contract for lighting the city for 6 yrs.

Duluth, Minn.—Bids will be received May 11 by the Common Council for $40,000 bonds, to be used for extending, improving, and enlarging the water and light plant. H. W. Cheadle, City Clk.

St. Cloud, Minn.—The Council has granted Mr. Carter a franchise for an electric light and power plant.

Breckenridge, Minn.—It is reported that a new engine is proposed for the village electric light plant.

Faribault, Minn.—It is reported that the Polar Star Electric Co. will install a power plant at the Scott mill property and transmit power to this city. A new dam will also be constructed.

St. Louis, Mo.—The Choctaw Gas, Light, Heat & Power Co. has been incorporated; capital, $150,000. Stockholders: Stanley D. Pearce, G. S. Hoss and Manton Davis.

Great Falls, Mont.—Fred. L. Hill, Clk. Bd. Co. Comrs., writes that the only bid received Apr. 20 for furnishing, delivering and installing electrical fixtures in the Court House was that of Mitchell-Vance Co., of New York, N. Y., for $3,000.

Vailsburg, N. J.—The Northern Jersey Light, Heat & Power Co. has been incorporated, with a capital of $100,000. Geo. Francis O'Neill and Jos. Wehrle, of Vailsburg, and Thos. Boyle, of Newark, are the incorporators.

Trenton, N. J.—The Trenton Water Power Co. is having plans prepared for a power plant to be constructed in the neighborhood of the American Bridge Works.

Clayton, N. J.—L. Leddon, Town Clk., writes that the Swedesboro Gas Co. will probably receive a franchise. C. E. Pugh, Secy. & Treas., Witherspoon Bldg., Philadelphia, Pa.

Potsdam, N. Y.—The Municipal Lighting Com. estimates the cost of an electric light plant for Potsdam, at $28,733. F. A. Cassada, Chmn.

Lumberton, N. C.—The citizens are reported to have voted Apr. 15 for electric lights.

Albany, Ore.—It is reported that the Canal & Water Co. will expend about $20,000 in improvements to its electric light plant and system.

Harrisburg, Pa.—Edw. H. Wert, C. Raymond Fritcher and Herbert F. Harris, of Harrisburg, have secured the following charters for gas, heat and electric light companies, to operate in Delaware, Chester and Montgomery Counties, with principal offices in this city. Each company is capitalized at $10,000. The Haverford Township Electric Light Co., Radnor Township Light Co., Radnor Township Heat Co., The Upper Merion Electric Light Co., Newtown Township Electric Light Co., Easttown Township Light Co., Easttown Township Heat Co., Easttown Township Electric Light Co., Willistown Township Electric Light Co., Tredyffrin Township Electric Light Co., and the Radnor Township Electric Light Co.

Pottstown, Pa.—The Peoples Gas Co., of Pottstown, will erect a new gas holder. S. L. Cramer, Supt.

Memphis, Tenn.—A correspondent writes that the petition of the Memphis Con. Gas & Electric Co. has been granted to place underground conduits, at a cost of about $93,000.

Floresville, Tex.—H. C. Thompson, City Clk., writes that the citizens voted Apr. 22 to issue $18,000 bonds for constructing water works and an electric light plant.

Belton, Tex.—C. H. Denny, C. W. Meyers and Thos. Fairweather have purchased the plant of Belton Light & Power Co., and will install a day circuit.

Port Angeles, Wash.—It is stated that the Council will install new machinery at the electric light plant.

New Martinsville, W. Va.—A charter has been granted to the Paden Valley Co., of Pittsburg, Pa., for the construction of water works and for carrying on operations to procure gas and electricity for supplying Paden Valley, in W. Va., with light, heat, power and water; capital, $200,000. The plant is situated between New Martinsville and Sistersville. Incorporators: Thos. A. Watkins, Robt. Miller, and others, all of Pittsburg, Pa.

Monroe, Wis.—The Monroe Gas Co., of Monroe, has been incorporated; capital, $50,000. Incorporators: Colin W. Wright, Fr. B. Luchsinger and Benj. K. Mills.

La Crosse, Wis.—It is stated that the La Crosse Gas & Electric Co. will extend the gas mains.

Regina, Assa., N. W. Ter.—Jas. Balfour, City Secy., writes that it is proposed to construct an electric light plant, to cost $30,000, water works to cost $50,000, and a sewerage system to cost $50,000. Engineer, John Galt, of Toronto, Ont.

ELECTRIC RAILWAYS.

Visalia, Cal.—The Superv. have granted John Hays Hammond and Harold Wheeler a franchise for an electric railway.

Hanford, Cal.—Louis M. Cole has received a franchise for the electric railway in Kings County.

Berkeley, Cal.—The Pacific Improv. Co. is reported to be preparing plans for the construction of an electric railwsy along Berkeley Hills.

Palo Alto, Cal.—John F. Parkinson has petitioned the City Council for a franchise to construct an electric railway.

Stockton, Cal.—H. H. Griffiths has applied for franchises for an electric railway along the Cherokee Lane and the Sacramento Road.

Los Angeles, Cal.—The Los Angeles & Redondo Ry. Co. is reported to have voted to increase its capital from $500,000 to $1,000,000. The new capital to be used in building necessary extensions, increasing wharf facilities and improving the system generally.

Surveys have been completed for the new electric railway to be built from Hueneme to Bakersfield, a distance of 115 miles. Gervaise Purcell, engineer of the road, is in charge of purchasing construction material and equipment. The promoters are: John W. Burson, of Ventura, and Major H. M. Russell, of Los Angeles.

Riverside, Cal.—It is stated that bids are wanted May 12 for an electric street railway franchise. C. H. Stibbens, City Clk.

Santa Cruz, Cal.—The City Council has granted Fred W. Swanton a franchise to operate an electric railway on Pacific Ave. to connect with the electric road that is being constructed to Capitola.

Norwich, Conn.—A resolution incorporating the Norwich, Mystic & Westerly St. Ry. Co. has passed the General Assembly. The company is authorized to construct an electric railway in Norwich, Preston, Ledyard, Stonington and North Stonington, and provision is made for an extension into Rhode Island; capital, $700,000.

Meriden, Conn.—An agreement has been reached between the Meriden Electric R. R. Co. and the Middletown St. Ry. Co., by which the cities of Meriden and Middletown will be connected by an electric railway. It is understood that each company will build and own a section of the connecting line.

Washington, D. C.—John R. McLean and his associates have closed the deal for the purchase of the Great Falls & Old Dominion Electric R. R. The company will probably build a line from the Virginia end of the Aqueduct Bridge to Great Falls as soon as the bridge has been repaired by the District Government and its superstructure altered to allow laying of tracks for the railway. John R. McLean and R. D. Weaver are among the new directors.

A certificate of the incorporation of the U. S. Lighting & Traction Co. of the District of Columbia has been filed; capital, $2,000,000. Incorporators: Edw. White, of Washington, D. C.; Herbert L. Stillman, of West Acton, Mass., and Thos. W. Bickwell, of Providence, R. I.

The East Washington Heights Traction Co. has secured a franchise for an electric railway on Pennsylvania Ave. S. E., from the terminus of the Capital Traction Co.

Kewanee, Ill.—An electric railway is projected to connect Morrison, Annawan, Hooppole and Prophetstown. Chas. Dunbar, of Kewanee, is reported interested.

Springfield, Ill.—The Springfield & St. Louis R. R. Co. is stated to have decided to construct an electric railway from Springfield to St. Louis. Horace Riordan, Pres.

Monmouth, Ill.—Articles of incorporation have been filed by the Illinois Union Ry. Traction Co., with a capital of $500,000, to construct a system of interurban electric roads north from Monmouth to Aledo, Rock Island and Muscatine, and from Monmouth south to Roseville, Macomb, Hamilton and Keokuk. Incorporators: P. E. Elting, of Macomb, Ill.; W. H. Beaver, of Abingdon, Ill.; S. S. Hallam, of Monmouth, and others.

Michigan City, Ind.—The Chicago & South Shore Ry. Co. has increased its capital from $300,000 to $1,000,000. The company will expend the $700,000 in extending its line which connects Michigan City and LaPorte, east to South Bend.

South Bend, Ind.—The City Council has granted a franchise to the Chicago Air Line Electric Ry. Co., giving the company entrance to the city for the proposed route from Chicago, via Michigan City. The road is backed by J. B. Hanna and Judge C. M. Stone, of Cleveland, O.

Hammond, Ind.—The Union Traction Co., of Indiana, is stated to have secured franchises from Hammond, Valparaiso and Hobart for a line which will connect Indianapolis with Hammond and there join the electric system to Chicago.

Anderson, Ind.—Franchises have been granted to the Richmond & Northwestern Traction Co. and to the Union Traction Co. for electric railways from this city to Newcastle and Richmond.

Muskogee, I. T.—John J. Geghan, of Cincinnati, O., is stated to have petitioned Council for a franchise to build an electric railway. It is the intention to connect Webber Falls and Muskogee.

Burlington, Ia.—John W. Topping and others propose constructing an electric railway to Farmington.

Wichita, Kan.—The findings of the experts employed to report on the feasibility of building an electric railway from Wichita to Arkansas City have been reported to the Wichita Interurban R. R., which has the road in contemplation. It has been decided formally to charter a company to build the road, and to go ahead with the details. A. H. Barnes, of Oxford, and A. L. Barner and S. C. Barnett, of Belle Plaine, have been added to the board of directors of the company.

Easton, Md.—The Eastern Shore Improv. Co. is said to be considering the advisability of building an electric railway to connect Cambridge Ferry, Easton, and Love Point.

Cumberland, Md.—The Co. Comrs. have granted a franchise to the Lake Westernport & Keyser Ry. Co., recently incorporated, to use the county roads from Luke to McCoole, Md. The completion of the line contemplates a bridge across Potomac River, one-half of the cost to be borne by company and the other half by County.

Melrose, Mass.—The Aldermen are stated to have granted a franchise to the Boston & Northern St. Ry. Co. for laying double tracks from the Wakefield town line to Porter St.

Fall River, Mass.—The Secretaries of the States of Massachusetts and Rhode Island have forwarded to Abraham Manchester, of Adamsville, R. I., notice that a charter is issued for the proposed electric railway which will be built to connect with the Old Colony system at Stafford Road terminus, Fall River, and run to Adamsville, across the bridge to Horseneck, thence to Russell's Mills, a distance of 22 miles, and connecting with the Union St. Ry. in New Bedford at Bliss's Corners. J. C. McKenzie, of Fall River, and Gifford Cornell, of Westport, are also interested.

Topsfield, Mass.—The notices of the incorporation of the Haverhill, Danvers & Ipswich Street Railway Co. are being advertised. The company is to build an electric railway from Boxford through Groveland, Georgetown, Rowley, Ipswich and Topsfield, a terminus, and to connect with the Essex County St. Ry. at Bixby's corner, in Ipswich. Its length will be 20 miles. Jos. N. Green, of Boston; Chas. M. Perley, of Ipswich, and Alphonso T. Merrill, of Topsfield, are interested.

Muskegon, Mich.—The work of surveying the right of way for the new interurban from Grand Rapids to Hart has begun. F. A. Nims is the local promoter.

Sault Ste. Marie, Mich.—The Street Ry. Co. is reported to be making surveys for an extension to Algonquin.

Hibbing, Minn.—The Mesaba Electric Ry. Co. has petitioned for a franchise through this city.

Great Falls, Mont.—John D. Ryan and his associates have been granted a 25-year franchise for the construction of an electric railway here.

Gardnerville, Nev.—It is stated that a company to be known as the Gardnerville & Carson Electric R. R. is to be organized to build an electric railway to connect Gardnerville and Carson.

Elizabeth, N. J.—The Council has granted permission to the Essex Cross Ry. Co. to extend its proposed line from the outskirts of Elizabeth through Union Ave. and West Grand St. to Broad St.

Atlantic City, N. J.—The Central Passenger Ry. Co. has been incorporated, with a capital of $40,000, to build an electric railway here. The route to be applied for is from Adriatic Ave. to the Boardwalk, on Virginia Ave. and South Carolina Ave. Wm. McLaughlin, Louis Kuehule and John A. Jeffries, of Atlantic City, are interested.

Alamagordo, N. M.—The Alamagordo St. Ry. Co. has been organized, with a capital of $50,000, to build and operate a street railway and electric light system. Arthur P. Jordan, Wm. Hodge and Thad. H. Llayford of Alamagordo, are interested.

Oyster Bay, L. I., N. Y.—The Highway Comrs. have granted two electric railway franchises—one to the South Shore Traction Co. for an east and west line running through the lower portion of the town, and another to Wilkins K. Putnam for a cross island route.

Batavia N. Y.—The Aldermen have granted a franchise to the Buffalo & Depew Electric Ry. Co. for the construction of its line through Batavia.

Newburg, N. Y.—The Orange County Traction Co. is reported to be considering the advisability of extending its lines from Walden to Montgomery.

Little Falls, N. Y.—It is stated that J. M. Farley, of White Plains, is forming a company to build an electric railway from Johnstown to Little Falls.

Holley, N. Y.—A franchise has been granted the Albion Electric Ry. Co. to build an electric railway through the northern part of the village of Holley, crossing Main, Union and Canal Sts.

White Plains, N. Y.—Supreme Court Justice Keogh, at White Plains, has signed the final orders granting a franchise to the New York & Port Chester Electric Ry. Co. to build its four-track third-rail rapid transit system over the highways in the towns along the northern shore of Long Island Sound. The company intends to build a road from Port Chester to New York, connecting with the New York Subway.

New York, N. Y.—See "Water."

Medina, N. Y.—The Union Traction Co. recently secured permission from the State R. R. Comn. to construct a line to connect Batavia, Medina, Lyndonville and Olcott, and will be ready in a few days to receive bids for construction and equipment. It will be 50 miles long, and principal office will be at Medina.

Oak Harbor, O.—The Council has granted a franchise through town to the Toledo, Port Clinton & Lakeside Ry. Co.

Marion, O.—M. C. Ayre, of Marion, has applied to the Co. Comrs. for a franchise for the Mt. Vernon, Mt. Gilead & Western Ry. Co.

Toledo, O.—The Toledo, Bowling Green & Southern Traction Co. is planning to reconstruct a portion of its line between Findlay and Toledo in order to eliminate a number of curves.

The Aldermen have granted two ordinances to the Toledo Rys. & Light Co. to extend its lines on Wayne St. and on Starr Ave. and E. Broadway St.

The Toledo, Port Clinton & Lakeside Ry. Co. is reported to have awarded a contract to the Westinghouse Co. for its electrical equipment and to the Erie City Iron Wks. Co. for engines and boilers.

The People's Itapid Transit Co. has increased its capital to $500,000. It is claimed that right of way has been secured from Toledo to Greenville, 123 miles, and that construction work will begin May 1.

The Toledo & Chicago Construction Co. has been incorporated, with $10,000 capital stock, by J. R. Seagrave, J. H. Ainsworth and others, to have charge of the construction of the Toledo & Chicago Interurban Ry.

Portsmouth, O.—The Portsmouth St. Ry. & Light Co. is reported to be planning to make important extensions to its system in Portsmouth. The company will build its new power house at Millbrook Park, near Yorktown.

Hamilton, O.—Frank Hughes, of Hughes Station, is reported interested in a railway from Hamilton to Lebanon by way of Hughes.

Galion, O.—Chas. Brumfield, of Mansfield, has secured a franchise in Galion for the proposed electric railway from Mansfield to Galion.

Springfield, O.—The Bushnell syndicate is planning the erection near Springfield of a large power station with which to operate the Springfield, Troy & Piqua line and the Springfield & Xenia line, recently acquired by the syndicate.

Newark, O.—The Columbus, Buckeye Lake & Newark Traction Co. has secured a franchise for the extension of one of its local lines in Newark.

Cincinnati, O.—The Cincinnati, Milford & Eastern Traction Co. has completed plans and specifications for all the material that will be required for building and equipping the road, and all contracts will be closed in the near future.

Elyria, O.—The Elyria, LaGrange & Southern Traction Co. has been incorporated, with a capital of $80,000, by F. H. Foster, H. J. Ely, and others. The company has secured private right of way from Elyria to LaGrange.

Mt. Vernon, O.—The Mt. Vernon, Mt. Gilead & Western Railway Co. is stated to have practically secured all franchises and rights of way required. W. C. Bennett, of Mt. Gilead, is one of the promoters.

Perintown, O.—The Cincinnati & Columbus Traction Co. is having plans prepared for a power station to be erected at Perintown, with sub-stations at Perintown, Milford, Fayetteville and Hillsboro. Philip C. Swing, of Cincinnati, is reported interested.

Greenville, Pa.—The Boro. Council has granted a street railway franchise to Ernest Acheson and J. V. Clark, of Washington, Pa., and W. I. Berryman, of Pittsburg, who recently purchased the plant of the Greenville Water Co. The line is to be a local one, and is called the Greenville & Westside St. Ry.

Ambridge, Pa.—A correspondent writes that the construction of an electric railway through this new town is under consideration. I. A. Gasteiger, Engr. in Charge of all work, 323 Rosedale Ave., Pittsburg.

Providence, R. I.—An act incorporating the Western Rhode Island Ry. Co. has been passed by Legislature. The company is authorized to build an electric railway from a point on the line of the Rhode Island Suburban Ry. Co. at or near the village of Hope, in the town of Scituate, through Scituate and the towns of Smithfield, Gloucester and Burrillville, to a point on Wallum Pond in said town of Burrillville; capital, $1,000,000. Franklin P. Owen and Geo. W. Prentice are the incorporators.

Greenville, S. C.—The City Council has granted a franchise to Geo. E. Coughlin, Jas. F. Wilson and associates to construct an electric railway between Greenville and Anderson.

Beaumont, Tex.—Edw. Kennedy has secured a franchise for the construction of an electric railway in this city, with the understanding that the line will be built to Sour Lake.

Bennington, Vt.—A charter is stated to have been granted to the Bennington & North Adams St. Ry. Co. to construct a line about 20 miles in length; capital, $150,000. Geo. F. Graves, of Bennington, Pres. First Natl. Bank, is reported interested.

Clarksburg, W. Va.—Clarence M. Watson, of the Consolidation Coal Co., and J. H. Wheelright are reported to have purchased the electric railway of Fairmont and Clarksburg, W. Va. It is reported they will build a connection from Monongah, 6 miles out of Fairmont, to Clarksburg, 26 miles.

Morgantown, W. Va.—The Comrs. of Monongahela and Marion Counties have granted the Fairmont, Morgantown & Cheat River R. R. Co. a right to begin at once the construction of an electric railway connecting Fairmont, Morgantown and the Cheat River Valley with the Pittsburg, McKeesport, Connellsville Ry.

Stevens Point, Wis.—The Wisconsin River Ry. & Power Co. has secured a franchise for a street railway through the city.

RAILROADS.

Gadsden, Ala.—The Seaboard Air Line is reported to have a corps of engineers surveying for an extension from Lock Three to Gadsden. W. W. Gwathmey, Jr. Ch. Engr., Portsmouth, Va.

Central City, Colo.—The Denver, Yankee Hill & Western Ry. Co. has been incorporated, with a capital of $500,000, to construct a railroad from Central City to Russell Gulch and to the town of Alice. Incorporators: John McShane and E. E. Seymour, of Central City; George R. Stewart, of Alice, and others.

Washington, D. C.—A press report states that bids will be received on May 11 by W. H. Brown, of Philadelphia, Pa., Ch. Engr. Pennsylvania R. R., for the construction of 2 tunnels and a 2-track line about 5 miles in length. This is the first step toward the construction of the Washington terminal and union station.

Apalachicola, Fla.—A charter has been granted to Chas. B. Duffy, of Worcester, Mass. H. O. Clements, of Valdosta, Ga., and others, for the construction of a railroad from Apalachicola to River Junction, Fla., a distance of about 70 miles.

Blueridge, Ga.—A charter has been granted to the Tennessee, Georgia & South Carolina R. R. Co.; capital, $250,000. The road is to be built from Blueridge, Ga., to Anderson, S. C., a distance of about 50 miles. Wm. A. Frank, Pres., Chicago, Ill.

Louisville, Ky.—Local press reports state that contracts will be let about May 15 for the construction of the steam railroad proposed from Cincinnati to Louisville via Madison. H. L. Jackson, Ch. Engr.

Eustis, Me.—The Eustis R. R. Co. has been incorported, with a capital of $48,000, by Fletcher Pope, H. F. Beedy, J. H. Byron, and others, to construct a railroad 16 miles in length, extending from the Phillips & Rangeley line in Dallas Plantation through Longtown and Coplin plantations to Redington Township.

Baltimore, Md.—A press report states that it is proposed by the Gould syndicate to construct 390 miles of railroad between tidewater and a few miles west of Pittsburg, to construct terminals at Pittsburg costing $1,250,000, and invest $3,000,000 in docks and lines near Baltimore, as well as $1,000,000 at a number of Virginia points. Extensive sums will also be invested in Toledo, where the Ann Arbor syndicate will co-operate with the Wabash to connect the two lines. Jos. Ramsey, Jr., Pres., St. Louis, Mo.

Cloquet, Minn.—A press report states that the Weyerhaeuser interests propose extending the Duluth & Northeastern R. R. (H. C. Hornby, Mgr., Cloquet) from Island Lake, on Little Cloquet River, to Cloquet, a distance of 25 miles.

Decatur, Miss.—A charter is stated to have been granted to the Gulf & Chicago R. R. Co. to construct a line from Decatur to Jackson, Tenn. W. A. Liddell, of New Albany, Miss., and C. F Morgan, of Ripley, Miss., are among the incorporators.

New York, N. Y.—The Legislature is reported to have passed bills authorizing the enlargement of the terminal of the New York Central in New York (Henning Fernstrom, Ch. Engr.) and permitting the construction of the Pennsylvania Railroad's tunnel terminal station in New York (W. H. Brown, Ch. Engr., Philadelphia, Pa.).

A press report states that improvements to cost about $1,000,000 are contemplated by the Central R. R. of N. J. in New York City. Jos. O. Osgood, Ch. Engr., Jersey City, N. J.

Ellicottville, N. Y.—The Ellicottville, Mansfield & East Otto R. R. Co., of Ellicottville has been incorporated; capital, $300,000. Directors: Chas. C. Locke, of Randolph; Devin S. Laing and F. H. Holmes, of East Otto.

Plymouth, O.—It is stated that the Lake Shore R. R. Co. will soon commence the construction of additional yards at Plymouth, O.; 69 car tracks will be laid; probable cost of work, $100,000.

Sandusky, O.—A press report states that the Chicago Short Line and associate railroads will build from Sandusky to Beaver, Pa., and construction will begin about June 1.

Cleveland, O.—A charter has been granted to the Lake Erie, Ravenna & Southern R. R. Co., of Cleveland, to construct and operate a steam railroad between Mentor Marsh and Alliance; capital, $50,000. J. E. Mosley, E. A. Foote and Virgil P. Kline are among the incorporators.

The Newburgh & South Shore Ry. Co., of Cleveland, has increased its capital from $25,000 to $750,000. It will build a road from the central furnaces north of the Erie tracks to the Newburgh steel works. A rolling lift bridge will be constructed across Cuyahoga River. C. A. Gallagher, Gen. Supt., Newburgh.

Lorain, O.—The Lake Erie & Southern R. R. Co. has been incorporated at Columbus, with a capital of $100,000. The road will extend from Lorain through Amherst and Russia Townships to or near Oberlin and to Wellington.

Flushing, O.—Local press reports state that bids are now being received at the office of Dist. Engr. W. B. Hanlon, Cleveland, O., for the work of making over the Baltimore & Ohio road from Flushing to Bellaire, O., a distance of 32 miles. The work will involve an expenditure of over $1,500,000.

Port Perry, Pa.—A charter is reported to have been granted to the Allegheny & Westmoreland R. R. Co. for the construction of a line from Port Perry, on the main line of the Baltimore & Ohio, to a point near Mt. Pleasant, Pa., a distance of about 28 miles. Directors: W. B. Linn, T. B. Franklin, and E. S. King, all of Philadelphia.

Pittsburg, Pa.—A press report states that the Pittsburg, Lisbon & Western R. R. Co. has completed securing rights of way for its north and west extensions. The extensions involve about 31 miles of road, 8 miles of which will be heavy and extensive; probable cost of work said to be $1,000,000. K. E. Barlinger, Supt., Lisbon, O.

Philadelphia, Pa.—Local press reports state that bids will be received by W. H. Brown, of Philadelphia, Ch. Engr. Pennsylvania R. R. Co., for work on six divisions. Part of the work will consist of changing the line of the road.

Jasper, Tenn.—It is stated that the Cumberland Mountain Coal, Iron & Ry. Co. will construct a line from Kismet to Jasper or South Pittsburg. J. H. McCord, Pres., West Point, Miss.

Jackson, Tenn.—A charter has been granted to the Gulf & Chicago R. R. Co. to construct a railroad from near Jackson to a point on the boundary line between Tennessee and Mississippi, in Hardeman County; capital, $50,000.

Orondo, Wash.—The Washington Ry. Co. has been incorporated, with a capital of $100,000, to construct a railroad from Orondo, on the upper Columbia via Waterville, through the Big Bend wheat district.

Charleston, W. Va.—The Imhoden & Odell R. R. Co. has been incorporated, with a capital of $500,000, to build and operate 43 miles of railroad in Kanawha County, W. Va. Edw. S. Jones, Pres., Scranton, Pa.

Hoult, W. Va.—The Fairmont & Colfax R. R. Co. has been incorporated to build a railroad from Hoult to Colfax; capital, $25,000. Incorporators: Levi B. Harr, M. F. Hutchinson, and others, all of Fairmont, W. Va.

PUBLIC BUILDINGS.

Birmingham, Ala.—It is stated that bids are wanted May 16 for erecting the First Christian Church at 3d Ave. and 21st St. D. A. Helmich, Archt., 306 N. 19th St.

Denver, Colo.—Varian & Edwards, of Denver, have prepared plans for a 3-story brick and stone building as Home for Nurses to be erected on 19th and Pearl Sts., to cost $30,000.

The plans of T. McLaren, of Colorado Springs, are stated to have been accepted for the Colorado building for the La. Purchase Exposition. The structure will be 70x90 ft. and cost about $25,000.

Noroton, Conn.—Bids are wanted May 11 for erecting an addition to the hospital at the Soldiers' Home. Henry H. Gallup, State Treas., Hartford.

Athens, Ga.—The city has decided to undertake the construction of the City Hall under the direction of J. W. Barnett, City Engr.

Louisville, Ga.—The County Bd. of Roads and Revenues is reported to be considering the erection of a court house, to cost $30,000.

Moscow, Idaho.—The regents of the Univ. of Idaho desire a general plan June 5 to which the buildings required by the future growth of the university shall conform; also a complete set of plans for a combined armory and gymnasium, to cost not more than $25,000. Address H. T. Condon, Registrar.

Lewiston, Idaho.—Galbrath & Jones, of Spokane, Wash., are reported to have been commissioned to prepare plans for the jail in addition to the court house; probable cost, $40,000.

Monmouth, Ill.—Bids will be received May 16 by the Co. Comrs. for furnishing material for erecting an Alms House. J. A. Beadle, Archt., Galesburg. J. D. Diffenbaugh, Chmn.

Carthage, Ill.—A correspondent writes that bids were recently opened and rejected for the Hancock County Court House, and new bids will be received by the Bd. of Superv. recently elected; probable cost, $100,000.

Richmond, Ind.—Contracts are about to be let for a home for the Sisters of St. Marys Parish, to cost $20,000. Architects, Mariatt & Co., of Richmond.

Greencastle, Ind.—P. F. Stoner, Co. Aud., writes that the plans of J. W. Gaddis, of Vincennes, have been accepted for the court house; probable cost, $200,000.

Logansport, Ind.—It is stated that Judge D. D. Dykeman will erect a hospital for this city; probable cost, $50,000.

Lafayette, Ind.—Plans for the 4-story brick Y. M. C. A. building to be erected here have been accepted by the building committee; estimated cost, $50,000.

Indianapolis, Ind.—Bids will soon be received for the erection of a market house here, to cost $30,000.
Plans are about to be prepared for the Indiana Building to be erected at the St. Louis Exposition; appropriation, $150,000. Newton W. Gilbert, of Ft. Wayne, Pres. Bd. of Comrs.

Remsen, Ia.—It is stated that the Catholics propose erecting a $75,000 church. Rev. F. X. Schulte, Pastor.

Osawatomie, Kan.—Bids are wanted May 4 for erecting an ice and cold storage plant of 20 tons capacity at the Osawatomie State Hospital. L. L. Uhls, Supt.

Emporia, Kan.—It is stated that bids are wanted by the Co. Comrs. until May 12 for erecting a jail and sheriff's residence. C. W. Squires, Archt., 613 Exchange St.; W. F. Eggers, Co. Clk.

Louisville, Ky.—Andrew Carnegie is atated to have offered this city $250,000 for the erection of a library.

Baltimore, Md.—It is stated that the Calhoun St. Disciples will erect a $40,000 edifice. Rev. Peter Ainslie, Pastor. Chas. E. Cassell, Archt.

Marlboro, Mass.—The Bd. of Aldermen is reported to have voted to rebuild the city hall recently burned; estimated cost, $75,000.

Jackson, Mich.—Bids will be received May 19 by the Carnegie Library Com. for erecting a library. B. L. Carlton, Secy.

Perham, Minn.—The Catholic Society is stated to have decided to erect a church, to cost about $30,000. Rev. Father Schout, Pastor.

Monticello, Miss.—Bids are wanted June 1 for erecting a county jail at Monticello. W. H. Sprights, Clk. Bd. Superv.

Moberly, Mo.—Bids are wanted May 14 for erecting a library. Legg & Holloway, Archts., 715 Locust St., St. Louis.

Fulton, Mo.—Gen. M. F. Bell is reported to have submitted plans for the State Hospital for the Insane, to cost about $35,000.

St. Joseph, Mo.—The Congregation of the First Methodist Church is reported to be considering the erection of an edifice, to cost about $50,000. Rev. B. F. Crissman, Pastor.

Albany, N. Y.—Local press reports state that bids will probably be received by the Bd. of Contract & Supply until May 11 for erecting a hospital for contagious diseases. Appropriation, $40,000.

New York, N. Y.—Bids will be received May 7 by Homer Folks, Comr. Dept. of Pub. Charities, for furnishing material for erecting a reception hospital on Randall's Island; also a solarium at the Metropolitan Hospital, Blackwell's Island.

Brooklyn, N. Y.—The following bids were opened Apr. 29 by Thos. Sturgis, Fire Comr., for a building for Engine Co. 146 on E. 23d St., near Voorhees Ave., Sheepshead Bay, and one for No. 145, on W. 8th St., near Sheepshead Bay Road: Jas. McFerran, $59,683; Geo. Hildebrand, $67,550; D. J. Ryan, $68,600; Tolmie & Kerr, $74,292; Wm. Horne Co., $82,398.

Millersburg, O.—Bids are wanted May 18 for furnishing material for erecting a hospital at the Co. Infirmary. M. C. Mackey, Co. Aud.

Columbus, O.—Bids will be received May 21 by the Ohio Comn. for the Louisiana Purchase Exposition for furnishing material for erecting the Ohio building for the St. Louis Purchase Exposition. Frank L. Packard, Archt., New Hayden Bldg. S. B. Rankin, Executive Comr.
Bids will be received May 18 for erecting the Eastwood Congregational Church. Frank L. Packard, Archt., Hayden Bldg.
Bids will be received May 13 for ventilating, gas fixtures etc., for Senate Chamber and House of Representatives, Ohio State Capitol. Frank L. Packard, Archt., Hayden Bldg.

Chillicothe, O.—Bids will be received May 16 for erecting a stone Methodist Episcopal Church. Frank L. Packard, Archt., Hayden Bldg.

Gallipolis, O.—Frank L. Packard, Archt., Columbus, writes that the contract for furnishing material and erecting cottages "A" to "E," also farmhouse for the Ohio State Hospital for Epileptics, bids for which were received by Bd. of Trus. Apr. 23, has been awarded to Caldwell & Drake, of Columbus, Ind., for $68,998.

Cincinnati, O.—Elzner & Anderson, 18 E. 4th St., are stated to be preparing plans for a building for the elephants of the Zoological Garden; approximate cost, $60,000.

Toledo, O.—Cram, Doodhue and Ferguson, of Boston, Mass., are stated to have been selected to prepare plans for an edifice for the Congregation of St. Mark's Church, to cost $40,000.

Bradford, Pa.—Bids will be received May 11 by A. J. Bond, Chmn. Bldg. Com., for erecting an opera house exclusive of foundation; estimated cost, $85,000.

Philadelphia, Pa.—It is stated that plans are being prepared for 4 buildings for Hahnemann Hospital; cost in all, $300,000.

Burrillville, R. I.—It is stated that bids are wanted May 14 for erecting a sanitorium. C. A. Potter, Chmn. Comn.

Darlington, S. C.—Competitive plans and specifications will be received May 16 by the Bd. of Co. Comrs. for erecting a court house. W. A. Dowling, Co. Superv.

Richmond, Va.—The Church of the Covenant (Rev. J. Calvin Stewart, Pastor) will erect a new edifice. Plans not yet prepared.

Whitewater, Wis.—Bids will be received May 5 by N. M. Littlejohn, Pres. Bd. of Trus., Whitewater Memorial Library Assoc., for erecting a library. Claude & Starck, Archts., Madison.

Winnipeg, Man.—It is stated that bids are wanted May 15 for erecting a stone church. Address J. J. W. Bell, Hicksvale, P. O. Assa.

BUSINESS BUILDINGS AND DWELLINGS.

Birmingham, Ala.—It is stated that a site has been selected for the erection of the Y. M. C. A. building; probable cost, $75,000.

San Francisco, Cal.—Chas. J. Rousseau is stated to have prepared plans for a 6-story building to be erected at Bush and Powell Sts., for M. Fleisher; estimated cost, $80,000.

Springfield, Mass.—W. B. Reid, of Holyoke, is preparing plans for a block of 32 flats, 4 stories high, to be erected on State St., for A. A. and S. T. Bael.

Boston, Mass.—A permit has been issued for the erection of an annex to the Walter Baker & Co. chocolate mill at Dorchester, to be of brick, 158x33 ft., and 3 stories high. Architects, Winslow & Bigelow, 3 Hamilton Pl. Builder, Jas. Smith, 166 Devonshire St.; estimated cost, $25,000.

Flint, Mich.—Pratt & Haeppe, of Bay City, are about to receive bids for a new hotel for W. A. Patterson, of Flint, Mich.

St. Louis, Mo.—Thos. J. Prosser is stated to have prepared plans for a 300x200-ft. temple for the World's Fair Fraternal Bldg. Assn.; estimated cost, $200,000. Noah M. Givan, Pres. Bd. of Dir.

Kansas City, Mo.—J. O. Hogg, Helat Bldg., has prepared plans for a $20,000 barn for the Depot Transfer Co., to be erected on 4th and Wyandotte Sts.
J. H. Hamrick, Jr., will erect brick dwellings at 3624 to 44 Wyandotte St., to cost about $60,000.
A. Van Brunt & Bro., 716 Delaware St., are the architects for a brick store to be erected at 1009 W. 64th St. for the Sewell P. & G. Co., to cost $38,000.
W. L. Bell, Mgr. Century Theater, is reported to be considering the erection of a theater here, to cost $125,000.
The Scottish Rite Masons are reported to have had plans prepared for a temple to be erected at 15th and Troost Sts.; probable cost, $50,000.

Buffalo, N. Y.—It is stated that the University Club has decided to erect a building at Delaware Ave. and Allen St., to cost about $50,000.

New York, N. Y.—See "Railroads."

Columbus, O.—The Bronson Blk. and the Union Clothing Co.'s building are reported destroyed by fire Apr. 26.
Bids will be received May 6 for remodeling the Hayden-Clinton National Bank. Frank L. Packard, Archt., Hayden Bldg.

Cincinnati, O.—The Harrison Estate is stated to have decided to erect a 10-story, 57x100-ft. building on 4th St.; estimated cost, $100,000.

St. Marys, O.—C. W. Schmehl, Secy. Shawnee Temple Co., writes that the contract for erecting the I. O. O. F. temple at E. Spring and Spruce Sts. (bids opened Apr. 9) has been awarded to W. F. Brodbeck, of St. Marys, for $10,929, including heating and plumbing.

Cincinnati, O.—Saml. Hannaford & Sons, Hulbert Blk., are reported to have prepared plans for a building to be erected at 5th St. and Bway. for John Van Rouge Co.; probable cost, $100,000.

Philadelphia, Pa.—Newman & Harris are stated to have been selected to prepare plans for a 6-story building to be erected at 32 N. 11th St. for H. C. Kahn; probable cost, $30,000.

Philadelphia, Pa.—Wm. J. Gilmore is reported to have purchased a site at 15th and Chestnut Sts., for the erection of a theater thereon; probable cost, $200,000.

Ambridge, Pa.—Numerous business buildings and dwellings are about to be constructed at the new town of Ambridge I. A. Gasteiger, 323 Rosedale Ave., Pittsburg, Engr. in Charge.

Allegheny, Pa.—Ellsworth Dean, 331 4th St., Pittsburg, is reported to be preparing plans for a 6-story, 54x100-ft. building to be erected on Federal St. for Boggs & Buhl.

York, Pa.—John D. Mishler is reported to have decided to erect an opera house here, to cost $100,000.

Roanoke, Va.—The Norfolk & Western R. R. Co. (Gen. P. Johnson, Div. Supt.) is stated to have prepared plans for an addition to the round house, to cost about $150,000.

Edmonton, Alberta, N. W. Ter.—J. H. Johnson is preparing plans for 75x100 brick and stone business block, for C. Sandison to cost about $25,000.

SCHOOLS.

Los Angeles, Cal.—It is reported that the following architects have been selected by Bldg. Com. of City Council to prepare plans for the following schools: Polytechnic High School, Burnham & Bliesner, $200,000; Westlake School, Solano Ave., $59,200, Hudson & Munsell; 30th St. and Custer St. Schools, $35,900, E. Weisser; 28th St., $28,800, Train & Williams; Prospect Park and Hostetter St., $23,900, Thornton Fitzhugh; Harper and Casco St. Schools, $21,900.

San Francisco, Cal.—An ordinance is stated to have been passed providing for the erection of 17 schools.

Pocatello, Idaho.—It is stated that bids are wanted by the Bd. of Trus. until May 12 for erecting a dormitory for the Academy of Idaho. C. G. Rose, Secy. pro tem.

New Albany, Ind.—It is stated that bids will soon be received for the erection of the high school at E. Spring and 6th Sts.; probable cost, $75,000.

Richmond, Ind.—It is proposed to erect a $10,000 addition to the high school. Wm. Kaufman, Archt., Hutchinson Blk.

Bedford, Ind.—Bids will be received May 18 by the Bedford School City for remodeling and erecting an addition to the high school in W. Bedford. M. Pritchett, Archt., "K" and 14th Sts.; bids will also be received June 16 for erecting an 8-room school in E. Bedford. S. B. Lowe, Secy.

Ft. Dodge, Ia.—Rev. E. Heelan, Pastor Sacred Heart Church, writes that the contract for erecting a 2-story and basement brick parochial school (bids opened Apr. 23) has been awarded to W. J. Zitterell, of Webster City, for $15,475.

Orono, Me.—Bids will be received May 6 by Geo. Emory Fellows, Pres. Univ. of Maine, for the mason work on foundation for an engineering building for the Univ. of Maine. Thomas & Crowell, Archts., Bangor.

Wenham, Mass.—The citizens are stated to have voted to erect a school at Cherry and Main Sts., to cost $15,000.

No. Chelmsford, Mass.—It is stated that bids are wanted May 5 by the Co. Comrs. for erecting a dormitory building at the truant school. H. P. Graves, Archt., 40 Middlesex St., Lowell.

Attleboro, Mass.—It is stated that bids are wanted by the School Bd. until May 5 for erecting an extension to the high school at Bank and Peck Sts. C. E. Bliss, Chmn., 20 Peck St.

East Boston, Mass.—Bids will be received May 4 by the Schoolhouse Comrs. for masonry, etc.; also installing plumbing system in the old E. Boston High School. R. Clipston Sturgis, Chmn.

St. Paul, Minn.—E. J. Daly, 36 W. Lawson St., has secured contracts for erecting the Davis School, for $12,921, and an addition to Irving School, for $25,939.

Meridian, Miss.—It is stated that the East Mississippi Female College recently destroyed by fire will be rebuilt, at a cost of about $75,000.

Rolla, Mo.—Bids will be received May 11 by Dr. John D. Vencil, Chmn. of the Executive Com., 510 Pine St., St. Louis, for completing the new main building of the State School of Mines and Metallurgy, including heating, plumbing, electric wiring, etc. Van Brunt & Howe, Archts., Kansas City.

New Brunswick, N. J.—New Jersey Hall of the Rutgers College is reported destroyed by fire Apr. 23.

New York, N. Y.—See "Water."

Brooklyn, N. Y.—Jas. Fay, 205 E. 51st St.; New York City, has secured the contract for sanitary work in School 142, Boro. of Brooklyn, for $14,987, and Hartman & Horgan, 287 4th Ave., New York City, for sanitary work and improvements to Schools 27 and 43, Boro. of Brooklyn, at $7,470 and $17,800 respectively (bids opened Apr. 27).
Bids will be received May 11 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work and alterations in school No. 84.

New York, N. Y.—The Otis Elevator Co., 71 Bway., bid $14,950 for installing elevators in Morris High School, Boro. of Bronx, bids opened Apr. 27.
Bids will be received May 11 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary work in school No. 23, Boro. Bronx.

Alexandria Bay, N. Y.—Williams & Johnston, of Ogdensburg, have prepared plans for a 6-room addition to the old school at this place. A. H. Houghton, Chmn. School Bd.

Long Island City, L. I., N. Y.—Bids will be received May 11 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work and alterations in school No. 51, Boro. Queens.

New Brighton, N. Y.—Bids will be received May 11 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work; also installing ventilating and heating apparatus in school No. 34, Boro. Richmond.

Marietta, O.—It is stated that bids are wanted by the Bd. of Educ. until May 21 for furnishing sanitary plumbing, steam heating and ventilating system in the Norwood school. C. H. Danford, Clk.

Columbus, O.—Bids will be received May 23 by Lucian Livingston, Clk. Bd. of Educ. of Marion Township, P. O. Columbus, for erecting a 4-room school in Dist. No. 6. D. Reibel, Archt., Rms. 61 and 62 Eberly Blk.

Martins Ferry, O.—Bids are wanted May 14 for erecting a school. Address S. F. Dean.

Green, O.—Bids will be received May 16 by the Bd. of Educ. for erecting a school. Oscar Ellis, Clk.

Cleveland, O.—Bids are wanted May 18 for furnishing material for erecting a school on Fruitland Ave., including gasfitting, plumbing and sewers; also a school on Mill St., including ventilating, heating, plumbing, sewers, gasfitting, structural iron and steel, fireproofing, electric wiring, etc. Starr Cadwallader, School Dir. Bd. Educ.

Glenville, O.—Bids will be received May 21 by C. A. Judson, Clk. Bd. of Educ., for furnishing material for erecting a 12-room brick school, including ventilating, heating, plumbing, sewers and gas fitting, structural iron and steel, fireproofing, electric wiring, etc. F. S. Barnum & Co., Archts., Rose Bldg., Cleveland, O.

Reading, Pa.—Contracts for erecting schools have been awarded as follows: To D. E. Dampman, for a 12-room school at 10th and Green Sts., for $29,804, and to Geo. Meinholz, for a 4-room school on Maple and Cotton Sts., for $11,543.

Anderson, S. C.—Bids will be received May 7 by the Bldg. Com. for erecting a brick school. Thos. C. Walton, Secy.

Charleston, S. C.—Bids will be received May 9 by the Com. of City Bd. Pub. School Comrs. for remodeling the Memminger school. A. W. Todd, Archt., No. 28 King St. Jas. Simons, Chmn.

STREET CLEANING AND GARBAGE DISPOSAL.

Elwood, Ind.—A press report states that a garbage plant is to be constructed here at a cost of $35,000. W. C. Smith, Mayor.

Burlington, Ia.—E. Steece, City Engr., writes that the contract for hauling garbage has been awarded to Hermau Hellmuth at $4 per day, and for the dumping ground to Fred. Suesens at $38 per yr. (bids opened Apr. 6).

Kearny, N. J.—The Newark Sanitary Reduction Co., of Newark, has petitioned the Bd. of Health for permission to operate a garbage reductory in Kearny.

Richmond, S. I., N. Y.—The Mayor has signed the resolution authorizing the issue of corporate stock for the Bureau of Street Cleaning, in Richmond Boro., as follows: $25,000 for a crematory; $45,000 for two stables, horses, carts, etc., and $20,000 for dumps, track and car equipments.

Brooklyn, N. Y.—Bids will be received May 12 by John McG. Woodbury, Comr. of Street Cleaning, N. Y. City, for collecting and removing garbage and kindred refuse from Sept. 1, 1903, until Jan. 1, 1904; bids will also be received May 13 (readvertisement) for completing an abandoned contract for collecting and removing garbage and kindred refuse for the period of 1 year, beginning Sept. 1, 1902.

Meadville, Pa.—A. C. Pardee, City Clk., writes that the time for receiving bids for erecting a brick building to enclose garbage crematory has been extended to May 6.

GOVERNMENT WORK.

Montgomery, Ala.—Bids will be received by the Super. Archt., Jas. Knox Taylor, Treas. Dept., Washington, D. C., until June 1 for the construction (except heating apparatus) of the extension to the U. S. Court House, Post Office, etc., at Montgomery.

Hot Springs, Ark.—Bids are wanted May 7 (readvertisement) for remodeling, enlarging, etc., the free bath house on the Hot Springs reservation. E. A. Hitchcock, Secy. Dept. of Interior, Washington, D. C.

Ft. Rosecrans, Cal.—Capt. Edgar Jadwin, Corps Engrs., U. S. A., Los Angeles, writes that the contract for a power house (bids opened Apr. 8) has been awarded to Sloan & Gray, 220 Henne Bldg., Los Angeles, Cal., for $4,900.

Denver, Colo.—The following bids were opened on Apr. 28 by R. E. Preston, Acting Dir. of Mint, Washington, D. C., for the installation of an electric light and power plant in U. S. Mint Bldg., Denver: Providence Eng. Wks., Providence, R. I., $64,937; Allis Chalmers Co., New York, N. Y., $80,000; Electrical Machine Co., Minneapolis, Minn., $76,500, and Minneapolis Steel Co., Minneapolis, Minn., $76,500.

New London, Conn.—The following bids were opened by Maj. Chas. F. Powell, Corps Engrs., U. S. A., Apr. 23 for dredging Quinnipiac and Mill Rivers, Conn.—*a*, Sec. 1, 40,000 cu. yds.; *b*, Sec. 2, 10,000 cu. yds.; *c*, Sec. 3, 160,000 cu. yds.; *d*, Sec. 4, 107,000 cu. yds., price given per cu. yd.: Wm. H. Taylor, Jersey City, N. J., *a*, 15 cts.; *b*, 35 cts.; *c*, 15 cts.; *d*, 17 cts. (recommended for acceptance). International Contr. Co., New York, N. Y., *a*, 16 cts.; *b*, 40 cts.; *c*, 14½ cts.; *d*, 22¼ cts. Morris & Cummings Dredging Co., New York, N. Y., *a*, 18 cts.; *b*, 40 cts.; *c*, 18 cts.; *d*, 30 cts.

Washington, D. C.—The following bids were opened by the Superv. Archt., Treas. Dept., Apr. 23 for vaults, cashroom, etc., in U. S. Treas. Dept. Bldg.: L. H. Miller Safe & Lock Co., Baltimore, Md., $35,350, and Henry Holt Marine Co., Hamilton, O., $22,041.

Bids are wanted May 6 for furnishing, electric fittings and materials, electric wires and cables, incandescent electric lamps, etc., to the U. S. Bldgs. under its control east of the Rocky Mountains during the fiscal year ending June 30, 1904. H. A. Taylor, Acting Secy., Treas. Dept.

Ft. Pickens, Fla.—W. E. Cole, Q. M., Ft. Barrancas, writes that the contract for an electric lighting system at Ft. Pickens (bids opened Apr. 4) has been awarded to P. R. Pearl, of Pensacola, Fla.

Ft. McRee, Fla.—Bids are wanted May 15 for constructing, including heating and electric wiring lavatory; also plumbing set Officer's quarters and barracks buildings at this post. Address W. E. Cole, Q. M., Ft. Barrancas, Fla.

Des Moines, Ia.—Bids are wanted May 26 for constructing roads, walks and drains at Ft. Des Moines. Address Maj. R. B. Turner, Q. M., Observatory Office Bldg.

Richmond, Ky.—The following bids were opened by Superv. Archt., Treas. Dept., Washington, D. C., on Apr. 27 for completing the U. S. Post Office at Richmond: Todd & Son, Richmond, $17,281; The Buckeye Car Co., Toledo, $17,420; Clark & Howard, Lexington, $15,958; Bailey & Koehner, Henderson, Ky., $16,296.

Annapolis, Md.—Bids will be received May 6 (readvertisement) by H. C. Taylor, Ch. of Bureau of Navigation, Navy Dept., Washington, D. C., for paving at the U. S. Naval Academy, Annapolis.

Boston, Mass.—Capt. Harry Taylor, Corps Engrs., U. S. A., writes that the following bids were opened on Apr. 25 for furnishing Portland cement (*a*) 3,500 bbls. at Little Harbor, N. H.; (*b*), 8,000 bbls. at Boston, 1st figures if delivered by bbl. per bbl., 2d figures if delivered in sacks: Berry & Ferguson, Boston, *a* and *b*, $2.28, and *a* and *b*, $2.08. W. G. Nash, Boston, *a*, $2.60; *b*, $2.50, and *a*, $2.30; *b*, $2.20. Waldo Bros., Boston, *a*, $2.41; *b*, $2.39, and *a*, $2.28; *b*, $2.24.

The Rockport Granite Co. and Pigeon Hill Granite Co., of Rockport, bid at the same time for 12,600 cu. yds. broken stone, $1.85 per cu. yd.

Pipestone, Minn.—Bids will be received May 22 by the Comrs. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing an addition to a stone dormitory, including steam-heating, plumbing and gasoline gas-piping, at the Pipestone Indian School. For further information address DeWitt S. Harris, Supt. Indian School.

St. Paul, Minn.—Bids are wanted by the Superv. Archt., Treas. Dept., Washington, D. C., until June 10 for making alterations to the U. S. Custom House at St. Paul.

Jefferson Barracks, Mo.—Gen. J. W. Jacobs, Deputy Q. M., U. S. A., writes that the contract for constructing roads at this post (bids opened Mar. 12) has been awarded to Wm. Ruprecht, 6731 S. Bway., St. Louis, Mo., for $7,120.

Ft. Wadsworth, N. Y.—Bids are wanted May 28 for erecting a ward wing at the hospital and building in rear for kitchen, etc. Address Lieut. Geo. L. Hicks, Jr., Q. M.

Ft. Stanton, N. Y.—Bids are wanted May 18 for grading and constructing roads and sidewalks here. Address C. K. Mower, 1st Lieut. Q. M.

Governors Island, N. Y.—Bids are wanted May 13 for laying 6-in. water main on Governors Island with proper connections to buildings. Address T. Norman, Q. M.

Bids are wanted May 14 for installing electric lighting appliances at Governor's Island. Address T. Norman, Q. M.

Pawhuska, Okla. Ter.—Bids will be received May 18 by the Comr. of Indian Affairs for furnishing and installing 2 high-pressure boilers, pump and receiver and hot-water tank at the Osage boarding school. O. A. Mitscher, U. S. Indian Agent.

Portland, Ore.—Bids are wanted June 8 for constructing 2 iron towers for defence, mouth of Columbia River. Capt. W. C. Langfitt, Corps Engrs., U. S. A.

Scranton, Pa.—Bids are wanted June 4 for constructing (including plumbing and heating apparatus) the U. S. Post Office, etc., extension at Scranton. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Chamberlain, S. D.—Bids will be received May 21 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing at the Chamberlain School a brick dormitory, school, and an addition to dormitory, including plumbing, acetylene, gas piping and steam heat, extending water and sewer system; also a gas machine house, including plumbing and heating. For further information, address John Flinn, Supt.

Ft. Hunt, Va.—Bids are wanted May 18 for resurfacing macadam roads and constructing brick gutters at this post. Geo. H. McManus, Constructing Q. M., Ft. Washington, Md.

Shoshone Agency, Wyo.—Bids will be received May 18 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing power house, moving machinery and installing boiler and smokestack, at the Shoshone School. For further information address A. C. Tonner, Acting Comr., Shoshone Agency.

Ft. D. A. Russell, Wyo.—A press report states that the following bids were opened on Apr. 23 by W. S. Scott, Q. M., U. S. A., Cheyenne, for the erection of buildings at this post: J. W. Atkinson, $122,000; M. P. Keefe, $128,680; H. O'Neal, $140,000; C. E. McGarvey and B. W. Bradley, $112,984; B. H. Sage, $132,250, and W. O. Morrison, $134,500.

Juneau, Alaska.—The lowest bid received on Apr. 20 for the new federal building at Juneau is stated to have been submitted by Albert Derens, of Tacoma, Wash., for $50,000.

NEW INDUSTRIAL PLANTS.

The McKinnon Dash Co., Buffalo, N. Y., is having plans prepared for a 90x235-ft. factory building of mill construction, partly one-story and basement and partly two stories and basement.

The Central Mfg. Co., Burlington, N. C., has been organized, and is in the market for two 40-H.-P. boilers, two 30 or 35-H.-P. engines, a planer, two sawmills and a resaw.

A correspondent writes that the Ohio Litholite Co., Bolton Ave. and N. Y., C. & St. L. Ry., Cleveland, O., will erect a 127x30-ft. pattern shop.

Plans are being prepared for an extensive enlargement of the works of the Rand Drill Co., 128 Broadway, New York, to meet the increased demand for compressed air plants, including the Imperial pneumatic hammers and piston air drills.

The Sherwin-Williams Co., 100 Canal St., Cleveland, O., paint and varnish maker, will add to its Montreal plant a 4-story, 340x50-ft. warehouse, a 4-story manufacturing building 100 ft. square, and a power house 100 ft. square. Electric power of 300-Kw., alternating current, has been provided for.

The Keystone Driller Co., Beaver Falls, Pa., will soon let contract for a 2-story, 120x138-ft. machine shop to have cement floors, slate roof supported by structural steel, and walls of brick and hollow building blocks. The power plant has been provided for.

MISCELLANEOUS.

Council Bluffs, Ia.—It is stated that bids are wanted May 25 for constructing the Fensler ditch, requiring about 17,600 cu. yds. of excavation. R. V. Innes, Co. Aud.

Baltimore, Md.—Local press reports state that the Western Maryland R. R. Co. will soon let the contract for dredging Patapsco River, at the site of the new docks. The work will involve the dredging of approximately 500,000 cu. yds. of material. S. M. Manifold, Gen. Supt., Baltimore.

New York, N. Y.—See "Water."

The following bids were opened Apr. 27 for furnishing, erecting and maintaining street signs and posts in Bronx Boro. by L. F. Haffen, Boro. Pres.—*a*, F. Riddell; *b*, Peter J. Constant; *c*, Caesar Bros.; *d*, Jos. N. Early; *e*, U. S. House Co.:

	Type "A." 1,600.	"B." 2,450.	"C." 150.	"D." 450.	Posts. 1,400.	Totals.
a.....	$1.25	$1.20	$1.50	$0.65	...	...
b.....	1.25	1.25	1.50	1.00	$6.50	$14,838
c.....	3.71	3.71	4.27	.48	6.96	25,626
d.....	1.50	1.50	1.50	1.00	7.00	16,550
e.....	5.00	4.00	6.00	.93	8.75	31,369

Syracuse, N. Y.—Bids are wanted May 5 for $14,000 Harbor Brook improvement and W. Fayette St. bridge bonds; also on same date $171,000 local improvement bonds. E. J. Mack, City Compt.

Buffalo, N. Y.—The Aldermanic Com. on Wharves & Harbor has voted to report in favor of contracting with the Buffalo Dredging Co. for dredging Buffalo River in Section 6, for $120,500.

Albany, N. Y.—The Legislature is reported to have passed the bill providing for the improvement of canals, at a cost of $101,000,000.

Brooklyn, N. Y.—The following bids were opened Apr. 24 by McDougall Hawkes, Comr. Docks, N. Y. City, for building a pier between 51st and 52d Sts.: Barth Cronin, $40,245; A. Walsh, $35,000; Spearin & Preston, $35,023; Wm. H. Jenka, $34,999, and Bernard Rolf, 39 Cortlandt St., N. Y., $34,933.

Mayor Low has approved the ordinance providing for the laying out as a public park the property bounded by 73d St., Ft. Hamilton Ave. and 7th Ave., Boro. of Brooklyn.

Tacoma, Wash.—The North American Dredging Co. is stated to have awarded to J. B. C. Lockwood, of Tacoma, Wash., the contract for building two mammoth dredgers, one for San Francisco, to cost $175,000, and the other for San Pedro, to be still larger.

BUSINESS NOTES.

The Robert F. Wentz Engineering Co., with principal office at 186 Newark Ave., Jersey City, N. J., has been incorporated with a capital of $150,000. The incorporators are: Robert F. Wentz and H. E. Clewell, of Nazareth, Pa., and A. C. Bagg, of New York City.

The Webster, Camp & Lane Co., Akron, O., and the Wellman-Seaver-Morgan Engineering Co., Cleveland, O., have been consolidated under the corporate name of The Wellman-Seaver-Morgan Co., with general offices in Cleveland. The officers of the company are: Pres., S. T. Wellman, Cleveland; Chairman, John McGregor, Akron; First Vice-Pres., S. H. Pitkin, Akron; Second Vice-Pres., J. W. Seaver, Cleveland; Third Vice-Pres., G. H. Hulett, Cleveland; Gen. Mgr., C. H. Wellman, Cleveland; Secy., T. R. Morgan, Cleveland; Treas., A. D. Hatfield, Cleveland.

The firm of Johnston Livingston, Jr., & Co., 13 Park Row, New York, has been formed by Johnston Livingston, Jr., and Albin Gustafson, to continue the business of the electrical construction department of The United Engineering & Contracting Co.

Pawling & Harnischfeger, Milwaukee, Wis., one of whose buildings was recently burned, have leased the shops recently vacated by the Nordberg Mfg. Co. The machinery for these shops has been purchased, and they will be put in operation at once.

The S. Obermayer Co., Cincinnati, O., makers of foundry facings, supplies and equipment, has just completed additions to its Chicago plant, which will increase its capacity 40 per cent. The capacities of the plants at Cincinnati and Pittsburg have been doubled during the past year. These three plants are being run 20 hours per day.

The York, Pa., Mfg. Co. reports the following among recent orders: Connecticut Fat Rendering & Fertilizing Corporation, 10-ton refrigerating plant; Camden, S. C., Water, Light & Ice Co., 15-ton ice-making plant; Safety Electric Mfg. Co., New Orleans, La., 10-ton ice-making plant to be erected at Clinton, La.; U. S. Coal & Coke Co., 15-ton ice-making plant to be installed at Tug River, W. Va.; Central Brewing Co., East St. Louis, Ill., 175-ton cross compound refrigerating machine and 50-ton ice-making plant; C. H. & M. Chrissafidis, Piraeus, Greece, 2-ton ice-making plant.

Westinghouse, Church, Kerr & Co. have recently received the third order for Roney mechanical stokers for equipping four 450-H.-P. B. & W. boilers from the Potomac Electric Power Co., Washington, D. C. The Roney stoker equipment at present aggregates 2,700-H.-P. The N. Y. C. & H. R. R. R. Co. has also ordered four Roney stokers for equipping the 2,000-H.-P. water-tube Aultman & Taylor boilers of the new elevator at Weehawken, N. J. The International Ry. Co., Buffalo, N. Y., has placed the sixth order for Roney stokers, increasing the present capacity to 6,900-H.-P. The Boston Edison Co. has recently purchased a complete equipment of Roney mechanical stokers, to be installed in their new central station. The boilers are 500-H.-P. B. & W. water-tube, and are arranged in batteries of eight each. The Ingersoll-Sergeant Drill Co. will install 12 stokers in the plant at Phillipsburg, N. J. Roney stokers of various sizes have also been sold to Stirling Co., for Berwind-White Coal Mining Co., Windber, Pa.; American Bridge Co., ninth order; American Locomotive Co., fifth order; and the Pennsylvania R. R. Co., for Altoona, Pa., seventh order, to be installed in new boiler-house designed and erected by Westinghouse, Church, Kerr & Co.

The Thomas Carlin's Sons Co., Allegheny, Pa., whose plant was recently burned, is erecting a 3-story, 60x118-ft. brick building and a 2-story, 118x200-ft. steel building, and is having its power plant rebuilt.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Beloit, Wis., Iron Works, 70-H.-P. engine for direct connection to a Northern generator; First National Bank Bldg., Chicago, four vertical cross-compound engines direct-connected to 150-Kw. Crocker-Wheeler generators.

The Standard Steam Specialty Co., New York, manufacturer of the Utility exhaust muffler, oil separator, return tank, pump governor and feed water heater and other steam specialties, has recently taken contracts for 20,000-H.-P. of its apparatus. To facilitate manufacturing and be in a position to carry in stock standard sizes of Utility oil separators, from 30 to 10,000-H.-P., it has leased the premises 542 and 544 West Broadway from May 1st, which gives it 10,000 sq. ft. of floor space.

Field & Hinchman, consulting engineers, of Detroit, Mich., have incorporated under the name of Field, Hinchman & Smith, the firm of Mortimer L. Smith & Son, architects, having affiliated with them. Quarters have been secured in the Washington Arcade Building. Reversing the usual order of things, it is their intention to design complete power and industrial plants and to house these plants in suitable buildings, thus adapting the latter to the needs of the former. A branch office has been established at Windsor, Ont.

The White Mountain Paper Co. has recently purchased from the Westinghouse Electric & Mfg. Co. three 1,000-Kw. and one 300-Kw., three-phase, engine-type alternators, which are complete with exciters, and are to be direct-connected to Hamilton-Corliss engines installed in its paper mill at Portsmouth, N. H. The various machines in this mill will be operated by Westinghouse type C induction motors, aggregating 5,500-H.-P.

Mr. J. Harkness Brown has recently closed a contract with the Nernst Lamp Co., of Pittsburg, Pa., for over 1,500 Nernst lamps, which are to be used for lighting his large department store on Euclid Avenue, Cleveland.

The Sprague Electric Co. recently installed direct-current motors in the new bakery of the American Pastry & Mfg. Co. in East 15th St., New York, to be used to operate the machines for mixing dough. An ingenious apparatus has also been perfected for electrically operating the ovens.

Northern Engineering Works, Detroit, Mich., crane builders, report recent sales of electric traveling cranes to Lambert Hoisting Engine Co., second order; Fort Pitt Bridge Works, fourth order; Sessions Foundry Co.; Waterbury Machine Co.; Union Carbide Co.; Webster, Camp & Lane Co.; and hand-cranes to Clarage Foundry Co.; Winton Motor Co.; Northern Electrical Works; Elk Tanning Co., Windsor Mills; Pawtucket Foundry Co.

The American Blower Co., of Detroit, Mich., is furnishing heating apparatus for the distillery of J. F. S. Brown & Sons, McBrayer, Ky.; 22d Ward School, Swissvale, Pa.; American Column Co., Battle Creek, Mich., and Schlesinger & Meyer, Chicago. Dry kilns for the Lansing, Mich., Spoke Co.; Severance Tank Works, Lansing, Mich.; Doane & Jones Lumber Co., Eldridge Park, Elmira, N. Y., and the Hazleton, Pa., Mfg. Co. It is also executing a number of orders for induced draft apparatus, brick dryers, etc. The company has recently opened offices in Philadelphia and Pittsburg. The former is at 615 Hale Bldg., in charge of Benj. Adams, and the latter at 318 Frick Bldg., in charge of H. P. Curtiss.

A contract for electrical generators for use west of the Rocky Mountains has been awarded by Stone & Webster, of Boston, managers of electric power, traction, and lighting plants along Puget Sound, to the General Electric Co. The order is for six machines, two to be furnished to the Tacoma Industrial Co. for use in the development of the White River, and four to the Pierce County Improvement Co. for the work of developing the Puyallup River, including the flow from the Mount Rainier glaciers. The generators will be three-phase, 60-cycle, of 3,500-Kw. capacity each, at 2,300 volts and 225 revolutions.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
May 4.	Klester, Minn.	May 2
May 4.	St. Paul, Minn.	May 2
May 5.	Jersey City, N. J.	May 2
May 5.	Reading, Pa.	May 2
May 5.	New York, N. Y.	Apr. 25
May 7.	Chicago, Ill.	May 2
May 7.	Dexter, Me.	Apr. 25
May 7.	Newark, N. J.	Apr. 4
May 10.	Corvallis, Ore.	Apr. 25
May 11.	Pipe, etc., Holyoke, Mass. Adv. Apr. 25, May 2.	Apr. 25
May 12.	Toronto, Ont.	Mar. 21
May 15.	Richmond, Va.	Apr. 25
May 18.	Engine, Burlington, Ia.. Adv. May 2.	May 2
May 18.	Pipe, etc., Sacramento, Cal. Adv. May 2.	May 2
May 18.	Sterling, Colo., Adv. Apr. 25, May 2.	Apr. 25
May 19.	New Bremen, O., Adv. Apr. 25, May 2.	Apr. 25
May 20.	Fayette, Ia.	May 2
May 20.	Tucson, Ariz.	May 2
May 20.	Pipe, Tacoma, Wash.	Apr. 25
May 21.	Yonkers, N. Y., Adv. May 2.	May 2
May 21.	Martinsburg, W. Va.	Apr. 25
May 22.	Washington, D. C., Adv.	Apr. 25, May 2. Apr. 25
May 25.	Conda, N. Dak., Adv. May 2.	May 2
Jun. 1.	Gouverneur, N. Y.	May 2
Aug. 1.	Allegheny, Pa.	Apr. 4
———	Quincy, Mass.	Mar. 28
———	Lonaconing, Md.	Mar. 28
	SEWERAGE AND SEWAGE DISPOSAL.	
May 4.	Oregon City, Ore.	May 2
May 4.	Ardmore, Pa., Apr. 11, May 2.	Apr. 11
May 5.	Saratoga Springs, N. Y.	May 2
May 5.	Poughkeepsie, N. Y.	Apr. 25
May 5.	Houston, Tex.	Apr. 25
May 5.	Belleville, Ill.	Apr. 25
May 5.	Beaumont, Tex.	Apr. 18
May 5.	Allentown, Pa.	Apr. 18
May 5.	Olathe, Kan.	Apr. 11
May 6.	Chicago, Ill.	May 2
May 7.	Aurora, Ill., Adv. May 2.	May 2
May 7.	New London, Conn.	Apr. 25
May 9.	Bowling Green, O.	Apr. 18
May 11.	Noblesville, Ind.	May 2
May 12.	Beaumont, Tex., Adv. Apr. 11.	Apr. 11
May 14.	Cleveland, O.	Apr. 25
May 15.	Newark, N. J.	Apr. 25
May 15.	Tonah, Wis.	Apr. 4
May 18.	Des Moines, Ia.	May 2
May 20.	Bond Hill, O.	May 2
May 20.	Amsterdam, N. Y.	Apr. 25
May 25.	Estherville, Ia.	May 2
Jun. 6.	Washington, D. C., Adv.	Apr. 25, May 2. Apr. 25
	BRIDGES.	
May 4.	Paterson, N. J.	May 2
May 4.	Corning, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 5.	Petersburg, Ind.	May 2
May 5.	La Grange, Ind.	May 2
May 5.	St. Paul, Minn.	May 2
May 5.	Astoria, Ore.	Apr. 18
May 5.	Harrisburg, Pa.	Apr. 18
May 5.	Atlantic City, N. J.	Apr. 11
May 5.	Winamac, Ind.	Apr. 25
May 6.	Eugene, Ore.	May 2
May 6.	Frankford, Ind.	Apr. 18
May 7.	Windom, Minn.	May 2
May 7.	Columbus, O.	Apr. 11
May 8.	Neodesha, Kan.	May 2
May 8.	Sullivan, Ind.	Apr. 25
May 8.	Hamilton, O.	Apr. 25
May 9.	Brompton, Ont.	May 2
May 9.	Plympton, Ont.	May 2
May 9.	Bay City, Mich., Adv. Apr. 25, May 2.	Apr. 25
May 10.	Surrey, B. C.	May 2
May 11.	Williston, N. D.	May 2
May 12.	Parker, S. D.	May 2
May 12.	Joliet, Ill.	May 2
May 14.	Greensburg, Pa.	Apr. 25
May 15.	Hagerstown, Md.	May 2
May 15.	Grand Rapids, Mich. Adv. Apr. 25, May 2.	Apr. 25
May 16.	Mt. Vernon, O.	May 2
May 18.	San Jose, Cal.	May 2
May 18.	Fredericton, N. B.	Apr. 4
May 19.	Woonsocket, S. D.	May 2
May 19.	Langdon, N. D.	May 2
May 19.	Milwaukee, Wis.	Apr. 18
May 20.	Jacksonville, Fla., Adv. May 2.	May 2
May 23.	Birmingham, Ala.	May 2
Jun. 1.	Gettysburg, Pa.	Apr. 25
Jun. 3.	Oak Ridge, La.	May 2
Jun. 3.	Livingston, Mont.	May 2
Jul. 10.	Castlewood, S. D.	May 2
	PAVING AND ROADMAKING.	
May 4.	Minneapolis, Minn.	May 2
May 4.	Boston, Mass.	May 2
May 4.	Morristown, N. J.	Apr. 18
May 4.	Newton, N. J.	Apr. 11
May 5.	Cincinnati, O.	May 2
May 5.	Wilkinsburg, Pa.	May 2
May 5.	Edgewater, N. J.	May 2
May 5.	St. Paul, Minn.	May 2
May 5.	Springfield, O.	May 2
May 5.	Princeton, Ind.	Apr. 25
May 5.	Beaumont, Tex.	Apr. 18
May 5.	Lisbon, O.	Apr. 11
May 5.	Marion, Ind.	Apr. 4
May 5.	Versailles, Ind.	Apr. 18
May 5.	Ft. Scott, Kan.	Apr. 25
May 6.	Paris, Ill.	May 2
May 7.	Danville, Ill.	May 2
May 7.	Brooklyn, N. Y.	May 2
May 7.	Newark, N. J.	May 2
May 7.	Madison, Ind.	May 2
May 7.	Brooklyn, Conn.	May 2
May 8.	Buffalo, N. Y.	May 2
May 8.	Waukesha, Wis.	May 2
May 9.	Watertown, Wis.	May 2
May 9.	Belvidere, N. J.	May 2
May 9.	Glencoe, Ill.	May 2
May 9.	St. Joseph, Mo.	Apr. 18
May 9.	Evansville, Ill.	Apr. 18
May 11.	Camden, N. J.	May 2
May 11.	Union, N. J.	May 2
May 11.	Weston, O.	Apr. 25
May 11.	Laporte, Ind.	Apr. 25
May 12.	Alexandria, La.	Apr. 18
May 14.	Geneva, N. Y., Adv. May 2.	May 2
May 14.	Norfolk, Pa., Adv. Apr. 11, 18.	Apr. 11
May 15.	Grove City, Pa.	May 2
May 15.	Marinette, Wis.	Apr. 25
May 18.	Frankford, Ind.	May 2
May 18.	Michigan City, Ind.	May 2
May 18.	Payne, O.	May 2
May 18.	Des Moines, Ia.	May 2
May 18.	Marshalltown, Ia.	May 2
May 18.	Toledo, O.	Apr. 25
May 19.	Bluffton, Ind.	Apr. 25
May 20.	Honolulu, H. I.	May 2
May 20.	Waynesburg, Pa.	Apr. 25
———	Albany, N. Y., Adv. May 2.	May 2
———	Pittsburg, Kan., Adv., May 2.	May 2
———	Union, S. C.	May 2
	POWER, GAS AND ELECTRICITY.	
May 11.	Toronto, Ont., Adv. Apr. 4, May 2.	Apr. 4
May 12.	Copenhagen, Denmark	Apr. 4
Jun. —	North Yamkill, Ore.	Apr. 4
Jun. 1.	San Diego, Cal.	Apr. 18
Jun. 18.	Portland, Ore., Adv. Apr. 18 to May 2.	Apr. 18
	GOVERNMENT WORK.	
May 4.	Catlettsburg, Ky., Adv. Apr. 4 to 25.	Apr. 4
May 5.	Denver, Colo., Adv. Apr. 18, 25.	Apr. 18
May 5.	Greensboro, N. C., Adv. Apr. 4, 11.	Apr. 4
May 6.	Annapolis, Md.	May 2
May 6.	Flandreau, S. D.	Apr. 18
May 6.	Grand Rapids, Mich. Apr. 11 to May 2.	Apr. 11
May 6.	Norwich, Conn.	Apr. 4
May 7.	Hot Springs, Ark.	May 2
May 8.	Ft. D. A. Russell, Wyo.	Apr. 18
May 11.	Elmira, N. Y.	Apr. 18
May 11.	Washington, D. C.	Apr. 25
May 12.	New Orleans, La.	Apr. 11
May 12.	Beaumont, Tex., Adv. Apr. 11, 18.	Apr. 11
May 13.	Governor's Island, N. Y.	May 2
May 13.	Merrill, Pa., Adv. Apr. 25, May 2.	Apr. 25
May 14.	Governor's Island, N. Y.	May 2
May 14.	Barracks, Johnson City, Tenn. Adv. Apr. 25, May 2.	Apr. 25
May 14.	Hartford, Conn.	Apr. 18
May 15.	Ft. McRee, Fla.	May 2
May 15.	Des Moines, Ia. Adv. Apr. 18 to May 2.	Apr. 18
May 15.	New York, N. Y. Adv. Apr. 18 to May 2.	Apr. 18
May 15.	New London, Conn. Adv. Apr. 18 to May 2.	Apr. 18
May 16.	Ft. Rosecrans, Cal.	Apr. 25
May 18.	Ft. Hunt, Va.	May 2
May 18.	Pawhuska, Okla. Ter.	May 2
May 18.	Shoshane Agency, Wyo.	May 2
May 18.	Ft. Stanton, N. Y.	May 2
May 18.	Zanesville, O., Adv. Apr. 18 to May 2.	Apr. 18
May 20.	Ft. Greble, R. I. Adv. Apr. 25, May 2.	Apr. 25
May 21.	Chamberlain, S. D.	May 2
May 21.	Wheeling, W. Va.	Apr. 25
May 22.	Pipestone, Minn.	May 2
May 22.	Washington, D. C.	May 2
May 22.	Philadelphia, Pa., Adv. Apr. 25, May 2.	Apr. 25
May 23.	Charleston, S. C.	Apr. 25
May 23.	Norfolk, Va.	Apr. 25
May 25.	Norfolk, Va., Adv. May 2.	May 2
May 25.	New York, N. Y., Adv. Apr. 25, May 2.	Apr. 25
May 25.	Ft. Morgan, Ala., Adv. Apr. 25.	Apr. 25
May 25.	Lockport, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 26.	Des Moines, Ia.	May 2
May 26.	Boston, Mass., Adv. Apr. 25, May 2.	Apr. 25
May 27.	Rock Island, Ill., Adv. May 2.	May 2
May 27.	Norfolk, Va., Adv. May 2.	May 2
May 28.	Chattanooga, Tenn., Adv. May 2.	May 2
May 28.	Ft. Wadsworth, N. Y.	May 2
May 28.	Tompkinsville, N. Y., Adv. May 2.	May 2
May 29.	Ft. Myer, Va., Adv. May 2.	May 2
Jun. 1.	Montgomery, Ala.	May 2
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 3.	Springfield, Ill., Adv. May 2.	May 2
Jun. 4.	Scranton, Pa.	May 2
Jun. 8.	Cleveland, O., Adv. May 2.	May 2
Jun. 8.	Portland, Ore.	May 2
Jun 8.	Sitka, Alaska	Apr. 25
Jun. 10.	St. Paul, Minn.	May 2
Jun. 15.	Manila, P. I., Adv. Mar. 14 to May 2.	Mar. 14
	BUILDINGS.	
May 4.	Hospital, Osawatomie, Kan.	May 2
May 4.	School, East Boston, Mass.	May 2
May 4.	School, Brooklyn, N. Y.	Apr. 25
May 4.	Station Houses, New York, N. Y.	Apr. 25
May 4.	Schools, New York, N. Y.	Apr. 25
May 5.	Library, Whitewater, Wis.	May 2
May 5.	School, Attleboro, Mass.	May 2
May 5.	School, North Chelmsford, Mass.	May 2
May 5.	Hospital, New York, N. Y.	Apr. 25
May 5.	Pub. Bldg., St. Paul, Minn.	Apr. 18
May 5.	Hospital, Jamestown, N. D.	Apr. 18
May 6.	Bank, Columbus, O.	May 2
May 6.	School, Orono, Me.	May 2
May 6.	Hospital, Rocheater, N. Y.	Apr. 25
May 6.	Bath, Brooklyn, N. Y.	Apr. 25
May 6.	School, Milwaukee, Wis.	Apr. 18
May 6.	Pub. Bldg., Topeka, Kan.	Apr. 18
May 6.	School, Ames, Ia.	Apr. 25
May 7.	School, Anderson, S. C.	May 2
May 7.	Hospital, New York, N. Y.	May 2
May 7.	Library, Cleveland, O.	Apr. 18
May 8.	School, Grand Rapids, Mich.	Apr. 18
May 8.	Htg. Court house, Shakopee, Minn.	Mar. 28
May 8.	School, Cleveland, O.	Apr. 25
May 8.	School, River Rouge, Mich.	Apr. 25
May 9.	School, Charleston, S. C.	May 2
May 9.	Pub. Bldg., Columbus, O.	Apr. 18
May 9.	School, Ledyard, Ia.	Apr. 25
May 9.	Pub. Bldg., Williamsport, Pa.	Apr. 25
May 10.	Bus. Bldg., Rochester, N. Y.	Apr. 18
May 11.	Hospital, Noroton, Conn.	May 2
May 11.	School, Rolla, Mo.	May 2
May 11.	Court house, Bloomington, Ill.	May 2
May 11.	Hospital, Albany, N. Y.	May 2
May 11.	School, Brooklyn, N. Y.	May 2
May 11.	School, New York, N. Y.	May 2
May 11.	School, Long Island City, N. Y.	May 2
May 11.	School, New Brighton, N. Y.	May 2
May 11.	Opera House, Bradford, Pa.	May 2
May 11.	Court House, Lincoln, Ill.	Apr. 25
May 11.	School, Cleveland, O.	Apr. 25
May 12.	Pub. Bldg., Emporia, Kan.	May 2
May 12.	Dormitory, Pocatello, Idaho	May 2
May 12.	Asylum, Little Rock, Ark.	Apr. 25
May 12.	Court House, Washington, Ga.	Apr. 25
May 13.	Pub. Bldg., Columbus, O.	May 2
May 14.	Library, Moberly, Mo.	May 2
May 14.	School, Martins Ferry, O.	May 2
May 14.	Sanatarium, Burrillville, R. I.	May 2
May 14.	Library, Johnson City, Tenn. Adv. Apr. 18 to May 2.	Apr. 18
May 15.	Church, Winnipeg, Man.	May 2
May 15.	Pub. Bldg., New York, N. Y.	Apr. 25
May 15.	Church, Carrollton, Ky.	Apr. 18
May 16.	Church, Chillicothe, O.	May 2
May 16.	Court house, Darlington, S. C.	May 2
May 16.	School, Green, O.	May 2
May 16.	Church, Birmingham, Ala.	May 2
May 16.	Alms House, Monmouth, Ill.	May 2
May 18.	School, Cleveland, O.	May 2
May 18.	School, Bedford, Ind.	May 2
May 18.	Church, Columbus, O.	May 2
May 18.	Hempstead, L. I., N. Y., Htg. School. Adv. May 2.	May 2
May 18.	Hospital, Millersburg, O.	May 2
May 19.	Library, Jackson, Mich.	May 2
May 19.	Jail, Elizabethtown, N. C.	Apr. 18
May 21.	School, Glenville, O.	May 2
May 21.	Pub. Bldg., Columbus, O.	May 2
May 21.	School, Marietta, O.	May 2
May 23.	School, Columbus, O.	May 2
Jun. 1.	Jail, Monticello, Miss.	May 2
Jun. 1.	Church, Liberty, Ind.	Apr. 25
Jun. 5.	Plans, Moscow, Idaho	May 2
Jun. 16.	School, Bedford, Ind.	May 2
Jul. 8.	Jail, Napoleon, N. D.	May 2
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21 to Apr. 4.	Mar. 21
	MISCELLANEOUS.	
May 5.	Wharf, New Rochelle, N. Y.	Apr. 25
May 5.	Dredging, etc., New York, N. Y.	Apr. 25
May 6.	Garb., Meadville, Pa.	May 2
May 8.	Wharf, Riviere au Renard, Que.	Apr. 25
May 9.	R. R. Work, Philadelphia, Pa.	May 2
May 10.	R. R. Work, Des Moines, Ia.	Apr. 18
May 11.	R. R. Work, Washington, D. C.	May 2
May 12.	Garb. Disp., Brooklyn, N. Y.	May 2
May 12.	El. Ry. franchise, Riverside, Cal.	May 2
May 13.	Garb. Disp., Brooklyn, N. Y.	May 2
May 15.	R. R. Work, Louisville, Ky.	May 2
May 18.	Garbage Plant, Shreveport, La. Adv. Apr. 18 to May 2.	Apr. 18
May 20.	Dredging, Falmouth, Jamaica	Apr. 11
May 25.	Ditch, Council Bluffs, Ia.	May 2
Jun. 1.	El. Ry. franchise, Redwood City, Cal.	Apr. 18
Jun. 1.	El. Ry. franchise, San Mateo, Cal.	Apr. 25
———	El. Ry. franchise, New Orleans, La.	Apr. 25
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21

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A Union Building for National Engineering Societies.

Many of the readers of The Engineering Record have heard by this time of the offer of Mr. Carnegie to give a million dollars to the four national engineering societies and the Engineers' Club of New York for the erection of a building to be used by them as a joint home. This princely gift is tied up by no conditions whatever. Mr. Carnegie heard the presidential address of Mr. Chas. F. Scott at the annual dinner of the American Institute of Electrical Engineers, and was interested by the president's idea of a united home for all the engineering societies. The next day he had a conference with two of the leading members of the Institute, and later talked with members of other societies. The matter has been under consideration this week by the directors of the various associations, and in due time a report of their recommendations will doubtless be sent to the members of the societies.

This very sudden resumption of an old discussion makes it desirable to put on record a few facts which seem to be overlooked. A union home for all societies was seriously discussed years ago when the American Society of Civil Engineers bought its house on Twenty-third Street, and the discussion was renewed when that house was enlarged. At that time, the advantages of a combined headquarters for all societies were pointed out, and the location of such headquarters downtown was strongly urged, mainly for the purpose of having the societies' libraries near the offices of the men using them. The high rental, cramped quarters and absence of a suitable room for meetings led to the rejection of a downtown site, and the financial condition of the other societies was such that an alliance with them for a union building uptown was out of the question, unless the civil engineers desired to pay most of the expense of its construction. At the annual convention of the American Society of Civil Engineers in 1895, the subject was again brought up; a few members spoke in favor of a union building, but the Society voted emphatically for a home of their own. The great majority of the Society probably has no desire to share the responsibilities of housekeeping with other organizations, which, on practically equal resources, have spent their incomes in ways that have left them without the admirable home, excellent library and voluminous professional literature which the civil engineers now enjoy. A few civil engineers, a very small number so far as The Engineering Record can perceive, have occupied considerable space in the correspondence columns of some journals with their arguments for a union house, but where one affirmative argument has been made in print there have been a dozen negative arguments in conversation. The feeling of the members of the Society at large is apparently strongly against any apartment-house home. The present house is an excellent one and ample for all purposes for a long time to come, except once a year during the annual meeting, when the auditorium is crowded. One of the arguments which led to the selection of the present site was the possibility of holding this specially attended meeting in one of the halls of the Carnegie Music Hall, a few steps distant. The library is now well arranged, growing rapidly and available day and night, except on Sundays and holidays. The kitchen accommodations are ample for all the modest requirements of the Society. As the Society's building is sufficient and its library is adequate for all needs, the great majority of the members, not residents of New York, have hitherto failed to see the advantages of any kind of an alliance with societies which, in their opinion, do not accomplish anywhere near so much for non-resident members. The recent flurry over the affairs of the American Society of Mechanical Engineers, whatever its facts may have been, led many members of the older organization to express their satisfaction that they were not entangled in any way in such a matter.

On the other hand the national organizations of the mechanical and electrical engineers, as well as the Engineers' Club, will find in this generous and unsolicited gift from Mr. Carnegie a means of meeting very urgent needs. The American Society of Mechanical Engineers, through a subsidiary corporation, owns a remodeled dwelling house barely adequate for its requirements, the Engineers' Club is also housed in a remodeled dwelling unsuited for its present purpose, while the electrical organization has simply a small executive office. The mining engineers' society has always been opposed to elaborate headquarters, its idea being to maintain only enough of an office for accounting and for editing its publications. The number of local members is small and, if the convenience of the membership at large were consulted, it might be found that an office in St. Louis or even Denver would be equally satisfactory with one in New York. None of these societies, however, is in the same position as the American Society of Civil Engineers, the oldest and strongest of all, with a good home, a fine library and a very large conservative non-resident membership not disposed to enter upon a hazard of new fortunes with no very definite gain in sight if successful, even to the local members. These non-resident members may be definitely counted upon to reject any plan for abandoning their present possessions for a situation whose main advantage seems to be a back-door approach to the dining room of the Engineers' Club. The generosity of Mr. Carnegie will be sincerely appreciated by the members of the American Society of Civil Engineers; but the statements of a few of its members to acquaintances in other societies, leading them to believe that this old and strong organization is in need of assistance to a lodging place, will probably produce a result surprising to the gentlemen who have been misinformed concerning its needs and desires. The Engineering Record doubts that one member in ten will vote to abandon the present house.

Engineering English.

The announcement that among the papers to be presented at the annual convention of the American Institute of Electrical Engineers there will be one on Engineering English, is particularly interesting in view of some remarks by President Humphreys, of Stevens Institute, published in the "Indicator" for last month. "The engineer," he said, "must be more a man of business than he has been in the past. It is not enough that the technically trained engineer should be practical in the shop and in the field; he must be practical in his ability to meet business men on their own ground. Some engineers fail to secure success because they carry too large a proportion of science; some because they have not enough; and others because they fail to recognize that commercial efficiency must outweigh theoretical efficiency. The training for the engineer must be a harmonious blend of science, practice and commercial judgment." In another address he emphasized the fact that the engineer must find his success within the limitations of commercial conditions, and, to that end, "must be able to convey to his employers or associates in language concise and explicit the results of his work or investigations." The commercial ability as well as the technical knowledge of the man making these remarks ought to impress their importance strongly on young engineers, particularly as other portions of the address in which they were made indicate President Humphrey's belief that the technical graduate is least satisfactory in his relations as a business man. President Pritchett, of the Massachusetts Institute of Technology, has also hinted at the same idea in the following terms: "The young engineer learns when he first goes into the world that the thing by which he is tried is not his technical training, not his ability to know about steel, but it is his ability to deal directly, pleasantly, effectively with other men."

The only means of dealing with other men is so manifestly by means of language that the lack of adequate training in the use of language in technical schools is astonishing. A feeling seems to prevail that the study of the English language and the study of English literature are the same. So the young engine builder or sanitary expert examines critically, laboriously and wearily the rumored beauties of "The Confessions of an Opium Eater," or "The Seasons," and wonders why such a waste of time is forced

upon him. Of all the still-used but antiquated relics of the dark ages of pedagogy, it will be difficult to find one more unsuited in every way for its purpose than the average language course in a technical school.

The trouble with the technical schools' language courses is that they are not practical in character. Many essays have to be written, but the young men are not trained to express their ideas clearly and concisely in all the recitation rooms. They are given the idea that language study is reserved for the language course, and that they can murder their native tongue with impunity save in their stilted "themes" on books they read for one professor. Some day a college president will take this subject in hand, and require every recitation to afford language training, he will throw out the "masters" and bring in editorials in good newspapers as the models for style, he will drive the idea into his classes that a heavy and ponderous style is a disadvantage to an engineer, and that the ability to explain clearly what one knows is as important commercially as the knowledge itself. His graduates may not know so much about gems of literature, but they will be able to write a letter without misspelling the unusual words, and their letters will be direct and clear.

The president who introduces such a change will find his output of graduates in remarkably high demand in a short time, and the graduates themselves will rejoice at the advantages they possess in business relations with other men.

The Sky-Line in Boston.

It will be recalled by those interested in affairs of national importance that some years ago, when the Commonwealth of Massachusetts had committed itself to the construction of a new state-house of a dignity in keeping with its purpose as the home of the Sacred Codfish and the scene of the deliberations of the General Court, it was proposed to enact a strict law against the erection of any building exceeding a certain height in the vicinity of the new forum. The purpose was to keep the sky line of the neighborhood so low that the gilded dome of the state-house could be seen from far, and thus serve as a beacon to attract all in search of legislation. Unfortunately for the success of this project, the numerous buildings of the neighborhood were already so lofty that the cost of lowering the sky line would be prohibitive. But a somewhat similar proposal was made about the same time for the preservation of the chaste isolation of the Art Museum, as well as for the sunny exclusiveness of Copley Square. Art in Boston is second only to Culture in the hearts of her citizens, and the home of Art was threatened with profanation by the construction of high buildings, which, with the assistance of the sun, would cast shadows on the Museum and darken the pathways of the Square trodden by the famous learned men of the city. As the course of the sun is not amenable to legislation and the city authorities were not open to conviction concerning the need of restricting the height of buildings in the neighborhood of the Square, pressure was brought to bear on the General Court, and an act was passed by it in 1898 restricting buildings facing on this select place to a height of 90 and 100 feet, depending on their location.

This act is an interesting piece of legislation. It limits the heights of buildings on a few of Boston's streets, as already mentioned, but permits the erection above the prescribed elevation of "steeples, towers, domes, sculptured ornaments and chimneys" which are approved by the city's Board of Park Commissioners. Parties interested in structures whose lofty aspirations are thus curbed by the rein of law are given redress from the City of Boston "by proceedings in the manner prescribed by law for obtaining payment for damages sustained by any person whose land is taken in the laying out of a highway in said city." It will be noticed that all the city is able to do in the matter is to fight against the damages property owners may endeavor to collect from it under the terms of the act.

One of the best of the new buildings of Boston, known as the Westminster Chambers, was erected above this elevated dead line, and the State Attorney General accordingly brought the infraction of the law to the attention of the State Supreme Court. Owing to the somewhat unique character of the legislation, two suits were begun, one by the State against the owners, and one by the owners against the City of Boston for damages. The conclusion of the litigation against the city has apparently not yet been reached, but the owners of the building have been ordered by the Supreme Court of the United States as well as the Supreme Court of Massachusetts to remove those parts of the structure, other than the towers and other embellishments which take the fancy of the Park Commissioners, rising above a height of 90 feet. The courts hold that it is lawful to order the reconstruction of the building before the cost of the work is determined by the first suit mentioned, because an adequate provision is made for compensation by an entirely solvent debtor, even though the debtor is disposed to fight against his assessment. In the terse and vivid language of 23 Sup. Ct. Rep. 440, in summarizing the decision of the United States Supreme Court: "Due process of law is not denied the owners of property damaged by the enforcement of a restriction on the height of buildings on certain Boston streets, imposed by Mass. act May 23, 1898, on the theory that the right of action thereby given to recover damages from the City of Boston in the manner prescribed by law for obtaining payment for damages by any person whose land is taken in the laying out of a highway does not afford adequate provision for compensation because the city, not being a party to the taking, is not technically estopped to deny its liability, since such statutory liability is of a character which, under the decisions of the State courts, the legislature may impose on a municipality."

Since the beginning of this litigation it has been decided to move the Art Museum, and so the pressing need of this altitudinous legislation has disappeared. But the fact that a lofty structure on its frontier might cast gloom over Copley Square, a locality as dear to the Bostonian as the Manhattan terminal of the Brooklyn bridge to the New Yorker or the Stock Yards to the man from Chicago, is sufficiently disquieting to warrant the belief in the futility of any hasty repeal of this interesting legislation. For many years this famous square will probably be as open to the sun as if protected by the law of ancient lights of our British friends, and the only shadows on its well-kept surface will be cast by those eminent citizens who pace its paths meditating on the achievements of the other great men who have made Boston famous. The fact that this exclusiveness has been obtained at considerable cost to the taxpayers and no little interference with building operations of an important nature need not be considered; for it was all due to legislation by men from the country districts, slow and steady of thought, and much more likely, of course, to know what Boston really needs than her own citizens and taxpayers.

Erection of the Manhattan Approaches to the Williamsburg Bridge.

The erection, which is now well advanced, of the viaduct approaches at the western end of the new East river bridge, known as the Williamsburg bridge, will substantially complete that $20,000,000 structure with the exception of its great suspended center span. The design of the bridge and the operations for its construction have been of a magnitude unequaled by any other bridge so far completed in this country, and exceeded by few in the world. As most of our readers will remember, the bridge has a main channel span 1,600 feet long, 150 feet high in the clear and 114 feet wide with a capacity for six railroad and street car tracks, two wide roadways, two sidewalks and two bicycle paths. There are two 3,000-ton steel towers about 335 feet high, four heavy 300-foot approach spans and over 4,100 feet of approaches with two-story steel viaducts like elevated railroad structures. Construction was commenced in 1897 and has continuously progressed in distinct operations, which include the building of the main tower piers with their difficult foundations about 100 feet below water level, construction of the anchorage piers on dry land, building the steel towers, the approach spans, the main cables, the earth and masonry portions of the approaches and the steel viaduct approaches, nearly all of which have been fully described and illustrated in The Engineering Record.

The Manhattan viaduct approach is 2,500 feet long and weighs about 12,000 tons. The details of its design were illustrated in The Engineering Record, May 12, 1900, and the general method of erection and plan employed are the same as for the work on the Brooklyn approach which was described in our issue of September 21, 1901. There are, however, some modifications of the work which are of interest to note; and the essential features of the erection are shown more graphically by the accompanying illustrations than by those previously published. There are four longitudinal lines of columns and plate girders supporting transverse double cantilever plate-girder floor beams 114 feet long in the lower floor of the viaduct. In the middle of this deck a double row of columns forms a second tier supporting the deck for the elevated railroads.

The columns, longitudinal girders and their bracing have been erected by a special double-boom steel traveler running on the longitudinal girders and overhanging them far enough to assemble a complete panel in advance with its trolley hoists. The lower story of the second panel of the viaduct from the Manhattan anchorage pier and the steel traveler were simultaneously erected by derricks on a wooden falsework tower. The traveler then erected the third panel of the viaduct and moved forward on it and the wooden tower traveler was erected on the second panel. The steel traveler then worked westward, assembling the lower part of the viaduct as shown in the progress picture where one boom is seen setting an inside longitudinal girder and the other boom is assembling the main transverse girder-strut.

The timber tower traveler for the erection of the elevated railroad structure and the main floor beams follows the steel traveler and runs on the two inner lines of longitudinal girders, moving backwards away from the second story which it erects. It is about 40 feet high with timber posts and horizontal struts, and pin-connected diagonal rods in each face. The two stiff-leg derricks which are mounted on top of it have 42-foot masts and 10-ton 54-foot booms operated by 4-drum Lidgerwood hoisting en-

gines seated on its lower platform. A third traveler, not shown in the photographs, consists of two special cars running on one of the trolley tracks on the main platform of the viaduct and carrying a complete air compressor plant for the pneumatic hammers by which nearly all of the field rivets are driven.

The steel work for this approach was delivered by lighters to the contractors' dock under the approach span, where as much as 800 tons are sometimes stored about 16 feet above street level and are handled by two 15-ton boom derricks which unload it from the lighters and deliver it to flat cars drawn by 15-ton standard gauge locomotives on a temporary elevated distribution track built alongside the viaduct from end to end on the 192-foot right of way. The distribution track was built with two lines of 12x14-inch yellow pine stringers, supported on timber trestle bents each consisting of two vertical and two batter posts scabbed to the caps and sills and X-braced.



ERECTING UPPER STORY OF VIADUCT.

Ordinarily, the materials were unloaded from the distribution cars by the booms of the steel derrick which erected the columns and longitudinal girders, and piled other members on the ground, whence they were hoisted by the tower derrick as required for erection. Other material, which was delivered by the distribution cars in advance of the steel traveler, was unloaded by a stiff-leg boom derrick on a special car between the locomotive and the material car. The boom was operated by the locomotive moving back and forth with the fall line. In some cases, when the material was received more rapidly than it could be stored on the dock or erected by the steel traveler, the 17-ton longitudinal girders were delivered by the distribution train to one boom of the steel traveler; passed from that to the other boom and loaded by it on trucks drawn by ten horses which carried them forward to the required place, where they were skidded to the ground, thus involving a considerable additional expense.

At the west end of the viaduct four bents of steel work were erected in advance of the traveler, so as to permit the masonry contractors to finish their work there without delay. Elsewhere the progress of erection was from east to west with the successive travelers operating in the manner already described. With the exception of two or three special spans, the Manhattan viaduct has now been erected up to the main floor beams, and the steel traveler has been taken to pieces and removed, and will be stored for future use on other contracts.



ERECTING LOWER STORY OF VIADUCT.

It is hardly necessary to add that the bridge is being built by the department of bridges of Greater New York. Mr. Gustav Lindenthal, commissioner of bridges; Mr. L. L. Buck, consulting engineer; Mr. O. F. Nichols, engineer in charge; Mr. Kingsley L. Martin, resident engineer and Mr. Alexander Johnson, assistant engineer on the Manhattan approach.

The Pennsylvania Steel Company is the contractor for the viaduct and its erection; Mr. J. V. W. Reynders, superintendent of bridge and construction department; Mr. Fred W. Cohen, engineer of erection; Mr. L. N. Gross, general foreman of erection.

Proposed Parkway in St. Louis.

The uniting of the park system of St. Louis into a harmonious whole is proposed in the recent recommendations of the Kingshighway Commission of that city, the members of which were appointed in July, 1902. A thorough investigation of the subject has been made by the commission, and plans prepared under the direction of Mr. George E. Kessler, of Kansas City, as landscape architect. It is proposed to construct a parkway extending mainly along Kingshighway from Carondelet Park, at the south, continuously through the city to the large cemeteries and O'Fallon Park, at the north, while it is further recommended that the city acquire the property necessary for an extension of the system to Chain of Rocks. The width of the proposed parkway varies from 100 to 250 feet, and the arrangment of the parking differs in the various sections according to the conditions. In the neighborhood of Manchester Avenue a viaduct about 3,500 feet long will be necessary to cross several railroads, and both the St. Louis chapter of the American Institute of Architects and the St. Louis Architectural Club have submitted designs for this viaduct. The former plan provides for several concrete steel arches of 100 and 125 feet span, while the essential feature of the latter is a single steel arch of 325 feet span. The cost of the viaduct proposed by the Architectural Club has been estimated at $600,000. Several builders of concrete steel structures have also submitted designs for this viaduct. The estimate of the cost of the contemplated improvements follows: Land and assessments for widening, $500,000; viaducts, $700,000; planting Kingshighway and improving parks, $300,000; making a total of $1,500,000. Mr. George B. Leighton is chairman of the Commission.

Types and Details of Bridge Construction.—V.

By Frank W. Skinner, C. E.

Spandrel-Braced Arches, Concluded.

The Niagara Railway Arch across the Niagara River, at Niagara Falls, replaces the famous railroad suspension bridge built on the same site by John A. Roebling in 1855, which had a center span of 821 feet and a height of 225 feet above the river. It was described in The Engineering Record of April 24, 1897, and in the "Transactions" of the American Society Civil Engineers, Vol. 40, page 125. The new bridge has two spandrel-braced two-hinge steel arch trusses with horizontal top chords, and bottom chords of straight sections, one panel long, which are chords of a parabolic curve. The span is 550 feet, the rise 114 feet, and the depth of truss is 20 feet at the crown and 134 feet at the ends. The trusses are 56 feet 9⅝ inches apart on centers at the skewbacks, and are battered 1:10 so that the top chords are only 30 feet apart.

All truss members are compression pieces with rectangular cross sections, built up of plates and angles and all connections are made with double gusset plates, except at the skewback hinges. There are stiff lateral braces in the planes of the top and bottom chords, sway braces in transverse vertical planes at panel points, and longitudinal horizontal struts from the haunches to the end posts to stiffen the longest web members. The main floor beams are 54-inch plate girders seated on the tops of the vertical posts, and carrying two railroad tracks. At each end of each beam, there is a curved knee brace with a solid web plate and flange angles, which is riveted to the vertical post and extends to the bottom flange of the roadway floor beam. Each pair of braces forms a sort of portal and gives great stiffness to the arch trusses, as well as affording a vertical flange connection for the ends of the lower floor beams, which are carried on the battered posts. The highway floor beams are 54-inch plate girders, and carry a 25½-foot roadway about 15 feet in the clear below the upper floor beams. There is an electric car track in the middle, and an 11-foot sidewalk on each side, which is partly cantilevered beyond the truss.

The ends of the lower chords have flat base plates bolted to the double beveled upper faces of steel castings with convex lower surfaces about 4 feet long, transverse to the bridge axis, and 7½ feet wide in the other direction. Each convex surface is a segment of a horizontal cylinder 9 feet in diameter. The shoe rests on forty-five segmental rollers 5 inches in diameter and 3 feet 10 inches long, set in the concave cylindrical concentric surface of the cast steel pedestal, which has a 7x14-foot base inclined about 45 degrees. The base has a narrow horizontal flange on the lower side to prevent any danger of displacement. The pedestal, rollers, shoe and chord are tied together by two pairs of eyebars having separate pins in the pedestal and meeting on one pin in the end of the chord through the center of the cylindrical bearing surfaces of the roller beds. The segmental rollers were designed for a uniform load of 2,200 pounds per linear inch and were adopted to avoid pins of excessive diameter, the assumption being that they would be equivalent to ball bearings. The tops of the rollers are almost in contact and there are 5/16-inch square bars riveted between their lower edges to restrict the movement should there be any tendency for overturning although the actual movement has been observed to be very slight. During erection they were held in correct radial position by temporary end stops. The cast steel skewback pedestals weigh 35 tons each and are seated on very large separate piers of dimension limestone with granite copings normal to the line of pressure, except for a short horizontal portion at the lower end which afforded a stop to take the vertical component of the thrust and prevent any possibility of displacement during erection. On the New York shore the piers are seated on the solid rock ledge, but on the Canada shore they have concrete footings.

The maximum masonry loads per square inch are, on top of coping 339 pounds, under coping 300 pounds and on concrete 113 pounds. The pedestals are bedded on the copings with a thoroughly rammed rust joint made 1:32 by weight of sal ammoniac and cast-iron filings. The trusses were designed for a live load on each track, of two locomotives each having 40,000 pounds on each of four axles and followed by a train load of 3,500 pounds per linear foot. The stresses were calculated by the method in chapter XII. of Professor Greene's text book on arches, and then the sections were increased to be a mean between these requirements and those assuming that there was a center hinge, thus providing for inaccuracy of adjustment. The camber was designed to be 8 inches at 60 degrees Fahrenheit, and has been observed to range from 7 inches in winter to 10 inches in summer. The calculated deflection under a moving load of 10,000 pounds per linear foot was 1 15/16 inches, and the observed deflection under a 6,500-pound test load was 13/16 inch. Vibrations due to a train at a speed of 20 miles per hour are scarcely noticeable and the structure is believed to be more rigid than any other bridge of equal span. The total weight of the bridge, including a 115-foot deck truss span at each end is about 7,200,000 pounds.

The skewback piers are located half way between the feet of the cliffs and the edges of the water lines, on very steep rocky slopes where framed trestle bents were set and braced together in alternate panels to make falsework on which the approach spans were erected, operations for them and all other parts of the erection being carried on simultaneously in duplicate on both sides of the river. On each shore a two-bent steel strident traveler was erected on the river ends of the falsework beyond the steel towers of the old suspension bridge which still maintained traffic at the same level and alignment as was to be provided for in the new span. The travelers cleared the old cables and stiffening trusses and had, on the forward corners, two 40-foot, 40-ton booms, which commanded one panel of the truss in advance.

The travelers set the 35-ton skewback castings and assembled all the members of the first panels which were temporarily supported on falsework bents under the lower chords. After the end panels were completed the skewbacks received the vertical loads and thrusts and the tendency to rotate around them was resisted by the erection anchorages connected to the ends of the top chords. These had pin-connected chains, with a minimum area of 80 square inches, which extended horizontally nearly 300 feet from the shore ends of the top chords, were deflected vertically over radial struts, and had bottom pins engaging reaction beams solidly concreted in the enlarged bottoms of narrow vertical shafts in the solid rock.

Commencing at the river end the chains were made with three panels of eyebars, six panels of the temporarily assembled riveted top chords of the deck approach spans, two 26-foot panels of adjustment eyebars, four short panels of square-ended un-forged deflection bars and one panel of vertical eyebars. The bars in each pair of adjustment panels were arranged in the



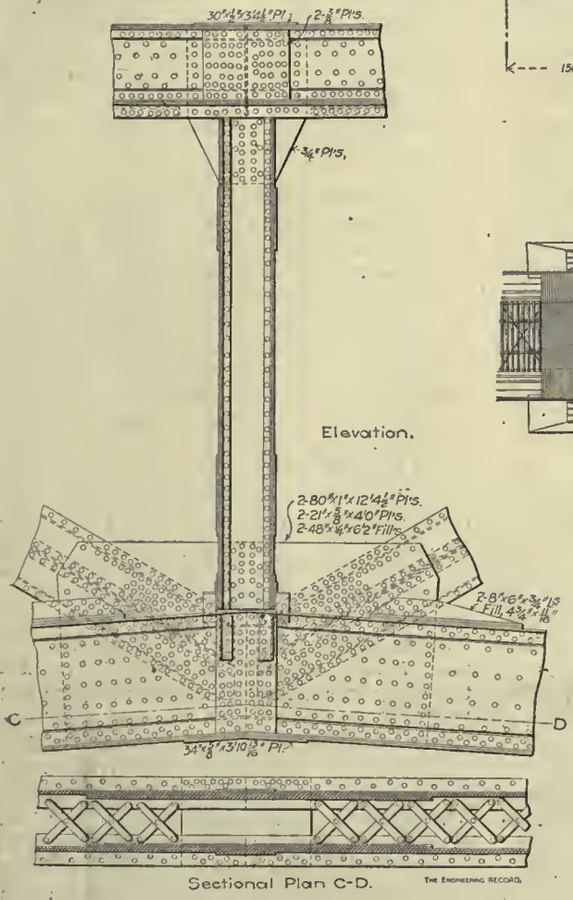
Making Final Connections in Center Panel.



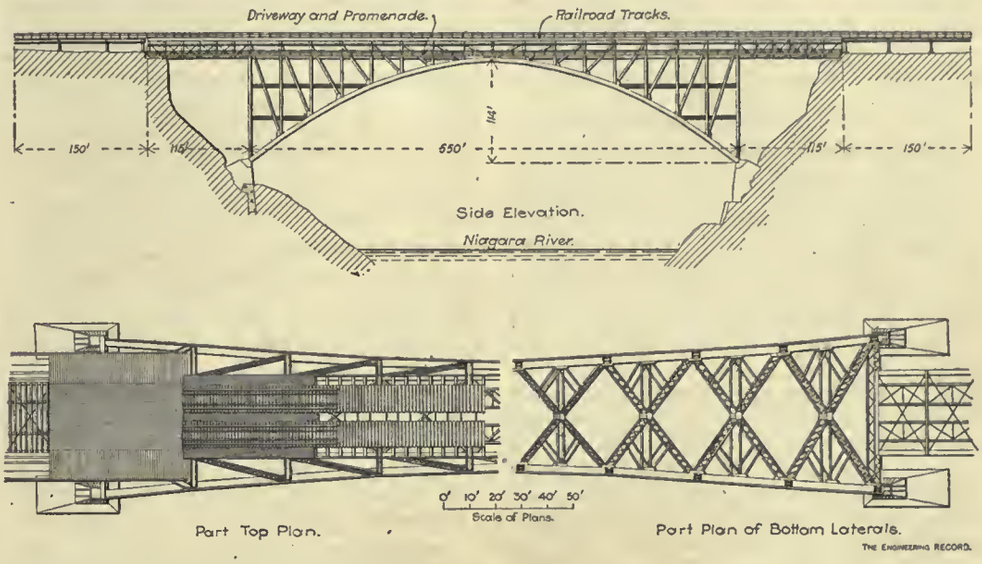
Arch Span before the Removal of Suspension Span.

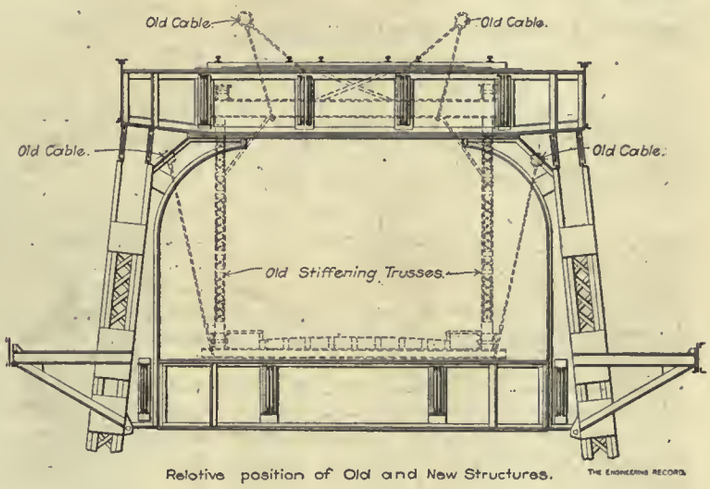
form of an oblique parallelogram having for the short diagonal, a vertical screw 9½ inches in diameter and 17 feet long. The ends of the screw had right and left handed threads engaging the yokes to which the eyebars were pin connected, and the lower ends had also capstan heads by which they were turned to lengthen or shorten the diagonal of the parallelogram and correspondingly vary the length of the anchor chain. As its shore end was fixed this necessarily gave a horizontal movement to the river end which was attached to the top of the end vertical post of the arch truss and, revolving it through an arc around the skewback pin, raised or lowered the river end of the semi-truss by the combined action of the screw and toggle.

As the travelers erected the panels of the trusses in advance, cantilever-wise, they successively moved forward on the top chords and received the truss members from cars on tracks made with the railroad stringers temporarily

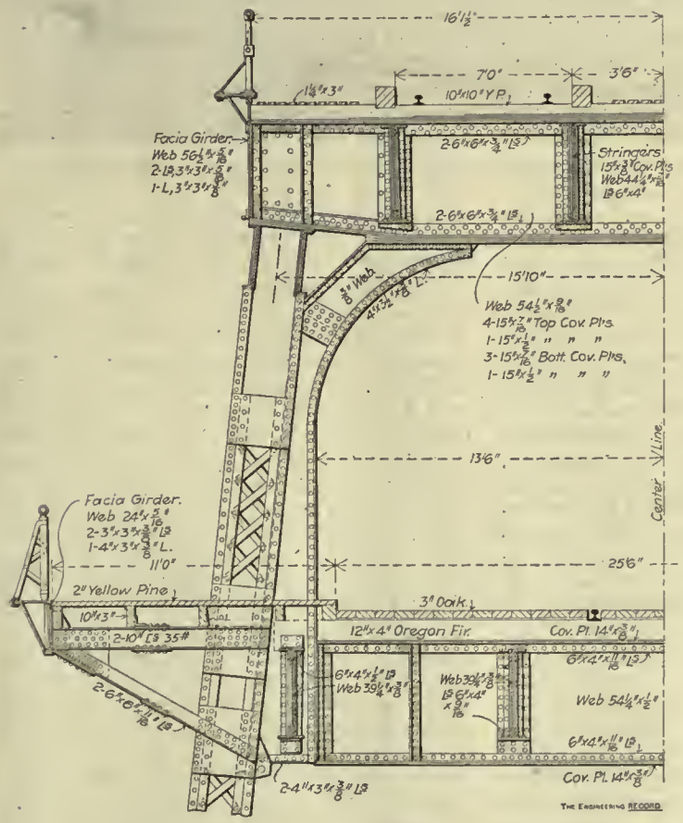


Typical Detail of Truss.

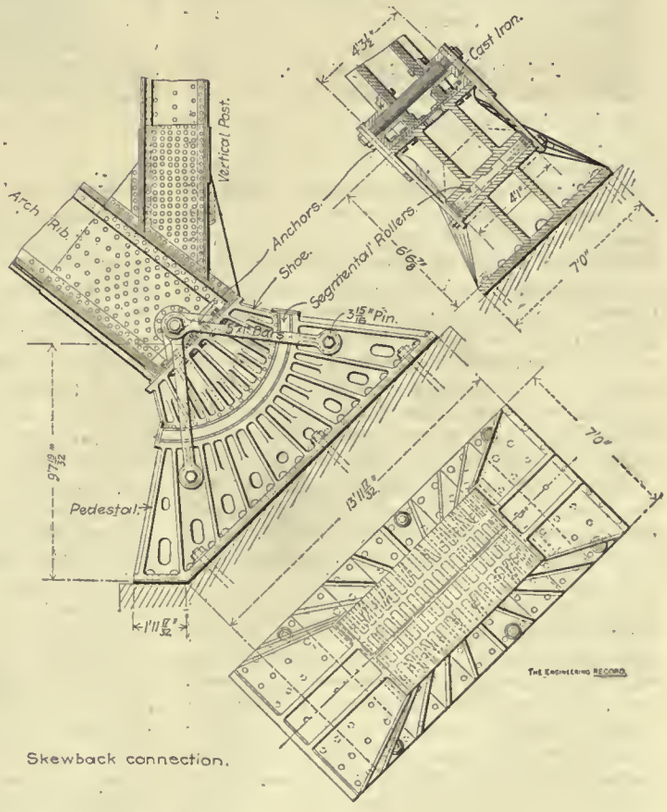




Relative position of Old and New Structures.



Typical Half Sectional Elevation of Arch Span.



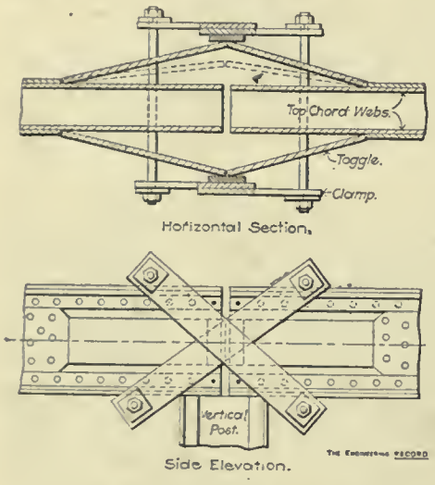
Skewback connection.

DIAGRAM AND DETAILS OF NIAGARA RAILWAY ARCH.

supported on the sidewalk brackets and afterward permanently assembled between the same floorbeams. The travelers were made with four double posts, each of which was much wider at the top than at the bottom, so as to secure transverse rigidity without diminishing the train clearance by kneebracing. The tops of the posts were connected by light deep longitudinal and transverse lattice-girders, and the longitudinal faces of the travelers were X-braced by screw rods.

Owing to the absence of crown hinges it was necessary that the location and alignment of the skewback pins be very accurate and so their centers were plumbed down to the piers from the old suspension bridge and lined in by a transit on shore. When the center panels of the two arch trusses had been erected there was an opening of 8 inches between the ends of the top chords, due to the upward inclination which had been provided for erection clearance. Six horizontal operating levers were inserted in the capstan head at the foot of the vertical screw in each of the four adjustment toggles and two men on each lever slacked them off under a stress of over 1,000,000 pounds each, lowering the ends of the semi-arch trusses. One of them being inadvertently lowered too far was raised again by eighteen men on its toggle.

Theoretically, the crown joints should have closed first at the top chords, and as they shortened under compression the lower chords or arch ribs should have come into abutting contact. On the contrary, the bottom chords met first, and when the toggles had been slacked off and the anchorages entirely released, there still remained a clearance of ½ inch between the ends of the middle top chord sections and all the compression at the center was taken through the bottom chords whereas 700,000 pounds of it should have been taken in the top chords. The anchor chains were then removed and drift pins and bolts were taken out of the rivet holes in the bottom chord splices, allowing the joints there to close more accurately and reducing the crown opening to ¼ inch.



Adjustment Toggle at Crown.

As the ends of the center lengths of top chords could not be brought to contact it was determined to separate them a little more and insert a filler thick enough to wedge them apart and develop the required compression when they were released and thus secure the desired distribution of compression between the top and bottom chords. This was effected by means of an improvised compression toggle constructed from simple materials at hand and applied to the top chord center joints. Pairs of square-ended, thick flat steel bars were set in a V-shape each side of each joint, with their adjacent ends in contact and their opposite ones abutting against the vertical ends of thick plates riveted to the chord webs. A pair of similar heavy flat bars were arranged in X-shape in the vertical longitudinal planes through the abutting ends of the V-bars, parallel with the chord webs, and the ends of these pairs of bars were connected by horizontal bolts above and below the chords. Screwing up these bolts flattened the angles of the V-bars and forced the ends of the top chords 1 inch apart and a permanent shim of corresponding thickness was inserted, the toggle slacked off and removed and the adjustment effected so as to conform closely to the theoretical camber.

The lower floor was raised to its final position, the stiffening trusses of the suspension bridge were blocked up on the arch trusses and removed in one-panel sections, the new upper floor was put in, the field riveting was done with two 70-ton pneumatic riveting machines operated by a compressor plant on the American shore, and finally the main cables and towers of the old bridge were removed, all without serious accident or the interruption of the service of trains sometimes only 15 minutes apart. The contract for the superstructure was let June 15, 1896, erection was commenced September 17, 1896, and the bridge was tested July 29, 1897.

Recording Pressure Gauges as Aids in Water Works Management.

By A. O. Doane, Division Engineer, Metropolitan Water Works, Boston.

The use of recording instruments in all branches of engineering is constantly increasing as their advantages are realized and new devices extend their field of operation. Many water-works systems are now equipped with recording gauges, and even small plants find it to their advantage to have at least one gauge connected with the main pipe system. By the use of these instruments, the manager or superintendent of a water-works system is kept informed of what is going on by a corps of watchmen who do not sleep, but faithfully and impartially record the variations of pressure in the pipes to which they are connected, the height of water in tanks or reservoirs or the pressure of steam on the pumping station boilers. The person in responsible control is thus enabled to keep his finger on the pulse of the system and detect in this way much that might otherwise escape his observation.

The gauges furnish a check on the operations of subordinates when engaged in work on the mains, show the time of opening and closing gates and often bring confusion to some employe who thinks he can disobey orders and not be found out. Knowing the normal pressure at the point where the gauge is located, the cause of any serious departure therefrom may be investigated and the proper remedy applied. In case of leaks or breaks a record is obtained showing the date and hour that the accident occurred, the drop in pressure and the time when gates were shut to cut off the leaky section, thus furnishing indisputable evidence of the efficiency of the maintenance force in emergencies. When a large fire causes great destruction of property, with perhaps loss of life as well, the fire department is often severely criticized, and sometimes the firemen attempt to put the blame on the water department saying that the pressure was too low or main gates were shut that should have been open. In such cases the recording gauge charts will show the real condition of affairs, and it may be found that the drop in pressure was not serious, or if there was a large loss of pressure in the immediate vicinity of the fire it may have resulted from injudicious attempts to take too many hose streams from a single line of small pipe or from a dead end, when a better distribution of apparatus would have given more effective service.

The question of the unauthorized use of water from fire supply pipes by mill corporations and others is causing considerable discussion in water-works circles at the present time. The authorities of some manufacturing towns have successfully employed the recording gauge as a detective whose evidence has often proved conclusive and resulted in a settlement of the controversy. In some cases a portable gauge is used which may be attached to a hydrant or other convenient fixture near the suspected premises. The gauge is sometimes enclosed in a strong box or case which may be locked securely.

Much damage to water mains is caused by shocks or water ram and the origin of the trouble is sometimes hard to locate. In cases of this kind the recording gauge is of great service, as it fixes the exact time that the shock occurs, and this will often furnish the needed clew to the mystery. If several gauges are distributed about the system the location of the disturbance is often indicated by the records, the one nearest the source of trouble will show the most marked variation in pressure. Some of the common causes of shocks in water pipes are the operation of hydraulic elevators, the filling of locomotive tanks from the mains direct, filling tanks of electric sprinkler cars from a large connection with the water mains, too rapid closing of gate valves, hydrants or watering cart standpipes.

An approximate measure of the amount of water flowing in a main having no side connections may be obtained by knowing the size and length of the pipe between the gauges and the difference in elevation of the instruments, thus determining the loss of head due to friction and the corresponding flow of water.

When installing a recording gauge it is best to connect it with the water main by means of an independent service pipe wherever possible and avoid putting it on the piping system of a building, where the gauge will be subjected to sharp shocks whenever the fixtures are used. These variations in pressure will confuse the record and the vibrations have a tendency to injure the spring of the instrument. The corporation cock nozzle of a gauge service should be long enough to go through the wall of the water main and project at least ¼ inch inside, in order to prevent rust tubercles from closing the opening. The connection should always be made at the side of the main—never on top—and it is well to incline the cock slightly downwards, thus preventing air from entering the pipe and causing an error in the pressure recorded. The ⅝-inch and ½-inch sizes of lead pipe make good gauge connections and are easily laid. A piece of brass pipe is commonly used to connect the gauge to the lead pipe. The gauge cock should be fitted with a union coupling above the shut-off so that the gauge may be easily removed for testing and repairs without having to go down cellar to shut off the water. It is well to put a sidewalk stop in the line so that the water may be shut off outside the building without digging up the corporation cock. Especial care should be taken to protect the pipe from freezing, as owing to the lack of circulation, gauge services are particularly liable to damage from frost. In selecting a gauge, care should be taken to get one which will register a maximum pressure at least 40 pounds higher than the normal pressure at the point where it is to be placed. This avoids unduly straining the spring causing a permanent set in the metal, and also allows shocks and maximum pressures to be recorded.

The paper dial or chart of the gauge should be about 8 inches in diameter. A smaller record is unsatisfactory, because the scale is too small to show small variations in pressure or differences in time. Recording gauges should be tested at least once a year either by comparison with a gauge of known accuracy or by the use of an oil gauge tester which operates by means of a piston to which weights may be applied, thus causing a known pressure in a small reservoir of oil to which the gauge to be tried is connected. Where a number of gauges are in use some filing device will be found convenient. The dials are commonly kept on spindles set in circular wooden or light metal bases, the pins being made long enough to hold a year's supply of dials for one gauge. These files are placed in a cabinet having shelves of a convenient size. The records are thus preserved from dust and may be readily consulted at any time. A rubber stamp to mark the dials with the name of the station, elevation of the gauge, and date line will be found useful.

The gauge charts are commonly graduated to show the pressure in pounds per square inch, but if in comparing records from different gauges of known elevation the head in feet equivalent to the pressure shown on the dial is added to the elevation of the gauge a convenient basis of comparison is furnished. In order to avoid numerous computations a special scale has been devised made of transparent celluloid about 1/32 inch thick. It is of the same size and shape as the paper charts with a center hole of the same diameter as the one in the paper dial. The graduations are engraved on radial lines and one dozen or more may be laid out on the same celluloid disc. The individual scales are made to conform to the scale and elevation of the particular recording gauge with which they are to be used, and when placed above the chart from this gauge with the central holes coinciding the elevation in feet above the datum plane equivalent to the pressure shown on the record may be read directly, and by revolving the dial any part of the record may be examined. The best way to use the device is to have a circular base made with a short stud in the center made to fit the hole in the record chart exactly. The chart is placed on the wooden base and the celluloid dial put on top, the stud making scale and chart concentric. The scale may then be revolved and any part of the record examined with ease and rapidity.

The pen of a recording gauge should be of the enclosed reservoir type, as this protects the ink from dust and evaporation, also from flying about when the arm moves quickly. The pen should bear lightly on the paper, as it will affect the correctness of the record if it presses too strongly, or only mark in spots if the pressure of the pen is too light. In cases where there is considerable violent vibration it may be necessary to throttle the gauge cock to avoid damage to the spring, but this should be done cautiously, as it will often cause the gauge to register less than the true pressure.

Shipping a Pair of Long Plate Girders.

A pair of 105-foot plate girders, 9 feet high and weighing 62,000 pounds each, were recently built by the Phoenix Bridge Company and shipped complete from their shops to Jefferson, Ala., for the Southern Railway Company. They were set as close together as possible on a pair of transverse sills, about 74 feet apart, on the decks of two steel flat cars of 100,000 pounds capacity each, with a third similar idle car between for a spacer. The sills were placed nearly in the centers of the end cars and were pivoted to them by vertical 3-inch pins in the centers, one of them having a round hole in the car deck and the other having its hole slotted about 6 inches to allow for longitudinal displacement. The ends of the 12x14-inch sills were shod with steel plates and slipped on segmental track plates to allow angular displacement on curves.



SHIPPING TWO 105-FOOT PLATE GIRDERS.

On the ends of the sills were seated 8x8-inch inclined posts, with their upper ends fitted to bear against the webs and under sides of the top flange angles, connected by horizontal bolts through the tops of bent channel-bars bolted to the upper ends of the braces. The lower ends of the braces were beveled to fit the upper sides of the sills and bear against the vertical flanges of short heel angles bolted across the sills. The sides of the braces were filleted out with wooden blocks to receive steel jaw plates bolted to them and to the sides of the sills. Each end of each sill had a pair of 1⅛-inch horizontal diagonal rods passing through it in opposite directions with their nuts bearing on beveled washers. The opposite extremities of the rods had loop eyes with connection bolts engaging open rivet holes in the bottom flange of the girder.

Biological and Chemical Laboratories of the Water Department of New York City.

By George C. Whipple, Director.

Mt. Prospect laboratory, of the Department of Water Supply, Gas and Electricity of the City of New York, has been recently enlarged and its scope of operations greatly increased. When this laboratory was established in 1897 by Mr. I. M. de Varona, C. E., then engineer of water supply, and now chief engineer of the Department for the Borough of Brooklyn, the city of Brooklyn was an independent municipality and the work of the laboratory was practically confined to the Ridgewood water system. After consolidation the work was extended to cover the water supplies of the Borough of Queens. Since June, 1902, samples of water from the Central Park Reservoir, in Manhattan, have been regularly analyzed. In January of the present year the work of the laboratory was further extended to cover all the water supplies of greater New York, present and proposed. On the appointment by the mayor of the Commission on Additional Water Supply, Messrs. William H. Burr, Rudolph Hering and John R. Freeman, the facilities of Mt. Prospect laboratory were placed at their disposal by Commissioner Monroe, and this commission in turn placed the sanitary investigations involved in the selection of the future supply of the city in the hands of the director of the laboratory. All this has necessitated a material increase in the working staff and the establishment of two branch laboratories, one at Katonah on the Croton watershed and one at Poughkeepsie, N. Y., on the Hudson River.

The present staff organization is as follows: Director, George C. Whipple. Mt. Prospect laboratory: Chief chemist, Daniel D. Jackson; chemists, P. Schuyler Miller, Justin S. Brewer and Frank E. Hale; bacteriologist, Luther R. Sawin; two laboratory assistants, one clerk, one stenographer, three laborers and two office boys. Katonah laboratory: Bacteriologist, Edward P. Walters; one laboratory assistant. Poughkeepsie laboratory: Director of field work, George A. Johnson; one laboratory assistant, one stenographer, one office boy, six field assistants, one boatman, and about twenty-five sample collectors and gauge-readers. Division of Soil Physics: Field assistant in charge, Langdon Pearse; field assistant, A. D. Kinsman; one laborer. Including the special sample collectors on the watershed, this makes a total of 56 men. The work of the laboratory may be subdivided as follows: (1) Supervision of present water supplies of New York City; (2.) Tests and analyses of supplies, such as cement, coal, and lubricating oil; (3.) Sanitary investigations for the Commission on Additional Water Supply; (4.) Experiments on soil physics for the Commission on Additional Water Supply.

Supervision of the Present Water Supplies. The water supply of Manhattan is taken from impounding reservoirs on the Croton watershed, led by aqueducts to reservoirs in Central Park and thence distributed. A portion of it is pumped from the aqueduct at High Bridge into the high-service system. Practically all of the water passes through the 135th Street gatehouse, which marks the end of the aqueduct lines, and from this point daily samples are collected and carried by messenger to Mt. Prospect laboratory for bacteriological and physical analysis. Daily samples are also collected from a tap at City Hall Square. Weekly samples for complete sanitary analysis are collected from these points and also from the reservoirs in Central Park, where at times extensive growths of microscopic organisms occur. The results

of these analyses are transmitted weekly to Chief Engineer Nicholas S. Hill, Jr.

In order that proper sanitary supervision may be kept over the watershed, a thorough and systematic inspection of nuisances has been devised and placed under the charge of Mr. Fred K. Betts, assistant engineer, who will have his office at Katonah. The laboratory has been built near Mr. Betts' office and is just being put in operation. Thus, analysis and inspection will go hand in hand, as they should do to obtain the best results. The problems involved in the storage of the Croton water are largely biological, and the Katonah laboratory, in its scope and equipment, resembles the old Chestnut Hill laboratory of the Boston water works. Samples for chemical analysis are sent to Mt. Prospect laboratory, Brooklyn. Samples are now being collected each week from all the reservoirs at various depths and from the most important streams. Special studies upon matters connected with pollution are in progress, and plans for the filtration of some of the more polluted streams are being drawn.

The Borough of the Bronx is supplied with water from the Bronx and Byram rivers, collected in impounding reservoirs and carried by aqueduct to the Williamsbridge reservoir. As this supply is not sufficient for the entire borough, a supplementary supply is furnished from the Croton system. Samples from various points on the system are analyzed each week.

The Borough of Brooklyn is supplied chiefly from the Ridgewood system, but partly from isolated driven-well stations, some of which are owned by private companies. The Ridgewood system is a complex one, there being fifteen surface supplies and as many driven well-stations. These all enter the conduit and pipe-lines terminating at the Ridgewood pumping station, from which the water is pumped into distribution reservoirs at Ridgewood and Mt. Prospect. There are two mechanical filters on the watershed nearly ready for operation and other filters of the slow-sand type are projected. The complicated character of the supply makes the amount of analytical work considerable. Daily samples from the two pumping-stations at Ridgewood and from a tap in the laboratory are examined physically and bacteriologically. Weekly samples for complete sanitary analysis are collected from the distribution reservoirs and from various taps in the city. Weekly samples are also received from the surface waters on the watershed, and monthly or quarterly samples from the driven wells. A weekly report embodying the results of the analysis is made to the chief engineer for Brooklyn, Mr. I. M. de Varona, C.E.

The boroughs of Queens and Richmond are supplied by local driven-well stations, of which there are sixteen in the two boroughs, some of which are operated by private companies. These water supplies are analyzed once each month or once each quarter, according to the uniformity of the results obtained. The operation of the above schedule yields an average of about 100 samples a week, and this number is often increased by special studies, tests of filters, etc., to 200 or 300 samples per week. Since the establishment of the laboratory in 1897, nearly 20,000 samples of water have been examined.

Tests and Analyses of Merchandise Supplies. In addition to the work of water analysis carried on at Mt. Prospect laboratory, much work is continually being done in testing the supplies purchased by the department. This work is under the personal charge of Mr. D. D. Jackson, the chief chemist, and consists chiefly of the determination of the heating power of coals, tests of lubricating oils, etc. Boiler scales are also examined and much experimental work done in connection with problems of engineering chemistry. The laboratory is also well equipped for physical and chemical tests of cement. Most of this work is now confined to the Borough of Brooklyn, but it is proposed to establish uniform specification for the purchase of supplies for the entire department.

Sanitary Investigations for the Commission on Additional Water Supply.—The selection of an additional water supply for the city of New York has involved an extensive sanitary investigation of all the possible sources which are available for this purpose, and when it is considered that the territory involved covers an area of about 15,000 square miles, the magnitude of the problem may be appreciated. The present work is confined largely, however, to the drainage area of the Hudson River, which includes the Adirondack region, the watershed of the Mohawk, the Catskill region and the region east of the Hudson River. The headquarters of this field work is at Poughkeepsie, where a laboratory has been established at 302 Main Street. There are three rooms completely equipped for physical and biological examinations of water and for experimental work. No chemical work is done there, but samples that need to be analyzed chemically are sent by express to Mt. Prospect laboratory. The work which has its headquarters at the Poughkeepsie laboratory may be subdivided as follows: (1.) Study of the physical condition of the water in the various streams and tributaries of the Hudson and in all other streams which have been considered as possible sources of supply for the city of New York. (2.) Sanitary survey of the entire region with respect to the rural and urban population, existing sources of pollution, etc. (3.) Studies of the self-purification of the Hudson and Mohawk rivers. (4.) Amount and character of the turbidity of the Hudson River in the vicinity of Poughkeepsie with reference to sedimentation and filtration. (5.) Investigation of the saltness of the Hudson River.

In order to ascertain the physical character of the water throughout the proposed watersheds twenty-six different collecting stations have been established at salient points, and at these stations daily samples of water are collected and observations made upon the height of the water in the stream, the weather and other conditions. The daily samples are sent to Poughkeepsie at frequent intervals, and their turbidity, color, alkalinity, etc., ascertained. Rain gauges have been established at various points in these regions, and the records of rainfall and stream-flow will be compared with the results of the analyses. The geology of the watersheds is being studied with reference to clay, limestone and other deposits, the existence of cultivated areas near the streams and other factors likely to affect the quality of the water.

For the purpose of sanitary investigation the entire region under consideration has been divided into twenty-five sanitary districts, based upon drainage areas of the important streams. Each district is to be visited by inspectors who will make observations upon all matters naturally included in a sanitary survey. In some sections it is particularly important to estimate the floating summer population as compared with the permanent population; in others the question of manufacturing wastes is most prominent, while in all cases sewerage systems and water supplies are being carefully investigated. Statistics are also being compiled with reference to pollution due to steamboat traffic on the Hudson River. In connection with this sanitary survey it is hoped that a sufficient number of normal chlorine samples can be collected to make a normal chlorine map of the eastern portion of New York State and to connect the isochlors with those of New England and New Jersey.

In view of the possible use of the Hudson River as a source of supply, and in view of the fact that in the vicinity of Albany and the lower Mohawk there are large sources of pollution, the self-purification of these streams is receiving considerable attention. Series of samples are being taken throughout their entire lengths, and it is hoped that results of general scientific value will be obtained. In view of the fact that the Hudson River is a tidal estuary, the amount of analytical work required to ascertain the sanitary condition of the river at any one point is unusually great. In order to obtain rational results, samples are being collected by integration across the river, at various depths and at different stages of the tide. To facilitate the collection of these samples, a naphtha launch is being used. Regular trips up the river between Poughkeepsie and Albany are made in connection with the study of the self purification of the stream, and trips down the river are made in connection with the study of the saltness. Numerous samples are collected throughout the entire length of the Hudson with reference to the source and amount of its turbidity, and experiments with large tanks 10 feet deep, supplemented by bottle-experiments in the laboratory, are being made to determine the subsiding value of the suspended matter. One interesting point to be considered is the relative subsidence in fresh and in salt water, this being a subject of greater importance in the Hudson River than in most streams which have been considered as sources of water supply.

One of the most interesting and important studies is that of the saltness of the water in the lower Hudson. It is well known that the distance to which the sea water extends up the river varies at different seasons according to the flow of the stream, and it is hoped that these studies may be carried to such completeness that it will be possible to predict to what extent salt water will be found in the river in the vicinity of Poughkeepsie at times of greatest drought. Careful studies are being made upon the vertical distribution of the salt water in the river at various points by means of an electrical apparatus especially devised for this purpose, and laboratory experiments are being conducted by Mr. Miller to show the relation between the specific gravities of the Hudson River water and the harbor water under various conditions of saltness, temperature, etc. The ground water of Long Island is also receiving a careful investigation from the sanitary standpoint, and experiments are being made upon surface pollution and its effect upon the underground water under various conditions.

Experiments on Soil Physics.—In connection with the investigation of the ground water of Long Island, undertaken jointly by the Commission on Additional Supply and the United States Geological Survey, studies are being made of the sand of Long Island with reference to its physical qualities, such as its effective size, uniformity coefficient and porosity. Experiments are being made also upon capillarity, percolation, etc., using carefully selected materials covering a wide range from clay to coarse sand, while field observations are to be made upon the rate of percolation of the rainfall through the upper strata of soil, the evaporation from the soil, and similar phenomena.

The foregoing outline of work indicates that during the coming summer Mt. Prospect laboratory will be the scene of great activity and it is hoped that the results obtained will be not only of practical benefit to the department, but will have a permanent scientific value. The importance of such work is now more widely appreciated than ever before.

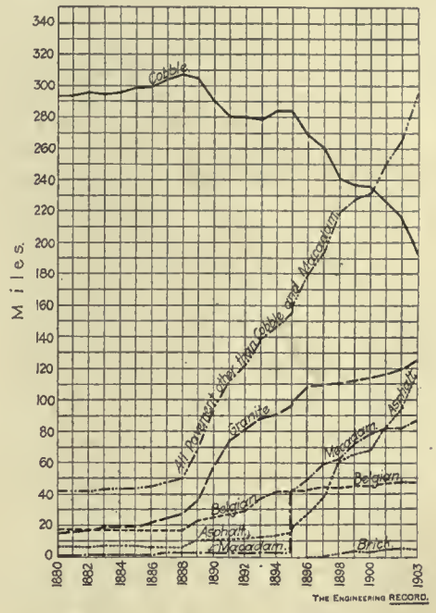
The Pavements of Brooklyn, N. Y.

In 1888 there were 308 miles of cobblestone pavement in the city of Brooklyn, and 50 miles of all other kinds of pavement. Since then one of the main problems facing the municipal authorities has been to replace this enormous amount of cobblestone pavement with something better. The success which has attended this effort is shown graphically on the accompanying diagram. In 1900 the amount of cobble pavement just equalled the amount of all others, each being 235 miles. Since then the change has been more rapid and it is expected that at the end of the present year the cobble pavement will have been reduced to about 140 miles, while all other pavements will have been extended very considerably.

The work which has been laid out for the highway department of Brooklyn for the coming season under the efficient direction of Chief Engineer George W. Tillson is nearly three times as great as was ever planned before. The appropriation for the repaving portion of this work gives a good idea of its extent. This year it is $3,200,000; for 1902 it was $1,200,000, and the highest amount ever appropriated previously was $700,000. In carrying out this work all original improvements are paid for by the property owners benefited, while repaving is done at the expense of the city at large from a bond fund. The amount of repaving alone which is planned for the coming year is about 65 miles. Including original improvements there will have been put under contract during 1903 at least 90 miles of pavement, including that which has already been contracted for.

All pavements laid hereafter will be on concrete foundations varying in thickness according to circumstances. Cement or tar and gravel joints are being used now exclusively for all stone block pavements. It is the aim of the engineers in charge to use the kind of pavement best adapted to a given locality, and although Brooklyn does not by any means offer itself as a place to carry on large-scale paving experiments, any pavement which can show good wearing qualities is given at least a fair trial. In 1902, two small contracts for Medina sandstone block pavement were entered into, the first of its kind to be laid in Brooklyn, and recently contracts for 35,880 square yards more of this pavement were awarded. This type of pavement is put on a par with granite. Asphalt block is another paving material which has only recently been used in Brooklyn, where it has been placed especially on grades, and is giving good satisfaction. Last year a small amount of wood block pavement was laid on State Street, largely as an experiment, the cost of everything but the foundation being paid by the paving company. On April 29 bids were opened for some 10,040 square yards of wood block pavement on several streets in the business section of the borough. The lowest bid was that of the United States Wood Preserving Company, at $3.79 per square yard, including concrete foundation. Belgian block is being discarded as a paving material.

The sentiment of the people is generally very decidedly in favor of sheet asphalt, and this will probably continue to be the main material used in paving and repaving throughout the borough. It has been used on grades as high as 4 per cent., and in some cases on steep grades it has been used to pave the sides of the street while the center is paved with granite. The asphalt and cement testing laboratory which has been established is worthy of note. It was first started in 1896, but after the consolidation of the cities it was taken to Manhattan. Last year, however, it was transferred back to Brooklyn, under the direction of Mr. William H. Broadhurst, who had charge of it before. Some of the apparatus desired has not been installed as yet, but additions are being made from time to time. In 1902 there were 633 analyses of asphalt made, and about 11,000 tests of cement. Samples of asphalt for analysis were taken from the work daily and if the material did not come up to the standard, it could be changed before much damage was done. In 1902 the average prices for different pavements were as follows: Sheet asphalt, 5-inch Portland cement concrete foundation, 1-inch binder and 2-inch top, $1.79; asphalt block, 4½-inch concrete foundation, $2.23; granite block, 6-inch concrete foundation, $3.20; Medina sand stone, 6-inch concrete foundation, $3.15. The prices for 1903 will probably be about 10 per cent. higher than those just given.



Mileage of Brooklyn Pavements.

The Good Roads Movement.

Taken in a broad sense, highways include all the ways over which men and goods are transported. Some kinds of ways, for example steam and electric railways and city streets, have been well developed in this country, but the great mileage of rural roads, for the most part, has undergone but slow improvement in many years. The importance of better roads is becoming more generally understood, however, as educational work along this line is being done by conventions and the press. In St. Louis, from April 27 to 29, a "national and international good roads convention" was held under the auspices of the National Good Roads Association. Like other conventions for furthering this movement, this gathering was largely popular and political in its nature, but some of the addresses made by distinguished speakers were not without interest for many readers of The Engineering Record.

Gov. Dockery, of Missouri, said: "Good roads are necessary to the highest development of the nation. Time has resulted in making changes in the construction of roads; electricity has brought modern nations into touch; distance has been annihilated; but there are very few counties which are not without adequate roadways. The time has fully come when the great railway systems of the United States should be supplemented by an improved system of public roads. Our state and other states, in the improvement of the country roads, have scarcely kept pace with the strenuous and expanding progress of the civilization of the



Cobblestone Pavement on Humboldt Street.



Medina Sandstone Pavement, South Third Street.

age. Our people must be awakened to the necessity for good country roads. Nothing can be done, however, in the line of substantial advancement until the people shall be willing to impose taxation upon themselves to construct these roads." President W. H. Moore outlined the progress made by the association, and advocated the establishment of an experimental train on the World's Fair site, where the visitor can readily see the manner in which the modern road can be constructed.

Hon. Martin Dodge, director of the office of public road inquiries of the Department of Agriculture, said: "I find that the governors of the different states are reluctant to recommend a tax levy or a bond issue to improve the roads. This has been the case in the older states for over a hundred years. The governors and state leaders think the states should have some assistance. The general government should do more than it is doing to aid in this matter. It did at one time help to build roads, but that was during the early part of the last century. The policy was then to appropriate the entire amount necessary, but this was changed, and now the appropriation of $320,000 is spent in the acquirement of facts concerning the building of roads and the publication of information. In twenty-two states object-lesson roads have been built, but the government only does this where the state asks it, and pays the greater part of the expense. I find that the Southern statesmen are more in favor of good roads than the Northern congressmen, and that greater general interest is evidenced in the South for good roads."

Senator Latimer, of South Carolina, voiced the sentiments of the convention when he stated that the farmers of the country should insist that their representatives in Congress should secure a liberal appropriation for road building. "This question is one of the most important now to be considered, and Congress must be aroused to the necessity of making appropriations for good roads. We have the same roads now that we had seventy-five years ago. This is not right. The government should pay its half. We of the country are as much of this government as the man who lives in the cities. We had the same trouble in getting rural mail routes. They said it would break the treasury of the United States. Now they say the rural routes are self-supporting. But the inspectors refuse in many instances to establish routes because of bad roads."

Mr. J. B. Killibrew, of Tennessee, said: "Congress has voted a large amount for the Panama Canal. I am not opposed to the Panama Canal, but good roads would do more for the citizens of this country than the Panama Canal will. We have authority to build post roads, and can build good general roads. If we can get appropriations from Congress we can have roads made over which the traffic of the country will pass, and not waste money on rivers, which are no longer used for commerce." Mr. Robert H. Kern, of Macon, Missouri, claimed that the farmer loses thousands of dollars every year because he can not reach the market with his goods when he wishes. "The farmer of Missouri is dependent upon the weather, not only for the yield of his field, but for permission to market his goods."

General Nelson A. Miles, speaking from a military standpoint, declared: "Any road that can be made useful for peaceful purposes can be utilized for military purposes, should the necessity arise. The subject of modern highways has been more neglected than any other element in our civilization. Our government has expended $500,000,000 for the improvement of our harbors and water-ways, and now the attention of the public is being called to our postal roads and avenues of communication that are most useful and important to all our people. If such expenditures of the national treasure have been made in the past for the development of railroads and water-ways, is it not now a most appropriate time that the improvement of our roads should receive national attention and government aid?" President R. H. Jesse, of the University of Missouri, spoke on "The Relation of Roads and Schools." He said that "there were good men turned out of the one-room school houses; but we realize that the six-room school house with six teachers is much better. The consolidated school with many rooms is what is needed. There children can gather from a distance of many miles. They can be brought to the school in wagonettes. But this cannot be done in Missouri, on account of the bad roads. When Missouri has good roads, then we shall have the consolidated school; but we cannot have it without good roads." Ex-Governor James Hogg, of Texas, said: "Down in my country we have good roads during dry weather, but when it rains the pedestrian leaves his foot-prints in the fence corners and the driver his vehicle in the mud."

Mr. William Jennings Bryan remarked that he had been an enthusiastic advocate of good roads ever since President Moore told him that the average modern road was 16 feet in width. "Sixteen feet to one road was good enough for me. I am now a life member of the Good Roads Association." Mr. Bryan compared the relative advantages gained by the city and country people through the expenditure of country money. He claimed that while the latter paid more taxes than the former, they derived much less benefit from the expenditure of the revenue. He also held that good roads will have a great effect upon the educational advantages gained by the country people.

President Roosevelt credited the permanence of the Roman influence largely to the permanence and excellence of Roman roads. "Wherever the Roman established his rule, the traces of that people remain deep to-day, not only stamped on the manners and customs of the people, but also in tangible form on the soil itself. Merely from the standpoint of historical analogy, we have a right to ask that this people, which has tamed a continent, which has built up a country with a continent for its base, which boasts itself, with truth, as the mightiest republic that the world has ever seen, which we firmly believe will in the century now opening rise to a position of headship, and leadership, such as no other nation has ever yet attained—merely from historical analogy, I say, we should have a right to demand that such a nation build good roads. Of course, during the last century there has been an altogether phenomenal growth in one kind of road, wholly unknown to the people of old—the iron road. The road of the railway is, of course, purely modern. Now a great many excellent people have proceeded upon the assumption that somehow or other, having good railways is a substitute for having good highways, good ordinary roads. A more untenable position cannot be imagined. What the railway does is to develop the country, and of course its development implies that the developed country will need more and better roads. The excessive, the wholly unheard-of rate of our industrial development during the past seventy-five years, together with the good sides, has had some evil sides. It is a fine thing to see our cities built up, but not at the expense of the country districts. The healthy thing is to see the building up of both the city and the country go hand in hand; and we cannot expect the best, the most eager and most ambitious young men to stay in the country, to stay on the farm, unless they have certain advantages. If farm life is a life of isolation and mental poverty, in which it is a matter of real and great difficulty for a man to communicate with his neighbor, you can rest assured that there will be a tendency to leave it on the part of those very people whom we should most wish to see stay in it. Good roads are needed for the sake of their effects upon the industrial conditions of the country districts; and I am almost tempted to say that they are needed even more for their effect upon the social conditions of the country."

Public Roads in Bibb County, Georgia.

Bibb County, Georgia, is divided into nine militia districts, and there are three road commissioners for each district, selected by the grand jury for a term of four years. The appointments are arranged so that the entire board is not changed at one time. Representative men from the different parts of the district in which they reside are chosen for this position. These commissioners meet once a month and determine upon the disposal of the force for the month, and also attend to other routine business in connection with road working. The roads are worked by the chain gang, composed of the convicts from the city court and from the recorder's court. The commissioners have no engineer, but the force is managed and the method of working is determined by the superintendent. The gang is supplied with a complete outfit of machines for making dirt roads, and in addition to surfacing, does such grading as may be necessary. It is estimated that in five years more all the roads in the county will be of easy grade and properly surfaced. It has been found by experience that a mixture of clay and sand makes a remarkably hard surface almost impervious to water, while giving a sure foothold for the horses. The method pursued in working the roads is that where the foundation is sandy, clay is hauled in, and vice versa, where the foundation is clay, sand is added. The roads are crowned so as to shed the water into the side trenches. No curbing is used, but on the steep inclines, half round sewer pipes are sometimes placed to prevent the side drain from washing out. The height of the crown is determined by the superintendent, who is governed by the grade.

There are in the county about 425 miles of public roads. The cost of maintaining the gang is about $20,000 per year, which includes $8,000 paid the city of Macon for her interest in the convicts. It speaks well for the commissioners that at this writing, after a winter of very heavy and continuous rainfall, there are no soft or bad roads in the county.

Quarters for the chain gang are provided in each district, and they occupy these quarters when working in the district. During the time of their employment in any district, the force is under the general direction of the three commissioners for that particular district. The commissioners also have the authority, in case of pressing need, to employ extra help, and have the roads and bridges put in order when the gang is not available for this purpose. The road commissioners handle no money. They approve the bills for extra services, advertise for supplies when necessary, but the actual payment of the funds is vested in the county commissioners. The road commissioners serve without compensation. The above information was obtained from Mr. W. H. Mansfield, who has for twenty years served as chairman of the board.

Colorado Roads.

Road construction in Colorado is referred to as follows in the eleventh biennial report (1901-2) of the state engineer, Mr. Addison J. McCune: Our present system of flimsy construction, characteristic of all new countries, was especially excusable in a state like ours, having long stretches of uninhabited mountainous country, but we have now advanced sufficiently in wealth and population to inaugurate a new policy. The configuration of the country is such that road systems should be planned with reference to more than one county. Counties should co-operate with each other and the state in the planning of the main thoroughfares. More care should be shown in locations where the road is to be permanent, both in the location and construction of culverts and small bridges as well as the large ones. At least a part of the county funds should be put into permanent work each year. Of course, we cannot afford expensive construction, such as macadam roads, neither do we need it in this dry country. What we need is to put our roads on the proper grade; to give them proper protection from wash by storm waters, and in the valley and prairie countries to grade them up, so as to give them drainage and provide necessary culverts. In this country of irrigating ditches many unsightly humps are seen in the roads where laterals cross them at a grade higher than the general level of the road. This should be remedied by siphoning the water under the road. It is recommended that care be taken in grading the roads of the thickly populated sections, with a view to adopting a system of road sprinkling similar to that practiced in some parts of California.

Work of the Massachusetts Highway Commission.

The Massachusetts Highway Commission, according to its tenth annual report, has continued the method of dividing the state into three sections, each commissioner giving his special attention to one section, it being found that under this system the commissioners can better understand the arguments presented by the different municipalities as to the merits of any particular road. Surveys have been more carefully worked up than formerly, drainage and other details more thoroughly studied, the specifications corrected to render them clearer, and everything possible has been done to direct contractors in making intelligent bids. During 1902 the commission experimented extensively with reinforced concrete in the place of steel I-beams and masonry in culverts and short bridges. By using reinforced concrete a saving of 25 to 40 per cent. was effected.

The standard width of roadway remains 15 feet. On some less traveled ways it has been reduced to 12, but 10 feet has proved too narrow, particularly on roads built on sand. Some saving of broken stone has been made by reducing the depth on the edges, which now varies from 5 inches on poor soil to 2½ inches on safer soil. Notwithstanding the attention given to details, the results from the use of telford have been far from satisfactory. In a few cases the large stones have come to the surface in a manner indicating frost action. It is thought that there are few if any cases where equally good results cannot be obtained by the use of sand, gravel, or small stones in the place of telford, and at a less cost. An observation of the roads built of unscreened broken stone shows that after a few years' wear the smaller stones are ground up, leaving the larger ones projecting above the surface. Rarely has this occurred on roads built of screened stone.

The average cost of maintenance of state roads per mile per year is, up to the present time, a little over $100. As far as possible the Commission is contracting for the repair of long stretches of state road, seven contracts of this character, covering 57½ miles, being now in operation. These require the contractor to furnish a horse, cart, and tools and to devote as much of his time as is necessary to the making of all general repairs, the Commission furnishing the materials. The average contract cost per mile for labor is $58.91, and including materials, $88.25.

During the past year several roads were resurfaced, the first of this work to be done by the Commission. These were not typical state roads, but approaches to large cities, subject to much wear by heavy traffic. The 24-foot Leicester road, leading into the city of Worcester, was thus repaired for 3,150 feet, 659.6 tons of local stone being used for the bottom course, and 835.7 tons of trap rock for the top. The cost was 30 cents per square yard, or 5.17 cents per square yard per year. The loss of stone was at the rate of .03 of a short ton per square yard per year. The resurfacing of the West Fitchburg road, 2,200 feet long and 15 feet wide cost 36 cents per square yard, or 5.15 cents per square yard per year. The loss of stone was at the rate of .023 of a ton per square yard per year. The resurfacing of the Beverly road, 2,150 feet long and 18 feet wide, cost 30 cents per square yard (5.2 cents per square yard per year), and the loss of stone was at the rate of .3 ton per square yard per year.

A study of five typical state roads has been made, to determine the amount of broken stone used in ordinary repairs, or such repairs as are required to maintain the surface of the road in good condition at all times until resurfacing is needed. The results are summarized in the accompanying table, the loss of stone being given in pounds per square yard per year. Road No. 1 is in Goshen, and has long grades and light country traffic; No. 2 is in Lexington, Lincoln and Concord; No. 3, in West Newbury, has some 6 per cent. grades and a fairly large traffic; No. 4, in Yarmouth, Dennis and Brewster, is at all times kept covered with sand, and is apparently in as good condition as when built; No. 5, in North Adams and Williamstown, is in part built over clayey soil, and has a fairly heavy traffic. This road has had a greater wear due to weather than any of the others.

BROKEN STONE USED FOR ORDINARY REPAIRS.

Road.	Material.	Length, miles.	Tons of stone.	Loss in pounds.
No. 1.	Soft native rock...	1.905	100.35	1.80
No. 2.	Good native stone and trap rock....	6.973	149.12	0.98
No. 3.	Soft native rock...	2.222	107.55	2.00
No. 4.	Good native stone..	17.008	19.00	0.06
No. 5.	Trap rock.....	3.610	219.58	2.20

The Commission recommends that it be given authority to make all repairs to rollers and other machinery, and to charge the towns not only for the maintenance of the rollers, but also an amount which would replace them when worn out. Based upon the number of days the rollers have been used during the year, the towns would have to pay only $1.08 per day. One man has been employed to have general oversight of the rollers. His duties are to make all repairs, load and unload when transit by rail is required, and to instruct local engineers in the management and operation of the machines. The efficiency of the roller is much greater and the cost of maintenance less with this arrangement than formerly. Two portable stone crushing plants were purchased during the year, at a cost of $3,200. These have been used in small towns where the appropriation was too small to permit the purchase of machinery or to economically contract for building roads. The towns are supposed to pay all the cost of repairs, moving and operating. Much improvement in town roads is expected to result from the use of state rollers and crushers. The engineering work of the Commission during the past year has been under the general direction of Mr. Austin B. Fletcher, the secretary of the Board. No chief engineer has been employed.

Daily Progress Reports on Construction Work.

There is often a marked difference in the degree of attention paid to the daily progress of construction on works for private and public owners. The officials of private corporations more often keep in close touch with the construction for which they are accountable to their stockholders than do the public authorities. It is questionable, for instance, if a daily progress report of similar detail to that reproduced below on a reduced scale is employed on half a dozen municipal works in the country.

T. & B. V. Ry. Construction,

DAILY PROGRESS REPORT:

Section No. _____ 1903.

Weather. _____

Went on work _____ o'clock, and remained until _____ o'clock.

FORCE AT WORK:

SUB-CONTRACTOR	TEAMS.	HOURS.	MEN.	HOURS.	D. S.	HOURS.	W. S.	HOURS.
TOTAL - - -								

Drillers _____, Number of holes drilled _____; total depth drilled _____.

Rock excavation made from Station _____, to Station _____.

Earth work in progress at Stations _____, _____, _____, _____.

PILES DRIVEN AT STATION.	LENGTH USED				CUT OFF				PENETRATION			
	A	B	C	D	A	B	C	D	A	B	C	D

Box Drain put in at Station, _____

Framed Trestle built at Station, _____

Cattle Guards put in at Station, _____

Track laid, Station _____ to Station _____

REMARKS.

_____

_____

_____

_____ Resident Engineer.

NOTE:—Pile farthest East or North is "A," next "B," &c.

This blank form is employed by resident engineers of the Trinity & Brazos Valley Railway in reporting to Mr. Benjamin Thompson, the chief engineer; it is only proper to say that this gentleman does not consider the blank as something above improvement, although it has answered the purpose satisfactorily of keeping his resident engineers watchful of the actual progress made daily by each sub-contractor under their supervision. Without such daily records a noisy and bustling contractor is liable to receive a higher rating than the quiet but more effective worker. These reports, in connection with the contract prices, enable the chief engineer to obtain without trouble a good idea of the cost of the work done at any time. All work on this railway is done by contract.

The blank is a sheet measuring 10x6 inches and arranged as shown in the illustration. In the books at the headquarters the section on which the contractor is working is described in detail, so that it is unnecessary to enter more than its number on the progress report. The heading "D. S." is for drag scraper and "W. S." for wheel scraper.

Electrical Equipment of the Farmers' Bank Building, Pittsburg.

By L. L. Emerson, E. E.

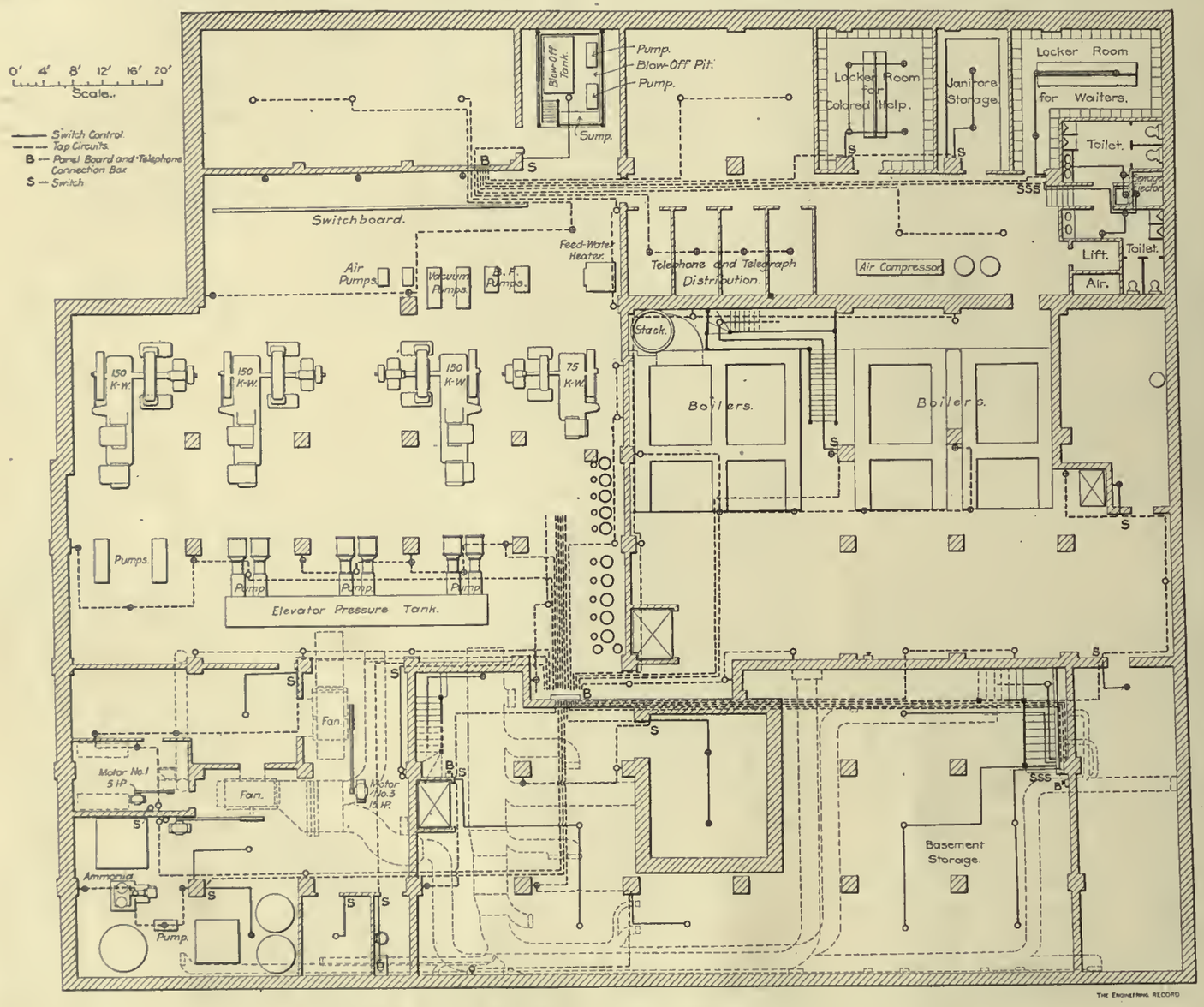
The most recent addition to the list of great office buildings in the city of Pittsburg is the 24-story structure of the Farmers' Deposit National Bank now nearing completion. With its great height combined with a frontage of 110 feet on Fifth Avenue and running backward 130 feet along Wood Street, this building ranks as one of the largest office buildings in the country. The exterior is of red brick with white marble trimmings, and is embellished with a row of white marble statues of female figures of heroic size at the third story, while above these at the fourth and fifth stories are pedestals of bronze, seven on the Fifth Avenue front and ten on the Wood Street side, the purpose of which is to support in each case a globe illuminated from within by a cluster of incandescent lights. This attention to beautifying the exterior is in marked contrast to anything yet attempted in the business section of a city noted for the disfiguring effects of its atmosphere.

A feature of the equipment of the Farmers' Bank is the introduction of an alternating-current system of electric service throughout the building. An extensive power plant has been installed, and the entire wiring of the building arranged for the purpose of illumination by the Nernst lamp. Below the street level is a mezzanine floor occupied by departments of the bank and the basement floor, on which is the engine room. In common with most of the down-town buildings in Pittsburg in season of freshets, there is danger of flooded basements. This has been guarded against by costly waterproofing, and a special pump is provided to clear the sump in case water should back up into it.

The electric plant consists of four generating sets, one of 75 kilowatts, and three of 150 kilowatts capacity. The engines were built by the Phoenix Iron Works Company, of Meadville, Pa. The 75-kilowatt unit is driven by a 120-horse-power, single-cylinder, enclosed-type center-crank engine running at 277 revolutions per minute, and the remaining generators by three center-crank tandem-compound engines of 240-horse-power, running 240 revolutions per minute. Steam at 125 pounds is delivered from a battery of four Babcock & Wilcox boilers of 300-horse-power each, fitted with B. & W. chain-grate stokers. The generators are Westinghouse composite wound two-phase machines of a frequency of 60 cycles per second and a voltage of 225. The frequency of the 75-kilowatt machine is the same as that of the 150-kilowatt machines, so that although running at different speeds all four may be operated in parallel. The separate excitation of each machine is by a dynamo mounted at the end of the main shaft and driven by it. The capacity of the separate exciters is 4.4 kilowatts for the larger size and 3.1 for the smaller. A series transformer in the armature spider produces a secondary current of low voltage which is rectified by a commutator on the shaft, and excites the series windings of the alternator field.

The switchboard, built by the Walker Electric Company, is over 43 feet long and is made up of seventeen panels; four of these are the generator panels, one panel for the power circuits, eleven for the lighting circuits and one is spare for additional light and power switches. Four bus bars are provided for power distribution and six for light. The light switches are triple pole, a three-wire system being in use for lighting with a Westinghouse balancing coil or phase splitter of 20-kilowatt capacity installed in each phase, so that a voltage of 110 is obtained between the middle bus and each outside conductor, and they are also double throw so that the light load may be distributed on either phase. These balancing coils are mounted on the wall back of the switchboard, as are also the rheostats for exciters and generators. The board is furnished with Noark fuses mounted on the front, I. T. E. circuit breakers and Keystone instruments.

From behind the switchboard the feeds run to three main risers, A, B and C on the plans, and distribute up through the building. These risers have pull boxes on the sixth, twelfth and eighteenth floors, where the feeds may be tied in, in cases where they do not terminate. There are panel boards at each riser on each floor,



PLAN OF THE BASEMENT, FARMERS' BANK BUILDING.

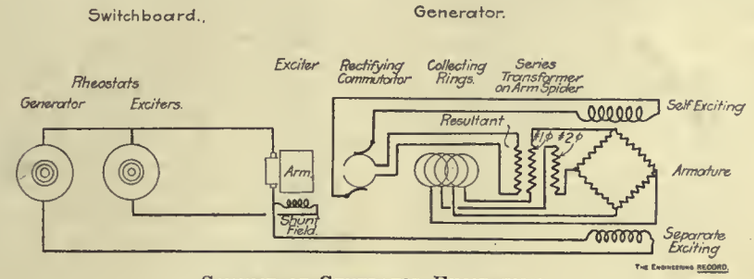
and on these panel boards are three sets of bus bars fed by different feeders. These three sets of busses are intended for the lights in the offices, the regular hall lights and the special hall lights or night circuit. All main switches to the panels are triple pole, and the busses, which extend horizontally across the board, are secured in place by removable screw connections to the main vertical bus bars. This arrangement allows the changing of any branch circuit from 110 to 220 volts by means of these movable connections. The Nernst Lamp Company is supplying lamps for halls and offices at 225 volts. Two 110-volt circuits are run to small tablet boards in each office. In cases where so desired, these circuits may be continued from the tablet boards by means of the chair rail to locations where desk lights are needed. These lights are the only cases where other than Nernst lamps are likely to be used. There are installed 1,000 55-watt single-glower, 1,250 88-watt single-glower, 20 two-glower and 20 six-glower Nernst lamps in the building. The halls are finished in green with white marble trimmings, which illuminated by the soft steady light of the Nernst lamps has a most pleasing effect. The office trimmings are of mahogany, and the offices are in general attractiveness and beauty especially noteworthy. A peculiarity of the Pittsburg regulations respecting the electric wiring of buildings is that switches must be provided on all lighting circuits, not more than eight lights on a circuit. The use of smaller than No. 12 wire is prohibited.

There are installed in the building seven induction motors aggregating about 75-horse-power. In the attic are three disk exhaust fans of 7, 5 and 3½ feet diameter, which are belt driven from 15, 7½ and 5-horse-power two-phase Westinghouse induction motors. In the basement are three motors of the same type; one of 20-horse-power drives a 7-foot steel-plate fan supplying fresh air to the engine and boiler room, another of 10-horse-power for a 6-foot blower supplying tempered air to the banking room and the third of 5-horse-power running the filter cleaning fan.

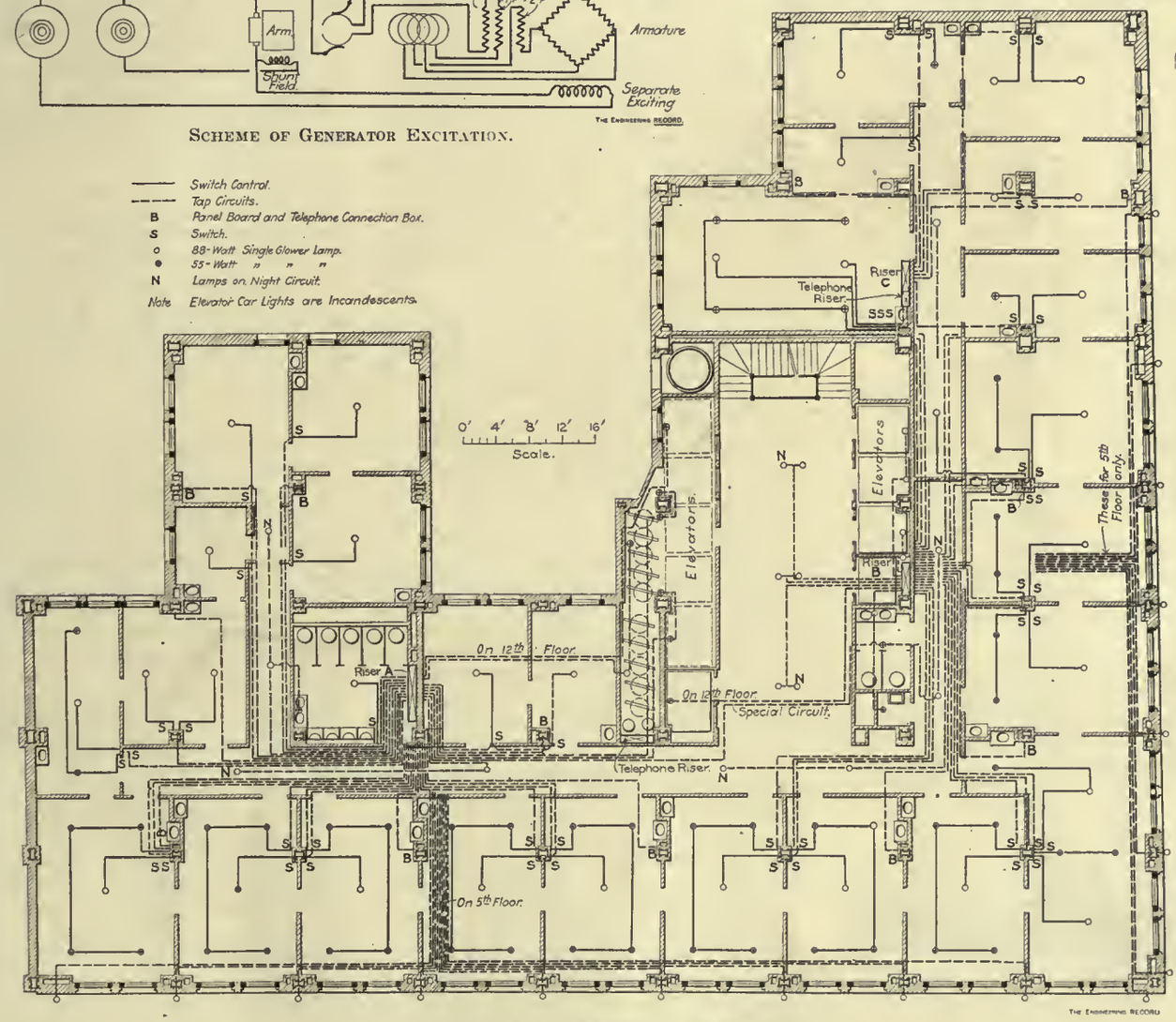
In addition to ten Otis hydraulic elevators for general passenger service, there are two electric elevators in operation between the bank floors, one as a book lift and the other for passengers. The electric equipment for the electric elevators include a motor generator for the control and a 5-horse-power variable-speed Westinghouse induction motor for each elevator. They are also of Otis manufacture and of the automatic push-button type of control. The absence of direct-current in the building has made necessary the employment of a motor generator in only one other instance and that is of very small size, for the signal system for the elevators. It was thought that the electric winding mechanism in the bank vault, installed by the Hollar Lock Inspection & Guarantee Company of Philadelphia, would require a separate mechanism for supplying direct current; but by running a line back to the main switchboard, the direct current from the exciters at 110 volts was made available for the purpose.

Above the two revolving doors at the main entrance are two smaller General Electric motors installed by the Van Kannel Revolving Door Company, of New York. As these motors were provided after work had advanced too far to allow of a separate power line, they were placed on the lighting circuits and furnished a suitable type, having 100 per cent. power-factor single-phase with condenser compensator.

The telephone cables on entering the building run along the ceiling of the basement to the terminal booths, where each company is assigned its space, there being in Pittsburg two telephone companies, two telegraph companies, one ticker company and the Electric Protective Company to be provided for. On leaving the booths the cables run up the riser situated back of the elevator shaft and terminate at boards in the halls on each floor. From these floor terminals a 1-inch conduit is run to each of the office sub-tablet boards already mentioned in connection with desk lights. A portion of the space in the boxes where these sub-tablet boards are placed is divided off and provided with terminals for eight pairs of tele-



SCHEME OF GENERATOR EXCITATION.

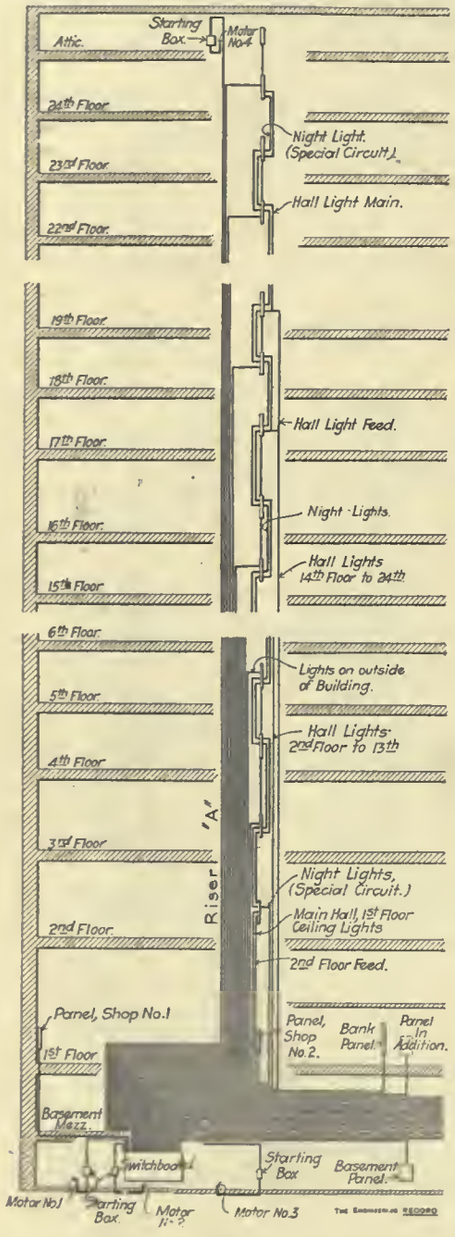


TYPICAL FLOOR PLAN, FARMERS' BANK BUILDING.

phone wires. From these boxes through either the chair rail moulding or around the baseboard the connection is made to the instruments.

After the plans were drawn for the main building and work well under way a 40-foot addition was decided upon on the Fifth Avenue front. To provide for this annex the generators were ordered of larger capacity and feeders increased in proportion. This addition is now completed to the height of the original structure, but the interior is still in the rough.

The building was erected by the George A. Fuller Company after plans of the Pittsburg architects, Messrs. Alden & Harlow. Messrs. Clark & MacMullen, of New York, are the electrical engineers for the work, which has been installed under direction of their Pittsburg office by Messrs. Hatzel & Buehler, of New York. The contract for the steam plant and the heating and ventilation was awarded to Messrs. Baker, Smith & Company, also of New York.



Riser Diagram.

Water Meters for hotels and manufacturing places are advocated in the last annual report of Mr. S. D. Heffner, superintendent of water works, Bradford, Pa., who states that in unmetered places the consumption is found to be about 100 gallons per capita daily, but as soon as a meter is placed it drops to 35 gallons.

Reconstruction of Mayence Bridge.

Standard methods of erecting steel bridges have been so ably developed in this country to correspond with the advanced systems and details of construction that American practice has been very different from foreign practice in most essentials and obviously superior to it, especially in the abundant use of power appliances. Much greater rapidity and economy is generally accomplished in the United States than anywhere else in the world in this class of work. Where conditions are exceptionally difficult, and especially where a superstructure has to be replaced on the old substructure, various special methods have been developed which have given remarkably good results and have, from time to time, been illustrated in The Engineering Record. These have generally involved some method of translation by which the old spans were simultaneously removed, while the complete new spans displaced them with movements in vertical or horizontal planes. This applies only to bridges of short and moderate length spans, typical illustrations of which were published in the descriptions of the Florence bridge, the Girard avenue bridge and others of less importance.

A recent issue of "The Engineer," London, contains a description of the reconstruction of part of the double track Frankfort-Mayence railway bridge over the Rhine by the use of advanced erection methods corresponding so closely to those used here that it is evident that the principles of field construction in this country are appreciated abroad, and this work is interesting as one of the first important cases in which we have noticed the adoption of this class of operations.

The spans for one track of the original structure were commenced in 1859 and were built at temporary shops erected for the purpose at the site. In 1871 similar parallel spans were erected adjacent to them to carry the second line of track. The structure consisted of four lines of light riveted trusses with curved top and bottom chords, which were supported on massive masonry piers and included thirty channel spans having a total length of 2,060 feet and weighing only 600 tons. The lengths of the spans vary up to a maximum of 117 feet. The new spans, which are to replace those built in 1859, correspond to the old ones in length and in position; but required new seats. All the new spans are made much heavier than the old ones and with top chords which are horizontal, except in the end panels where they converge to meet the bottom chords, so that they are full deck spans instead of having the part "through" arrangement of track which was provided for the old structure.

It was required to complete the reconstruction in nine weeks, and it was first proposed to accomplish it without interrupting traffic by merely reinforcing the members of the old spans. It was also proposed to build for each span a falsework adjacent to the oldest trusses, which were to be replaced, and another on the opposite side of the bridge adjacent to the old trusses which were not to be replaced. On the latter falsework the new span was to be assembled complete and then the three pairs of trusses were to be moved laterally until the lightest and oldest trusses had been moved onto the adjacent falsework and had been exactly displaced by the heavier pair of old trusses, which in their turn were replaced by the new trusses. It was decided, however, that there was not time to effect these changes during the intervals of traffic, and the work was finally accomplished by means of a pair of very large transverse steel gantries which spanned the whole bridge and traveled longitudinally on surface rails each side of the piers.

A trolley moved across the top of the gantry, transverse to the bridge axis, carrying an electric hoist. The two gantries being set over the quarter points of one span hoisted it clear of the track, traversed it over the adjacent track and lowered it to bearing on a pair of special cars which carried it off from the bridge. The new span, which was previously completed and loaded on cars, was then run in on the same track to position under the gantries which lifted it, traversed it back and lowered it to the position previously occupied by the old span. The gantries were then advanced to the next span and repeated the operations and so on, one old span being removed and a new one brought in ready to lower to position in two hours, notwithstanding that the difficulties of the work were increased by the fact that some of the piers were skewed at a considerable angle. The track is about 40 feet above the ground and the gantries had a total vertical clearance of about 80 feet, a span of 60 feet and a capacity of 40 tons each, the long spans weighing 76 tons being lifted by both gantries together, while some of the shorter spans were lifted by a single gantry. Each gantry was built with two bents in vertical longitudinal planes about 60 feet apart. Each bent consisted of two inclined posts separated about 30 feet at the base and united at the top where they supported the transverse girders carrying the trolley hoists. The inclined posts of each bent were braced with horizontal and diagonal struts and each post was seated on a four-wheel truck which traveled on a narrow gauge track. The trolley hoists were operated by electricity.

Reinforced Concrete in Egypt.

Armored concrete has been extensively used in Egypt during the past few years. According to the report of the public works department for 1901, the foundations for the new postoffice in Cairo and for large stables at Boulac, floors and roofs of museums at Cairo and roofs of large storehouses in Alexandria have been built of this material. At the site of the Cairo postoffice the ground was not suitable for supporting the building on ordinary foundations, as there were old walls with soft filling between them as deep as 22 feet below the surface. Under the whole area to be covered by the building an 18-inch layer of rammed and watered sand was placed as the foundation for a 10-inch sheet of armored concrete. Under each wall and resting on this table, there is a reinforced concrete beam 18 inches high and about 18 inches broad; these beams being stiffened at intervals by similar structures connecting them transversely. The whole table is so arranged as to give a maximum pressure of about 400 pounds per square foot of ground surface. The beams are made strong enough to resist the transverse stress which would be caused should the ground below them collapse for a length of 11 feet 6 inches; they are also capable of acting as continuous girders in case of several collapses taking place at intervals. Unfortunately the report gives no details as to the method of armoring nor of the quantity of steel or iron used. A point of interest in connection with the floors is that they have been continued right through, the thickness of the walls giving increased solidity to the structure as a whole, whilst the floors themselves are much stiffer. The Monier system has been used for some of the sewers in the Cairo drainage system. This information was obtained from a recent issue of "Indian Engineering."

Heating and Ventilating Railroad and Other Shops.

At a recent meeting of the New York Railway Club an interesting discussion took place on the subject of heating railway shops and other one-story buildings of the same nature. While such buildings are very simple in construction, they are not so simple as might appear in regard to the problem of effectively and efficiently distributing heat and air. On account of the large amount of roof, wall and window surface, the loss of heat is very great, and also, because of this and the relatively great height of the building considered as a single room, there is a tendency towards unequal distribution of the heat, the warm air rising to the roof and the cold air flowing to the floor, where it renders the workmen uncomfortable. It is important, then, not only that a sufficient quantity of heat should be delivered to the building, but also that it should be delivered where it will do the most good.

If an attempt is made to supply the heat directly by means of steam or hot-water coils, the vicinity of the coils is apt to be uncomfortably hot from the heat radiated directly therefrom, while places at a distance are cold. The heat transmitted to the air of the room from the coils is largely lost, since the hot air rises vertically and imparts its warmth to the roof and skylights. It is also to be objected to this system of heating, that it makes no provision whatever for ventilation and the extended system of steam or water pipes is subject to damage by freezing during the coldest weather.

For these reasons, the direct system of heating for work of this character has been superseded in many instances by the fan or hot-blast system. The heater for such a system will contain a considerable less length of pipe than would be required for direct heating, due to the higher velocity of the air over the pipe surfaces. The blower is additional equipment, but its use is justified in some cases on the score of ventilation alone, and the exhaust of the engine is usually turned into the heater, thus obviating any loss from that source.

The distribution of the air by means of pipes should be so carried out that the lower part of the room is kept at a comfortable temperature, while at the same time no disagreeable drafts are produced. It has been found that by properly proportioning and directing the delivery flues most satisfactory results can be secured. Some interesting examples illustrating this point were cited, at the meeting mentioned above, by Mr. C. H. Gifford, of the B. F. Sturtevant Company. He said that if air or almost any other form of gas is desired at any particular place at any particular time, the best way to deliver it there is to provide a suitable conduit. If there is any difficulty, which there may be, by air blowing on an individual workman, it is a simple mechanical detail to rectify it and, if it is impossible to predetermine where the men or machines are to be located in a building, it is only necessary to provide an adjustable discharge opening from the pipe delivering the air. If the air blows upon someone there generally is some space near the person, toward which the air can be directed and therefore cause no inconvenience whatever.

As an example of what can be accomplished by distribution he cited the machine shops of the New York Shipbuilding Company, a building about 1,100 feet long, about 250 feet wide and 82 feet high. The proposition was to heat one-half of this building and leave the balance of it unheated. It was decided to place a partition across the middle of the building about 12 feet high, and bring the heated air down to the zone which it was desired to heat, which was not over 8 feet above the floor. In that way the air could be confined in the space, and not have much effect on the rest of the building.

The apparatus is arranged under the landing platforms of the gallery which surrounds the shop, so that it is out of the way of the cranes. Pipes are carried beneath the runaway of the cranes, and branches are brought down on the posts and discharge the air towards the floor, the outlet being in the form of a Y, which is adjustable. After the plant was started, it performed just as was expected and the difference in temperature between the two sides of the partition is almost the same as the difference between the indoor and outdoor air. The result is due to the fact that the air is brought down and continually pressed into the space which it is desired to heat.

During very cold weather, or in the morning when the building is being heated up, the air supply may be drawn from within the building itself, thus effecting a great economy of heat. In some buildings having a very high cubic space per occupant, sufficient ventilation during the winter time will be supplied by the leakage of air through doors and crevices about the windows, by transfusion, etc.

The most satisfactory heating will result from the use of numerous pipes discharging on the outside walls at an elevation about 6 to 8 feet above, and directed towards the floor, according to Mr. E. T. Child of the same company. These pipes should be located from 25 to 40 feet apart, depending upon the character of the building. This arrangement causes hot air to be blown downward, whence it spreads on the floor, keeping it warm before the air has a chance to follow its natural tendency and ascend to the roof. In the case of an underground duct, it is well to use short outlet pieces which will discharge along the walls at the floor.

At the works of the Fore River Ship and Engine Building Company, they have an overhead pipe system with drops on the walls, which was put in according to the regular practice. Later they added 50 per cent. to the building and are now heating it with the same apparatus. A fan heater was originally chosen which was considered to be the proper size for that particular building and it worked in a satisfactory manner. When, later, the ship company added 50 per cent. to the length of the building the piping was extended and drops carried on the walls every 30 feet, through which the air was blown on the floor with ample outlets on the ends. In the coldest weather the heating of the building, which is 50 per cent. larger than the Sturtevant Company would care to guarantee with its apparatus, was satisfactory to them. The success is entirely attributed to the excellent system of air distribution.

At one of the shops of the Atchison, Topeka & Santa Fe Railway, the underground system was adopted and low horizontal outlets were provided which distribute the air at the floor and along the walls. This is an extremely large shop, the contents being about four or five million cubic feet. It is heated by four large sets of apparatus and the underground ducts extend almost entirely around the building. The pipes are not over 3 feet high, the air being discharged along the floor.

Paint shops require to be practically dustless and, consequently, the air velocities must be low. The temperature requires to be higher, and it is customary to arrange to circulate the air in a much more thorough manner than in machine shops. This is done in the Pennsylvania Railroad shops at Altoona by means of ducts and in the New Haven shops at Readville, Mass., by a similar overhead system. There has been a great deal of hesitation among railroad men about installing the hot-blast apparatus in paint shops, owing to a fear of getting the varnish dusty, but this is disappearing. The circulation in such installations is brought about by a counter-exhaust system, which circulates the air, returning the whole or a part to the apparatus. There are two ways of establishing this return; one by an underground duct system, and the other by an overhead galvanized system. In the Pennsylvania shops at Altoona there is a Sturtevant installation that has been in a dozen years; it is one of the first put in which returned the air underground and back to the fans, using very ample distribution of air-pipe in the discharge. In the Readville shops the air is brought back by means of an overhead galvanized pipe. In this way circulation is kept up in all parts of the room, and thereby the paint is dried more rapidly than it would be by any system where the air in the room is practically still.

Chicago River Car Ferry.

Because of the delay occasioned in the transportation of freight between mercantile houses, railway freight depots and steamboat docks, a car ferry on the Chicago River is to be established by the Merchants' Lighterage Company. Under present conditions, it is said, it takes in general as long to get a carload of goods switched to the Merchants' warehouse from the place where it is dropped by the delivering line, as it does to bring the car from New York to the railway yards in Chicago. The same delay is occasioned in shipping freight from the warehouses of manufacturing concerns. By means of the proposed ferry, loaded cars will be carried on the river between the mercantile houses and the yards of the receiving and delivering railway companies, relieving the congestion in the switching yards, giving more prompt delivery and, what is of equal importance to the shipper, materially reducing the cost of such transportation. It is proposed to have the railroads construct switch tracks and slips, so that cars can be loaded upon the proposed ferryboats. The Lighterage Company has been in operation for a few months, and already the demand on it is said to be sufficient to warrant a substantial increase in the capacity of its service. An immediate advance on the present plan of handling loose freight, which requires two handlings, is to transport the loaded trucks.

Electrolysis of Water Pipes.

Electrolysis of water pipes in Middletown, Conn., has led to recommendations of the double trolley system. The Board of Water Commissioners, in their 1902 report state that "in granting a franchise for the extension of the single trolley system of street railway, there should be, in addition to the requirement of perfect bonding of rails and a return wire connecting with the bonds, a condition made in the contract or agreement that the electric railroad company shall be responsible for all damages to water pipes that is caused by stray currents of electricity from its railway system, and that they shall prevent such currents of electricity from passing on to the water pipes. With the probable extension of the single trolley road in this city and from this city, and the building of new electric railroads and the use of large currents of electricity, the safety of the property of the city in its water pipes may best be secured in the future by making the company responsible for the damage that may result to them from the operation of an electric railroad."

The Use of Reheaters in Compound Engines.

Among the valuable papers read before the New England Cotton Manufacturers' Association last month was an unusually clear and non-technical explanation of the use of the reheater in compound engines. While intended more for people not particularly familiar with steam engineering, the paper possesses much interest to engineers on account of the valuable data it contains, based on tests made by the author, Mr. George H. Barrus.

At the outset, it was shown that condensation in compound engines is not, as a rule, distributed equally between these cylinders, but it is generally greater in the low pressure cylinder than in the high pressure cylinder. The extent of the loss and its distribution may best be exhibited by referring to the results of a number of tests, made by Mr. Barrus on fairly tight Corliss compound engines. In these tests the loss is expressed in percentage of the actual consumption of feed water, and it applies to a point on the diagram a little later than the cut-off. The percentages for the high-pressure cylinder range from 21.1 per cent. to 28.3 per cent., and those for the low-pressure cylinder from 23.7 per cent. to 40 per cent.; the averages being, respectively, 23.8 per cent. and 31.4 per cent.

In view of the fact that the loss from condensation is noticeably greater in the low pressure cylinder than in the high pressure cylinder, being, in the instances just referred to, no less than one-third more in the one than in the other, there seems to be good ground for employing special means, such as the reheater furnishes, for securing the object in this part of the engine. The principle on which the action of the reheater depends is the re-evaporation of the water and moisture contained in the exhaust steam discharged from the high-pressure cylinder, and further, in cases where the extent of reheating surface is sufficient, the superheating of the whole quantity exhausted. The result is two-fold; first, an increase in the relative amount of power developed by this cylinder on account of the new supply of steam produced; and second, the use of the steam with increased efficiency, owing to the saving of cylinder condensation due to its dryer condition. The reheater tests to which Mr. Barrus referred showed these actions in detail, and were made on three independent engines. In each case one test was made with the reheater in complete operation, and one with the heating pipes shut off, which practically threw the reheater out of use.

The first engine is a Greene horizontal cross-compound, having unjacketed cylinders 26 and 50 by 60 inches. The steam was slightly superheated, being furnished by Manning boilers. An independent air pump operated the condenser and the quantity of steam it used was ascertained and allowed for.

The results show a substantial agreement between the total quantity of feed water consumed per indicated horse-power per hour, whether the reheater was on or off. This surprising result occurred notwithstanding the fact that the reheater caused a marked improvement in the action of the steam in its passage through the cylinders. It appears that the reheater actually did reduce the condensation in the low-pressure cylinder, thus securing at this point the expected gain. When it was in use, the condensation here was 4.4 per cent. greater than in the high pressure cylinder. When the reheater was not in use the difference was 10.6 per cent. Although there was a saving within the cylinder, nevertheless the loss of steam due to that condensed in the reheating pipes to accomplish this result was so great that the net economy was reduced to zero.

The effect of the reheater upon the power developed by the low-pressure cylinder is most noticeable. With practically the same power in the high-pressure cylinder in the two cases (the difference being only 2.1 horse-power) that developed in the low-pressure cylinder was 35.5 horse-power less when the reheater was off than when it was in use.

The second engine is a Corliss horizontal tandem compound, with unjacketed cylinders 18 and 40 by 48 inches, made by the Hewes & Phillips Iron Works. The steam was supplied from Cahall vertical boilers. The amount of heating surface in the reheater was 75 square feet. The condenser was of the siphon class, and no steam was used for operating it.

The results of the tests show that the consumption of feed water is almost identically the same whether the reheater pipes were in use or out of use. There is, however, a greater action going on in the cylinders as the effect of the reheater than in the first engine. The condensation in the low-pressure cylinder, when the reheater was on, was 1.3 per cent. less than that in the high-pressure cylinder. When the reheater was off, it was 9.2 per cent. more in the low-pressure cylinder than in the high-pressure cylinder, thus making a total difference amounting to 10.5 per cent. There is also greater effect upon the low-pressure power. With the reheater on, the low-pressure cylinder developed 58.7 horse-power more than the high-pressure, whereas, with the reheater off, it developed 19.7 horse-power less, making a total difference due to the reheater of 78.4 horse-power.

The third engine is a Corliss horizontal cross-compound, with steam-jacketed cylinders 16 and 40x48 inches, built by C. & G. Cooper Company. The steam was supplied in a superheated condition from Manning boilers. The independent air pump was operated from a separate boiler. In this engine the high-pressure cylinder was jacketed both on the heads and around the barrel. The low-pressure cylinder was jacketed only on the heads. On both tests, the steam was shut off from all the jackets and the engine operated as an unjacketed machine. The reheater contained about 550 square feet of heating surface.

Here again there is practically the same consumption of feed water per indicated horse-power, whether the reheater was in use or not. There is also the same kind of effect produced by the reheater as regards the reduction of cylinder condensation and increase of power in the low-pressure cylinder, as in the two previous engines, but in this case the actions are even more marked. The difference between the condensation in the two cylinders with the reheater in use was 1.2 per cent., being less in the low-pressure cylinder than in the high-pressure cylinder, but with the reheater out of use there was 17.1 per cent. more condensation in the low-pressure cylinder than in the high-pressure cylinder, making the total difference in the two cases 18.3 per cent. This improvement is a large one, but so large a quantity of steam was required to be condensed in the reheater to produce it that all the advantage was lost. It may be noted here that in this engine the amount of heating surface in the reheater was so great that the steam entering the low-pressure cylinder was superheated 38 degrees, but even this failed to secure a net saving of steam by the operation.

The effect upon the low-pressure power was quite as marked as that upon the condensation. With the reheater on, the low-pressure cylinder developed 18.7 horse-power more than the high-pressure cylinder. With the reheater off, it developed 40 horse-power less than the high-pressure cylinder, making a total difference in the two cases of 58.7 horse-power.

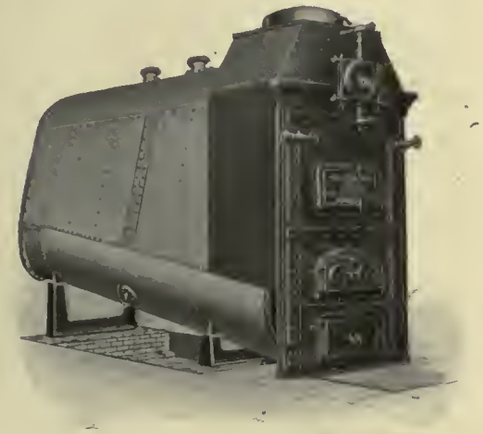
The three tests, reported very completely in Mr. Barrus' full paper, all show the same action with regard to cylinder condensation. There is a great reduction in the condensation within the low-pressure cylinder, but, owing to the loss of steam in the reheater itself, the resulting advantage is practically nothing. That the reheater produces no saving, however, is true only when the steam condensed by the reheating pipes is allowed to go to waste and the heat which it contains is lost. In the first engine there was 4 per cent. of the steam thus condensed; in the second, 8.7 per cent.; and in the third, 10.3 per cent. The temperature of the resulting water, with the high pressures used, is 340 to 350 degrees, Fahrenheit. If it is assumed that the temperature of the feed water supplied to the boiler is 125 degrees, each pound of condeused steam thus lost carries away with it over 200 heat units, or, in round numbers, 20 per cent. of the total heat of evaporation. Taking the third engine, this loss represents 20 per cent. of 10.3 per cent., or about 2 per cent. expressed in fuel consumption. Consequently, if the condensed steam from the reheater of this engine were returned to the boiler, there would be a saving of fuel, due to its use, amounting to about 2 per cent. It may be safely concluded, therefore, that, although a reheater produces no saving in steam consumption, it will, if properly applied, secure a slight economy at the coal pile.

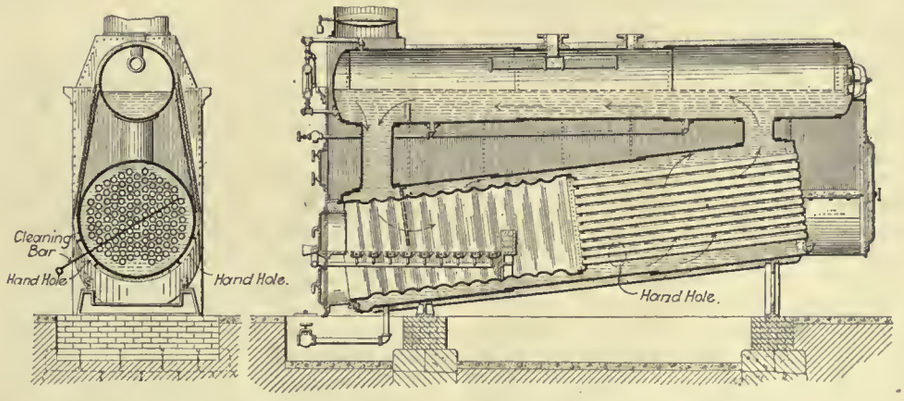
Apart from the consideration of fuel economy, there is the important question of the effect of the reheater upon the engine capacity. The tests show, without exception, that with the same power in the high-pressure cylinder, the reheater produces a considerable increase in the power of the low-pressure cylinder, and to that extent it increases the capacity of the entire engine. In the case of the first engine the increase was 4.6 per cent. of the total power. In the second engine the increase was 6.3 per cent., while in the third it was 11.8 per cent. This means that an engine without reheater must have larger cylinders to do the same work than an engine with reheater; or, if the cylinders are of the same size, there is more reserve power in the engine which is provided with a reheater. This feature of the subject makes the reheater advantageous even if it produces no other gain.

Observations Upon Temperatures acquired by cements during setting, made at the Watertown Arsenal, showed, in the case of some Portland cements, a temperature above the boiling point of water. These experiments were made upon 12-inch cubes, set in plank moulds; and the rise in temperature was measured by a thermometer resting in a thin copper tube, embedded in the cement, having a small quantity of oil in the bottom to aid in conducting the heat. The temperature of the room was about 23 degrees Centigrade. With neat Portland cement, the maximum temperature was attained in from six to twelve hours, and ranged from 50 to over 100 degrees Centigrade. With 1:1 Portland cement mortar the maximum temperature was attained after about eighteen hours, and in no case reached over 52 degrees Centigrade. With less rich mixtures, the maximum temperatures were still lower. The natural cements, all samples of which were neat, generally attained their maximum temperature, ranging from 30 to 50 degrees Centigrade, in from two to four hours. Cement held in the mixing bed for a time and then put in the mould showed a less increase in temperature than cement promptly put in the moulds.

A Double Drum Boiler.

There is now being brought to the attention of steam users in the United States an internally fired boiler, suitable for almost all purposes, which has been in use in various parts of Canada for several years, with good and bad water and a variety of fuels. During this period of practical test several improvements were made as weaknesses were discovered. This boiler consists essentially of two steam and water drums similar to those used in water tube boilers, the lower containing the furnace and the tubes, the two being connected by two large circulating pipes. The lower shell has an inclination from the horizontal of about 1 inch to the foot, for promoting circulation and draught. A steel casing, stiffened by angle irons and lined with asbestos air cell blocks, forms the rear smoke box and return smoke flue between the lower and upper shells, the upper half of the steam drum and bottom of the lower shell being also covered by non-conducting material. The furnace is of the "Fox" or "Morrison" corrugated type, without joints providing for expansion and contraction, and requiring no staying. The heads of the steam drum are spherical, and the tube sheets are stayed by the tubes, hence no other staying is required. The general arrangement of the boiler is shown in the illustrations.





THE ROBB-MUMFORD BOILER.

The gases, after leaving the furnace, pass through the tubes, and return between the lower and upper shells to the outlet at the front of the boiler. The furnace being of large diameter, and highest at the back, with considerable space beyond the grate surface, is favorable to good combustion. The tubes are short and most of the soot is carried through them and deposited in the rear smoke box, so that all the heating surfaces are very effective. The water flows around the furnace and tubes, up the rear circulating pipe into the steam and water drum, where the steam is released, along the upper drum towards the front, and down the front circulating pipe. A semi-circular baffle plate, placed about half way around the furnace, causes the down-flowing water to circulate to the lowest part of the shell under the furnace. The feed water enters the rear part of the upper drum, where it meets the hot water flowing towards the front, so that as it passes towards the front, its temperature is raised to that of the steam and water in the boiler, and an opportunity is given to deposit sediment on the bottom of the upper drum, particularly in the pocket formed by a baffle plate, placed back of the front circulating pipe, where a blow-off is provided.

A second sediment pocket with a blow-off is provided beneath the furnace. Thus two mud drums are interposed before the water reaches the hot surfaces of the furnace and tubes, where scale might otherwise be formed. Experience has shown that when using dirty water the boiler can be readily cleaned by regular use of the blow-offs, and the usual washing out through the hand-holes at the front and back of the lower shell and through the man-hole in the upper drum. There are besides two large hand-holes in the shell, back of the furnace, for cleaning between the tubes, by means of a bar, as indicated in the cut, for scale will form here, if at all. Owing to the rapid circulation of water around the upper part of the furnace and tubes, it has been found that scale will not form, except at the lower part of the boiler. If exceptionally bad water is to be used, the furnace and tubes are bolted in, so that by removing a row of bolts passing through the front ring and an exterior angle iron ring, and another row through the rear tube sheet and ring, the furnace and the tubes may be removed for inspection and cleaning.

The boiler is supported on a low cast-iron saddle near the front, and a higher saddle at the rear, both resting on low masonry piers. An open pit affords convenient access to the bottom of the lower drum, as indicated. All parts of the boiler can be easily reached for inspection. It is claimed for this boiler that it has many of the advantages of the Scotch marine and similar types of internally fired boilers, without the large diameter of shell, thick plates and expensive combustion chamber; that it has the lighter weight, small floor space and more perfect circulation of the best boilers of the sectional or water tube type, while avoiding the large number of hand-holes and joints usually necessary in boilers of the sectional type. It is considered to be as safe as the best of that type. A battery of 1,000 horse-power occupies a space 32x23 feet and 14.25 feet in height. Each unit is distinct and may be completely isolated.

This boiler is now manufactured in the United States by the Robb-Mumford Boiler Company, Incorporated, with offices at 135 Broadway, New York, and 170 Summer Street, Boston. The makers say the best results are obtained by having a rather small grate surface, strong draught, and a thick fire—or, in other words, a high rate of combustion per square foot of grate; and they claim that the practice of furnishing a large grate surface, as is frequently done in boilers of the externally fired type, to increase the capacity of the boiler, is opposed to good economy; first, because if more coal is burned than the heating surface of the boiler is calculated for, the gases will escape too hot, and, on the other hand, when the boiler is worked at a less capacity, the grate surface is so large that the fire may not be properly distributed over the whole grate, and is liable to have thin or dead spots through which cold air may pass, causing imperfect combustion.

Resanding Filters at Poughkeepsie.

New sand for the filter beds of the Poughkeepsie, N. Y., water works was purchased during 1902, according to the last annual report of Mr. Charles E. Fowler, superintendent of public works. The effective size of the sand was 0.26 millimeter, and its uniformity coefficient, 1.38. The arrangements for unloading the sand, transporting it to the beds and washing it are especially interesting. At the dock it was hoisted by the engine and buckets used for hoisting coal to the coal platform 20 feet above the top of the dock and 5 feet below the top of the coping of the filter beds. An ejector having a 1⅜-inch jet and nozzle 2¼ inches in diameter was placed on this platform and a 6-inch cast-iron pipe laid to the filter beds, a distance of 600 feet. The sand was delivered over the top of a tank 6 feet above the top of the coping of the bed on to the beds and the water carried away by suitable troughs. The total quantity of sand received was 1,986 cubic yards, in four scow loads measured on the scow. The total number of hours occupied in unloading, washing and delivering it to the beds was 103.5, averaging 19.4 cubic yards per hour. The quantity of water used was about 10 cubic feet of water to 1 cubic foot of sand. The cost of unloading, washing and delivering on the beds, including the cost of water and coal used was 44.4 cents per cubic yard. The total cost of new sand including unloading, washing, delivering on bed and spreading was $3,260.56. It was furnished by the Phoenix Towing and Transportation Co., of New York city.

Before placing the new sand the old was taken off to a depth sufficient to insure the removal of all silt as well as most of the discoloration. The new sand was then placed and all the old sand removed during the year was then washed and placed on the top of it; 1,787 cubic yards, measured on the beds, were washed and replaced. Some improvements were made in the washing apparatus and the best record made was 486 cubic yards in 32 hours or 15.2 cubic yards per hour. The quantity of water used was 10 cubic feet of water to 1 cubic foot of sand. The cost of water is taken at 5 cents per cubic yard of sand. The cost of washing the old sand and delivering on the beds, including cost of water, was 34.5 cents per cubic yard. The cost of spreading the old sand was 39.3 cents per cubic yard. The old bed was cleaned twelve times and the new bed fourteen times during 1902.

During the latter part of last year and the early part of this year the work required of the beds was very heavy owing to the excessively muddy condition of the river. The head was often 5 or 6 feet and occasionally greater. Sometimes immediately after cleaning the head was greater than before.

Letters to the Editor.

THE SAGGING OF FLOOR BEAMS.

Sir:—Your recent remarks on the general theory of flexure are most pertinent. If you will allow me, I will supplement them by a few statements about floor beams. It is conceded as a law of mechanics that if a beam of a given span be fixed at both ends or even at only one end it will be stiffer and have less tendency to sag at the center than when bearing loosely on the supports. But though the ends of the beam be said to be fixed, the fact is generally, that they cannot be considered so, unless as in the case of an iron beam, for example, they be bolted or riveted to some immoveable abutment. A slight yielding may add considerably to the deflection. The ordinary fixing of the extremities of beams in walls cannot be relied on for any length of time, even if perfect at first. The only way of obviating this tendency to sag is to cause the beams to bear on three points of support instead of two.

We happen to have here in Quebec, in a public school building, a deplorable example of this sagging of floors over most of the wider spaces (20 to 25 feet). All the beams were short lengths, just reaching from wall to wall with the result that considerable expense has been incurred for rejoisting, not by putting in longer beams, which would now be impossible, except at great cost, but by using deeper beams, spaced more closely. In one wing of this building there is such a depression at the center of the floor (several inches) that the cabinets around the room have had to be wedged up with 1¼-inch stuff to keep them against the walls; and the vibration is such, when any one crosses the room diagonally, that one cannot write. The rooms below will have to be obstructed by one or more columns in order to properly support the floor.

Of course the strongest way in which to timber or joist a floor, is when wood can be got long enough for the purpose, to let the beams run through from outer to outer wall, with intermediate bearings on partitions. The worst plan, altogether inadmissible, is the cutting of all the beams into short lengths reaching from wall to wall, unless in such case their stiffness be increased by additional depth and closer spacing.

Yours truly, A Subscriber.

Quebec, April 13, 1903.

MUNICIPAL ACCOUNTING.

Sir:—In your report last week of the discussion of municipal accounts that took place recently in Detroit, mention is made of the former involved condition of Chicago municipal bookkeeping and the saving of a million dollars a year insured by the introduction of a good accounting system. Such a statement ought to carry great weight with city officials who have hesitated about retaining auditors to improve their system of accounting because of a belief that the noise made about municipal bookkeeping arises mainly from editors and professors yearning for data now beyond their reach. It is difficult to persuade a city official to change his system of accounts to enable half-informed critics to bother him with unjust attacks based on alleged comparative studies of municipal statistics. Anyone who has taken the trouble to analyze one of these ponderous statistical essays does not need to be told of their uselessness. But if good accounting can produce a saving of a million dollars a year in Chicago, the agitation takes on an immediate practical aspect. It passes from the ethereal plane of uniform blank forms for reports to the practical foundation of sound business.

At the present time, the systems of municipal government in different cities vary very widely and the accounting and auditing methods suitable for one type of organization will be useless for another. This is as true in private as in public corporations; every public accountant of much experience has seen unlike systems of accounting employed with equal satisfaction by companies in the same trade. Two cities having similar organizations may have unlike systems of accounts, both of them good and each suited to its own purpose, owing to local conditions and past records.

To sum up what I have endeavored to say in a wandering way, municipal booking is a subject which can only be definitely settled by considering each case independently. While it is desirable to collect and classify accounts in the same way in different cities, it is much more desirable to have each city's books conducted by the most accurate, expeditious and economical plan. This aim will be best attained by calling in a firm of experienced accountants to draw up and open the necessary books. If the city puts itself in the hands of a "uniform-blank" enthusiast, it may have some nice details in the classification of sewer connections and the number of men required in laying service pipe, but the chances are slim for any suitable broad system of accounts.

Yours truly, Public Accountant.

New York, May 5.

The Two-Hinged Arch.

Sir:—Referring to Mr. Edward Godfrey's letter in your issue of April 25, in regard to neglecting the effect of the web members in calculating the horizontal thrust for two-hinged arches, I quite agree with Mr. A. R. McKim's reply to that letter. Professor Mueller-Breslau, of Berlin, makes the statement in his "Graphische Statik" that it is permissible to neglect the effect of the web members in calculating the horizontal thrust, but he also proves his statement and shows that the difference is very small. However, in calculating the horizontal thrust due to change in temperature, there is quite a difference when the effect of the web members is taken into consideration. But by neglecting this in the calculation, the horizontal thrust is larger than it would be if the web members were considered, and for this reason I would deem it advisable to neglect their effect.

Yours truly, G. M. Braune.

Birmingham, Ala., April 30, 1903.

New Books Received.

Under this heading books received from publishers will be punctually announced. Reviews may be published in subsequent issues. Publishers are requested to send retail price with each book.

Improvement of Rivers. A treatise on the methods employed for improving streams for open navigation, and for navigation by means of locks and dams. By B. F. Thomas and D. A. Watt, members Am. Soc. C. E., United States Assistant Engineers. New York: John Wiley & Sons. 356 pages, illustrated. Price, $6 net; postage 47 cents.

Notes on Track Construction and Maintenance. By W. M. Camp, M. Am. Soc. C. E., Editor "Railway and Engineering Review." Published by the author at Auburn Park, Chicago. 1,214 pages, illustrated. Price, $3.

Experiments on the Flexure of Beams, Resulting in the Discovery of New Laws of Failure by Buckling. By Albert E. Guy. New York: D. Van Nostrand Company. 122 pages, illustrated. Price, $1.25 net.

British Standard Sections, Issued by The Engineering Standards Committee. New York: D. Van Nostrand Company. Pamphlet. Price, $1.

Interesting Street Railway Figures.

The Division of Manufactures of the Census Office is making public an interesting summary of street and electric railway statistics of the United States for the year ending June 30, 1902. There are 987 operating companies and 22,590 miles of single track, not including track under construction but not operated. The passenger cars number 60,290 and all others 6,909. For generating power 2,337 steam engines of 1,298,133 horse-power and 3,257 dynamos of 1,200,138 horse-power are used. Passengers paying fares numbered 4,813,466,000 and the total number of transfer passengers was 1,062,403,392, while accidents resulted in the loss of 1,216 lives and injuries to 47,428 persons. The total car mileage was 1,097,806,884. The earnings from operation amounted to $241,584,697 and from other sources there was an income of $2,907,156. The total operating expenses were $139,012,004; and taxes, interest, rentals and miscellaneous expenses amounted to $74,524,616, giving a net income of $30,955,233. The operating expenses were 57.54 per cent. of the earnings. The total assets of the companies are $2,428,317,117, of which cost of construction and equipment represents $2,088,963,677 and other permanent investments $128,458,625. Total capital stock amounts to $1,216,277,989 and the funded debts to $929,328,656.

The companies employ 2,749 salaried officials, 4,301 clerks and 131,133 other persons, whose salaries and wages amount to $84,636,275. While the statistics reported in 1890 are not strictly comparable with those of 1902, the totals indicate that in the interval the total length of line has increased nearly 188 per cent., the number of miles of single track 178 per cent., the number of passenger cars 85.48 per cent., the number of fare passengers 138 per cent. and the number of miles of single track operated by electric power 1,637 per cent. During the same period the number of miles of single track operated by animal power decreased to 259 miles or by 95.42 per cent., the miles operated by cable 50.71 per cent. and the miles operated by steam 76.15 per cent.

The Old Croton Aqueduct, carrying a portion of the water supply for New York City, will when the new Croton dam is completed, be submerged to a depth of about 36 feet for the 3 miles or so between the two dams. The portions of this aqueduct built on embankments have already caused considerable trouble due to settlement and consequent cracking, and it is thought that when submerged, the settlement would be so great as to destroy the usefulness of the aqueduct; so that Chief Engineer William R. Hill recommends that at the crossing of all ravines new sections of the aqueduct made of concrete resting upon concrete foundations be built in lieu of those portions that are upon embankments, and that near the old dam where leaks have occurred or where the invert is unsound, the foundation be grouted with Portland cement and reinforced with concrete about a foot in thickness placed upon the present invert. To compensate for the loss of area of the aqueduct due to this it is proposed to remove the arch of the aqueduct and reconstruct it 1 foot higher than before, as the grade is such that this can be done without decreasing the carrying capacity of the aqueduct. The covering arch is only 8 inches thick, and it is recommended that this should be reinforced with 8 inches of concrete.

New Jersey Drainage Law.

A State Drainage Law for New Jersey became operative on March 31, 1903. It provides that any ten or more citizens who deem it necessary for the public health that "any pond, artificial reservoir, marsh, swamp, bog, meadow, or low or wet lands," should be drained, may present a petition to that effect to the court of common pleas of the county, and ask for the appointment of three commissioners, one of whom shall be a civil engineer or surveyor, to determine, first, whether the drainage petitioned for is necessary, and second, through what lands, ditches or other channels would have to be constructed in order to accomplish the desired end. If the commissioners favor the plan, they cause an accurate survey and map of the region affected to be made. If, after two weeks' notice of the intention to construct the drains, there are no objections to the work which are sustained by the court, the commissioners proceed to drain the lands in accordance with the plans adopted. The commissioners are empowered to compensate the owners of any land through which it is necessary to build drains, and in case any valuable water rights shall be injuriously affected, just compensation is to be awarded. The salaries of the commissioners are to be fixed by the court which appoints them, and paid by the municipality in which the drained district lies.

Upon the completion of the work the commissioners assess the cost upon the lands benefitted, but not in any case exceeding the amount of such benefit. Any assessment not paid within 6 months of the time it is due becomes a lien on the property. In case the total expenses shall exceed the amount of benefits, such excess shall be raised by general taxation in the municipality or municipalities in which the drained district lies. In case funds are necessary before the assessment can be made, the commissioners are authorized to borrow as much as may be necessary, with interest at 6 per cent., payable upon the collection of the assessment. All labor and materials required involving the expenditure of over $100 must be advertised for in the usual way, and the contract awarded to the lowest bidder.

The commissioners are required to make a report within 30 days after the expiration of one year from the date of their appointment and yearly thereafter unless the work be sooner completed, and then immediately upon the completion of the work, such report giving a detailed description of the work completed and that still to be done, the amount of the assessment levied, expenses paid, etc. This act does not apply to the ponds or artificial reservoirs of any canal or water supply company.

An English Steel Highway Bridge.

An English highway bridge across the River Sawdde, which is described in London "Engineering," has three lattice-girder through spans of about 50 feet, supported on massive stone piers with rounded ends carried up above the tops of the girders. The girders have T-shaped flanges built up with vertical and horizontal plates and angles and are divided into square panels by double vertical T-bars riveted together back to back, while the diagonal X-bracing consists of a single T-bar intersected by a single flat bar in each panel. A characteristic peculiarity of construction is the manner in which the ends of the vertical T-bars are bent nearly 45 degrees to clear the top flange angles, and give bearings riveted to the outer edges of the flange plates. The lower ends of the outside T-bars are the same, but the inner ones are bent sharply to an angle of 45 degrees and riveted to the top flanges of 8-inch horizontal I-beams which have no web-connections, but are seated on the horizontal leg of the inner flange angle and the wide projecting flange cover plate, and are riveted to the latter near the edge. These beams are 4½ feet apart, support on their lower flanges solid ¼-inch full length steel plates, which form transverse arches with a rise of 4 inches, and are covered with concrete leveled up to about 2 inches over the top flanges of the beams. Above the concrete there is about 3 inches of road metal.

Notes.

Surveys for a Topographic Map of Long Island will be completed by the United States Geological Survey during the coming summer.

Cement Walks to the amount of 162,707 square feet were built in Mankato, Minn., during 1902, according to the annual report of City Engineer J. R. Thompson. The total cost was $19,148, of which the city contributed 17 per cent. All walks are built entirely under city inspection. It has been found that one barrel of cement will make from 90 to 96 square feet of walk, depending on the grade of sand used. Repairs to wooden walks were made by the city without notice to the property owners, and the lumber so used was charged to the property at $30 per thousand feet.

The Daily Sprinkling of Macadam necessary to prevent its loosening during the summer was fixed by the late Santo Crimp as equivalent to a rainfall of 0.04 inch. This was for a roadway of broken granite in South England, where the climate is damp. Mr. R. J. Thomas, county surveyor of Buckinghamshire, states in a recent paper that he has found this estimate correct, after close observation for some time. It follows that in that part of the country, the proper maintenance of the highways require them to receive one heavy or two light sprinklings daily on about 120 days in the year.

Clogging Material in Contact Beds has been removed in some cases from the experimental beds of the Massachusetts State Board of Health, by applying large volumes of sewage to them within a limited period and at the same time leaving their outlets wide open. It has been made evident, according to the last annual report of the Board, that the beds, especially where broken stone was used, would not have become so seriously clogged in their lower portions if very coarse gravel or other open underdrains had been placed in them. The lack of underdrains has also prevented the easy removal of clogging matter by flushing.

That Irrigation Ditches should be lined was demonstrated by Mr. M. M. O'Shaughnessy, M. Am. Soc. C. E., in an article in the "Hawaiian Planters' Monthly" recently, in which he stated that he had made measurements of a ditch carrying 3,965,565 gallons at its head and 2,241,000 at the end,—a loss of 43.5 per cent. Two other unlined ditches showed losses of 40 per cent., one in 12 miles through good formation, and the other in 4 miles through sandy soil. He adds: "If ditches cannot be made tight, it is greater economy to build good flumes and renew them when necessary than allow pumped water to escape in leaky and porous ditches. A 3-foot diameter semi-circular galvanized iron flume laid on a grade of 10 feet per mile, delivers without loss 10,000,000 gallons daily on the Pioneer plantation on Maui, where the ground is porous."

The Capacity of Bricklayers has recently been the subject of some observations by Capt. John Stephen Sewell, Corps of Engineers, U. S. A. It is widely taken for granted that a bricklayer can lay 2,000 bricks per working day of 10 hours. In connection with the construction of the Government Printing Office, in Washington, D. C., of which he was in charge, it was found, however, that 1,000 bricks per 8-hour day is nearer the truth; that 1,200 bricks in a day of the same length is an average, and 1,600 bricks a maximum, these data being based on the erection of a 3-foot wall. In the general brickwork in the building the average dropped to 660, owing to the fact that face bricks had to be laid on both the inside and outside of the walls, that it was required that all bricks be firmly bedded in the mortar to ensure no voids, and that the construction included interior piers of brickwork enclosing columns of the steel framework.

The Mechanical Filter Plant at Binghamton, N. Y., recently put in operation, has given very satisfactory results, a summary of the tests being given in the annual report of Superintendent John Anderson. The supply is taken from the Susquehanna River, which has been very roily much of the time. The average quantity of water filtered has been 6,860,000 gallons per day, at the rate of 77,400,000 gallons per acre per day. The average amount of alum used was about .5 grain per gallon and the percentage of wash water, 2.53. Referring to the final tests made during the week ending January 10, 1902, the consulting chemist, Mr. George C. Whipple, states that the turbidity was almost completely removed, and the color was reduced from 21 to 3, while the odor was changed from a decided vegetable odor to a very faint one. The organic matter as shown by the albuminoid ammonia was reduced more than one-half, and all the iron was removed. The use of the alum, while not increasing the total hardness of the water, had changed a small amount of it from a temporary to a permanent condition.

The Liberal Arts Building, which was used during the dedication ceremonies of the Louisiana Purchase Exposition, was selected for the purpose because it has the largest clear floor space of any of the main group of structures. It is 525x750 feet in plan and has been built by the Kellerman Construction Company in nine months, despite delays incident to work during the winter. The main facade has one center and two end pavilions, in which the entrances are placed, the style of architecture being French Renaissance, the decoration depending largely on sculpture. Messrs. Barnett, Haynes & Barnett are the architects. In the construction 61,000 feet of piling, averaging 28 feet to the pile, nearly 700 tons of iron and nails, 47,000 cubic yards of filling, 2,500,000 feet of lumber, 36,000 squares of roofing, 300 tons of plaster, 450 tons of cement, and 65,000 square feet of ribbed glass were needed. Some of the staff construction, particularly columns and caps, is believed to be the most massive ever employed. The building has a system of fire stops, and a sprinkler system with 2,000 automatic heads. In case a serious fire should occur, it can be brought under control by the four monitors with 6-inch nozzles, such as are used on fire boats. The building will contain a part of the exhibits which Col. J. A. Ockerson, M. Am. Soc. C. E., chief of the Liberal Arts Department, is securing to illustrate, among other subjects, paper making, printing, binding, mapping, theatrical design and construction, the planning of tenements, photography, musical instruments, scientific and medical apparatus, municipal art, chemistry, and civil and military engineering.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal Notes.

Mr. G. P. Coleman has been re-elected city engineer of Winona, Minn.

Mr. Paul B. Davis has been appointed assistant city engineer of Reading, Pa.

Mr. George Blair has been appointed chief engineer of public works for Sherman, Tex.

Mr. J. Martin Thumm has been appointed superintendent of lighting for Cleveland, O.

Mr. A. G. Young has been elected superintendent for the construction of new water works at Richfield, Utah.

Messrs. James S. Duffy and F. L. George have opened an office as architects at 18 Main St., New London, Conn.

Mr. Ole Davidson has been promoted to be a division engineer of the Iowa Central Railway to succeed the late R. H. Wight.

Mr. E. H. Shipman has been appointed assistant engineer of the Lehigh Valley Railroad, with headquarters at Sayre, Pa.

Mr. H. A. Collar, city engineer, and Mr. William Ferris, superintendent of public works, of Lansing, Mich., have been reappointed.

Mr. Frank M. Sawyer has been appointed assistant engineer in charge of new work on the middle division of the Pennsylvania Railroad.

Mr. Frank B. Gilbreth, of Boston, has opened a permanent branch office for general contracting work in the Park Row Building, New York.

Mr. H. H. Safford has been made principal civil engineer, St. Louis division, Illinois Central Railroad, with headquarters in Chicago.

Mr. William Peach, formerly city engineer of Pueblo, Col., has opened an office at 317 Central block, that city, to engage in general engineering work.

Mr. Henry S. Thompson has been appointed superintendent of buildings for the borough of Manhattan, New York City, succeeding Mr. Perez M. Stewart.

Mr. C. C. Vermeule, artesian well expert and civil engineer, has been engaged as consulting engineer for the improvement of the water supply of Ithaca, N. Y.

Mr. E. E. Hughes has been appointed superintendent of the Pere Marquette Railroad, with headquarters at Grand Rapids, Mich., succeeding Mr. J. K. V. Agnew, resigned.

Captain Francis R. Shunk, corps of engineers, U. S. A., has been ordered to transfer the engineer office at St. Augustine to Jacksonville, Fla., and to take station at the latter place.

Mr. Elmer D. Fletcher has resigned as town engineer and superintendent of sewers of Winchester, Mass., and his assistant, Mr. James Hinds, has been appointed to the position.

Mr. Frank Case, a major in the regular army, as the outcome of conspicuous bravery while a captain of volunteers in the Philippines, is now engineer of the water works at Manila.

Mr. F. M. Wilkes has been appointed assistant superintendent of construction for the New York Continental Jewell Filtration Co., in the erection of a new dry dock at the Charleston Navy Yard.

Mr. George Smith has been appointed chief engineer of sewers for Hyde Park, Mass., to succeed Mr. A. D. Nickerson, who has resigned to engage in work on the New York water supply system.

Professor G. W. Bissell, Iowa State College, Ames, Ia., has been retained by the Guthrie Center Electric Light Co., Guthrie Center, Ia., to prepare plans and specifications for an electric light plant.

Major Theodore A. Bingham, corps of engineers, U. S. A., has retired as officer in charge of public buildings and grounds in the District of Columbia, after six years of active and efficient service.

Mr. F. H. Seymour, for a number of years connected with the Holly Mfg. Co., Lockport, N. Y., has accepted the position of chief mechanical engineer for the U. S. Sand & Filtration Co., of Pittsburg.

Mr. J. Albert Holmes, for nearly seven years engineer of the park department of Cambridge, Mass., has accepted a position with Mr. Charles W. Leavitt, Jr., landscape architect, 15 Cortlandt St., New York City.

Rear Admiral George W. Melville, engineer-in-chief of the United States Navy, read a paper on the "Importance of Military and Naval Engineering Experiments" before the Engineers' Club, of Philadelphia, May 2.

Mr. Maximilian Toch sailed May 7 as a delegate to represent the Society of Chemical Industry and the New York section of the Verein Deutscher Chemiker at the convention of Applied Chemistry in Berlin, Germany.

Mr. Frederick McL. Falck has been appointed engineer of the Wilmington division of the Philadelphia & Reading Railway, succeeding Mr. R. J. Stackhouse, who becomes superintendent of the Reading & Columbia division.

Mr. W. H. Ham, Assoc. M. Am. Soc. C. E., formerly engineer for the New York Expanded Metal Co., is now in charge of the department of steel-concrete structures for Messrs. Tucker & Vinton, Inc., 156 Fifth Ave., New York city.

Mr. George S. Pierson, M. Am. Soc. C. E., has been retained by the board of public works of Jackson, Mich., to prepare plans for the improvement of Grand River, the work including intercepting sewers, a sewage pumping station and sewage disposal.

Professor R. H. Thurston, director of the Sibley College of Engineering, Cornell University, has accepted an invitation to deliver the address of dedication at the opening of the new hall of engineering at the Iowa State College, Ames, Ia., on May 21.

Mr. J. B. Hutchinson, formerly general manager of the Pennsylvania Railroad, is now assistant to the second vice-president. His new work will relate principally to engineering and construction problems in connection with the transportation department.

Mr. William Kent, past vice-president of the American Society of Mechanical Engineers, compiler of Kent's Mechanical Engineers' Pocket-Book, has accepted the call to Syracuse University to become dean of the L. C. Smith College of Applied Science.

Mr. Arthur L. Adams, M. Am. Soc. C. E., has resigned the management of the Contra Costa Water Co. and resumed practice as a consulting hydraulic engineer, giving special attention to municipal water supply and water power, with office in the Crocker Building, San Francisco.

Mr. Daniel W. Hyde, formerly of Messrs. Hyde and Sherry, civil engineers and surveyors, and Mr. Edgar P. Sellew, recently connected with the Board of Survey, of Boston, have become associated as Messrs. Hyde & Sellew, civil engineers and surveyors, 15 Court St., Boston.

Mr. George L. Reis has been made general superintendent of the works of the United States Steel Corporation, in South Chicago, succeeding Mr. C. J. McCullough, Jr., and will be succeeded by Mr. Richard B. Charlton as general superintendent of the Bay View works of the Illinois Steel Company.

Messrs. H. G. Field, T. H. Hinchman, Fred L. Smith and Ralph Collamore are now associated in the firm of Messrs. Field, Hinchman & Smith, engineers and architects, 708 Washington Arcade, Detroit, Mich., as successors to Messrs. Field & Hinchman, consulting engineers, and Messrs. Mortimer L. Smith & Son, architects.

Obituary Notes.

Charles A. McAlpine, superintendent of the Providence division of the New York, New Haven & Hartford Railroad, died April 27, at his home in Hyde Park, Mass. He was born in Concord, N. H., in 1848, and at the age of 22 entered the employ of the Boston, Clinton & Fitchburg road. During his career he occupied, at one time or another, a wide range of positions in railroad work and was finally, in 1891, promoted to the position which he held at the time of his death.

Bailey H. Hitchcock, a well known civil and railroad engineer, died at his home in Toledo, O., April 23, at the age of 75. He was born in Hanson, Mass., received his education in civil engineering in Boston, and made the first surveys for the Hoosac tunnel, thus beginning his career as a railroad engineer. In 1853 he went west, where for six years he was engaged in large undertakings for the Wabash Railroad, among them the construction of the line between Ft. Wayne and Toledo and a number of large elevators and warehouses. Locating in Toledo in 1859, he established what presently became the largest lumber and manufacturing plant in that vicinity. In 1874 he resumed his old profession of civil engineering, designing a number of bridges for the Cincinnati Southern Railroad and being engaged by the government on river and harbor work along Lake Erie. During the last few years of his life Mr. Hitchcock was associated with the late J. D. Cook in a consulting civil engineering practice in Toledo.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 23, 25 and 26.

WATER.

Geronimo, Ariz.—See "Miscellaneous."

Phoenix, Ariz.—Local press reports state that the Phoenix Water Co. will expend about $150,000 in improvements.

Los Angeles, Cal.—The South Los Angeles Water Co. has been incorporated with a capital of $250,000, by E. V. Baker, A. L. Burbank, and others, all of Los Angeles.

The Kalorama Water Co., of Los Angeles, has been incorporated; capital $30,000. Chas. S. Mann, Frank A. Nance, and T. J. Magner, are among the directors.

San Francisco, Cal.—The Spring Valley Water Co. is stated to have filed articles of incorporation on Apr. 23 with a capital of $28,000,000. The company will take over the plant of the old company and carry out its plans for improvements. Directors: Wm. Alvord, R. J. Tobin, M. B. Kellogg, and others.

San Diego, Cal.—G. A. D'Hemecourt, City Engr., writes that it was voted Apr. 25 to issue bonds as follows: For water distributing system, $199,000; for extension of sewerage system, $140,000; for construction of buildings for Fire Dept., $37,000, and for construction of bridges, $5,000.

Alturas, Cal.—J. A. Yates writes that he proposes to construct water works, at a cost of $45,000. To be let by private contract.

Redlands, Cal.—The Bd. of Trade is reported to be investigating the question of obtaining an additional water supply for irrigation purposes.

Sacramento, Cal.—The Bd. of Trus. is stated to have adopted report of Special Com. recommending that the City Surveyor be instructed to prepare plans and estimates for a filter plant to be connected with present pumping system. Jas. H. Devine, Chmn. Com.

Delta, Colo.—J. E. Beckley, City Clk., writes that the Bonney reservoir, owned by the Garnet Ditch Co., will be rebuilt at a cost of $3,000.

New Britain, Conn.—Press reports state that bids will be received on May 14 for constructing the new retaining reservoir in Wolcott, to cost about $75,000.

Milford, Del.—See "Power Plants, Gas and Electricity."

Madison, Ga.—S. F. Beckham, City Clk. and Treas., writes that it is proposed to construct water works.

Summerville, Ga.—The citizens are stated to have voted Apr. 30 to issue $25,000 bonds for the extension of water works and sewer system.

Nezperce, Idaho.—The citizens are reported to have voted to issue $6,700 water bonds.

Shelbyville, Ill.—See "Power Plants, Gas and Electricity."

South Bend, Ind.—The city proposes to buy a Corliss engine to run the power pumps at Central Station. Geo. W. Shock, Supt. Water Wks.

Sioux City, Ia.—The report of F. W. Cappelon, Consulting Engr., of Minneapolis, and J. M. Lewis, City Engr., has been submitted to Bd. Trus. of City Water Wks. It calls for an expenditure of $250,000. The work will consist of constructing a new pump house at main station, erection of two 3,000,000-gal. pumps, three 120-H.-P. boilers, one sub-station building, two 250,000-gal. pumps; standpipe 120 ft. high and 20 ft. diameter, lowering suctions, mains and conduits around main station, laying 2 miles of 16-in. pipe, 1½ miles 12-in. pipe, together with necessary valves, hydrants, etc.

Ottumwa, Ia.—A press report states that an ordinance has passed first reading in Council providing for granting a franchise for 25 yrs. to the City Water Supply Co., with provision that company shall within 18 months after contract takes effect provide an intake W. or N. W. of Turkey Island; erect a sedimentation basin and 2 additional Jewell filtration tanks. A purchase clause is contained in the ordinance giving the city the right to purchase plant any time within 3 years for $275,000, plus the cash cost of the improvements made.

Ft. Scott, Kan.—It is stated that the Frisco R. R. Co. will construct a water tower here, to be 60 ft. high, and have a capacity of 50,000 gals. A. S. Blodgett, Supt. of Bridges and Bldgs., Springfield, Mo., will have charge of work.

Holton, Kan.—It is stated that J. F. McCabe, City Engr. of Topeka, will furnish estimates for water works and a sewerage system for Holton.

Monroe, La.—See "Power Plants, Gas and Electricity."

Quincy, Mass.—H. Flood, City Engr., writes that the contract for 170 tons of 4, 6 and 10-in. c. i. pipe has been awarded to W. D. Briggs, of New York, N. Y., for $5,000.

Grand Rapids, Mich.—The Bd. of Pub. Wks. has adopted the report recommending the immediate issue of $80,000 water main extension bonds.

Andrew Brittel is stated to have secured the contract of setting new boilers at the pumping station for $7,660.

Battle Creek, Mich.—A press report states that a stock company has been formed here, with a capital of $150,000, to construct water works.

Minneapolis, Minn.—The following bids are reported to have been received for c. i. pipe for the ensuing year: U. S. Cast Iron Pipe & Fdry. Co., of Chicago, Ill., $32.60 per ton for 30-in. and $33.35 for 6-in., and the Dimmick Pipe Co., New York, N. Y., $31.90 for 30-in. and $33.40 for smaller sizes.

Bids will be received May 23 by Com. on Ways and Means of City Council for $815,000 bonds, part to be used as follows: $100,000 for extending water works; $215,000 for repairing, building and reconstructing bridges and $150,000 for improving streets. Joshua Rogers, City Compt.

Marshall, Mo.—A. R. James, City Clk., writes that the citizens voted Apr. 28 to purchase the water works.

Kansas City, Mo.—According to local press reports the Allis-Chalmers Co., Chicago, Ill., has secured the contract for a high service engine in two sections, with a combined daily capacity of 16 million gals., to be installed at the Turkey Creek Station, for $106,000, and the Barr Pumping Engine Co., Philadelphia, Pa., for a 25 million gal. engine for Quindaro Station, for $85,000. Both contracts are subject to approval by lower house of Council.

Cape Girardeau, Mo.—See "Power Plants, Gas and Electricity."

Belgrade, Mont.—See "Power Plants, Gas and Electricity."

Atlantic City, N. J.—Bids will be received by the Water Comrs. until May 12 (readvertisement) for installing a plant for pumping 3,000,000 gal. per day from 12 artesian wells. Bids will be received on an air lift plant and laying vitrified clay discharge mains, or else for installing a centrifugal pump plant, with impulse wheel or electric motor and laying suction main. Kenneth Allen, Engr. & Supt.

Jersey City, N. J.—Bids will be received May 12 by the Bd. of Street and Water Comrs. for furnishing and delivering special castings. Geo. T. Bouton, Clk.

Avon-by-the-Sea, N. J.—Water bonds amounting to $34,000 are reported sold and bids for $32,000 sewer bonds are being received.

Manasquan, N. J.—W. A. Mount, Town Clk., writes that it is proposed to construct water works, at a cost of $35,000. An election on question will soon be called. Engineers, Pugh & Downing, Philadelphia, Pa.; T. B. Wolley, Mayor; J. W. Van Vouter, Chmn. Water Com.

Greene, N. Y.—Bids will be received by the Village Bd. of Trus. until May 19 for furnishing material and constructing a gravity water works system. M. L. Cowles, Clk. of Bd.

Long Island City, L. I., N. Y.—The Dept. of Water Supply is stated to have planned a general system of water mains for Long Island City that will cost about $100,000.

Bids will be received May 19 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing materials, building and installing new boilers and appurtenances at pumping stations Nos. 1 and 3, in Boro. Queens.

Alexandria Bay, N. Y.—J. P. Thomson, Village Clk., writes that bids will be opened in about 10 days for water works and a sewerage system, to cost $70,000. Engineer, Frank Hinds, of Watertown.

Poughkeepsie, N. Y.—R. D. Wood & Co., of Philadelphia, Pa., are stated to have secured the contract for furnishing water pipe (bids opened April 28), at $32.60 per ton for 6-in. and $33 for 4-in.

Ilion, N. Y.—Press reports state that bids are wanted May 18 for $60,000 water bonds.

New York, N. Y.—The following bids were opened May 5 by R. G. Monroe, Comr. Dept. Water Supply, for (*a*) 800 tons straight pipe (6 and 12-in.) and (*b*) 105 tons branches and specials: M. J. Drummond, *a*, $29.85; *b*, $52.50; John Fox & Co., *a*, $30.85; *b*, $55. U. S. Cast Iron Pipe & Foundry Co. (informal), *a*, $31.40; *b*, $60.

Bids will be received May 19 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing and delivering c. i. water pipes, branch pipes and special castings and stopcocks.

New Brighton, S. I., N. Y.—Bids will be received May 19 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing materials, building and installing a new boiler and appurtenances at the pumping station of the Tottenville Water Wks., Boro. Richmond.

Columbus, O.—J. A. Connor, Clk. Bd. Pub. Wks., writes that the contract for furnishing 13,000 ft. of galvanized iron pipe (bids opened Apr. 28) has been awarded to the Columbus Supply Co., of Columbus, O.

Cordell, Okla. Ter.—The citizens are stated to have voted Apr. 20 to issue $25,000 bonds for water works.

Alva, Okla. Ter.—Bids will be received May 26 by the City Council for constructing water works. Jas. D. Hunter, City Clk.

Indiana, Pa.—A charter is stated to have been granted to the Rayne-Dixon Water Co., to operate in Rayne Township; capital, $5,000. Incorporators: T. E. Hildebrand and H. M. Bell, of Indiana, and J. M. Thompson, of Deckerspoint.

Mt. Carmel, Pa.—Local press reports state that the systems of the Mt. Carmel Water Co. and the Bear Gap Water Co. are to be connected with a line of 6-in. pipe about 6,000 ft. in length.

Reading, Pa.—C. Arthur Hague, of New York, N. Y., and Water Wks. Supt. Nuebling in a report to Council recommended the purchase of a new 15,000,000 gal. pump, at a cost of about $80,000, and other water works improvements, to cost in all $131,451.

Pottstown, Pa.—See "Power Plants, Gas and Electricity."

Gary, S. D.—The question of constructing water works is reported under consideration at Gary.

Belmont, S. D.—It is reported that water works are to be constructed here, at a cost of $10,000.

Salem, S. D.—The National Constr. Co. is reported to have secured the contract for a compressed air system of water works for $5,500.

Spencer, S. D.—C. W. Lendekugel, Town Clk., writes that it is proposed to construct water works, at a cost of $5,000. Election on question will soon be called.

Seattle, Wash.—The City Council on Apr. 20 ordered the construction of the 11th Ave. N. water main system, to cost $31,000.

Ballard, Wash.—See "Power Plants, Gas and Electricity."

Pomeroy, Wash.—S. S. Russell, City Clk., writes that the Pacific Coast Pipe Co., of Spokane, secured the contract for 5,000 ft. of 10-in. and 7,000 ft. of 8-in. wire-wound wood stave pipe at 50 cts. and 42 cts. per ft. respectively. The Washington Pipe Co., of Spokane, bid for same 56 cts. and 46 cts. per ft. respectively, and the Nati. Tube Works, of Seattle, bid for steel pipe 90 cts. and 66 cts. per ft. respectively (bids opened Apr. 21).

Niagara Falls, Ont.—John Robinson, Supt. Water Wks., writes that it is proposed to install a new pump, at a probable cost of $12,000. Bids will probably be received in June.

Burks Falls, Ont.—E. Bazett, Town Clk. and Treas., writes in regard to the construction of water works that the proposition has not yet been voted on by the ratepayers. If constructed it will probably cost about $20,000 and John Galt, of Toronto, will probably be the engineer.

SEWERAGE AND SEWAGE DISPOSAL.

San Diego, Cal.—See "Water."

New Haven, Conn.—Thos. F. Maher is stated to have secured the contract for constructing the Chestnut St. sewer, for $12,555.

Wilmington, Del.—Bids are wanted May 22 for the construction of Prices Run Sewer and branch, as advertised in The Engineering Record.

Summerville, Ga.—See "Water."

Havana, Ill.—Pollard, Goff & Co., of Champaign, are stated to have secured the contract from the Drainage Trus. of Mason County for a ditch 11 miles in length, 60 ft. wide and 10 ft. deep, to cost $75,000.

De Kalb, Ill.—S. W. Patten, Chmn. Sewer & Drain Com., writes in regard to the storm water sewers, for which bids were to have been opened Apr. 29, that same were not opened but returned to bidders, and bids will again be called for later.

Montpelier, Ind.—It is stated that bids are wanted May 12 for constructing pipe sewers. J. F. Jones, City Clk.

Winchester, Ind.—It is stated that plans are being prepared for the construction of a lateral sewer.

Connersville, Ind.—Karl L. Hanson, City Engr., writes that the following bids for constructing a combined storm and sanitary sewer system were received by Common Council May 1: Municipal Eng. & Constr. Co., Chicago, Ill., $80,092 (bid informal, not including all items); Thos. Bridge's Son, Wabash, $81,372 (awarded contract); Phil. Hipskind & Sons, Wabash, $83,529; Geo. M. Cheney & Co., Indianapolis, $84,427; J. H. Green & Son, Appleton, Wis., $84,617; Elkhart Constr. Co., Elkhart, $87,925, and Neal Paving Co., Hartford City, $103,582. This work includes 54,320 ft. brick and pipe sewers from 4 to 48 inches in diameter, 78 manholes, 129 catch basins and 11 flush tanks. The trench is expected to average 10 ft. in depth and will be excavated in gravel, sand and loam with clay. Chas. Carroll Brown, Consulting Engr., Indianapolis, Ind.

Lafayette, Ind.—Bids will be received May 11 by Common Council for constructing a 12-in. pipe sewer on Main St., from 5th St. east to alley between 6th and 7th Sts., and 24 in. from Pearl River sewer at 8th St. to 9th St.; also a 10-in. pipe sewer in portions of 7th St. Chas. F. Williams, Jr., City Clk.

South Bend, Ind.—A. J. Hammond, City Engr., writes that bids will be received by the Bd. of Pub. Wks. May 20 for pipe sewers in 4 streets requiring about 10,812 ft. of 20 to 6-in. pipe.

The City Engr. has prepared plans for a trunk sewer on the east side of river; estimated cost, $21,000, and plans are being prepared for a trunk sewer on the west side.

Independence, Ia.—R. C. De La Hunt is stated to have secured the contract for sewer work at Independence, for $4,655.

Sioux City, Ia.—Bids are wanted May 12 for furnishing material for constructing a sanitary sewer in portions of 9 streets. A. L. Harding, Chmn. Sewer Com.

Waterloo, Ia.—It is stated that bids are wanted May 21 for constructing 12-in. pipe sewers in various streets. B. G. Stewart, City Clk.

Holton, Kan.—See "Water."

Beechmont, Ky.—See "Power Plants, Gas and Electricity."

Frederick, Md.—T. C. Hatton, of Wilmington, Del., estimates the cost of constructing a sewer between 5th St. and Carroll Creek, at $8,077.

Worcester, Mass.—F. A. McClure, City Engr., writes in regard to the construction of 3 pumping stations and sewers in Lake View, that the work under consideration is for 3 ejector stations, Shone system, 150 ft. lift, Akron pipe being used. Approximate cost, $40,000; work to be done by day labor by Sewer Dept.

Beverly, Mass.—The Legislature is stated to have authorized this city to issue $250,000 bonds, part of which will be expended in improving the sewerage system.

Westfield, Mass.—A press report states that bids will soon be asked for remaining portion of northerly section of surface drainage system.

Hyde Park, Mass.—Sewer bonds amounting to $40,000 are reported sold.

Fall River, Mass.—It is reported that $50,000 has been appropriated for new sewers.

Medford, Mass.—The Comrs. of Sewers have ordered the construction of a double line of sewers in Playstead Road; also a sewer in Auburn St. All work to be done under direction of Wm. Gavin Taylor, City Engr.

Everett, Mass.—According to press reports the City Engr. estimates the cost of constructing about 20 miles of sewers for Everett, at $100,000.

Quincy, Mass.—Bids are wanted May 18 for constructing pipe sewers in Wards 1 and 2. The work comprises about 6,702 ft. of 8 to 20-in. pipe. A. F. Schenkelberger. Chmn. Bd. of Sewerage Comrs.

Richmond, Mich.—A press report states that it is proposed to construct sewers in the western part of village.

Jackson, Mich.—Geo. S. Pierson, of Kalamazoo, has been employed by the Bd. of Pub. Wks. to prepare plans for the improvement of Grand River. The work includes intercepting sewers, a sewage pumping station and sewage disposal.

St. Paul, Minn.—Bids will be received May 11 by the Bd. of Pub. Wks. for constructing a sewer in portions of Aurora Ave. R. L. Gorman, Clk. of Bd.

St. Louis, Mo.—The lowest bids opened by the Bd. of Pub. Improv. on Apr. 28 for sewers are stated to have been submitted as follows: By the Municipal Eng. Co., of Chicago, Ill., for constructing sewer in Cabanne Dist., known as Blackstone Sewer Dist. No. 1, for about $159,000, and the Rich Constr. Co. for the public sewer in Blackstone Sewer Dist. 1, for about $126,000; the Rock Spring sewer in Dist. No. 12, for about $134,000, and for a sewer in joint Sewer Dist. No. 1, for about $56,000.

Kansas City, Mo.—D. W. Pike, City Engr., is stated to have suggested to the Bd. of Pub. Wks. that a general plan for sewer extensions be prepared.

Red Lodge, Mont.—The City Council is stated to have decided to construct a sewerage district, which will take in the residence district lying west of railroad track and north of school house.

Avon-by-the-Sea, N. J.—See "Water."

North Bergen, N. J.—The following bids are reported to have been received by the Township Com. on Apr. 23 for a brick and pipe sewer on Fisher Ave. to the Hudson Boule.: Henry M. Schneider, $42,246; Palisade Constr. Co., $41,354, and Callery & Murphy, $39,402.

Collingswood, N. J.—See "Paving and Roadmaking."

East Syracuse, N. Y.—Local press reports state that bids will be received until June 1 by the Village of E. Syracuse for $55,000 bonds, to be issued for the purpose of constructing a sewer system.

Depew, N. Y.—Bids will be received May 18 by the Bd. of Village Trus. for constructing a concrete retaining wall at the sewage disposal plant. J. C. Glade, Village Clk.

Canajoharie, N. Y.—Press reports state that bids are wanted May 12 for $36,000 sewer bonds.

Alexandria Bay, N. Y.—See "Water."

Rome, N. Y.—The Governor has signed the bill providing for extension of the sewerage system.

Elmira, N. Y.—Leon D. Conkling, City Engr., writes that Dani. Connors, of Elmira, has secured the contract for constructing sewers on Gray and Fulton Sts., at $1.04 and $1.54 per ft. respectively; total cost, $2,343.

Niagara Falls, N. Y.—A press report states that about $35,000 will be expended this year for new sewers.

Jamestown, N. D.—The City Council is reported to have authorized the Sewer and Water Wks. Com. to secure estimates of cost of making improvements to the sewerage system.

Cincinnati, O.—T. P. Strack is stated to have secured the contract for constructing sewers in 4 streets for $8,295.

Lockland, O.—The Com. of citizens appointed to investigate and report on improvements are stated to have recommended to Council that a sewerage system be constructed, that 8 streets be paved with brick, and all other streets be macadamized, and curbs and gutters laid with concrete; estimated cost of this work is $284,134.

Guthrie, Okla. Ter.—T. A. White, C. E., would like to correspond with parties having disposal plants for sale or construction, suited to the needs of a hospital.

Lewistown, Pa.—The Town Council is reported to be considering the construction of a sewerage system, to cost $65,000.

Chambersburg, Pa.—Howell & Co., of Philadelphia, are about to petition the Boro. Council for a franchise for a sewerage system.

Providence, R. I.—Robt. E. Smith, Comr. of Pub. Wks., writes that the contract for about 2,152 ft. 18, 20, and 24-in. and 400 ft. 50-in. brick sewer, also 10,237 ft. 8, 12 and 15-in. pipe sewer in portions of 12 streets, for which bids were received on Apr. 28, has been awarded to Fred. E. Shaw, of Providence.

Aberdeen, S. D.—D. C. Washburn, City Engr., writes that the date of opening of bids for proposed sewers has been extended to May 29. The approximate quantities are as follows: 9,245 ft. 10-in. pipe, 1,129 ft. 15-in. and 2,010 ft. 18-in., and 34 manholes, and 1 catch basin.

Nashville, Tenn.—The following are reported to be the lowest bids opened by the Bd. of Pub. Wks. Apr. 30 for improvements to be made on property of Murphy Land Co.: For extending Lick Branch sewer, Foster & Creighton, Berry Blk., $39,695; for lateral sewers, Nashville Plumbing Co., $6,682; grading and macadamizing streets, J. W. Quinn, $16,807; grading and macadamizing alleys, Foster & Creighton, $3,232, and for furnishing water pipe, J. H. Fall & Co., and Dimmick Pipe Co., of New York, N. Y., each bid $28.50 per ton.

Fair Haven, Vt.—Bids are wanted May 22 for constructing a system of sewers, as advertised in The Engineering Record.

Ballard, Wash.—J. Murdoch, City Clk., writes that bids will probably be received in June for brick and pipe sewers, to cost about $39,000. Engineer, G. P. James.

La Crosse, Wis.—Contracts for pipe sewers are stated to have been awarded as follows: 12-in. sewer on 10th St. to Olaf Swennes, at 74¾ cts. per ft.; 12½-in. sewer on 7th St., at 69 cts., and a sewer from 15 to 20 in. on 3d St., to R. F. Weston, at $1.50 per ft.; total cost of sewers, $11,000.

BRIDGES.

Los Angeles, Cal.—R. B. Burns, Ch. Engr. of the coast division of the Santa Fe R. R., has completed plans for 30 bridges for the Southern California Division of the R. R. Reports state that 15 of the bridges will be on the line between Los Angeles and San Diego, and 15 on the line between here and Barstow.

Pueblo, Colo.—The Pueblo Bridge Co. is reported to have secured the contract to construct a bridge across Arkansas River, between Pueblo and Florence, for $12,000.

New Haven, Conn.—See "Paving and Roadmaking."

Rock Island, Ill.—The Comrs. of Rock Island and White Counties have each appropriated $10,500 toward building a bridge across Rock River near Hillsdale.

Indianapolis, Ind.—Local press reports state that bids will be received until May 22 by the Bd. of Co. Comrs. for constructing a bridge across Fall Creek at College Ave.

Winchester, Ind.—It is stated that bids are wanted by the Co. Comrs. until May 16 for constructing 7 bridges and abutments. John H. Boltz, Co. Aud.

Gosport, Ind.—The Lafayette Engineering Co. is stated to have received the contract to construct a bridge across White River, 3 miles from Gosport, for $11,140.

Laporte, Ind.—Press reports state that a $10,000 steel wagon bridge will be constructed across Big Creek, this city.

Terre Haute, Ind.—Local press reports state that the Co. Comrs. have decided to receive bids on both a 36-ft. and a 50-ft. roadway for bridge across Wabash River. The cost of the 36-ft. roadway is estimated at $177,800, and the 50-ft., it is estimated, would cost $42,000 additional.

Jonesboro, Ind.—The Co. Comrs. have appropriated $13,000 for a bridge to be built across Mississinewa River at Wilson's Ford, above Jonesboro.

Mishawaka, Ind.—A. J. Hammond, City Engr., of South Bend, has prepared plans for a bridge to be constructed over St. Joseph River at Misbawaka; length, 375 ft.; width, 40 ft.

Rushville, Ind.—The Co. Comrs. have appropriated $14,000 for county bridges. This includes $9,000 for a bridge, having a 225-ft. span and 18-ft. roadway, to be built across Big Blue River.

Davenport, Ia.—Press reports state that the Bridge Com. of the Bd. of Superv. has decided to build a steel bridge across Duck Creek.

Des Moines, Ia.—The St. Ry. Co., it is reported, intends building a 3-span steel bridge across Des Moines River.

Ft. Dodge, Ia.—The Co. Comrs. have instructed the Engr. to prepare plans and specifications for a steel bridge to be built across Paint Creek at Slate Mills, at a probable cost of $7,000.

Sioux City, Ia.—See "Miscellaneous."

Ft. Scott, Kan.—It is stated that the Ft. Smith Electric Light & Traction Co. will build a bridge across Arkansas River near Van Buren.

Hoxie, Kan.—Bids will be received May 21 by the Co. Comrs. for furnishing material and constructing a 50-ft. steel bridge. B. R. Reed, Co. Clk.

Lawrence, Mass.—Press reports state that the Boston & Maine R. R., the County, the City of Lawrence, and the Boston & Northern St. Ry. Co. intend constructing, jointly, a $20,000 bridge at So. Union St.

Gloucester, Mass.—The City Council has petitioned the Co. Comrs. for a new bridge over Gloucester Canal.

Minneapolis, Minn.—See "Water."

Grand Ledge, Mich.—The citizens are reported to be considering the issuing of $18,000 bonds for the purpose of building a bridge across Grand River.

Ft. Benton, Mont.—Plans, specifications and bids will be received June 4 by the Bd. of Co. Comrs. for constructing a 200-ft. Howe truss or combination bridge over Milk River at Bowes Ford. E. Frank Sayre, Co. Clk.

Omaha, Neb.—Bids are wanted May 21 for constructing a highway bridge over Central boulevard at Leavenworth St., including abutments, retaining walls, foundation and superstructure. Bids will be received for a concrete steel bridge, a steel plate girder bridge and a stone arch bridge. J. H. Evans, Pres. Bd. Park Comrs.

Newark, N. J.—Essex County's Bd. of Freeholders on Apr. 30 adopted a resolution declaring a new bridge across the Hackensack River on the Plank Road a public necessity. Essex's and Hudson's County Engrs. were instructed to prepare plans, and they will also superintend the construction of the bridge, which will cost about $200,000. The structure will be 40 ft. wide and nearly one-half mile long.

New York, N. Y.—Bids will be received May 14 (readvertisement) by the Bd. of Park Comrs. for constructing a concrete steel arch bridge, with stone parapet walk and stone arch facings over the Bronx River, at the crossing of the Bronx and Pelham Parkway. Wm. R. Willcox, Chmn.

Buffalo, N. Y.—There has been allowed in the estimates for the year $10,000 to start the construction of a new bridge at Ohio St. over Buffalo River.

Port Henry, N. Y.—The Eastern Bridge & Structural Co., of Worcester, is reported to have secured the contract for doing all of the railroad bridge and span work for the Lake Champlain & Moriah R. R. of Port Henry. The largest of the bridges is to be of the plate girder design, 80 ft. long, with the girders weighing about 30 tons each.

Elizabeth City, N. C.—The Camden Ferry Co. have been organized, and, it is stated, will build an iron bridge across Pasquotank River. H. T. Greenleaf, Pres., and W. N. Gregory, Secy. & Treas.

Coshocton, O.—The Canton Bridge Co., according to reports, has secured the contract to build a bridge across Walhounding River at $5,700.

Elyria, O.—Plans and specifications have been adopted for a 2-arch bridge to be built near the water works dam at a cost of about $12,000; also specifications for a 2-arch bridge to be built at Washington St. It is to have a 70-ft. span, a 40-ft. driveway, and a 7-ft. walk on each side, and is estimated to cost $25,000.

Cleveland, O.—City Engr. Carter is reported to be in favor of constructing an entirely new high level bridge at Superior St., instead of replacing the old draw in present structure, as contemplated.

Uniontown, Pa.—Bids will be received May 15 by the Co. Comrs. for constructing a bridge over Jacob's Creek, near Scottdale; bids will be received on the superstructure for either iron or steel, also for masonry. O. G. Chick, Co. Clk.

Central Falls, R. I.—The cities of Central Falls (W. F. Keene, City Engr.) and Pawtucket (G. A. Carpenter, City Engr.) have in contemplation the building of a bridge across Blackstone River at Central Ave.

Brookings, S. D.—Bids will be received May 25 by the Bd. of Co. Comrs. for constructing 1 70-ft. span steel bridge and 4 small wood or combination bridges. John Aiton, Co. Aud.

Huntdale, Tenn.—The Yancy Bridge Co. is reported to have been incorporated to build a number of bridges in E. Tennessee and Western N. Carolina. The company proposes, according to reports, to build a steel bridge across Yoe River in Yancy Co., N. C. J. M. Bush, of Knoxville, Tenn., is reported to be Pres. of the company.

Georgetown, Tex.—The Co. Comrs. are reported to be contemplating the building of several bridges.

Hondo, Tex.—Asst. Attorney-Gen. Johnson has approved $30,000 Medina Co. bridge bonds.

Bids will be received June 1 by H. E. Haass, Co. Judge, for $14,000 bridge bonds.

Everett, Wash.—Press reports state that a $30,000 bridge is to be built at Everett Ave.

Tacoma, Wash.—The Puget Sound Bridge & Dredging Co., Seattle, has secured the contract for a steel sewer and bicycle bridge across gulch, near De Lin St., for $5,492, and for cement work, per cu. yd., $8.49, and stone caps, per cu. ft., $1.50.

Walla Walla, Wash.—It is stated that bids are wanted May 18 for the iron work for bridge to be constructed at E. Main St. R. P. Reynolds, City Clk.

Carleton Place, Ont.—It is stated that bids are wanted May 25 for constructing the substructure and the superstructure of a bridge to be built across Mississippi River in Dalhousie Township. E. T. Wilkie, Engr.

Montreal, Que.—Press reports state that a petition has been presented for the incorporation of the Montreal-Longueil Bridge Co., with power to build a general traffic bridge across St. Lawrence River and to charge tolls. The bridge is to be a single span, with a clear headway of 150 ft. for 800 ft. The application also covers the building of a railway in Montreal, with terminals therefor. The incorporators are reported to be: W. H. Dandurand, S. T. Willett, Mayor James Cochrane, and others.

PAVING AND ROADMAKING.

Mobile, Ala.—The Bd. of Pub. Wks. is considering the paving of a considerable section of the city. Granite and vitrified brick will probably be the materials selected. It will be several months before plans are perfected and bids solicited. J. N. Hazlehurst, Ch. Engr.

San Diego, Cal.—See "Water."

New Haven, Conn.—City bonds amounting to $80,000 have been sold; they include $50,000 street paving bonds, $20,000 high school bonds and $10,000 bridge bonds.

Milford, Del.—See "Power Plants, Gas and Electricity."

Decatur, Ill.—The Barber Asphalt Paving Co. is reported to have secured the contracts for paving on Bradford St. and Central Ave., and for resurfacing on E. Main and N. Water Sts. at $1.65 per sq. yd., and $1.25 per sq. yd. respectively. Total amount of contracts reported to be over $32,000.

Chicago, Ill.—It is stated that the Bd. of Local Improv. has ordered the paving of State St., from Madison St. to Jackson Boule., with asphalt at a probable cost of $24,500. The paving of 43d St. with asphalt, at a cost of $60,000, is reported contemplated.

Rock Island, Ill.—The City Council has adopted an ordinance authorizing paving with brick on a portion of 17th St., at an estimated cost of $23,033.

Indianapolis, Ind.—Boulevard bonds amounting to $100,000 have been sold.

The Bd. of Pub. Wks. has adopted a resolution to resurface a portion of Virginia Ave., at an estimated cost of $25,450.

The Bd. of Pub. Wks. has taken final action on a block roadway and curb in 20th St., between Talbott Ave. and Bellefontaine St., estimated to cost $30,750.

The Bd. of Pub. Wks. has decided to pave with wooden block on Ashland Ave., from 23d to 28th Sts., at an estimated cost of $48,000.

Evansville, Ind.—Aug. Pfaffin, City Engr., writes that Wm. Eishel, of Evansville, bid $1.42 per sq. yd. for brick paving and 50 cts. for curbing; total, $27,000 on 4 streets (bids opened Apr. 18). Asphalt work for which bids were opened on same date, has been postponed.

New Albany, Ind.—The City Council has ordered asphalt and brick paving, to cost about $300,000. E. B. Coolman, City Engr.

Connersville, Ind.—It is stated that bids are wanted May 18 for constructing 30,000 sq. ft. of cement sidewalks and 2 miles of gravel streets. K. L. Hansom, City Engr.

Huntingburg, Ind.—Bids will be received June 1 by the Co. Comrs. for improving by grading, draining and macadamizing certain highways in Patoka Township and certain streets in city of Huntingburg. August H. Koerner, Co. Aud., Jasper.

Vincennes, Ind.—It is stated that bids will be received by the Co. Comrs. until May 18 for constructing about 36 miles of gravel roads.

Montpelier, Ind.—It is stated that bids are wanted May 12 for constructing block pavement and cement sidewalks in Jefferson St. J. F. Jones, City Clk.

Plymouth, Ind.—It is stated that bids are wanted May 25 for paving about 38,000 sq. ft., with brick on Liberty St. A. E. Rhodes, City Clk.

Veedersburg, Ind.—Bids will be received May 18 by the Common Council for building and improving portions of North St. I. J. Walker, City Clk.

Salem, Ind.—Bids will be received May 28 by the Bd. of Co. Comrs. for constructing about 10 miles of macadam road in Brown Township. Frank E. Morris, Co. Aud.

Greencastle, Ind.—It is stated that the Co. Comrs. will receive bids for constructing 9 miles of county roads.

Anderson, Ind.—Bids will be received May 18 by Frank A. Sharp, City Clk., for improving portions of Jackson and Main Streets and constructing sidewalks; also for constructing sidewalks on portions of Union Ave. and Park Pl.

Des Moines, Ia.—The Bd. of Pub. Wks. has been authorized to receive bids for paving with asphalt on a portion of W. 13th St.

Marshalltown, Ia.—Bids are wanted May 11 for improving by curbing with Portland cement and paving with Trinidad Pitch Lake asphalt, or Bermuda Lake asphalt on a concrete foundation. L. Derby, City Clk.

Topeka, Kan.—Local press reports state that contracts have been awarded for paving and curbing as follows: To Ramsey & Ramsey, for 31,603 sq. yds. of paving and 2,685 lin. ft. of curbing, total cost $38,308; Wall & Hanley, 21,842 sq. yds. of paving, total cost $25,629; John Ritchie, 16,724 sq. yds. of paving and 16,819 lin. ft. of curbing, total cost $27,974; J. H. Maxwell, for grading about 59,299 cu. yds., total cost $22,488; Kepley & Webster, 14,576 lin. ft. of curbing, total cost $7,288.

Beechmont, Ky.—See "Power Plants, Gas and Electricity."

Cumberland, Md.—Bids will be received May 23 by the Street and Alley Com. for grading and paving about 14,000 ft. of Green St. J. J. Stump, Chmn.

Baltimore, Md.—Bids will be received May 13 by the Bd. of Awards for granite-paving blocks. B. T. Fendall, City Engr. Thos. G. Hayes, Pres.

Baltimore, Md.—The City Council has passed an ordinance to repave a portion of Conway St. with Belgian block; appropriation, $13,000.

Worcester, Mass.—W. S. Prior, St. Comr., writes that the contract for 35,000 lin. ft. curbstone, 2,000 lin. ft. circular curbstone, and 12,000 sq. yds. paving blocks, etc. (bids opened Apr. 13) has been awarded to Webb Granite & Constr. Co., of Worcester, for $21,425.

Boston, Mass.—Harry P. Nawn, of Boston, has secured a contract, at $23,638, for constructing a telford-macadam roadway in Columbia Road, South Boston Dist.

Lowell, Mass.—The Com. on Streets has voted to recommend the borrowing of $65,000 for street construction.

Boston, Mass.—W. E. McClintock, Chmn. Mass. Highway Comn., writes that the contract for building a State highway 7,900 ft. long, from Somerset to Swansea (bids opened Apr. 30) has been awarded to Coleman Bros., Union St., Everett, for $6,628.

Detroit, Mich.—The Com. of the Bd. of Estimate has decided to recommend the appropriation of $165,000 for the resurfacing of Jefferson Ave.

Saginaw, Mich.—Bids will be received by the Bd. of Pub. Wks. until May 22 for furnishing material and laying 120,000 sq. yds. of asphalt, brick bitulithic, asphalt block and macadam pavement. Bidders are required to furnish a 5 and 10-year guarantee for each street bid upon. H. W. Roberts, City Engr.

Pontiac, Mich.—Bids will be received May 11 by the Common Council for paving 10,471 sq. yds. on W. Huron St. Wm. J. Fisher, City Engr.

Duluth, Minn.—P. McDonnell, of Duluth, has secured the contract for paving with sandstone on Second Ave. W., at $13,255 (bids opened Apr. 27).

Minneapolis, Minn.—See "Water."

Ross, Minn.—Bids will be received May 23 by E. A. Aase, Clk. of Dieter, P. O. Ross, for $6,000 bonds for road improvements in the Town of Dieter.

St. Paul, Minn.—The following bids were opened by the Bd. Pub. Wks. Apr. 27 for paving University Ave.: Barber Asphalt Paving Co., $1.90 per sq. yd., total $67,405, and the Conway Paving Co., $2.10 per sq. yd., total $74,261. The following bids were opened at the same time and place for paving E. 3d St. with granite block, 5,212 sq. yds.: Fielding & Shepley, $12,360 (awarded contract); P. H. Thornton, $11,629; P. J. Ryan, $12,443; Jas. Forrestal, $12,900, and Chris. Johnson, $12,893. L. W. Rundlett, City Engr.

J. P. Ryan is reported to have secured the contract for grading Fairfield Ave. Engr.'s estimate, $17,000.

Minneapolis, Minn.—The Council has authorized the following paving and has also directed the City Engr. to purchase the material for the same: 7th St., S. E., with 5-in. slate; Central Ave., with sandstone; Washington Ave., N., with brick; 3d Ave., S., with creosoted block. The total cost is estimated at $112,000.

St. Louis, Mo.—The following are the lowest bids received by the Bd. of Pub. Improv. Apr. 28 for paving 15 streets with bituminous macadam: Parker Washington Co., 5 streets, $114,758; H. Ruecking & Co., 2 streets, $68,836; Missouri Granite & Constr. Co., 2 streets, $42,405; Henry Rueckert, 2 streets, $31,598; Gottlieb Eyerman, 2 streets, $31,204; J. E. Perkinson, 1 street, $18,609, and J. C. Fink, 1 street, $2,707.

Columbia, Mo.—The City Council is reported to be contemplating the paving of 1 street with brick, at an estimated cost of $30,000.

Butte, Mont.—Local press reports state that $75,000 is to be expended in improving the streets of the West Side.

Concord, N. H.—The City Council has appropriated $9,000 for macadamizing Pleasant St., the work to be done by the Street Dept.

Press reports state that contractors wishing to bid for the work of constructing and repaving highways and roads in Coos, Carroll and Grafton Counties can address John W. Storrs, of Concord, State Engr. for these counties. About $50,000 will be expended for this work.

Collingswood, N. J.—The town will pave Haddon Ave., and extend the pipe sewer system.

North Bergen, N. J.—The lowest bid received on Apr. 23 by the Township Com. of North Bergen for grading, flagging and curbing Fisher Ave. from Hudson Boule. is stated to have been submitted by Callery & Murphy, at $24,930.

Woodbury, N. J.—Bids are wanted May 16 for furnishing stone, stone screenings and labor for resurfacing Crown Point Road, from Delaware St. to Great Mantua Creek at Paulsboro, estimated at 17,800 sq. yds. Chas. Wilson, Chmn. Com. of the Bd. of Chosen Freeholders.

Kearny, N. J.—Bids will be received May 13 by the Town Council for macadamizing portions of 7 streets, requiring in all about 22,700 sq. yds. 8-in. macadam. Theo. C. Wildman, Town Clk.

Trenton, N. J.—Contracts for road improvements have been awarded, according to reports, as follows: John V. Carr & Co., 4 roads, namely, Shabbakong road, $10,600; Centerville road, $9,940; Harbourton road, $12,281, and for extending Scotch road, $13,200; Richard Newton, River road, $38,248; Wm. F. McGovern, Princeton Hill Road, $8,400.

Ft. Totten, N. Y.—See "Government Work."

New York, N. Y.—The following bids were opened Apr. 27 by L. F. Haffen, Boro. Pres. Bronx, for (*a*) 45,000 cu. yds. 1½-in. trap rock stone and (*b*) 15,000 cu. yds. ½-in. trap rock screenings:

	a	*b*
Jacob E. Conklin	$1.71	$1.71
H. Miller	1.51½	1.51½
Clinton Point Stone Co.	1.97	1.97
Manhattan Trap Rock Stone Co.	1.59	1.58
Housatonic River Trap Rock Co.	1.44	1.44

The following bids were opened same time and place for repaving E. 134th St. from Southern Boule. to Locust Ave., etc., with asphalt blocks—*a*, Continental Asph. Pavg. Co.; *b*, Cleveland Trinidad Pavg. Co.; *c*, Hastings Pavt. Co.:

	a	*b*	*c*
Asph. bl., 13,530 sq. yds.	$1.59	$1.64	$1.66
Concrete, 2,000 cu. yds.	6.32	6.40	6.00
New curb, 2,550 ft.	.95	.98	1.00
Old curb reset, 3,000 ft.	.25	.27	.25
Totals	$37,325	$38,298	$37,760

Asph. blocks, Southern Boule.—138th to 174th Sts.

	Earth exc., 3,000 cu. yd.	Rock exc., 100 cu. yd.	Fill, 11,500 cu. yd.	New curb, 10,000 ft.	Old curb, 18,000 ft.	New flag, 20,600 s. ft.	Old flag, 2,450 sq. ft.	New bridge, 600 sq. ft.	Old bridge, 5,550 sq. ft.	Dry rubble, 100 cu. yd.	Concrete, 14,350 c. yd.	Asph. bl., 96,500 s. yd.
Continental Asphalt Paving Co.	$0.30	$1.50	$0.30	$0.95	$0.25	$0.25	$0.04	$0.50	$0.07	$1.64	$6.40	$1.75
John L. Robertson	.45	3.00	.45	.99	.30	.25	.05	.60	.09	1.79	5.60	2.00
Hastings Pavt. Co.	.01	2.50	.10	.99	.25	.25	.05	.70	.05	1.57	6.32	2.00
Cleveland Trinidad Paving Co.	1.00	1.00	.20	.90	.27	.23	.10	.70	.10	1.80	5.75	3.00

Totals—Continental, $274,708; J. L. Robertson, $281,548; Hastings Co., $264,195; Cleveland Co., $281,726.

New York, N. Y.—The following bids were opened Apr. 27 by L. F. Haffen, Pres. Bronx Boro., for grading, setting curbs, etc., in White Plains Road from Morris Park Ave. to city line:

	Earth exc., 77,500 c. yd.	Rock exc., 147,500 c. yd.	Filling, 212,500 cu. yd.	New curb, 49,400 ft.	New flag, 170,500 s. ft.	New bridge, 44,300 s. ft.	Dry rubble, 4,000 cu. yd.	Rub. masby., 200 cu. yd.	15" vit. pipe, 7,700 ft.	20" vit. pipe, 2,850 ft.	Catch basins, 70.
T. E. & Thos. Crimmins	$0.50	$2.10	$0.45	$0.80	$0.28	$0.70	$2.50	$4.00	$1.00	$2.00	$100.00
F. Thilemann, Jr.	.45	1.70	.50	.85	.26	.60	1.50	5.00	3.00	4.00	65.00
Jas. Malloy & Co.	.90	.90	.30	.80	.30	.65	3.25	5.00	1.50	2.25	40.00

Totals—Crimmins, $593,595; Thilemann, $550,825; Malloy, $420,478.

The following bids were opened same time and place for grading, curbing, etc.—*a*, John J. Hart Co.; *b*, F. V. Smith Contr. Co.; *c*, F. Thilemann, Jr.; *d*, Aahbei G. Vermilye (low, $73,271); *e*, Geo. I. Bailey: Hoe St.—West Farms to Boston Roads.

	Earth exc., 21,000 c. yd.	Rock exc., 32,000 c. yd.	Filling, 17,600 cu. yd.	New curb, 8,800 ft.	New flag, 36,000 sq. ft.	New bridge, 900 sq. ft.	Dry rubble, 100 cu. yd.
a	$0.48	$1.57	....	$0.70	$0.25	$0.63	$3.00
b	1.08	1.18	....	.75	.23	.60	3.00
c	.40	1.75	$0.40	.80	.24	.55	1.50
d	.50	1.50	.01	.65	.23	.55	1.00
e	1.10	1.10	.12	.69	.23	.62	1.50

Ryer Ave.—Burnside Ave. to E. 183d St.

	Earth exc., 8,970 c. yd.	Rock exc., 11,140 c. yd.	Filling, 4,610 c. yd.	New curb, 4,670 ft.	New flag, 18,330 s. ft.	New bridge, 1,360 sq. ft.	Dry rubble, 165 cu. yd.	12" vit. pipe, 500 ft.	Lumber, 1,500 ft.
F. V. Smith Contr. Co.	$0.50	$1.50	$0.40	$0.80	$0.24	$0.60	$2.00	$1.00	....
P. J. Duffy (lowest)	.50	1.55	.01	.65	.22	.50	1.00	.50	$5.00
John J. Hart Co.	.46	1.50	.10	.70	.25	.60	2.50	1.00	40.00
F. Thilemann, Jr.	.40	1.75	.60	.80	.24	.55	1.50	1.50	....
Peter Handibode, Jr.	1.20	1.20	..	.65	.20	.50	1.00	1.25	.01

E. 182d St.—Arthur Ave. to Boston Rd.

	9,200	*5,100*	*30,000*	*8,200*	*32,150*	*5,550*	*750*	*160*	*1,000*
F. V. Smith Contr. Co.	..	$1.40	$0.50	$0.80	$0.24	$0.60	$2.00	$1.00	....
F. Thilemann, Jr.	$0.50	1.25	.65	.80	.24	.55	1.50	1.00	....
John J. Hart Co.	.50	1.60	.35	.70	.25	.63	2.50	1.00	$40.00
W. F. Murray	.99	.99	.32	.89	.24	.62	2.00	1.00	27.00

Totals—Smith, $41,406; Thilemann, $49,089; Hart, $42,609; Murray, $43,899.

Poughkeepsie, N. Y.—Local press reports state that the Bd. of Pub. Wks. will receive bids until May 12 for paving with Syracuse vitrified brick on Vassar St.

Dunkirk, N. Y.—The property owners of Deer and Eagle Sts. have, according to local press reports, voted in favor of asphalt pavement. The lowest bid received Apr. 1 for asphalt pavement on these streets was submitted by the Barber Asphalt Paving Co., of Buffalo, at 35 cts. per cu. yd. for excavation and $1.74 per sq. yd. for paving.

Perry, N. Y.—The Village Clk. writes that it was voted May 5 to issue $15,000 bonds for street improvements.

Walden, N. Y.—Bids are wanted May 20 for paving Main St. with brick, as advertised in The Engineering Record.

Rochester, N. Y.—The paving of Maple St. with asphalt, at an estimated cost of $21,000, is being considered.

Troy, N. Y.—Ordinances have been adopted by the Common Council for resurfacing with asphalt, grading and curbing on portions of Broadway and Fulton St.

Hamburg, N. Y.—The citizens have voted to macadamize about 4,400 ft. on Main St., at an estimated cost of $17,000.

Canandaigua, N. Y.—W. E. Martin, Village Clk., writes that it was voted May 5 to issue $200,000 bonds for street improvements.

Buffalo, N. Y.—The Mayor has signed the Seawall Strip Bill, which authorizes the city to build a public highway along the seawall property to connect the lower part of the city with the Steel Plant.

Gloversville, N. Y.—Bids will be received until 5 P. M. May 11 for 3,500 sq. yds. brick paving and 1,702 lin. ft. curb setting. Morrell Vrooman, City Engr.

Helena, N. Y.—The City Council has passed an ordinance to pave about 6 blocks on Cherry St.

Greenville, N. Y.—Plans and specifications have been approved by the Bd. of Superv. for the building of a State macadam road between Greenville and Port Jervis, estimated to cost $62,800.

The building of a State road between Greenville and Slate Hill, estimated to cost $57,500, is reported to be under consideration.

Oneida, N. Y.—The Bd. of Pub. Wks. has declared its intentions to pave portions of 4 streets.

Cincinnati, O.—E. Evans is reported to have secured the contract for paving Hatch St. at $8,443.

The Bd. Pub. Service is reported to have awarded the contract for constructing Spring Grove Ave. bridge approaches to the Barber Asphalt Paving Co., at $10,541, and the contract for improving Calhoun St. to the Kirchner Construction Co., at $36,112.

Lorain, O.—Bids are wanted May 29 for furnishing material and draining, grading, curbing, and paving with brick on portions of 3 streets. J. J. Mahony, City Clk.

Lockland, O.—See "Sewerage and Sewage Disposal."

Bowling Green, O.—Bids will be received by the Co. Comrs. June 2 for grading, draining, macadamizing and constructing an earth or dirt roadbed adjacent to macadam roadbed on portions of 3 highways. B. C. Harding, Co. Aud.

Cleveland, O.—It is stated that bids are wanted May 16 for draining and paving with brick on Woodlawn Ave. W. P. Rice Engineering Co., 752 Society for Savings.

Findlay, O.—J. W. S. Riegle, City Engr., writes that C. B. Hall & Son, of Findlay, on Apr. 27 received the contract for 3,360 sq. yds. paving on Defiance Ave., at $1.23 per sq. yd. Material: Hocking Valley block on 8-in. rolled stone, with Portland cement fill.

Findlay, O.—The City Council has adopted an ordinance to pave with vitrified block on a portion of Elm St., at an estimated cost of $7,411.

Oil City, Pa.—Bids are wanted May 11 for improving Hoffman Ave., repaving Main St. and grading and paving the gutters of Smedley St.; probable cost, $30,000. S. W. Barnhart, Compt.

Harrisburg, Pa.—Bids are wanted May 12 for paving with either sheet asphaltum, asphaltum blocks, vitrified brick, on a concrete base, Warren's bituminous macadam waterproof pavement, or other pavement, and curbing with either granite, marble, bluestone, medina stone or steel on portions of 8 streets. Chas. McConkey, Highway Comr.

Easton, Pa.—The Co. Comrs. are reported to have taken preliminary steps toward the building of a public road from Easton to Bath, a distance of about 11 miles, and estimated to cost $66,000.

Nashville, Tenn.—See "Sewerage and Sewage Disposal."

Dallas, Tex.—The City Council has passed an ordinance authorizing the paving of a portion of 12th and 10th Aves. and a portion of 7th St., at an estimated cost of $35,000.

Dallas, Tex.—Judge Lauderdale has declared the good roads election, held recently, legal, and has authorized the Co. Comrs. to issue $500,000 good roads bonds.

Charlottesville, Va.—It is stated that bids will be received by the St. Improv. Com. until May 19 for laying 30,000 sq. yds. of bituminous macadam, brick or granite block pavement. De Mott & Winfree, Engrs., City Hall.

Norfolk, Va.—The Mayor has approved the ordinance appropriating $21,926 for improving certain streets.

Ballard, Wash.—T. Ryan & Co., of Seattle, are reported to have submitted the lowest bid for paving Ballard Ave. and constructing cement sidewalks, at $37,670.

Tacoma, Wash.—N. L. Taylor, City Engr., writes that bids for paving about 26,000 sq. yds. with asphalt in Dist. No. 63, which were to have been opened Apr. 10, and all similar paving improvements, have been indefinitely postponed.

Jas. Lee has secured the contract for the 18th St. improvement, which includes 1,486 sq. yds. concrete sidewalk and 24,696 ft. curb and gutter for $5,375.

Milwaukee, Wis.—The paving of 3d St. with brick is reported contemplated.

Superior, Wis.—The Bd. of Aldermen is reported to have under consideration the paving of Bway. with asphalt.

The Council has authorized the Bd. of Pub. Wks. to take preliminary steps toward paving with asphalt on a portion of Ogden Ave. and has authorized the City Engr. to report upon the paving with sandstone on 8th St. from Tower Ave. to Omaha freight depot.

Madison, Wis.—Bids will be received May 22 by the Street Assessment Com. for furnishing material and macadamizing a portion of Washington Ave. O. S. Norsman, City Clk.

Chatham, Ont.—It is stated that bids are wanted May 11 for paving with asphalt on various streets. W. G. Merritt, City Clk.

POWER PLANTS, GAS AND ELECTRICITY.

Stockton, Cal.—The American River Electric Co. is stated to have applied to the Bd. of Supervs. for a franchise along the roads in this county. The power plant is to be located on American River near Placerville, and the line will run down mother lode to San Andreas. A branch from there will run to Stockton.

Ridgefield, Conn.—Geo. E. Benedict, Boro. Clk., writes that an electric light plant will probably be constructed here. Thos. E. Wing, 20 Nassau St., N. Y. City, N. Y., is reported interested.

South Norwalk, Conn.—A. E. Winchester, Gen. Supt. Electric Wks., writes that bids will be received about May 12 for the construction of an electric light plant. Specifications now ready.

Milford, Del.—Theo. Townsend, Clk. of Council, writes that it was voted Apr. 27 to issue $20,000 bonds for electric light, paving and water works improvements.

Decatur, Ill.—It is stated that the Decatur Gas Co. will expend about $20,000 in improving its plant this summer.

Aurora, Ill.—Local press reports state that plans have been completed for the power house of the Fox River Light, Heat & Power Co., which will cost with equipment about $100,000.

Shelbyville, Ill.—The Shelbyville Water & Light Co. is stated to have secured the city contract for ten years. The cost of each hydrant for a yr. will be $30; arc lights, $60 ea.; incandescent lights, $18 each. The company will expend $15,000 in improving its plant.

Ashley, Ill.—The citizens are reported to have voted to issue $5,000 electric light bonds.

South Bend, Ind.—The South Bend & Elkhart Power Co. is preparing to construct a transmission line from the Hen Island Dam to South Bend. Jas. DuShane, Secy., South Bend.

Anderson, Ind.—A press report states that bids will be received by the City Clk. May 12 for improving and enlarging the city electric light plant, at a probable cost of $75,000.

Bristol, Ind.—Attorney Jas. DuShane, of South Bend, representing the Bristol Power Co., is reported to be securing options along St. Joseph River. The company intends building a water power near Bristol.

Indianapolis, Ind.—The Marion County Htg., Light & Power Co. is reported to be asking for bids for the construction of a plant in Northwestern Ave.

Shelby, Ia.—It is stated that bids will probably be received May 18 for installing a city gas plant, estimated to cost $5,000. About 3 miles of mains will be installed. H. D. Reed, Mayor.

Atlantic, Ia.—The City Council is reported to be considering a proposition to transmit electric power to the water works.

Des Moines, Ia.—See "Public Buildings."

Guthrie Center, Ia.—Prof. G. W. Bissell, of Ames, has been employed to prepare plans for an electric light plant for the Guthrie Center Electric Light Co.

Beechmont, Ky.—The Village Improv. Society (Jas. B. Short, Pres.) is reported to be considering the construction of an electric light plant and sewerage system, and also some paving.

Monroe, La.—Water and light bonds amounting to $60,000 are reported sold.

Jackson, Mich.—The Jackson & Battle Creek Power Co. is reported incorporated, with a capital of $100,000, by J. H. Bootes, Chas. Zang, and others, to furnish light and power in Jackson and Calhoun Counties.

Fosston, Minn.—Bids will be received May 18 by Common Council for furnishing and delivering f. o. b. cars a direct-connected and combined 125-H.-P. simple non-condensing engine and generator. Generator must be not less than 90-Kw. capacity, 220-volt, direct-current. W. E. Black, Village Recorder.

Duluth, Minn.—Local press reports state that the Zenith Furnace Co. will construct a gas plant here, to cost about $400,000.

Spring Grove, Minn.—Bids will be received June 2 by F. E. Joerg, Village Recorder, for $5,500 electric light bonds.

Rochester, Minn.—The Rochester Gas Co. is reported to be having plans prepared for improvements to its system.

Cape Girardeau, Mo.—Thos. Fox, Supt. Cape Girardeau Water & Electric Co., writes that about $15,000 will be expended in improvements, to be done by day work.

Great Falls, Mont.—The citizens voted Apr. 25 to grant a 25-yr. franchise to John D. Ryan & Co. for an electric light plant and street railway, and City Council on Apr. 27 passed the necessary ordinances for same. C. W. Swearingen, City Engr.

Belgrade, Mont.—Alex. Freeman, of Bozeman, Mont., is stated to have petitioned for a franchise for water works and an electric light plant.

Lincoln, Neb.—Bids will be received May 25 by Beman C. Fox, City Treas., for $65,000 street lighting bonds.

Laurel Springs, N. J.—The Electric Light Co. of the Township of Clementon, has been incorporated with Jacoby Ludy, Pres., and Jos. Borden, Secy. The company will light Laurel Springs, Overbrook and Lindenwold.

Dunkirk, N. Y.—The Bd. of Water Comrs. has decided to put in a 300-Kw. generator and outfit for city lighting, to be used for lighting the outskirts of the city, not now covered by electric light.

Clinton, N. Y.—Thos. F. McBride, of Clinton, has purchased the old grist mill and property adjacent at Millburn, near Clinton, with the intention of developing a power plant. The property is located on Oriskany Creek.

Hoosick Falls, N. Y.—The Schaghticoke Electric Co. has been incorporated by Geo. E. Greene, E. H. Libby and H. J. Greene, with a capital of $30,000, to develop water power about one mile below Schaghticoke in Rensselaer County on Hoosick River. The company proposes to construct a tunnel and build a dam 35 ft. high.

Albany, N. Y.—In the supply bill, there is reported to be an item for $65,000 for the purpose of constructing an electric light plant, to light the Capitol.

Schuyler, N. Y.—The Watkins Illuminating Co. is about to petition the Bd. of Trus. for a franchise to pipe the streets and furnish village with gas.

New York, N. Y.—Bids will be received May 19 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing and delivering street lamps, Boulevard globes, tops and reflectors, bridge globes, tops and reflectors, miner lanterns and globes, lamp posts, brackets, frames, cross-heads, fire alarm lanterns and police globes.

Marion, N. C.—Col. Sinclair is stated to have secured a franchise for an electric light plant.

Bismarck, N. D.—See "Electric Railways."

Cooperstown, N. D.—C. J. Lucken & Co. are stated to have petitioned for a franchise for a gas plant.

Cincinnati, O.—Henry W. Sage, Secy. Cincinnati Gas & Electric Co., writes that it was voted May 4 to increase the capital stock by $2,000,000 for improvements and extensions.

Cleveland, O.—C. E. Phelps, Jr., of Baltimore, Md., is reported to be here for the purpose of advising with the city officials in regard to the establishment of a municipal electric light plant. He estimates the cost of establishing a municipal electric light plant for Cleveland at $400,000. An ordinance has been introduced in Council, providing for the issue of $200,000 bonds for the purpose of constructing an electric light and power station.

Columbus, O.—The contract for the erection of a building for the municipal electric light plant has been awarded to D. W. McGrath, of Columbus, for $68,675. Bids for poles and wires still under consideration.

Hubbard, O.—The citizens are reported to have voted to issue $10,000 bonds for an electric light plant.

Heppner, Ore.—A. M. Slocum will install an electric plant at his mill to utilize water power and transmit electric power to this city. The plant complete will cost $20,000.

Corry, Pa.—Bids are wanted June 1 for lighting the streets of the city with 16 1,200-c.-p. enclosed arc lights, and 80 65-c.-p. series incandescent lights or in place of the 65-c.-p., 300 25-c.-p., incandescent lights, and the furnishing of 50 16-c.-p., incandescent lights in the City Bldgs. Nevin R. Dickson, City Engr.

Upper Merion Township, Pa.—The Upper Merion Electric Light Co. has been incorporated to furnish heat and light for Upper Merion Township; capital, $10,000. Directors: Edw. H. Wert, C. Ramond Fritcher and Herbert F. Harris, all of Harrisburg.

Pottstown, Pa.—The Town Council has appointed a Com., with L. W. Z. Fillmen as Chmn., to consider the construction of water works and an electric light plant.

Harrisburg, Pa.—Bids are wanted May 11 for lighting the highways, streets, and avenues with electricity for 1, 2, 3 and 5 yrs. commencing June 1, 1904. Geo. A. Hoverter, Chmn. Joint Com. on Water and Light.

Lancaster, Pa.—A press report states that a syndicate of Philadelphia capitalists, consisting of Ervin Lyndall, John I. Kyle, and others, are about to apply to the State Dept. for charters for 3 companies to develop water power in Colerain, Providence and Conestoga Township.

Pittsburg, Pa.—The Manufacturers Light & Heat Co. on April 28 organized with H. B. Beatty, Pres., and H. E. Seibert, Secy. The company is also reported to have decided at this meeting to authorize the awarding of contracts for the pipe line to be constructed from Pittsburg to the W. Va. fields. It will be a 20-in. pipe and will be 60 miles in length, and cost about $3,000,000. It will be let in 2 sections, one contract for the pipe, the other for the construction work.

Ogden, Utah.—Chas. Pulver is reported to be making surveys for a power plant and pipe line on Chalk Creek, Fillmore.

Martinsville, Va.—The Town Council will, according to press reports, receive bids until May 23 for a franchise to use the streets for poles, wires and other appliances for the transmission of electric power. The party to whom franchise is granted is required to establish and operate an electric power plant of not less than 650 H.-P. and an electric lighting plant, the price to be paid by town for each 2,000 c.p. electric arc light being $75 per yr. The plant to be in operation within 6 months from award of franchise.

Wenatchee, Wash.—Arthur Gunn, of the Wenatchee Development Co., is stated to have secured controlling interest in the Wenatchee Light & Power Co., and will shortly put in a large plant and furnish light and power for this city, Mission and Leavenworth. L. V. Wells, Mgr.

Northport, Wash.—T. A. Winter and Saml. Douglas, of Colville, have petitioned the City Council for a 30-yr. franchise to put in an electric system for light, power and fuel.

Ballard, Wash.—The City Council has passed a resolution leasing the municipal plant to the Kilbourne-Clark Co. The new company agreed to maintain a pumping station in connection with the light plant, having a capacity of 350,000 gals. daily, and pump 200,000 gals. daily for use of city.

Wheeling, W. Va.—Bids are wanted May 12 for improving the city electric light works. C. B. Cooke, City Engr.

Onalaska, Wis.—The La Crosse Gas & Electric Co. is planning to extend its electric lines to Onalaska, and will petition the City Council for a 25-yr. franchise.

Ladysmith, Wis.—A press report states that the Ladysmith Light & Power Co. contemplates constructing a dam across Flambeau River near Ladysmith.

Cedarburg, Wis.—It is stated that bids are wanted May 15 for $11,000 electric light bonds. W. P. Jochem, Mayor.

Kingston, Ont.—See "Electric Rys."

ELECTRIC RAILWAYS.

Whittier, Cal.—It is stated that bids are wanted June 1 for an electric street railway franchise. Walter E. Butler, City Clk.

Fresno, Cal.—Wm. G. Kerchoff, Pres. of the Pacific Light & Power Co., has purchased the Fresno, Belmont & Yosemite R. R. and the Fresno R. R., both operated by horses. It is reported to be the intention to equip both lines with electricity.

Wallingford, Conn.—The House has passed a resolution incorporating the Wallingford Tramway Co. The company is authorized to build from Wallingford south, through North Haven to Montowese. Incorporators: Walter J. Leavenworth, Frank A. Wallace, both of Wallingford.

Hartford, Conn.—The Woodbury & Seymour St. Ry. Co. has been chartered to build an electric railway in Woodbury, Southbury, Oxford and Seymour; capital, $400,000. Incorporators: Floyd F. Hitchcock, of Woodbury; Chris. Strobel, of Waterbury, and Fred. L. Averil, of Branford.

Washington, D. C.—The Chesapeake Beach Ry. Co. has under consideration the subject of converting its line into an electric railway.

Winchester, Ill.—The City Council has granted a franchise to the Jacksonville Traction Co., which will build an electric railway between Winchester and Jacksonville.

Belleville, Ill.—The City Council has granted franchises to the Belleville & Mascoutah Electric Ry., the Belleville & Freeburg Electric Ry., and to the Interurban Electric Ry. Co.

Kewanee, Ill.—It has been decided to increase the capital of the Kewanee, Cambridge & Geneseo Ry., which has in contemplation the construction of an electric railway to connect Kewanee, Cambridge and Geneseo, from $100,000 to $850,000.

Sterling, Ill.—The contract for constructing about 17 miles of the Sterling, Dixon & Eastern Electric Ry. is stated to have been awarded to the Columbia Constr. Co., of Milwaukee, Wis. About 17 miles of road are to be built.

Marion, Ind.—It is reported that the Union Traction Co., of Indiana (A. J. Black, Ch. Engr., Anderson) will begin work this summer on an electric railway from Ft. Wayne to Indianapolis by way of Huntington, Warren, Marion, Elwood and Noblesville.

Shelbyville, Ind.—The Shelbyville Traction Co. is reported to have made arrangements for extending its line from Shelbyville to Greensburg, a distance of 20 miles.

Anderson, Ind.—The Union Traction Co. has secured franchises at Winamac and North Judson for its line from Logansport to Hammond, which will connect with the Lake system at Hammond and the Indianapolis & Northern at Logansport. Franchises have also been secured in all principal points from Logansport to Chicago, including Royal Center, Valparaiso, Hobart and Hammond.

Hartford City, Ind.—The Council has granted the Eastern Indiana Traction Co. a 50-yr. franchise for a single track interurban line from the east to the west corporation line.

Madison, Ind.—In about sixty days the Madison, Greensburg & Indianapolis Ry. Co. expects to be ready to let contracts for furnishing the equipment and constructing its proposed line; 30 miles of line are to be built. Richard Johnson, Pres.; Lincoln V. Cravens, Secy.

Richmond, Ind.—The Eastern Indiana Traction Co. and A. H. Lama & Co., New York bankers, have closed a deal for the construction of 86 miles of electric railway between Richmond and Marion.

Plainfield, Ind.—The Indianapolis-Plainfield Ry. Co. is planning to extend its lines to Greencastle this summer.

Indianapolis, Ind.—The Union Traction Co. has secured franchises at Winamac and North Judson for its line from Logansport to Hammond.

Sullivan, Ind.—The Western Indiana Traction Co. has applied for a franchise in Sullivan. The company has already secured franchises in Vincennes, and through Bruceville, Bicknell, Freelandville and Oaktown, and through County.

South Bend, Ind.—The Mayor has vetoed the franchise recently granted to the Chicago Air Line Electric Ry. Co. and the Council has sustained the veto.

Decatur, Ia.—It is stated that rights of way are being secured to Tekamah for the Omaha & Decatur Northern Electric Ry. This, the first section of the road to be built, will be 18 miles long. The power station and repair shops will be located at Decatur. P. B. Gordon, of Decatur, Pres.; A. M. Anderson, of Tekamah, Secy.

Des Moines, Ia.—The Des Moines City Ry. has completed plans for the construction of several extensions of its lines within the city limits. One of these will be from 19th and Crocker Sts. to the coal mines in North Des Moines.

Columbia, Ky.—The Columbia Interurban Ry. Co. has been organized here, with a capital of $15,000. Prof. W. K. Azbill, Pres.; C. S. Harris, Secy.

Louisville, Ky.—The Louisville Interurban Ry. Co., organized to build the suburban extension of the Louisville Ry., has about secured all rights of way for its line between Louisville and Valley Station.

Laurel, Md.—The Laurel Traction Co. has secured a franchise for the construction of a third-rail electric railway in Laurel. Chas. L. Fox and Chas. J. Barth, of Philadelphia, Pa., are reported interested.

Cumberland, Md.—The City Council has granted a franchise to the Cumberland Electric Ry. Co. to extend its line over Wineow St., Oldtown Road, Thomas, Second and Harrison Sts.

Frederick, Md.—Surveys are now being made for the proposed Frederick, Legore & Gettysburg Electric Ry.

Worcester, Mass.—The Worcester Consolidated St. Ry. Co. is having a survey made for an extension of its line to Tatnuck.

Paxton, Mass.—Geo. E. Macomber, of Augusta, Me., a street railway promoter, has been in conference with residents of Paxton and Barre relative to the construction of an electric railway between those towns and Worcester.

Worcester, Mass.—The Worcester Consolidated St. Ry. Co. is securing options on land between Worcester and Leominster, over which it proposes to build a second line to Leominster. R. T. Laffin, Mgr., Worcester.

It is reported in Worcester and in Providence, R. I., that the Western Rhode Island Co., of which Geo. W. Prentice, of Providence, is a promoter, is to build connections necessary for a line between Providence by way of Webster, Mass. Several miles of track will have to be built.

Pepperell, Mass.—The Pepperell & Ayer St. Ry. Co. is to be organized to build an electric railway through Ayer, Groton, Pepperell and Dunstable to a point on the N. H. line near Hollis; length of road to be 12 miles; capital $120,000. Wm. S. Murray, of Boston; Loring N. Farnum, of North Andover, and Everett E. Tarbell, of Pepperell, are interested.

Jackson, Mich.—W. H. Hall, Jr., of the Hanover Natl. Bank of New York, N. Y., and W. A. Foote, of the Jackson & Suburban Traction Co., are said to have organized a company to complete the connection of the Jackson & Battle Creek Ry. east of Jackson to Detroit.

Hazlehurst, Miss.—Plans are being discussed for building an electric railway from Hazlehurst to Gallatin, Dentville, Barlow, Brown's Wells. R. P. Wiling, Jr., is reported interested.

Great Falls, Mont.—See "Power Plants, Gas and Electricity."

Anaconda, Mont.—The Anaconda Copper Mining Co., which operates the local electric railway, contemplates making extensive improvements in the system.

Nashua, N. H.—The Goff's Falls, Litchfield & Hudson Ry. Co. has perfected its organization, and will proceed with the work of perfecting arrangements for building its proposed line. The road will extend from Hudson to Manchester. Isaac N. Carter, of Litchfield, Pres.; John J. Baker, of Hudson, Treas.

Long Branch, N. J.—A franchise has been granted to the Monmouth County Electric Co. to operate a double track line on Bway. and a single track on 3d Ave.

Penn Yan, N. Y.—The Lake Keuka & East Side R. R. Co. has been incorporated to build an electric railway from Penn Yan to Keuka; capital, $130,000. J. C. Harris, of N. Y. City, and M. F. Shepard, of Penn Yan, are among the incorporators.

Jamestown, N. Y.—It is stated that the Jamestown, Chautauqua & Lake Erie R. R. (C. M. Harrison, Supt., Jamestown), which runs from Jamestown to Westfield, is to be converted into an electric railway.

Troy, N. Y.—The Railroad Commissioners have granted a certificate to the Forest Park Railroad Asso. to construct a street railway from the tracks of the United Traction Co. on Pawling Ave. to Forest Park Cemetery.

Buffalo, N. Y.—The United Light, Power & Traction Co., of Buffalo, has been incorporated; capital, $500,000. Directors: Louis B. Grant and Ashley T. Cole, of N. Y. City; Jos. B. Mayor, of Buffalo, and others.

Glens Falls, N. Y.—The Hudson Valley Ry. Co. is stated to have acquired property and franchises of North River Ry. Co., which was organized to build an electric railway from Saratoga to Glens Falls. The Hudson Valley Railway Company will begin laying rails in Saratoga at once. Addison B. Colvin, Pres.

Oneida, N. Y.—The Oneida Ry. Co. is stated to have secured a franchise for extension of its line through Canastota.

Bismarck, N. D.—The State Bd. of Capital Comrs. is having plans prepared for the street car line from State Capitol to depot. The power plant will be installed at Capitol, and will include a light and heating plant for building.

Youngstown, O.—Bids are wanted May 20 for grading and constructing 2½ miles of electric railway track for the Mahoning Valley Ry. Co. J. M. Walker, Engr., Hazel & W. Federal Sts.

Oklahoma City, Okla.—The Oklahoma Electric Company has been incorporated to build an electric railway to connect Oklahoma City, Norman, El Reno and Shawnee; capital, $1,000,000. Incorporators: F. B. Ziegler, Wm. Young, J. S. Alexander, and others.

Lawton, Okla. Ter.—The Lawton St. Ry. Co. has been incorporated. Besides operating street cars the company will furnish power for lighting and commercial purposes; capital, $600,000. W. J. Pearson, of New York, N. Y., is one of the incorporators.

Wilkesbarre, Pa.—The Wilkesbarre & Wyoming Valley Traction Co. has decided to spend $200,000 on betterments to its syatem during the coming year.

York, Pa.—The York County Traction Co. will extend its line to Shrewsbury. The people of Craleyville have asked company to build an extension to that place.

Shenandoah, Pa.—A charter has been granted to the Shenandoah & Suburban Electric St. Ry. Co. (capital, $75,000) to build a 5-mile line between Shenandoah & Ringtown. Dr. D. J. Langton, Pres.; J. S. Hauswick, Secy.

Connellsville, Pa.—The Pittsburg, McKeesport & Connellsville Electric Ry. Co. has filed with the Recorder a plan for the proposed extensions from Fairchance to the Pennsylvania-West Virginia State line via Haydentown, Rubie and Woodbridgetown, and from Fairchance to Smithfield and across Georges Township.

West Pittston, Pa.—The Boro. Council has under consideration an ordinance granting a franchise to the Lackawanna Island St. Ry. Co., which seeks to operate an electric railway on Luzerne Ave., and from Sturmerville to Pittston.

Siegfried, Pa.—All rights of way have been secured for the Siegfried & Danielsville St. Ry. Surveys have been completed to Danielsville, and are now being made to Palmerton and Bowmans.

Dillsburg, Pa.—The Boro. Council has granted a franchise to the Star Electric Ry. Co., which has secured rights of way from Mechanicsburg to Wellsville.

Mt. Pleasant, Pa.—Surveys are completed for the new line of the Mt. Pleasant, Unity & Baggaley St. Ry. Co. It will be 16 miles in length.

Lancaster, Pa.—The Conestoga Traction Co. has decided to make surveys for an extension of the New Holland branch to Terre Hill, a distance of about 5 miles. Frank S. Given, Gen. Mgr., Lancaster.

Fairhaven, Wash.—The Whatcom-Skagit Interurban Ry. Co. recently incorporated for the purpose of building an electric railway through this county, has organized, with S. M. Day, Pres., and A. H. Wright, Secy.

Whatcom, Wash.—The Whatcom-Skagit Interurban Ry. Co. has been incorporated by Geo. G. Shelton, Thos. Tyler and others, to build two roads, one to connect La Conner, Mt. Vernon and Edison, the other to connect Deming, Sumas and Lynden.

Parkersburg, W. Va.—The County Court has granted a franchise to the Williamstown & Moundsville Electric R. R. Co.

Wheeling, W. Va.—The Williamstown & St. Mary's R. R. Co. has secured partial franchises from counties and towns through which the line will pass. The line starts at Williamstown, and runs to Moundsville, a distance of about 80 miles.

Morgantown, W. Va.—The Morgantown, Fairmont & Cheat River St. Ry. Co. has been incorporated, with a capital of $750,000, by Davis Elkins, Jos. H. McDermott, and others. About 20 miles of road will be constructed.

La Crosse, Wis.—A bill has been passed granting the La Crosse & Black River Falls Ry. Co. the right to dam Black River 3 miles above the falls. The company plans to construct an electric railway from La Crosse to Black River Falls.

Kaukauna, Wis.—Wm. Phillips, of Kaukauna, Wis., and others have secured a right of way for the East Shore Interurban Electric Ry. from Fond du Lac to Kaukauna.

Kingston, Ont.—The promoters of the Ontario Electric Ry. are said to have decided upon developing power by damming Trent River at Glen Miller, 7 miles from Trenton.

Quebec, Que.—The following bills were adopted by the Quebec Legislature during its last session, ended April 25 1903: Acts incorporating the St. George Electric Ry. Co., Valleyfield Electric Tramway Co., Roberval Electric Ry. Co., and Levis County Electric Ry. Co.

RAILROADS.

Brilliant, Ala.—The Stockholders of the Canton, Aberdeen & Nashville R. R. Co. have decided to extend the line from its present terminus near Brilliant, through Winston and Lawrence Counties to the Mississippi line.

Duke, Ala.—A corps of engineers are reported to be making a survey for an extension of the Seaboard Air Line from Duke to Gadsden, a distance of about 14 miles. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

East St. Louis, Ill.—The St. Louis Valley R. R. Co. has been incorporated, with a capital of $5,500,000, to build from East St. Louis, Ill., to Cairo, Ill., with branches and spurs necessary, the projected line going through the Counties of St. Clair, Monroe, Randolph, Jackson, Union and Alexander.

Sailor Springs, Ill.—Right of way for the Toledo, St. Louis & New Orleans R. R. Co. is stated to have been secured through Sailor Springs, Clay County and Rinard.

Dubuque, Ia.—The Iowa, Illinois & Missouri Ry. Co., recently incorporated to construct a steam short line from Dubuque to St. Louis, is reported organized with Geo. T. Cram, of St. Louis, Mo., Pres., and T. J. Medill, of Rock Island, Ill., Secy.

Glenwood, Minn.—The contract for about 125 miles of new line is reported to have been awarded by the Ch. Engr. of the Soo System to Richards, Lundeen & Co., of Minneapolis. The new line will extend from Glenwood through Alexandria and northward through White Earth Reservation.

New York, N. Y.—Mayor Low has approved the Park Ave. improvements contemplated by the N. Y. Central & Hudson River R. R. The improvements include the depression of the Central tracks north of 42d St., a system of viaducts for foot and vehicle traffic, the improvement of the Park Ave. tunnel, and the introduction of electric motors which will carry all trains to and from Harlem River. Henning Fernstrom, Ch. Engr., N. Y. City.

Schenectady, N. Y.—It is stated that the N. Y. Central & Hudson R. R. Co. is planning to construct a belt line between Schenectady, Albany and Troy. Henning Fernstrom, Ch. Engr., N. Y. City.

Conneaut, O.—The South Shore Terminal Co., of Cleveland, has been incorporated, with a capital of $10,000, by H. C. Burrell, I. N. Oakes, and G. A. Resek. The eastern terminus of the steam railway will be at or near Conneaut, and the other at or near Toledo, passing through Ashtabula, Lake, Cuyahoga, Lorain, Erie, Sandusky, Ottawa, Wood and Lucas Counties.

Ashtabula, O.—The South Shore Terminal R. R. Co., of Cleveland, has been incorporated, with a capital of $10,000, to construct a standard gauge railroad from Ashtabula to Toledo. Harry C. Burrell, I. N. Oakes and G. A. Black are among the incorporators.

Lisbon, O.—It is reported that the Wabash management will construct a new line, to be known as the Pittsburg, Lisbon & Western R. R., from Lisbon to a connection with the Wheeling & Lake Erie, at Minerva, O., and northward to a connection with the Salem R. R. at Salem, O., a distance of about 30 miles. An overhead bridge will be constructed about a mile east of Salem; probable cost of improvements, $1,500,000. Jos. Ramsey, Jr., Pres., St. Louis, Mo.

Latrobe, Pa.—According to press reports about $3,000,000 is to be expended by the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) in regrading and eliminating sharp curves on the Pittsburg division of main line at Derry Summit between Latrobe and Millwood. It is also reported that bids have been invited for the work.

Williamsport, Pa.—It is stated that the Delaware & Hudson R. R. Co. (Jas. McMartin, Ch. Engr., Albany, N. Y.) will build the Binghamton & Southern R. R., which will run from Williamsport to Binghamton.

Pratt, Wis.—The Superior & Southeastern R. R. has been incorporated, by John E., George C. and Leslie E. Glover, of New Richmond, and H. C. Baker, of Hudson, to construct a railroad from Pratt.

Chippewa Falls, Wis.—Articles of incorporation of the Chippewa Falls, Phillips & Northwestern R. R. Co. are stated to have been adopted and filed with the Secy. of State at Madison.

Parkersburg, W. Va.—The Kanawha & Northern Ry. Co., of Ivydale, has been incorporated to build a railroad from east side of Elk River at mouth of Otter Creek to Parkersburg; capital, $10,000. Incorporators: V. L. Black and Angus W. McDonald, of Charleston, W. Va.; J. W. Angus, Elizabeth, N. J., and others.

Kingwood, W. Va.—A charter has been granted to the Hardman Branch R. R. Co. to run a line from Kingwood to Halleck; capital, $5,000. Incorporators: Hugh McNeil, Jr., of Baltimore, Md.; John J. Baumgartner, of Westminster, Md., and others.

Wheeling, W. Va.—A press report states that the Baltimore & Ohio R. R. Co. (J. M. Graham, Ch. Engr., Baltimore, Md.) has completed arrangements for the erection of a $50,000 depot in this city, and will also expend $1,000,000 in building an elevated road through the city from east to west.

Nicaragua, C. A.—The Great Central R. R. Co. has been incorporated to construct a railroad from the head of navigation on Coco River, Nicaragua, to connect with the National Ry. of Managua, and also to construct a main line through Honduras into Salvador; capital, $10,000,000. Directors: Robt. Pitcairn, of the Pennsylvania Co.; Thos. B. Riter, D. M. Clemson, of the Carnegie Co., and others, all of Pittsburg, Pa.

Morelia, Mexico.—Powell & Mason, of Baltimore, Md., are stated to have secured the contract for building and equipping the Morelia & Tacambaro R. R., recently incorporated with a capital of $6,000,000. At Iraquato the new road will run south to Morelia, via Turnandico, and to Arlo, which will be the western terminus; 65-lb. steel rail will be used. Contract reported to be about $2,000,000.

Montreal, Que.—It is reported that plans have been prepared for the elevation of Grand Trunk R. R. (J. Hobson, Ch. Engr., Montreal) from St. Henry to Bonaventure Station, which will cost about $2,500,000.

PUBLIC BUILDINGS.

Little Rock, Ark.—Press reports state that Eckle & Mann, of St. Joseph, Mo., will supervise the erection of the $2,000,000 State house of Arkansas. The legislature is stated to have passed bill providing for same.

San Diego, Cal.—See "Water."

La Grange, Ga.—It is stated that bids are wanted by the Co. Comrs. until July 13 for erecting a court house. A. J. Bryan & Co., Archts., 1104 Hennen Bldg., New Orleans, La.

Belleville, Ill.—Bids are wanted May 16 for erecting a 3-story addition; also installing an electric elevator for the St. Elizabeth Institute. Address Rev. Louis Hinsses.

Winchester, Ind.—Bids are wanted May 13 for erecting the First Presbyterian Church. Crapsey & Lamm, Archts., 76 Groton Bldg., Cincinnati, O.

Lafayette, Ind.—Bids will be received by W. S. Haggard, Pres. Bd. Trus., State Soldiers Home, for a system of either hot water or steam heating for the institution; probable cost of work, $35,000. W. F. M. Goss, of Lafayette, Consulting Engr.

Kokomo, Ind.—All bids were rejected for erecting the Carnegie Library, being in excess of the $25,000 appropriation. New bids will be received.

Indianapolis, Ind.—Local press reports state that bids will be received May 13 by the Bd. of Pub. Wks. for improvements at the east market, including iron work, on which bids are to be submitted separately.

Des Moines, Ia.—The plans of Engr. C. L. Finley, employed by State Capitol Comn. to prepare for new work on State Capitol, have been approved, and the Comn. will soon let contracts for the work. The Capitol will be completely overhauled and new plumbing and an electric lighting system installed; probable cost of work, $75,000.

Des Moines, Ia.—Jas. Rowson & Son, of Iowa City, is stated to have received the contract for erecting a portion of the city library, for $56,800.

Dubuque, Ia.—Martin Heer, 1301 Clay St., is preparing plans for a $60,000 building for the Sisters of St. Francis.

Clinton, Ia.—Bids are wanted May 20 for erecting a library. Geo. B. Phelps, Secy. Bd. of Trus. of Free Pub. Library.

Boston, Mass.—Geo. F. Clarke, Secy. Park Comrs., writes that contracts for erecting (*a*) 3 stone sanitary buildings, and (*b*) brick storehouse (bids opened Apr. 27) have been awarded as follows: (*a*), John A. Rooney, $13,895, and (*b*), Chas. H. Dodge Constr. Co., $10,455, both of Boston.

Lawrence, Mass.—Governor Bates has signed the bill to allow the further expenditure of $50,000 on the old Court House, and work will be begun at once on the remodeling, the building to be ready for use for the Sept. term of court.

Lansing, Mich.—The Bd. of State Auditors, according to local press reports, is receiving bids until May 13 for heating the State Capitol.

Manchester, N. H.—Alfred A. Collins, of Danville, N. H., and Frank E. Kaley, of Milford, N. H., have been appointed a committee to have charge of erecting the union armory for Manchester; appropriation, $48,000.

Concord, N. H.—Dr. C. P. Bancroft, Supt. State Hospital, writes that the contract for erecting additions to the Rumford and Chandler Bldgs. (bids opened Apr. 28) has been awarded to Head & Dowst, of Manchester, N. H., for $52,235.

Brooklyn, N. Y.—Bids will be received May 11 by the State Bd. of Armory Comn. at the Capitol, Albany, for constructing, plumbing and heating in connection with additions and betterments at the 47th Regiment Armory. G. L. Heins, State Archt., Albany; Maj. Gen. Chas. F. Roe, Chmn.

New York, N. Y.—The contract for the Scarlet Fever Pavilion at the Willard Parker Hospital (bids opened May 5) has been awarded to John Monks & Sons, 130 Water St., for $22,700. F. D. Bell, Chief Clerk, Dept. of Health.

Albany, N. Y.—Bids will be received May 18 by the Bd. of Contract and Supply for furnishing material for erecting a contagious disease hospital, including heating, plumbing and drainage work, electrical work, etc. I. Wachaman, Clk. of Bd

Ogdensburg, N. Y.—Bids will be received May 13 by the State Comn. in Lunacy, at the Capitol, Albany, for alterations to steam plant at St. Lawrence State Hospital, Ogdensburg. T. E. McGarr, Secy.

Brooklyn, N. Y.—Bids will be received May 20 by J. Edw. Swanstrom, Boro. Pres., for furnishing material for repairs and alterations to certain rooms in the Borough Hall; cost according to press reports, $50,000.

Youngstown, O.—Bids will be received May 23 (readvertisement) by the City Comrs. for furnishing material for erecting a fire station on Madison Ave. and Elm St. E. R. Thompson, Archt., Diamond Blk.; C. E. Cross, Clk.

Cleveland, O.—Bids will be received May 27 by the Pub. Library Bd. for furnishing material and erecting a library on Willson Ave. and Marquette St., including ventilating, heating, plumbing, sewers, gas fitting, structural iron and steel work, electric wiring, etc. W. R. Watterson, Archt., 1203 New England Bldg. Harry Dixon, Secy.

Marion, O.—C. F. Schweinfurth, of Cleveland, is stated to have been selected to prepare plans for an edifice for the Congregation of the Free Baptist Church; probable cost, $25,000.

Harrisburg, Pa.—Local press reports state that bids will be received about May 15 for erecting the R. C. Cathedral, which is to replace the present pro-Cathedral on State St. Geo. I. Lovatt, Archt., Philadelphia, Pa.

Harrisburg, Pa.—Bids are wanted May 14 for erecting a fire house. Geo. W. Lutz, Ch. Engr., Fire Dept., No. 16 N. 2d St.

Lancaster, Pa.—A correspondent writes that bids are being received for the Episcopal Parish House.

Homewood, Pa.—It is stated that the Congregation of the St. James Memorial Episcopal Church will erect an edifice at Kelly and Collier Sts., to cost about $75,000. Carpentio & Crocker, Archts.

Pittsburg, Pa.—R. M. Trimble, Ferguson Bldg., is reported to be receiving bids for the erection of a 3-story building at Federal St. and Vine Alley for the Pittsburg Free Dispensary; estimated cost, $50,000.

Olympia, Wash.—Bids will be received May 12 by the State Capitol Comn. for installing an automatic system of heat regulation and forced ventilation, according to the plans and specifications prepared by W. A. Ritchie, Archt., Spokane; D. B. Garrison, Secy.

BUSINESS BUILDINGS AND DWELLINGS.

Atlanta, Ga.—W. F. Denny, Prudential Bldg., is reported to be preparing plans for a 2-story brick residence to be erected at Washington and Clark Sts., for Jacob Elsas; probable cost, $20,000.

Chicago, Ill.—It is stated that the building of the Fulton St. Wholesale Market Co. at Fulton and Peoria Sts., recently damaged by fire, will be rebuilt; probable cost, $50,000.

Ottumwa, Ia.—Bids are wanted May 16 for erecting a 6-story and basement office building on Market and Main Sts. Frank Fiedler, Archt., Summer's Bldg.

Lexington, Ky.—Richards, McCarty & Bulford, of Columbus, O., are stated to have completed plans for a building to be erected at Short and Mill Sts. for the Security Trust & Safety Vault Co.; probable cost, $100,000.

Cambridge, Mass.—The Cambridgeport Savings Bank is to erect a new building at cost of $100,000. Chamberlain & Blackall are the architects.

Grand Rapids, Mich.—J. M. Wood, of Detroit, is reported to be preparing plans for an opera house to be erected here, to cost $75,000.

Detroit, Mich.—L. W. Tuller is reported to have had plans prepared for a 6-story apartment house to be erected at Jefferson and McDougall Aves.; estimated cost, $135,000.

Kansas City, Mo.—Root & Siemens, Postal Telgh. Bldg., have prepared plans for a brick store on Baltimore Ave. and 10th St., to cost about $60,000.

New York, N. Y.—Press reports state that the Erie R. R. Co. (C. W. Buchholz, Ch. Engr.) will erect an 11-story office building in connection with the proposed ferry house at West and Chambers Sts.

Syracuse, N. Y.—The Syracuse Rapid Transit Co. (John E. Duffy, Supt.) is to erect a car house at Tallman St. and Cortland Ave.; probable cost, $50,000.

Cleveland, O.—The Schatzinger Dickie Co. is reported to be preparing plans for a 4-story brick apartment house to be erected at E. Madison and Dellenbaugh Aves.; probable cost, $140,000.

Lancaster, O.—J. B. Price, Archt., writes that the contract for erecting a business building at Columbus and Chestnut Sts. (bids opened Apr. 28) has been awarded to Wm. H. Kober, of Lancaster, for $18,296.

Portland, Ore.—The Elks of this city are stated to have decided to erect a 6-story 100x100-ft. building at 7th and Stack Sts., at a cost of $100,000.

Pittsburg, Pa.—The Germania Savings Bank Co. (A. E. Niemann, Cashier) is reported interested in the erection of an 18-story office building at Wood and Diamond Sts.; probable cost, $1,500,000.

John Ommert is reported to have purchased a site at Forbes St. and Murray Ave. for a residence, to cost $25,000.

Delaware Watergap, Pa.—It is stated that the Delaware & Lackawanna R. R. Co. (L. Brush, Ch. Engr., Hoboken, N. J.) will rebuild the depot recently destroyed by fire at a cost of $20,000.

McKeesport, Pa.—It is stated that the Noble Livery & Undertaking Co. (C. L. Noble, Pres.), recently incorporated with a capital of $100,000, will erect a building at 9th Ave. and Market St., to cost about $60,000.

Waco, Tex.—Reports state that bids will be received May 17 for erecting a Masonic Temple.

Galveston, Tex.—Parlin & Orendorff Co. are reported to have decided to rebuild their building recently destroyed by fire. The structure will be 50x200 ft., probably 7-story; approximate cost, $75,000.

Wheeling, W. Va.—Plans have been drawn by the Wheeling Traction Co. (C. E. Flynn, Gen. Supt.) for a car house at 42d St. The building will be 165 ft.x 40 ft.

Mannington, W. Va.—The Star Opera House Co., of Mannington, W. Va., is reported incorporated, with a capital of $100,000, to erect a building at Jefferson Ave. and 5th St.; probable cost $60,000. Incorporators: T. S. Ryner, J. O. Henry and others, all of Mannington.

NEW YORK, N. Y.

97 Cannon St, 2 6-story br tenemts and stores; total c, $76,000; o & b, Abraham Eiterman; a, G F Pelham.

Clinton and Henry Sts, 6-story br tenemt and storea; c, $45,000; o, Merberg Bros; a, Sass & Smallheiser.

Ave C and 10th St, 6-story br tenemt and stores; c, $40,000; o & b, H Kohn; a, G F Pelham.

Houston St and Ave D, 6-story br tenemt and stores; c, $55,000; o, S Steiner; a, Sass & Smallheiser.

5th Ave and 11th St, 10-story br tenemt; c, $375,000; o, W E Finn; a, Henry Andersen.

324 E 19th St, 2 6-story br tenemts; total c, $80,000; o, Leonor Spielberger; a, Sass & Smallheiser.

14 E 82d St, 4-story dwell; c, $25,000; o, Mrs Edith A Stralein; a, C P H Gilbert; b, Bunn & Nase.

Madison Ave and 107th St, 5 6-story br tenemts; total c, $290,000; o & b, Weinstein Bros; a, G F Pelham.

BROOKLYN, N. Y.

Prospect Pl and Nostrand Ave, 4-story br stores and tenemt; c, $20,000; o, J Strauss & S Charig; a, W Debus.

8th Ave and 9th St, 4-story br flat; c, $25,000; o, J Wilson; a, Pohlman & Patrick.

Winnipeg, Man.—The Canadian Northern R. R. Co. is stated to have decided to erect a depot at Main St. and Bway. The building will be 6-story, 300-ft. structure. E. Langham, Purchasing Agent, Winnipeg.

SCHOOLS.

Denver, Colo.—The Bd. of Educ. is stated to have purchased a site at 11th Ave. and S. 15th St. for a 12-room school house.

New Haven, Conn.—See "Paving and Roadmaking."

Athens, Ga.—Plans and specifications for the new library university of Georgia are now ready for bidders. Haralson Bleckley, Archt., Atlanta.

Lewiston, Idaho.—The Council is stated to have authorized the Bd. of Educ. to issue $35,000 bonds for the erection of a school in the Normal Hill Dist.

Chicago, Ill.—The following contracts have been awarded for erecting McKinley High School, for which bids were received by Com. on Bldgs. and Grounds, Bd. Educ., on Apr. 24: To Wm. A. Pope, 79 Lake St., for steam heating, $17,247; Andrews & Johnson Co., 256 W. Washington St., ventilating, $14,695; Thos. Conlin Pl. & Htg. Co., 3978 Cottage Grove Ave., plumbing and gas fitting, $20,834; Johnson Temp. Cont. Co., 411 Dearborn St., heat regulation, $2,050, and Cuthbert & Black, Royal Ins. Bldg., electric wiring, $7,537. T. J. Waters, Ch. Engr. Bd. Educ., 710 Tribune Bldg.

Henry Worthmann, 625 W. Chicago Ave., is stated to have prepared plans for a $35,000 school to be erected at W. Chicago Ave. and Lincoln St. for St. John's Congregation.

Rock Island, Ill.—Local press reports state that bids are wanted May 12 for enlarging the Ericson school, for which $20,000 has been recently issued.

Bedford, Ind.—Bids are wanted May 19 for an addition to a high school. Address S. B. Lowe.

Sugargrove, Ind.—Bids are wanted May 18 for erecting a brick school. Geo. Brown, Archt., Lafayette.

Indianapolis, Ind.—Press reports state that bids are wanted May 28 for $50,000 school bonds.

Ladora, Ia.—Bids will be received May 23 by W. G. Bair, Secy. School Bd., for erecting a 4-room brick and stone school. Prescott & Co., Archts., Marshalltown.

Covington, Ky.—Bids will be received May 20 by the Bd. of Educ. for heating the 3d Dist. School. Matt. A. Heyker, Clk.

Baltimore, Md.—Bids will be received May 13 by the Bd. of Awards for erecting a boiler, air pump and injector at the Baltimore Polytechnic Institute. Thos. G. Hayes, Pres.

Boston, Mass.—Plans have been filed for a 3-story brick school, 80x82-ft., to be erected at 241 St. Botolph St. Owners: Home for Crippled Children. Builder, McNeil Bros., 196 Freeport St.; Peabody & Stearns, Archts. Estimated cost, $100,000.

Newton Upper Falls, Mass.—Plans are about to be prepared for a new twelve-room school house. Geo. H. Elder, Pub. Bldg. Comr.

Red Wing, Minn.—J. J. Olson & Son, of Muskegon, Mich., is stated to have received the contract for erecting a building for the Red Wing Seminary, for $38,687.

Tyler, Minn.—Bids are wanted May 18 for $20,000 bonds for School Dist. No. 23. T. T. Gronlund, Clk. of Dist.

Vailsburg, N. J.—Press reports state that bids are wanted May 25 for $30,000 school bonds.

Newark, N. J.—Bids will be received May 11 by the Comr. on Schoolhouses of Bd. of Educ. for furnishing material for erecting additions to Central Ave., Charlton St., Oliver St. and Franklin schools, including ventilating, heating, plumbing, etc. R. D. Argue, Secy.

New York, N. Y.—It has been decided to postpone the opening of bids for the general construction of School No. 37, Boro. of Bronx (bids for which were to have been received on Apr. 27). New bids will be called for in a few weeks.

Contracts for installing electric wiring and fixtures in schools (bids opened May 4) have been awarded as follows: School No. 183, Boro. of Manhattan, Abr. L. Saruya, $5,634; School No. 19, Boro. of Brooklyn, T. Fred. Jackson, $3,666; School No. 34, Boro. of Richmond, Max Jakobson, $2,185.

Bids will be received May 18 by C. B. J. Snyder, Supt. School Bldgs., for installing electric light, wiring, fixtures and electric bell system in school No. 34, Boro. Bronx.

Brooklyn, N. Y.—Bids will be received May 18 by C. B. J. Snyder, Supt. School Bldg., N. Y. City, for alterations, repairs, etc., to school No. 70; also installing, ventilating and heating apparatus in schools Nos. 17 and 60.

Long Island City, N. Y.—Bids will be received May 18 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for sanitary work at Long Island City high school, Boro. Queens.

Mayville, N. D.—W. S. Albrant, Archt., Fargo, writes that the contract for a 3-story brick and stone addition to the Normal School (bids opened Apr. 17) has been awarded to Stewart Wilson, of Fargo, for $50,000.

Columbus, O.—Peters, Burns & Pretzinger, of Dayton, are stated to have prepared plans for a 3-story brick building for the Department of Physics of the Ohio State University; estimated cost, $130,000.

Toledo, O.—Bids will be received May 23 by the Jerusalem Township Bd. of Educ. for erecting a brick school on Corterrail Road. H. A. Schabow, Township Clk.

Edmond, Okla. Ter.—Press reports state that plans will be received May 12 by the Bd. of Educ. for erecting a Normal School; probable cost, $25,000. Rev. Rankin is a member of the Bd.

Lancaster, Pa.—Bids will be received May 14 by the School Bd. for erecting, including ventilating and heating system, a high school on W. Chestnut and N. Charlotte Sts. D. McMullen, Chmn. Bldg. Com.

Philadelphia, Pa.—M. W. Young, 60th St. and Woodbine Ave., is stated to have submitted the lowest bid, $29,770, for the erection of an addition to the Pennsylvania Ave. School.

Glassport, Pa.—Bids are wanted May 16 for a 6-room addition and auditorium to the Glassport School. Clepper & Moffit, Archts., 308 5th Ave.

Allegheny, Pa.—Bids are wanted May 20 for installing a steam-heating plant in the 12th Ward School. Address Thos. Scoville, 1520 Howard Ave.

Beaumont, Tex.—Glenn Allen, of Waco, is reported to be preparing plans for a high school to be erected here, to cost $65,000.

Ashland, Wis.—It is stated that plans are being prepared for a high school to be erected at Ellis Ave. and 10th St.; probable cost, $75,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Washington, D. C.—Local press reports state that the following bids were opened by the Dist. Comrs. May 1 for machine sweeping and flushing the streets: The Washington Sanitary St. Cleaning & Flushing Co., of St. Louis, Mo., bid only for the flushing work as follows: For 1 yr., 35 cts. per 1,000 sq. yds.; for 2 yrs., 32½ cts., and 3 yrs., 29½ cts., the flushing to be done with the company's improved flushing machine. Lilly & Robinson, of Indianapolis, Ind., and Washington, the present contractors for machine sweeping, offered to do the sweeping and flushing as follows: 1 yr., 20 cts. per 1,000 sq. yds.; 2 yrs., 20½ cts.; 3 yrs., 21 cts. R. V. Rusk, of Washington, who at present holds the contract for alley and unpaved street cleaning (awarded contract). He bid only upon the basis of a 3-yr. contract. He offered to do the work for 3 yrs. at 16 13/16 cts. per 1,000 sq. yds.

Chicago, Ill.—The city is reported to be considering the construction of a garbage crematory on the Bridewell grounds. F. W. Blocki, Comr. Pub. Wks.

South Bend, Ind.—The city has contracted with the Dixon Garbage Crematory Co., of Toledo, O., for a 25-ton cremator, to cost $6,885. The city to furnish the building.

Ft. Banks, Mass.—See "Government Work."

Hoboken, N. J.—Bids will be received May 27 by the Mayor and Council for removing ashes, garbage, rubbish, street sweepings, etc., for the ensuing year. Jas. H. Londrigan, City Clk.

Niagara Falls, N. Y.—The Council is stated to have adopted a resolution authorizing the Street Com., City Engr. and Supt. of Sts., to prepare plans and specifications for collection of garbage, and the City Clk. to secure bids for same.

Youngstown, O.—The Youngstown Garbage Co. proposes to enlarge its plant, at a probable cost of $5,000.

GOVERNMENT WORK.

Mobile, Ala.—Bids are wanted May 30 for furnishing material and labor necessary for protecting Ship Island Light Station, Miss., and Pass Manchac Light Station, La. Capt. Wm. E. Craighill, Engr., 8th Light-House Dist., Mobile.

Ft. Logan, Colo.—Bids will be received June 1 by Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, for constructing a gymnasium and post exchange building at this post.

Denver, Colo.—The Alfred Box Co., of Philadelphia, bid for a 3-motor traveling crane for U. S. Mint Bldg. at Denver $3,565, and the bids for a 45-H.-P. motor generating set were received as follows: Westinghouse Co., New York, N. Y., $1,550; General Elec. Co., New York, N. Y., $2,225; Sprague Elec. Co., New York, N. Y., $2,750 (bids opened at Washington, D. C., May 5).

Washington, D. C.—Secy. Root has approved the recommendation of the War College Bd. for the construction of various buildings at army posts throughout the United States. The session of Congress appropriated $6,000,000 for buildings and improvements, $1,000,000 of which was to be expended at Manila, P. I.

According to local press reports, J. K. Taylor, Superv. Archt., Treas. Dept., has sent invitations to 7 architects to submit plans for a post office building at Atlantic City. Within a few days invitations will be prepared and sent out for buildings in other places. Under the provisions of the Tarsney Act, the Superv. Archt. may invite architects to enter into competition for small Government buildings, ranging in cost from $50,000 to $100,000.

The contract for a new fire and burglar proof electrically equipped vault for the cash room of the Treasurer's office of Treas. Dept. has been awarded to the Herron-Hall-Marvin Safe & Lock Co., for $22,000.

Bids will be received May 23 by Elliott Woods, Supt. U. S. Capitol Bldg. & Grounds, for water tube steam boilers for Senate wing, plumbing and steam-fitting materials, electrical supplies, etc.

Bids will be received at the Dept. of the Interior, Washington, D. C., until May 21 for constructing a subway at the Government Hospital for the Insane at Washington. Thos. Ryan, Acting Secy.

Chicago, Ill.—Bids are wanted May 15 for furnishing and delivering f. o. b. cars a large quantity of galvanized steel roofing, gutters, pipe, etc. Address Maj. W. H. Miller, Q. M., U. S. A.

Ft. Riley, Kan.—The Junction City Electric Ry, Light & Ice Co., of Junction City, is said to have secured the contract for the plans and for furnishing current for electric lighting purposes at Ft. Riley; total cost of plant, work and material will be about $75,000. The contract calls for 6,000 16 c.p. incandescent lamps and 41 arc lights.

New Orleans, La.—Bids are wanted June 30 for improving Southwest Pass of Mississippi River, as advertised in The Engineering Record.

Baltimore, Md.—Bids are wanted June 4 for furnishing materials (except metal work) and constructing the Baltimore Light House; also on same date for the metal work, both advertised in The Engineering Record.

Boston, Mass.—The following bids for dredging in (*a*) narrows of Lake Champlain, Vt. (62,500 cu. yds.), and (*b*) Plattsburg Harbor, N. Y. (14,250 cu. yds.) were received by Capt. Harry Taylor, Corps Engrs., U. S. A., May 1, price given per cu. yd.: Daly & Hannan Dredging Co., Ogdensburg, N. Y., *a* and *b*, 28 cts. P. W. Myers & Son, Albany, N. Y., *a*, 26½ cts.; *b*, 27 cts. Emory R. Seward, 1027 Macy Pl., N. Y. City, N. Y., *a*, 22½ cts.; *b*, 30 cts.

Ft. Banks, Mass.—Bids will be received by T. E. Merrill, Q. M., Ft. Banks (P. O. Winthrop), May 28 for constructing a garbage crematory and shed.

Grand Rapids, Mich.—Bids are wanted June 5 for constructing steel hull and cabin for suction dredge, as advertised in The Engineering Record.

Kalamazoo, Mich.—The following bids were opened by the Superv. Archt., Treas. Dept., Washington, D. C., on Apr. 30 for an extension to the U. S. Post Office at Kalamazoo: C. W. Gindele Co., Chicago, Ill., $44,500; Congress Constr. Co., Chicago, Ill., $51,793; Riehmans Sons Co., Kalamazoo, $54,500, and H. L. Van Der Hurst, Kalamazoo, $59,300.

Duluth, Minn.—Bids are wanted May 29 for furnishing broken stone, etc., for pier at Superior Entry, as advertised in The Engineering Record.

St. Louis, Mo.—Bids will be received May 15 by Lieut. Col. J. W. Jacobs, Depot Q. M., for furnishing and delivering f. o. b. cars iron, galvanized steel roofing, etc., required for constructing a new post near Manila, P. I.

Tongue River Agency, Mont.—The following bids were opened on Apr. 30 for furnishing and delivering material and constructing buildings, water and sewerage systems, etc., on the Bushy Ranch: Ed. Wagner, Helena, Mont., $59,833; H. F. Rettinger, Fountain City, Wis., $64,270; A. Motchman, Chicago, $74,796. W. D. Lovell, of Minneapolis, Minn., bid for water and sewer system alone, $9,998.

Ft. Keogh, Mont.—Bids are wanted May 19 for house connections and installing interior plumbing in buildings at this post. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Athenia, N. J.—Bids will be received by Jas. Wilson, Secy. Dept. of Agriculture, Washington, D. C., until May 12 for constructing 2 brick barns on the grounds of the U. S. Animal Quarantine Station at Athenia.

Plattsburg Barracks, N. Y.—Bids will be received at the Q. M. Office, Burlington, Vt., May 25 for remodeling drill hall at this post, as advertised in The Engineering Record

Ft. Terry, N. Y.—Bids are wanted May 14 for constructing, including plumbing, heating and electric wiring barrack building; also constructing gunshed and machine shop at this post. Address Constructing Quartermaster, 27 Granite St, New London, Conn.

Ft. Totten, N. Y.—Bids are wanted May 18 for grading and constructing roads and sidewalks at this post. Address C. K. Mower, 1st Lieut. Q. M.

Greensboro, N. C.—The following bids were opened on May 5 for the construction (except heating apparatus) of an extension to U. S. Court House, Post Office, etc., at Greensboro: W. C. Bain, Greensboro, $47,225; Miles & Bradt, Atlanta, $42,500; W. E. Spier, Washington, $49,594; Congress Con. Co., Chicago, $56,893.

Philadelphia, Pa.—Bids are wanted May 14 for putting a roof on fireproof annex of storehouse No. 3 at Schuylkill Arsenal, including such repairs to wall and upper story as may be necessary. Address Col. J. M. Marshall, Depot Q. M., U. S. A.

Bids are wanted May 11 for installing an electric freight elevator plant in the U. S. Appraiser's stores building, Philadelphia. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Ft. Greble, R. I.—Capt. Thos. H. Slavens, Q. M., U. S. A., Newport, writes that the contract for furnishing and installing a boiler and pump in pump house (bids opened Apr. 1) has been awarded to Darling & Slade, of Fall River, Mass., for $2,220.

Springfield, S. D.—Bids will be received June 2 by W. A. Jones, Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for constructing addition to dormitory; also constructing laundry, water and sewer system, etc. at Indian Boarding School.

Memphis, Tenn.—The following bids were opened May 4 at Washington, D. C., for the construction (including plumbing, electric wiring and conduits) of the extension of the U. S. Custom House, Court House and Post Office at Memphis, Tenn.: Stafford Bldg. & Construction Co., St. Louis, $204,737; Miles & Bradt, Atlanta, $197,788 and $183,088; Congress Con. Co., Chicago, $211,367; Geo. Moore & Son, Nashville, Tenn., $197,400; F. B. Young & Co., Memphis, $245,000.

Nashville, Tenn.—Capt. W. J. Barden, Corps Engrs., U. S. A., writes in regard to bids opened on Apr. 22 that the Penn Bridge Co., of Beaver Falls, Pa., bid $30,400, to construct, deliver and erect 2 pairs steel Lock Gates, complete, at Lock "A"; $3,500, to construct and deliver the filling valve, etc., at Lock "A"; $23,400, to construct, deliver and erect 2 pairs steel Lock Gates, complete, at Lock No. 1, and $3,500, to construct and deliver the filling valve, etc., at Lock No. 1.

Chattanooga, Tenn.—The contract for constructing the Muscle Shoals Canal on Tennessee River, is reported to have been awarded on Apr. 28 to the Sheridan Kirk Constr. Co., of Valley Head, Ky., for $545,000.

Capt. H. J. Slocum, U. S. Cavalry, Q. M., writes that bids will be opened on May 25 for the construction of a railway spur on military reservation at Chickamauga Park, Ga.

Ft. Monroe, Va.—Bids will be received at U. S. Engr.'s Office, Norfolk, May 25 for piles, lumber, bolts, etc., at Ft. Monroe, as advertised in The Engineering Record.

Norfolk, Va.—No bids were received on Apr. 30 for rock removal and constructing riprap dam in Roanoke River, near Weldon, N. C.

Ft. Casey, Wash.—Bids are wanted May 11 for constructing, including plumbing, heating and electric wiring 3 buildings at this post. Geo. H. Penrose, Q. M., U. S. A., Port Townsend.

Milwaukee, Wis.—Bids are wanted June 3 for pile revetment at Two Rivers Harbor, as advertised in The Engineering Record.

NEW INDUSTRIAL PLANTS.

The Waterbury, Conn., Clock Co. is planning to erect a 5-story and basement, 43x116-ft. factory of slow-burning construction, with flat gravel roof, elevator, electric lighting and power in connection with its present electrical and steam plant.

The building of the Willard Bag & Mfg. Co., Wilmington, N. C., has been damaged by fire, and will be rebuilt at a cost of about $5,000. The company is considering the installation of 30 or 40-H.-P. engine and boiler.

The A. E. Holaday Mfg. Co., 101 Quinnipiac Ave., New Haven, Conn., will increase its capital from $20,000 to $50,000, and erect a 3-story, 50x100-ft. brick building. A 10-H.-P. gas engine will be put on each floor.

The Crawford Lumber Co., Whatcom, Wash., intends soon to install a shingle mill and box factory.

E. I. du Pont de Nemours & Co., Wilmington, Del., will erect a powder plant near Birmingham, Ala., to have a daily capacity of 1,000 to 1,500 kegs. The power plant for electric transmission will be 500-Kw.

The Penn Engineering & Foundry Co. has been organized, and will erect a new plant, but plans have not been completed. H. F. Biggam, Allegheny, Pa., is interested.

The United States Head-Light Co., Buffalo, N. Y., is erecting a 2-story building of mill construction. It has not been decided whether a steam or electric power plant will be installed.

J. E. Taylor, Crossville, Tenn., is in the market for roofing for saw-mill.

The Napier Iron Works, Nashville, Tenn., have acquired new ore lands near Blakney, Tenn., and will develop them. An ore washer will be erected, and the company is in the market for equipment.

The Northern Wire & Cable Co. has been incorporated with a capital of $300,000, and will at once erect a plant in Milwaukee for the making of lead-covered telephone, telegraph and power cables and wires; is now in the market for power equipment. J. B. Adams, Gen. Mgr., Wells Bldg., Milwaukee.

The L. Schreiber & Sons Co., Cincinnati, O., structural and ornamental iron work, is considering the erection of a 110x400-ft. foundry and fitting shop, a 110x180-ft. pattern building, and a 1,200-H.-P. power plant; electrical power or compressed air would be used.

R. O. Davis, Smyrna, Tenn., is interested in the erection of a 100-bbl. flour mill with cornmeal outfit. The steam power plant will be of about 60-H.-P. capacity.

The Cambridge-Byesville Steel Co. will erect at Byesville, O., an open-hearth furnace of 35-ton capacity with billet and bar mills. Buildings will be of steel, and dimensions of main building, 140x160 ft.; boiler house, 60x80 ft. Plant will be equipped with four 150-H.-P. boilers, one 28x48 or 54-in. engine, shears, shafting, belting, pulleys, a 35-ton electric traveling crane, one 100-Kw. generator, etc.

MISCELLANEOUS.

Geronimo, Ariz.—A press report states that Capt. Thos. C. McEnery, now at Sheldon Hotel, El Paso, Tex., is interested in the construction of 2 tunnels through Pinnelene and Graham Mountains in Black Rock Dist., Graham County, Ariz. On the ground which the syndicate owns are reservoir lands, and the reservoirs when dammed will supply a constant stream of water for the water subway, which will be conveyed through the mountain to Gila Valley for irrigation purposes.

Sioux City, Ia.—The Chicago & Northwestern Ry. Co. (E. C. Carter, Ch. Engr., Chicago, Ill.) and the Sioux City Stock Yards Co. are stated to have reached an agreement regarding the straightening of Floyd River through the stock yards district; $40,000 will be expended in building another bridge over new channel. Plans for bridge have already been approved by City Engr.

New Orleans, La.—Bids are wanted May 19 for furnishing lumber and piling that may be ordered by the Port Comr. for a period of 1 yr. from date of contract. Hugh McCloskey, Pres. Bd. of Comrs. of the Port of New Orleans.

Buffalo, N. Y.—The Mayor is stated to have approved the bill permitting the city to issue $100,000 bonds to abate the Clark & Skinner canal nuisance.

New York, N. Y.—All bids received on Apr. 14 by McDougall Hawkes, Comr. Docks & Ferries, for furnishing about 10,000 piles, have been rejected, and contract will be changed.

New York, N. Y.—The following were the two lowest bids opened May 5 by McDougall Hawkes, Comr. Docks, for dredging the North River between Battery and 159th St.: Henry Du Bois Sons Co., 17 State St., 16½ cts. per cu. yd.; W. H. Beard Dredging Co., 16.8 cts.

Of the bids opened same time for furnishing and placing small cobble and riprap, the lowest was H. C. Pearce, Class I, 62½ cts.; Class II, 58½ cts.

Philadelphia, Pa.—The American Dredging Co., 234 Walnut St., is stated to have secured the contract to dredge the docks into which the sewers empty, at 23 cts. per cu. yd.

Chattanooga, Tenn.—Bids will be received May 12 by J. Fred Ferger & Bro., Agents Stone Fort Land Co., 102 E. 8th St., for excavating about 30,000 cu. yds.

Austin, Tex.—The Legislature is stated to have passed the bill authorizing the city to enter into a contract for rebuilding the dam destroyed 3 years ago.

Montreal, Que.—Bids will be received until May 22 by L. O. David, City Clk., for the excavation, concrete, masonry, etc., in the substructure of the St. Denis St. subway.

Toronto, Ont.—It is stated that bids are wanted May 12 for furnishing the Portland cement required during the year ending May 31, 1904. Thos. Urquhart, Mayor.

BUSINESS NOTES.

E. P. Roberts & Co., Electric Bldg., Cleveland, O., consulting engrs., have opened a branch office at 25 Broad St., New York, under the management of Wm. C. Andrews, E. E., eastern representative of the company.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Morreau Gas Fixture Co., engine to be direct-connected to a Westinghouse generator; fourteen engines, amounting to 2,400-H.-P. and direct-connected to Crocker-Wheeler generators, for use in sugar factories.

The general offices of the Allis-Chalmers Co. will be located in the New York Life Bldg., Chicago.

At a special meeting of the Salford Borough Council, the recommendation of the Tramways Committee was approved, and the contract for fifty tramcars at approximately $3,700 each was given to the Westinghouse company. The London County Council recently received tenders covering the switchboard installations for the sub-stations at the Elephant and Castle, New Cross and Camberwell for the tramways, the contract being awarded to the British Westinghouse Electric & Mfg. Co., Ltd. This contract amounts to approximately $27,000.

The F. P. Smith Wire & Iron Works, 100-102 Lake St., Chicago, have been appointed sole agents in Chicago and several other States adjacent thereto, for the Columbus Steel Rolling Shutter Co., manufacturers of rolling steel doors for freight houses, car barns, warehouses, etc.

Rossiter, MacGovern & Co. on May 1 removed their offices to the Whitehall Bldg., New York.

The Buffalo Meter Co., Buffalo, N. Y., moved into its new factory building May 1, and hereafter its address will be 290 Terrace, Buffalo.

The steam turbine plant of the Hartford, Conn., Electric Light Co., which at present consists of a 2,000-H.-P. set, is soon to be duplicated by machines built by the contractors for the original installation, the Westinghouse Machine Co. This was the first American plant where steam turbine units of large size were installed. The aggregate power of steam turbine sets completed, in hand and in order to the Westinghouse Machine Co. does not fall far short of 200,000-Kw.

The Public Library at Waterbury, Conn., is to be lighted with Nernst lamps, furnished by the Nernst Lamp Company, of Pittsburg, Pa., which company controls the rights to manufacture and sell this illuminant in the United States and Canada. Portions of the streets of Madison, Wis., are being illuminated with Nernst lamps by business men.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
May 11.	Pipe, etc., Holyoke, Mass. Adv. Apr. 25, May 2.	Apr. 25
May 12.	Jersey City, N. J.	May 9
May 12.	Atlantic City, N. J.	May 9
May 12.	Toronto, Ont.	Mar. 21
May 14.	New Britain, Conn.	May 9
May 15.	Richmond, Va.	Apr. 25
May 18.	Engine, Burlington, Ia., Adv. May 2, 9.	May 2
May 18.	Pipe, etc., Sacramento, Cal. Adv. May 2, 9.	May 2
May 18.	Sterling, Colo., Adv. Apr. 25 to May 9.	Apr. 25
May 19.	New York, N. Y.	May 9
May 19.	New Brighton, N. Y.	May 9
May 19.	Long Island City, N. Y.	May 9
May 19.	Greene, N. Y.	May 9
May 19.	New Bremen, O., Adv. Apr. 25, May 2.	Apr. 25
May 20.	Fayette, Ia.	May 2
May 20.	Tucson, Ariz.	May 2
May 20.	Pipe, Tacoma, Wash.	Apr. 25
May 21.	Yonkers, N. Y., Adv. May 2	May 2
May 21.	Martinsburg, W. Va.	Apr. 25
May 22.	Washington, D. C. Adv. Apr. 25 to May 9.	Apr. 25
May 25.	Condo, N. Dak., Adv. May 2, 9.	May 2
May 26.	Alva, Okla. Ter.	May 9
Jun. 1.	Gouverneur, N. Y.	May 2
Jun. —	Pump, Niagara Falls, Ont.	May 9
Aug. 1.	Allegheny, Pa.	Apr. 4
———	Alexandria Bay, N. Y.	May 9
	SEWERAGE AND SEWAGE DISPOSAL.	
May 11.	Lafayette, Ind.	May 9
May 11.	St. Paul, Minn.	May 9
May 12.	Sioux City, Ia.	May 9
May 12.	Montpelier, Ind.	May 9
May 12.	Beaumont, Tex., Adv. Apr. 11.	Apr. 11
May 14.	Cleveland, O.	Apr. 25
May 15.	Newark, N. J.	Apr. 25
May 15.	Tonah, Wis.	Apr. 4
May 18.	Depew, N. Y.	May 9
May 18.	Quincy, Mass.	May 9
May 18.	Des Moines, Ia.	May 2
May 20.	South Bend, Ind.	May 9
May 20.	Bond Hill, O.	May 2
May 20.	Amsterdam, N. Y., Adv. May 9.	Apr. 25
May 21.	Waterloo, Ia.	May 9
May 22.	Fairhaven, Vt., Adv. May 9	May 9
May 22.	Wilmington, Del., Adv. May 9	May 9
May 25.	Estherville, Ia.	May 2
May 29.	Aberdeen, S. D.	May 9
Jun. 6.	Washington, D. C., Adv. Apr. 25, May 9.	Apr. 25
Jun. —	Ballard, Wash.	May 9
———	Alexandria Bay, N. Y.	May 9
	BRIDGES.	
May 12.	Joliet, Ill.	May 2
May 14.	Greensburg, Pa.	Apr. 25
May 15.	Gettysburg, Pa.	May 9
May 15.	Uniontown, Pa.	May 9
May 15.	Hagerstown, Md.	May 2
May 15.	Grand Rapids, Mich. Adv. Apr. 25, May 2.	Apr. 25
May 16.	Winchester, Ind.	May 9
May 16.	Mt. Vernon, O.	May 2
May 18.	Walla Walla, Wash.	May 9
May 18.	San Jose, Cal.	May 2
May 18.	Fredericton, N. B.	Apr. 4
May 19.	Woonsocket, S. D.	May 2
May 19.	Langdon, N. D.	May 2
May 19.	Milwaukee, Wis.	Apr. 18
May 20.	Jacksonville, Fla., Adv. May 2, 9.	May 2
May 21.	Omaha, Neb.	May 9
May 21.	New York, N. Y.	May 9
May 21.	Hoxie, Kan.	May 9
May 22.	Indianapolis, Ind.	May 9
May 23.	Birmingham, Ala.	May 2
May 25.	Brookings, S. D.	May 9
May 25.	Carleton Place, Ont.	May 9
Jun. 1.	Gettysburg, Pa.	Apr. 25
Jun. 3.	Oak Ridge, La.	May 2
Jun. 3.	Livingston, Mont.	May 2
Jun. 4.	Ft. Benton, Mont.	May 9
Jul. 10.	Castlewood, S. D.	May 2
	PAVING AND ROADMAKING.	
May 11.	Gloversville, N. Y.	May 9
May 11.	Oil City, Pa.	May 9
May 11.	Pontiac, Mich.	May 9
May 11.	Chatham, Ont.	May 9
May 11.	Marshalltown, Ia.	May 9
May 11.	Camden, N. J.	May 2
May 11.	Union, N. J.	May 2
May 12.	Harrisburg, Pa.	May 9
May 12.	Montpelier, Ind.	May 9
May 12.	Alexandria, La.	Apr. 18
May 12.	Poughkeepsie, N. Y.	May 9
May 13.	Baltimore, Md.	May 9
May 13.	Kearny, N. J.	May 9
May 14.	Geneva, N. Y., Adv. May 2.	May 2
May 14.	Norfolk, Pa., Adv. Apr. 11, 18.	Apr. 11
May 15.	Grove City, Pa.	May 2
May 15.	Marinette, Wis.	Apr. 25
May 16.	Woodbury, N. J.	May 9
May 16.	Cleveland, O.	May 9
May 18.	Anderson, Ind.	May 9
May 18.	Veedersburg, Ind.	May 9
May 18.	Indianapolis, Ind.	May 9
May 18.	Connersville, Ind.	May 9
May 18.	Frankford, Ind.	May 2
May 18.	Michigan City, Ind.	May 2
May 18.	Payne, O.	May 2
May 18.	Des Moines, Ia.	May 2
May 18.	Marshalltown, Ia.	May 2
May 18.	Toledo, O.	Apr. 25
May 19.	Charlottesville, Va.	May 9
May 19.	Bluffton, Ind.	Apr. 25
May 20.	Walden, N. Y., Adv. May 9.	May 9
May 20.	Honolulu, H. I.	May 2
May 20.	Waynesburg, Pa.	Apr. 25
May 22.	Madison, Wis.	May 9
May 22.	Saginaw, Mich.	May 9
May 23.	Cumberland, Md.	May 9
May 25.	Plymouth, Ind.	May 9
May 28.	Salem, Ind.	May 9
May 29.	Lorain, O.	May 9
Jun. 1.	Huntingburg, Ind.	May 9
Jun. 2.	Bowling Green, O.	May 9
———	Concord, N. H.	May 9
———	Albany, N. Y., Adv. May 2.	May 2
———	Pittsburg, Kan., Adv., May 2.	May 2
———	Union, S. C.	May 2
	POWER, GAS AND ELECTRICITY.	
May 11.	Toronto, Ont., Adv. Apr. 4 to May 9.	Apr. 4
May 11.	Harrisburg, Pa.	May 9
May 12.	Anderson, Ind.	May 9
May 12.	South Norwalk, Conn.	May 9
May 12.	Wheeling, W. Va.	May 9
May 12.	Copenhagen, Denmark	Apr. 4
May 18.	Fosston, Minn.	May 9
May 18.	Shelby, Ia.	May 9
May 19.	New York, N. Y.	May 9
May 23.	Martinsville, Va.	May 9
Jun. 1.	Corry, Pa.	May 9
Jun. —	North Yamkill, Ore.	Apr. 4
Jun. 1.	San Diego, Cal.	Apr. 18
Jun. 18.	Portland, Ore., Adv. Apr. 18 to May 2.	Apr. 18
	GOVERNMENT WORK.	
May 11.	Ft. Casey, Wash.	May 9
May 11.	Philadelphia, Pa.	May 9
May 12.	Athenia, N. J.	May 9
May 12.	New Orleans, La.	Apr. 11
May 12.	Beaumont, Tex., Adv. Apr. 11, 18.	Apr. 11
May 13.	Governor's Island, N. Y.	May 2
May 13.	Merrill, Pa., Adv. Apr. 25 to May 9.	Apr. 25
May 14.	Philadelphia, Pa.	May 9
May 14.	Ft. Terry, N. Y.	May 9
May 14.	Governor's Island, N. Y.	May 2
May 14.	Barracks, Johnson City, Tenn. Adv. Apr. 25 to May 9.	Apr. 25
May 14.	Hartford, Conn.	Apr. 18
May 15.	St. Louis, Mo.	May 9
May 15.	Chicago, Ill.	May 9
May 15.	Ft. McRee, Fla.	May 2
May 15.	Des Moines, Ia. Adv. Apr. 18 to May 9.	Apr. 18
May 15.	New York, N. Y. Adv. Apr. 18 to May 9.	Apr. 18
May 15.	New London, Conn. Adv. Apr. 18 to May 9.	Apr. 18
May 16.	Ft. Rosecrans, Cal.	Apr. 25
May 18.	Ft. Hunt, Va.	May 2
May 18.	Pawhuska, Okla. Ter.	May 2
May 18.	Shoshone Agency, Wyo.	May 2
May 18.	Ft. Stanton, N. Y.	May 2
May 18.	Zanesville, O., Adv. Apr. 18 to May 9.	Apr. 18
May 18.	Ft. Totten, N. Y.	May 9
May 19.	Ft. Keogh, Mont.	May 9
May 20.	Ft. Greble, R. I., Adv. Apr. 25 to May 9.	Apr. 25
May 21.	Washington, D. C.	May 9
May 21.	Chamberlain, S. D.	May 2
May 21.	Wheeling, W. Va.	Apr. 25
May 22.	Pipestone, Minn.	May 2
May 22.	Washington, D. C.	May 2
May 22.	Philadelphia, Pa. Adv. Apr. 25 to May 9.	Apr. 25
May 23.	Washington, D. C.	May 9
May 23.	Charleston, S. C.	Apr. 25
May 23.	Norfolk, Va.	Apr. 25
May 25.	Ft. Monroe, Va., Adv. May 9.	May 9
May 25.	Plattsburg Barracks, N. Y., Adv. May 9.	May 9
May 25.	Chattanooga, Tenn.	May 9
May 25.	Norfolk, Va., Adv. May 2.	May 2
May 25.	New York, N. Y., Adv. Apr. 25 to May 9.	Apr. 25
May 25.	Ft. Morgan, Ala., Adv. Apr. 25.	Apr. 25
May 25.	Lockport, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 26.	Des Moines, Ia.	May 2
May 26.	Boston, Mass., Adv. Apr. 25 to May 9.	Apr. 25
May 27.	Rock Island, Ill., Adv. May 2, 9.	May 2
May 27.	Norfolk, Va., Adv. May 2.	May 2
May 28.	Ft. Banks, Mass.	May 9
May 28.	Chattanooga, Tenn., Adv. May 2, 9.	May 2
May 28.	Ft. Wadsworth, N. Y.	May 2
May 28.	Tompkinsville, N. Y., Adv. May 2, 9.	May 2
May 29.	Duluth, Minn., Adv. May 9.	May 9
May 30.	Mobile, Ala.	May 9
May 29.	Ft. Myer, Va., Adv. May 2, 9.	May 2
Jun. 1.	Ft. Logan, Colo.	May 9
Jun. 1.	Montgomery, Ala.	May 2
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 2.	Springfield, S. D.	May 9
Jun. 3.	Milwaukee, Wis., Adv. May 9.	May 9
Jun. 3.	Springfield, Ill., Adv. May 2, 9.	May 2
June 4.	Metal Work, Baltimore, Md. Adv. May 9.	May 9
Jun. 4.	Light House, Baltimore, Md. Adv. May 9.	May 9
Jun. 4.	Scranton, Pa.	May 2
Jun. 5.	Grand Rapids, Mich., Adv. May 9.	May 9
Jun. 6.	Leavenworth, Kan., Adv. May 9.	May 9
Jun. 8.	Cleveland, O., Adv. May 2, 9.	May 2
Jun. 8.	Portland, Ore.	May 2
Jun. 8.	Sitka, Alaska	Apr. 25
Jun. 9.	Htg. P. O., Paducah, Ky., Adv. May 9.	May 9
Jun. 11.	Bldg. P. O., Paducah, Ky., Adv. May 9.	May 9
Jun. 10.	St. Paul, Minn.	May 2
Jun. 15.	Manila, P. I., Adv. Mar. 14 to May 9.	Mar. 14
June 30.	New Orleans, La., Adv. May 9.	May 9
	BUILDINGS.	
May 11.	School, Newark, N. J.	May 9
May 11.	Armory, Brooklyn, N. Y.	May 9
May 11.	School, Brooklyn, N. Y.	May 2
May 11.	School, New York, N. Y.	May 2
May 11.	School, Long Island City, N. Y.	May 2
May 11.	School, New Brighton, N. Y.	May 2
May 12.	School, Edmond, Okla. Ter.	May 9
May 12.	School, Rock Island, Ill.	May 9
May 12.	Pub. Bldg., Olympia, Wash.	May 9
May 12.	Pub. Bldg., Emporia, Kan.	May 2
May 12.	Dormitory, Pocatello, Idaho	May 2
May 12.	Asylum, Little Rock, Ark.	Apr. 25
May 12.	Court House, Washington, Ga.	Apr. 25
May 13.	School, Baltimore, Md.	May 9
May 13.	Hospital, Ogdensburg, N. Y.	May 9
May 13.	Church, Winchester, Ind.	May 9
May 13.	East Market, Indianapolis, Ind.	May 9
May 13.	Htg. Capitol, Lansing, Mich.	May 9
May 13.	Pub. Bldg., Columbus, O.	May 2
May 14.	School, Lancaster, Pa.	May 9
May 14.	Fire House, Harrisburg, Pa.	May 9
May 14.	Library, Moberly, Mo.	May 2
May 14.	School, Martins Ferry, O.	May 2
May 14.	Sanatarium, Burrilliville, R. I.	May 2
May 14.	Library, Johnson City, Tenn. Adv. Apr. 18 to May 9.	Apr. 18
May 15.	Cathedral, Harrisburg, Pa.	May 9
May 15.	Church, Winnipeg, Man.	May 2
May 15.	Pub. Bldg., New York, N. Y.	Apr. 25
May 15.	Church, Carrollton, Ky.	Apr. 18
May 16.	School, Glassport, Ia.	May 9
May 16.	Pub. Bldg., Belleville, Ill.	May 9
May 16.	Bus. Bldg., Ottumwa, Ia.	May 9
May 16.	Church, Chillicothe, O.	May 2
May 16.	Court house, Darlington, S. C.	May 2
May 16.	School, Green, O.	May 2
May 16.	Church, Birmingham, Ala.	May 2
May 16.	Alms House, Monmouth, Ill.	May 2
May 17.	Masonic Temple, Waco, Tex.	May 9
May 18.	Hospital, Albany, N. Y.	May 9
May 18.	School, Sugargrove, Ind.	May 9
May 18.	School, Brooklyn, N. Y.	May 9
May 18.	School, New York, N. Y.	May 9
May 18.	School, Long Island City, N. Y.	May 9
May 18.	School, Cleveland, O.	May 2
May 18.	School, Bedford, Ind.	May 2
May 18.	Church, Columbus, O.	May 2
May 18.	Hempstead, L. I., N. Y., Htg. School. Adv. May 2.	May 2
May 18.	Hospital, Millersburg, O.	May 2
May 19.	School, Bedford, Ind.	May 9
May 19.	Library, Jackson, Mich.	May 2
May 19.	Jail, Elizabethtown, N. C.	Apr. 18
May 20.	Pub. Bldg., Brooklyn, N. Y.	May 9
May 20.	Library, Clinton, Ia.	May 9
May 20.	School, Covington, Ky.	May 9
May 20.	School, Alleghany, Pa.	May 9
May 20.	Police Station, Washington, D. C.	May 9
May 21.	Htg. Home, Lafayette, Ind.	May 9
May 21.	School, Glenville, O.	May 2
May 21.	Pub. Bldg., Columbus, O.	May 2
May 21.	School, Marietta, O.	May 2
May 23.	School, Toledo, O.	May 9
May 23.	Fire Station, Youngstown, O.	May 9
May 23.	School, Ladora, Ind.	May 9
May 23.	School, Columbus, O.	May 2
May 27.	Library, Cleveland, O.	May 9
Jun. 1.	Jail, Monticello, Miss.	May 2
Jun. 1.	Church, Liberty, Ind.	Apr. 25
Jun. 5.	Plans, Moscow, Idaho	May 2
Jun. 16.	School, Bedford, Ind.	May 2
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jul. 13.	Court House, La Grange, Ga.	May 9
———	Paper Plant, etc., Seven Islands, Que. Adv. Mar. 21 to Apr. 4.	Mar. 21
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May 12.	Cement, Toronto, Ont.	May 9
May 12.	Garb. Disp., Brooklyn, N. Y.	May 2
May 12.	El. Ry. franchise, Riverside, Cal.	May 2
May 13.	Garb. Disp., Brooklyn, N. Y.	May 2
May 15.	R. R. Work, Louisville, Ky.	May 2
May 18.	Garbage Plant, Shreveport, La. Adv. Apr. 18 to May 2.	Apr. 18
May 19.	Piling, etc., New Orleans, La.	May 9
May 20.	El. Ry., Youngstown, O.	May 9
May 20.	Dredging, Falmouth, Jamaica	Apr. 11
May 22.	Subway work, Montreal, Que.	May 9
May 25.	Ditch, Council Bluffs, Ia.	May 2
May 27.	Garb. Disp., Hoboken, N. J.	May 9
Jun. 1.	El. Ry. franchise, Whittier, Cal.	May 9
Jun. 1.	El. Ry. franchise, Redwood City, Cal.	Apr. 18
Jun. 1.	El. Ry. franchise, San Mateo, Cal.	Apr. 25
———	El. Ry. franchise, New Orleans, La.	Apr. 25
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21

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The Value of a Technical Education.

About a year ago Mr. R. T. Crane, president of the Crane Company of Chicago, published a little book giving the results of an investigation made by him regarding the utility of an academic or classical education for young men who have to earn their own living and expect to pursue a commercial life. The book attracted considerable attention when it was first brought out, and a revised and enlarged second edition reached The Engineering Record last week on the same day that it published a notice of President Humphreys' remarks on the defects of technical education. Mr. Crane goes much farther than President Humphreys in criticizing the value of technical education, but before taking up his ideas on that head it is of interest to notice what he says regarding a collegiate education as a preparation for business.

His investigation was made by sending letters of enquiry concerning the value of such education to the presidents of many colleges, the heads of companies employing large numbers of men, and to the graduates from numerous colleges. The answers were apparently not numerous from any class, and it is really instructive to note how few of the college men replying have been able to answer with clearness the questions put by Mr. Crane. The deduction made by the author of the book is perfectly justified by anything which appears in it, namely that the cash outlay, the loss of income during the preparatory and college years which would have been earned if in business, and the loss of time after graduation in learning commercial methods are greater than any direct cash gain. It is doubtful, however, if the author appreciates fully the increased interests in life which a college education gives. Money is not everything to the really broad-gauge man, although it cannot be denied that it is a great deal.

In his remarks on the value of technical education Mr. Crane makes some assertions which cannot be allowed to pass without a more critical notice, because his business position lends special weight to whatever he says on the commercial value of technical graduates. His statements on this subject read as follows:

"While I have had but a very limited experience with the ordinary college-taught man, I have come in contact with large numbers of men who have had a technical or scientific education in mechanical lines, and even these persons, instead of showing evidences of greater mental development, have almost invariably exhibited a total lack of common sense or reasoning power, and I am thoroughly convinced that what is true of them is true of college-trained men generally. But the importance of technically educated men in mechanical lines of work, aside from electricity, chemistry and mining, has, in my opinion, been greatly overestimated. Many people who are unfamiliar with manufacturing seem to feel that there is a great field for such men in this kind of business, apparently forgetting that almost all the success which this country has gained along these lines of industry was achieved before technical men were ever heard of. They should realize that practically all branches of manufacturing business have been brought to such a wonderful state of perfection that there is very little chance for further improvement in them, even by practical men who possess a large amount of experience, combined with good common-sense. This being the case, there surely is no opportunity for the technical man, who is notably lacking in this latter qualification, to accomplish anything new in the mechanical direction."

This assertion by a man of Mr. Crane's standing in the business world, or Mr. Roswell Miller's statement that he spent a year in college and considered it fortunate that it was no more, must be considered exceptional. It is a fact that to-day probably every man in the graduating classes of the really good technical colleges has had an offer of a position from some source having bright prospects of a good future. It is a fact that large employers of engineers endeavor to recruit their entire technical staff from such schools. This must not be understood to imply that the business departments are filled from this source, for every employer recognizes that the technical school graduate is not so well balanced commercially as a young man of the same age who has grown up in business life. On the other hand, there is a growing tendency for the shrewdest of the technical graduates to enter business life, and if Mr. Crane were to take the list of the Engineers' Club of New York and investigate the schooling of the large number of sales agents and other business men who are members of that organization, he would probably find that a considerable proportion of them have attended technical schools and owe their present influential places in the commercial world to their education.

It will be noticed that Mr. Crane makes the same criticism concerning the lack of business ability of technical graduates that was made by President Humphreys, of Stevens Institute, and President Pritchett, of the Massachusetts Institute of Technology, although his language is stronger. Unless all indications are at fault, however, this defect in engineering education is gradually disappearing. It must be recalled that such education is a new thing, only a generation old. It started in a groping way, resting somewhat precariously on the old classical methods of instruction in many subjects and trying to develop other methods for the new subjects. That the result has been a desirable thing for the country and for the young men who took the courses is shown by the lists of graduates issued by the various schools. There can be no question that the technical school enables a young man to obtain to-day a large amount of professional information of direct value which he could not acquire otherwise in anywhere near the same period of time. On the other hand, the young man has often fallen into habits which would have been knocked out of him had he gone to work instead of to technical school. He would not be so afraid of working long hours; from half-past seven to six would not seem tyrannical. He would learn that his time to speak was when he was spoken to, and that there are others beside himself in the world who know something, even if they cannot use logarithms. If he had gone to work in the right kind of a place, he would have absorbed the idea that appearances are of value in this world; he would carry himself erect, wear clean clothes, and be tidy. When he was spoken to he could answer without a long explanation of what he did and did not know. In short, he would have learned something about being a man, which is a hard subject to acquire in any school, with its protecting and restraining environment. But schools are now beginning to take a leaf from the lesson books of the cadets at West Point and Annapolis, they are learning that they must teach something more than formulas if their boys are to escape such criticisms as those of Mr. Crane and many more employers, and the future is bright for the young men whose resources will enable them to enter the best of our technical institutions. The schools as well as their students are learning rapidly.

Improved Macadam.

It is not an uncommon experience in engineering practice to receive suggestions of much value from critics of no technical experience. Being without a knowledge of precedent, they are without that overpowering respect for past accomplishments which is likely to prevent present achievements. The means they suggest for carrying out their projects contribute at times a desirable touch of lightness to a literature with an unfortunate tendency to take on unnecessary weight. Therefore, The Engineering Record has always from motives of both profit and pleasure given due attention to the many suggestions made by amateur engineers.

Some of these suggestions reappear from time to time in the same general form at various places, as regularly as the measles and with about as much visible resultant good. For example, take the oft-repeated proposal for an improved macadam, which will be cheap in first cost, durable in service and inexpensive in renewal. All these benefits will result, it is claimed, from putting macadam top courses on a concrete foundation. The construction of this sort recently recommended by a Milwaukee official for a street subject to heavy traffic was a foundation of 6 inches of concrete, a 2-inch layer of crushed stone, and on top a 2-inch layer of crushed granite. The argument for such a construction was based on the durability of the concrete foundation, the low cost and cementing properties of the bottom course of broken stone, and the freedom from noise and dust of

the wearing surface as compared with asphalt.

This not exceptional argument is worth consideration for the information it furnishes, if for no other reason. It indicates that the asphalt pavements in Milwaukee, like those in other places at times, are not properly cleaned, for if they were nobody would assert that macadam is less dirty than asphalt. The latter is a high-grade paving material; its hard, uniform surface must be swept frequently, for the dirt accumulating on it will otherwise cause annoyance. If there is not enough money to pay for cleaning and maintaining the asphalt, it is nearly as foolish to lay it as to uniform boiler firemen in broadcloth clawhammers. The criticism of asphalt as dirty reveals an entire lack of appreciation of one of its greatest merits, for it is among the most hygienic materials of municipal engineering.

To advocate an impervious concrete foundation for macadam is like recommending pneumatic foundations for a frame cottage. Broken stone roads were of little value until it was learned that water must be kept from their interior and from their base. The rainfall is shed by crowning the surface, by furnishing in the interstices of the bottom course of broken stone ample drainage for the water entering them from above, and by constructing ditches and drains to keep the road dry. A concrete foundation will largely prevent this interior drainage and retain after every storm a quantity of moisture sufficient to cause the stones to wear out more rapidly than with a pervious base. A well built broken stone foundation on a subgrade rolled thoroughly affords a support strong enough for any macadam road and more suitable than any other for this purpose. In fact, some good brick and asphalt pavements have been laid on such bases, although the practice is not to be recommended generally.

Economy of Water Necessary.

When the operations of the Metropolitan Water and Sewerage Board, of Boston, made available a somewhat increased supply and the various towns in the district were connected with the Metropolitan works, a number of the smaller communities, by deeds if not by words, indicated that they regarded the new supply as inexhaustible. Some of these towns allowed their consumption to increase as if each alone had the exclusive use of the full capacity of the great new reservoirs. To counteract this extravagant tendency has been one of the most difficult and delicate duties of the Metropolitan board, and to this end much educational work has been done, by conferences with officials, by instructive illustrated talks before local public gatherings and by use of printed matter. The aim of these efforts has been to show the people not only the wastefulness and danger of the extravagant consumption of water, but the business folly and financial burdens entailed. Along with this moral persuasion, careful inspections have been made, and during the past year or more means for measuring the water supplied to each community have been in progress of installation.

While the use of house meters on all services has not been demanded by the Metropolitan board, the local authorities have been repeatedly urged to exercise all due diligence to reduce waste, and higher minimums have been insisted upon in some of the flat-rate schedules, as for example, the charge for the use of hand hose. The introduction of the Metropolitan supply has resulted in a substantial reduction of the cost of water to many if not all of the communities connected with the system, but with the unreasonable increase in consumption which has taken place, the large additional supplies are already severely taxed. Either this waste must be curtailed promptly or else further extensive works must be undertaken in the near future, with the consequent increased expenditure for construction and maintenance. Indeed the expenditure of several millions of dollars for the construction of the Weston Aqueduct, described in The Engineering Record of October 18 and 25, 1902, and now nearing completion, has been put forward several years by this very cause.

That the gravity of the situation is appreciated by some local officials is indicated by statements in the recent annual report of the Somerville water works. Recognizing at once the inequity and inconsistency of the flat-rate schedule and the urgent need of economy in consumption, Commissioner Frank E. Merrill writes: "Present conditions, however, point to the extension of our meter system as the rational solution of an equalization of the water charges and, at the same time, of a conservation of the water supply. It is generally admitted that the only truly equitable basis of charging for water is that of assessing the consumer according to the quantity that he uses; it is well known, also, that the meters used for measuring water are now so perfected as to be practically accurate in their registration. Under the meter system we should furnish, under our present schedule of fourteen cents per 100 cubic feet, 53,573 gallons of water, an abundant supply for an average family for a year, for the sum of $10. As this quantity represents about one barrel of water per day for each member of a family of five persons, there would seem to be no reason to fear any unsanitary or unhygienic conditions as a result of metering. As a business proposition, it would seem better for the Metropolitan water district, in which Somerville is a factor next in importance to the city of Boston, to restrict the wasteful use of water which we have already procured at so great cost, than to be compelled in a comparatively short time to incur a further large indebtedness for the construction of new works. The general adoption of water meters throughout the district would probably postpone the necessity of further extension of the Metropolitan works for many years."

The unfortunate tendency to extravagance mentioned is probably in a very large measure attributable to the failure of the legislature to incorporate in the Metropolitan water act a provision for basing the charges to the individual municipalities in part upon consumption instead of upon population and valuation solely. The moral effects, too, of enlarging upon the magnitude of new works are, doubtless, frequently other than those desired or expected; and the Boston district is not alone in its experience of having consumption unreasonably increased by the mere fact of the inauguration of a new, and for the time-being, abundant supply.

Steam Economy in Wire Mills.

One of the most important establishments of the American Steel & Wire Company will spend the major portion of this year's appropriation for betterments in remodeling its power plants. The manufacturing is carried on in two independent groups of buildings, several miles apart. Some of the buildings are over half a century old, and part of the power equipment in regular use to-day is in the last stages of senile decay. This establishment manufactures special grades of wire for which it has a world-wide reputation and from which it secures a profit of very satisfying proportions. Its mechanics possess a high degree of skill, its metallurgists are eminent abroad as well as in this country, and its mechanical engineers are among the leading American members of the profession. But its steam plants are something these gentlemen refer only in terms of apology. Two generations ago the managers of that date decided that heavy substantial engines were the proper type and that economy of operation was of relative unimportance in comparison with unquestioned durability. Measured by their tonnage, therefore, the numerous engines of these works have always been satisfactory, but their steam economy is something few ever knew with certainty, and they have been ashamed to reveal the secret. There were no breakdowns and there were abundant dividends, so the directors decided to let well enough alone. In fact the situation was very much like that in some Massachusetts cotton-mill towns a number of years ago, when any one investing in a compound condensing engine thereby immediately acquired local fame as a reckless plunger.

The American Steel & Wire Corporation maintains a system of accounts which shows in course of time the weak financial features of each of the works under its management. Hence it is not surprising that the order has gone forth that the simple non-condensing engines in the establishment in question must be replaced by compound condensing types to secure economy of power generation, and that interminable lines of shafting must give way to electric transmission. Estimated in percentages of total cost of operation, the saving these changes will introduce cannot amount to much, but measured in dollars the sum will be very large. The change illustrates clearly one of the advantages of a central control of similar works, first demonstrated by the success of the head bureau of the allied Solvay works, the advantage derived from a comparison of the cost of performing the same work at widely different localities. Works where the cost is high are notified of the fact, and works where it is unusually low are scrutinized carefully so as to learn the secret and reveal it to all the allied plants.

It is reasonable to expect that the consolidation of management of many of the great steel and iron works will see the same marked decrease in cost of steam power that was brought about in textile mill practice soon after the organization of the New England Cotton Manufacturers' Association, the clearing house of information concerning mill management. When the association was formed, the most economical engine was the simple Corliss condensing type requiring 19 to 20 pounds of steam per horse-power. The publicity given by this organization to the operation of economical steam plants has been a leading factor in the general introduction of high-grade power installations in this industry. The long array of figures it printed finally convinced the most skeptical. In some other branches of manufacture, economy in the use of steam simply does not occur at all. Many readers will recall, for example, the extraordinary waste of fuel found by the late Dr. Emory in the Bayonne refinery of the Standard Oil Company, a corporation not particularly noted for extravagance or wastefulness. Economical engines were installed under his direction at some places, and at others the exhaust from the old engines having low efficiency was employed in heating stills. The result of such relatively inexpensive alterations was a reduction in the

annual consumption of coal from 64,000 tons to about 32,000 tons.

The Engineering Record does not wish to assert that the same degree of economy in the use of fuel is as practicable in wire works as in textile mills. It simply wishes to point out that in at least one large wire mill the management has decided to introduce engines of a type which experience indicates to be as reliable in operation and much more economical in the use of steam. It is not improbable that in more than a fourth of the large manufacturing establishments in the country built over fifteen years ago, an expert steam engineer could find opportunities for improvement of such importance to the annual balance sheet that the owners would be astonished.

Notes and Comments.

The Lease of the Pittsburg, Pa., Water-Works by a syndicate is now under discussion in that city. Just what argument is employed to convince the people that the water will be better and cheaper when the works are run by a business corporation seeking dividends, than it is when they are managed by municipal officers with the sole aim of good results at a minimum cost, remains to be seen.

The Metered Water Consumption in Yonkers, N. Y., affords a particularly interesting subject of study because practically every service pipe in the city is metered. The total pumpage in 1902 was about 221,600,000 cubic feet, measured by plunger displacement without any deductions; while the amount metered was but 56.2 per cent. of this figure. Hence the street-main leakage, and the slip in the pumps and the meters must have amounted to about 44 per cent. of the quantity nominally furnished. From some statements about the condition of the pumping plant in the last annual report of the Commissioners, it would seem that pump slip may be charged with much of this marked discrepancy.

The Importance of Small Savings in a steam plant was strikingly shown by some tests made by Mr. George H. Barrus on an engine operating printing machinery. Just before he was retained in the matter, trouble began to occur whenever full load was thrown on, which only occurs intermittently in such an establishment. At full load, steam was admitted at full stroke and the speed dropped until one or more of the presses was shut down. Investigation showed that the only change in the details of the engine room management had been the adoption of a new grade of oil. Tests under similar conditions, except in the two oils, showed that the trouble was undoubtedly due to the new brand, but the most instructive fact was the demonstration that the marked difference in the running of the engine was due to a difference of only 2 per cent. in the power output. In other words, the use of a different grade of oil was the last straw that broke the camel's back, so to speak, illustrating the importance in some cases of even a trifling saving in power.

Oiling Macadam Roads has been tried in Bombay with but indifferent success, according to the "Indian Municipal Journal." The oil employed was probably a fuel oil, first applied in November of last year. The odor and appearance of the roadway were anything but pleasant while the surface was still damp, but after part of the oil had evaporated and the remainder had worked into the macadam material, these objectionable features vanished. After the first application had disappeared, a second was given the surface, which apparently toughened the materials of the roadway. Experience has shown, however, that the surface is more cut up by wheels than untreated sections of similar streets, and it does not return to a good condition after rainstorms so quickly. This experience again proves the truth of the lesson learned in California when oiling was first tried, that success can only be attained by careful attention to many little details, some apparently trivial.

A Gentle Rebuke, delivered in such a graceful manner that the recipients were made, with some amusement, to feel like naughty children, was administered to the members of the American Society of Civil Engineers at its last semi-monthly meeting by Prof. Mansfield Merriman. After the session was something more than two-thirds over, the second paper of the evening, one on the deflection of beams with variable moments on inertia, was brought up for discussion. It was a mathematical paper, and after a few remarks on the impracticability of presenting such a subject orally, the technical portion of the meeting was about to be closed. At this point, Professor Merriman rose to observe, with some apparent surprise, that such an important paper was allowed to pass without comment. He pointed out that it was a distinctly new contribution to engineering knowledge by a practicing engineer, and that it showed how to compute the stresses in plate girder swing-bridges with an increase in accuracy of 10 to 15 per cent. as compared with former methods. Then to illustrate how easy it is to discuss a mathematical subject in an interesting manner, he called attention to some of the author's discoveries concerning the modification of flexural stresses by shearing stresses. As a brief object lesson in the discussion of a mathematical paper, these few comments were very instructive.

The Proposed Union Building Project for the various national engineering societies and the New York Engineers' Club has advanced a little during the last week. It has been learned that the American Institute of Mining Engineers is not incorporated and has hitherto been very much opposed to incorporation, facts which will have to be remedied before it can take any very important part in acquiring title to real estate either as joint or sole owner. Moreover, Dr. Raymond, secretary of the Institute, has stated that he and the directors of the organization are expressly forbidden to attempt to bind it or to express its views on any subject except by vote of the members, which it is not possible to secure quickly. In some way, however, Dr. A. R. Ledoux, Mr. Charles Kirchhoff and Mr. Theodore Dwight have been selected from the Institute's membership to attend a proposed conference of representatives of the various societies which will discuss the subject more fully; these gentlemen are understood to have no power to express more than their own ideas on the subject of a union building. The American Society of Civil Engineers can do nothing officially toward approval or disapproval of the measure for several months, under its Constitution, as any such matters as the disposal of its present large property or the purchase of other property must be settled by a rather tedious but eminently safe process of letter balloting. It seems possible, however, that the Society will find a means of being represented unofficially at the conference and of assisting its sister societies toward the realization of their aspirations for a home. There is a very strong feeling in the Society, however, expressed forcibly in the letter from Past-President J. J. R. Croes elsewhere in this issue, that the proposition to make the Society a partner in a real-estate venture toward which it will contribute most of the cash and credit, both professional and financial, and yet have but a one-fifth representation in the management of the property, is not particularly business-like. It is of course a fact that the Society's one-fifth share in the proposed building will not be worth so much in cash as its present building and will certainly not be so commodious. The American Institute of Electrical Engineers has appointed Messrs. C. F. Scott, Calvin W. Rice and T. C. Martin as a committee to attend the conference, while Messrs. J. M. Dodge, F. R. Hutton and C. W. Hunt will represent the American Society of Mechanical Engineers. The Engineers' Club will be represented by Messrs. J. C. Kafer, W. H. Fletcher and W. A. Redding.

The South End of the Croton Dam continues to cause the Aqueduct Commission's chief engineer, Mr. William R. Hill, much anxiety. In The Engineering Record of November 30, 1901, there appeared a number of photographs of this part of the structure, which at that time had been partly built according to the first plans. Those plans called for an earth dam with a masonry core, a type of construction which was abandoned by the Commission on the recommendation of Messrs. J. J. R. Croes, Edwin F. Smith and the late Elnathan Sweet, who reported that the great height of the proposed embankment rendered it advisable to go to the extra expense of a masonry structure in order to secure a maximum of safety in this important work. It was felt that a dam which was so essential to the maintenance of the water supply of New York should be of unquestionable stability. The plans were accordingly changed and the core wall which had been laid was torn out. Six weeks ago, Mr. Hill made the startling report to the Commission that the natural limestone foundations underlying this southern end of the dam were more or less disintegrated and so soft in places that the material could be crushed in the hand into sand. He was soon afterward given authority to retain Prof. J. E. Kemp of Columbia University and Prof. J. J. Stevenson of New York University, as a board of advisory geologists to investigate the conditions thoroughly. A fortnight ago their reports were sent to the Commission by Mr. Hill. In certain locations under the core-wall which was partly taken out, the limestone was found to be so soft that it "runs with water like sand," and it is uncertain how far down this disintegration may have penetrated. More recently Mr. Hill stated that he had investigated the foundations for a depth of 45 feet below the level of the old core, and had found no improvement in the material at that depth. He stated that it might prove necessary to remove some of the work on an adjoining gate-house and some other structures and to conduct further geological and engineering investigations. The Commission very wisely consented to this course, and at his request has retained Prof. William H. Burr to consult with him on the whole subject. The main portion of the dam is apparently safely founded on stable material. Two seams of soft rock were found during its construction and properly treated, but there is no ground for suspicion that there will be any leakage under this portion of the dam. The Commission and Mr. Hill are certainly acting cautiously and commendably in this matter, in view of the result of the undermining of the limestone foundations of the Austin dam.

Power Plant of the Government Printing Office at Washington.

PART 1.—BOILER PLANT.

One of the most interesting developments that have been made in conjunction with the erection of the new Government Printing Office, at G and North Capitol Streets, Washington, D. C., is the enlarged power plant, adjoining the new edifice, and designed to serve both the new establishment and the old, adjacent printing plant. In the first place, it has a steam plant that has been laid down somewhat along the lines of marine practice, marine-type boilers with corrugated furnaces and individual economizers vertically over the smoke uptakes having been installed. The engine room contains four cross-compound direct-connected electric generating units, all run condensing and aggregating in electrical output at normal rating 1,625 kilowatts. While steam is required in the buildings for heating, it was deemed advisable to supply the heating apparatus during the five months or so that artificial warming is necessary with reduced pressure live steam and operate the steam engines condensing throughout the year, particularly as the amount of water demanded for house purposes is practically that which effects condensing. Among the more important features of the plant are the use of what are virtually ring steam mains, for both the main units and the auxiliary machinery; ample free area about the various machines and apparatus, the boiler room being conspicuous for light and ventilation; ready accessibility of white-painted basements under both the boiler and the engine rooms, making for easy control, inspection and repair of apparatus and piping at that level; an elaborate switchboard in the engine room; and a notable amount of attention to general workmanship and decoration to allow the plant to stand as an exhibition one, viewed from a gallery entered from the main or second floor of the new printing building. A noticeable point of the plant is the limited use of automatic controlling devices.

The power house is a brick building, 112x131 feet in plan with a longitudinal partition, making the boiler room 53 feet 2 inches wide and the engine room 58 feet 10 inches. The walls rest on a concrete footing on the firm sand of the site and enclose the steel columns which carry the roof trusses. The roof consists of corrugated iron sprung in arches between I-beams and covered successively as follows: Cinder concrete, cement mortar, asphalt mastic and glazed tiles. The tiles are bonded to the concrete and the interstices around them are filled with cement grout. The interior walls are of white glazed brick in the engine room for 9 feet above the floor and of red face brick above. The members of the roof trusses and an electric traveling crane overhead are painted a medium shade of green, standing out in pleasing contrast with the general interior. The gallery floor and that of the engine room along the outside wall and in front of the switchboard is of marble mosaic, arranged in figured panels. The rest of the room is separated by a brass railing, and the flooring on the inner side of the rail, and surrounding the machinery is of cast-iron diamond-grooved plates. The brick walls of the boiler room are white-washed and the floor is of vitrified brick. There is a monitor to the roof of each room, with the top entirely of glass.

The boiler room contains eight Scotch type boilers set in two rows facing each other and leaving a central gangway from end to end of the boiler room 21 feet wide. Four of them comprised the old plant, and they are all of the same size, 12 feet in diameter and 13 feet long. They contain two Morison corrugated furnaces 45 inches in minimum inside diameter and 236 3-inch outside diameter wrought-iron tubes about 10 feet 2 inches long. Of the tubes 68 have screwed ends and an inside diameter of 2.594 inches and 168 are plain and 2.782 inches in internal diameter. The total heating surface of each boiler amounts to 1803.2 square feet, distributed as follows: Furnaces, 127; combustion chamber, 151.3; tubes, 1,524.9. As each boiler is rated at 300 horse-power, 6 square feet of heating surface are regarded as the horse-power equivalent, which means an equivalent evaporation from and at 212 degrees Fahrenheit of 5¾ pounds of water per hour per square foot of heating surface. The furnaces are equipped with McClave shaking grates of 54¼ square feet per boiler, so that the heating-grate surface ratio is 33¼ to 1. The boilers were built by the I. P. Morris Company, of Philadelphia.

The boilers are hand fired with a West Virginia bituminous coal, and under actual every day running conditions, they evaporate 10 pounds of water per pound of coal, with steam at 120 pounds pressure, and water delivered to the economizers at 180 degrees Fahr., the coal being weighed as wheeled into the room and the feed-water metered on the discharge side of the feed pumps. The main supply of steam is taken through an 8-inch dry pipe in the top of the boiler, the dry pipe containing 285 ¾-inch holes on 1½-inch centers. The boilers are served by a self-supporting steel-plate smoke stack 150 feet high, and 9 feet in diameter at the top. This is carried on a granite top, brick foundation 24 feet square and 19 feet deep, and the stack is flared out at the bottom to 17 feet where the anchor bolts are located. It is lined within 30 feet of the top with fire brick. Though designed for the earlier plant, its performance to date proves that it is able to handle without the assistance of mechanical draft the maximum demand made upon it. Just below the cap, the stack can be illuminated by a belt of incandescent lamps encircling the outside. Outside one end of the boiler room coal storage has been provided in the basement of the new building with a space for about 1,200 tons. It is weighed in wagons on delivery and again in wheelbarrows on being carried into the boiler room.

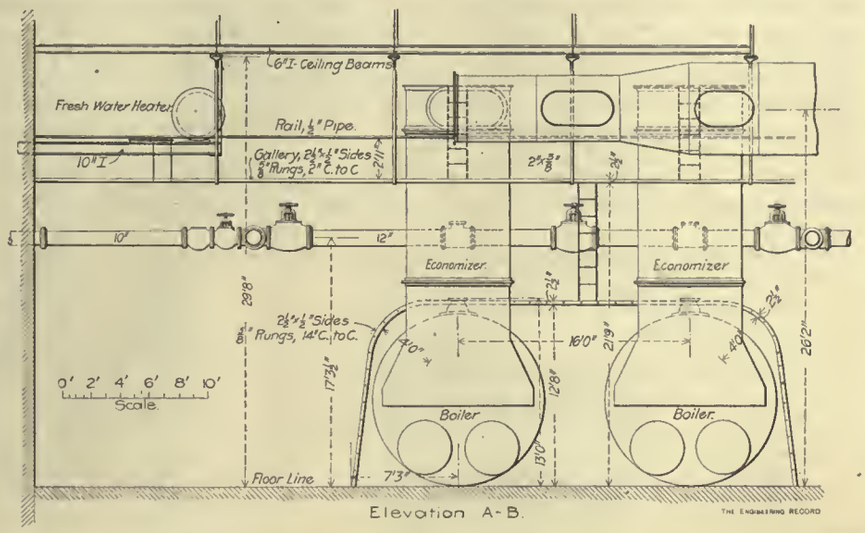
Feed water is taken from two return tanks in the boiler-room basement, one at each end of it, water being received from the heating system returns, from the condensers of the refrigerating apparatus and from the city mains, the water from the latter source being admitted from an Albany water filter under control of a ball float, when the water level in the tank drops. The returns from the heating system, it will be remembered, are condensed live steam which has not come in contact with oil. There are four feed pumps at each end of the basement, of the Worthington duplex type, 6x4x6 inches in cylinder dimensions, each capable of feeding one boiler. The description of the piping for the four of the recent installation will apply for the older group, which differs from the new only in general arrangement. They draw from a common 6-inch header and discharge into a 4-inch header which runs to the outside boiler house wall, rises into the boiler room to a feed-water heater, and is then carried overhead in that room to a point in the center line of the building. The discharge from the older group of pumps is brought to a point symmetrically situated at the other end of the line. Between the two is run a 4-inch feed main which can thus be fed at opposite ends from any one of the corresponding set of pumps. This forms the feed header, which has a cross opposite each pair of facing boilers, the side outlets of the crosses being connected to the boilers. At each boiler this branch feed pipe can supply water either through a connection direct to the boiler or through a pipe leading to the economizer, each connection with a stop valve. Beyond these connections, the feed branch has a dead end upturned about three feet to act as an air chamber to absorb the shocks of pumping, reliance for the necessary amount of air being had on that carried in solution by the fresh feed. Another valve is provided in the feed line, with a long stem ex-



GOVERNMENT PRINTING OFFICE, WASHINGTON.

tended within reach of the fireman for regulating the supply to the corresponding boiler.

The steam for the feed pumps is taken from an auxiliary system of steam mains. From an outlet on each boiler, behind the main outlet, a 3-inch pipe, fitted with two valves, rises to a 3-inch main which runs around the boiler room full size, constituting the auxiliary ring main.

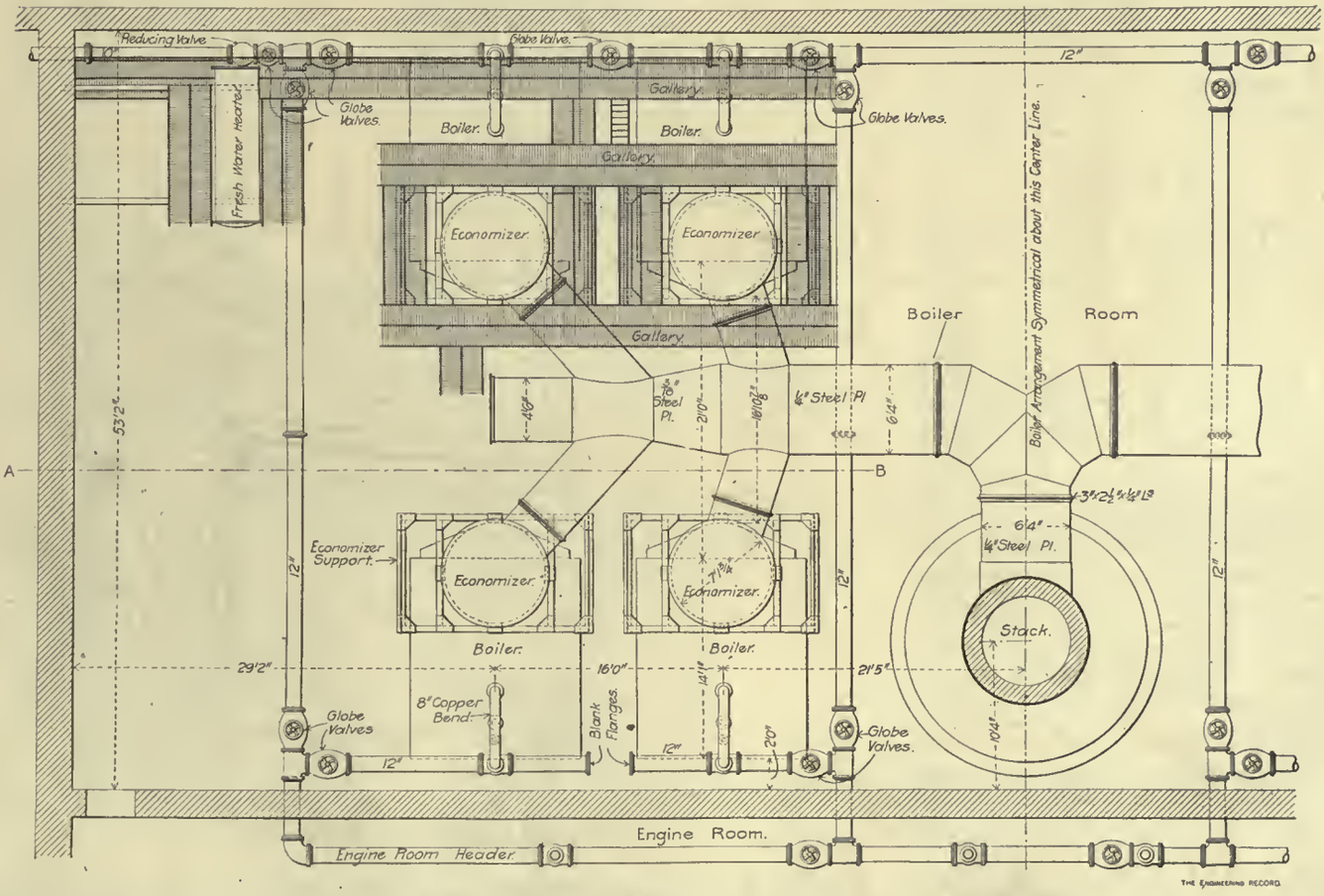


Elevation A-B.

heaters, located overhead in the boiler room. All other pumps are electrically driven.

The economizer is vertical, 7 feet in diameter and 10 feet 6 inches high. It has no bypass, so that all the products of combustion must rise through it to a smoke bonnet, 3 feet high. It is built with ⅞-inch shell and heads, of steel plate having a tensile strength of about 60,000 pounds per square inch, and the shell is composed of two plates with double butt strap vertical joints. There are 305 tubes 3 inches in diameter and 9 feet long, so that there is a tube heating surface in the economizer of about 2,155 square feet and a tube area for the passage of the products of combustion of about 15 square feet. The outlet area of the smoke bonnet into the breeching is 8 2/3 square feet, and is provided with a damper under hand control. The feed piping to the economizers is of 3-inch wrought-iron pipe, but the connection from economizer to boiler is of 4⅜-inch copper tube, No. 5 B. & S. gauge. Around the bottom of the economizer is attached a cast-iron gutter to catch the mud removed from the economizer in cleaning; and overhead, attached to the roof trusses, is a short length of track carrying a trolley hand chain hoist for removing the bonnet to clean the economizer. These hoists, of which there is one for each of the new boilers and one for each pair of the old boilers, are not allowed to be removed under any circumstances, so that they are always at hand for any emergency. The economizers are supported independently of the boilers by a substantial steel-frame structure, four heavy lugs riveted to the economizer shell, bearing on 12-inch 32-pound I-beams carried by columns formed of four 6-inch Z bars of ⅝-inch metal. This structure also carries a track, trolley and chain hoist for lifting the doors in front of the smoke uptake, for cleaning tubes.

The choice of this type of boiler has required the use of circulating pumps for drawing water from the bottom water spaces of the boiler and delivering it to the economizer, with the result that the economizer is practically at a part of the boiler and the water in it is at nearly the temperature of the water in the boiler. There are eight circulating pumps of the Worthington duplex pattern, 7½x5¼x10 inches in size, one for each boiler, set as are the feed pumps on glazed brick settings. They are located in pairs at the ends of the two rows of boilers, each pair, however, cross-connected to serve either of the adjacent pair of boilers.



BOILER ROOM OF THE GOVERNMENT PRINTING OFFICE, WASHINGTON.

Near the points where the reducing-valves and heating supplies are taken from the 12-inch live-steam main, a branch, full size, is dropped from the auxiliary main through the boiler room floor into the basement below. The supply to the four feed pumps at each end of the building is, however, controlled in the boiler room, by a short header connected with this drop main, with the four steam supplies, valved near the header, passing downward from the header to the basement. The exhaust from the feed and the boiler-circulating pumps is utilized in two Baragwanath closed type feed-water

In the center of the boiler-room basement, some space has been utilized to locate a crematory for burning the refuse from the printing office that cannot be disposed of in any other way. This amounts to considerable and has a high thermal value. There has accordingly been installed in the crematory a shell boiler 3½ feet in diameter and 10 feet long for heating water

for the whole building, and it has thus far been found fully equal to the requirements. It has a capacity of about 725 gallons and is connected with the house tanks in the loft by a 3-inch pipe, so that it is under a pressure corresponding to the static head of the tanks, about 60 pounds per square inch, and supplies the hot-water system of the building, without pumping, by a 3-inch pipe. There is, of course, a circulating pipe, to avoid the water getting too high in the boiler and to keep the entire system warm; and a relief valve is provided to prevent an excessive pressure under the possibility of steam formation. The refuse is wheeled into the boiler room and dumped down a chute near the crematory firing pit. The grate, which is supported on 6-inch I-beams, is about 43 inches wide and 86 inches deep, giving an area of about 25 square feet. The smoke is carried from the top at the back in an 8-inch pipe joined with the main smoke breeching in the boiler room. The crematory thus consists of a brick chamber, having a grate and carrying by lugs a tank of water around the outside of which the products of combustion pass. The exposed walls are of glazed brick.

The steam plant was designed by Mr. H. K. Collins, chief engineer of the Government Printing Office, and the switchboard and electric distribution by Mr. W. H. Tapley, electrical engineer of the Printing Office. This work so far as it affected the power house construction was done under the supervision of Capt. John Stephen Sewell, Corps of Engineers, U. S. A., who had charge of the construction of the new building, and of Hon. F. W. Palmer, the public printer and head of the Government Printing Office.

(To be continued.)

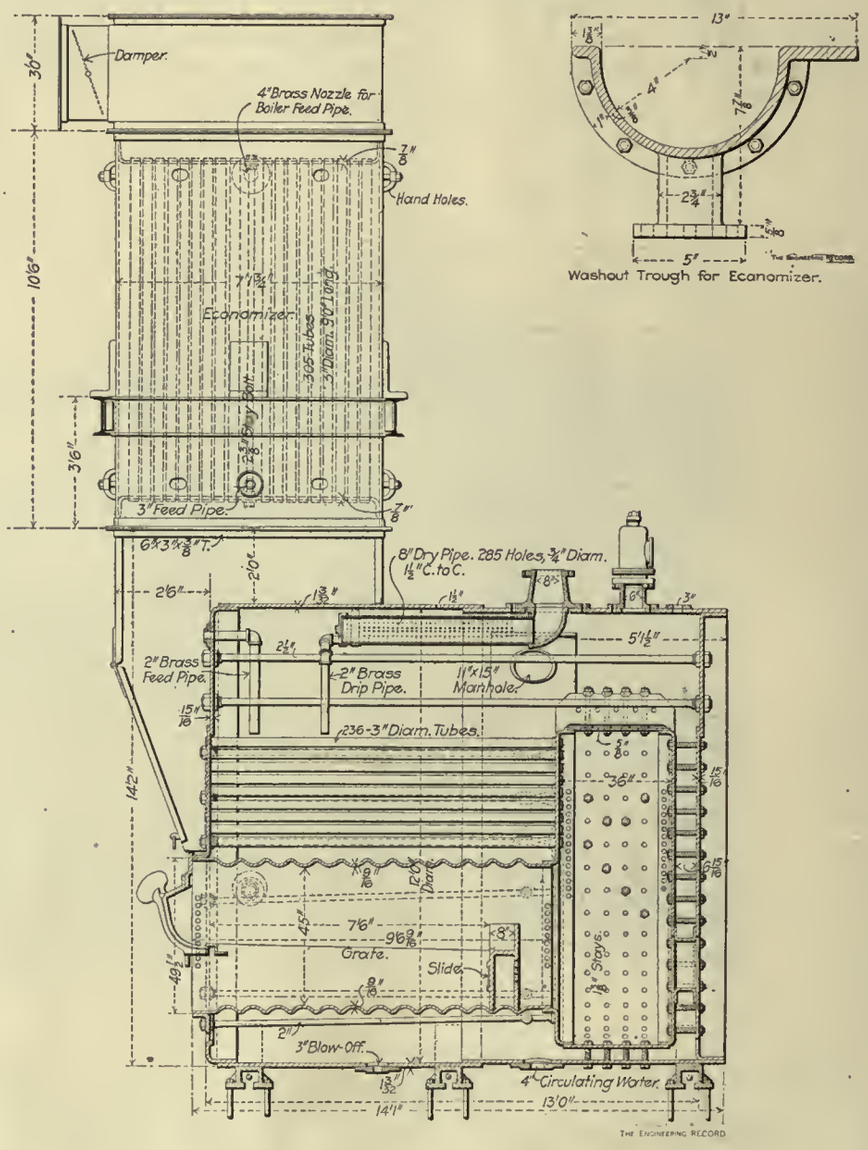
Mr. Carnegie on the Carnegie Steel Company.

Extracts from his address as President of the Iron and Steel Institute of Great Britain.

Looking over the list of your presidents, their successor is struck by the value of the service they have rendered. Great names are there, among them the chief inventors and pioneers in iron and steel—Bessemer, Siemens, Bell and others, whose names are household words. There is scarcely one who has filled the office who has not been able in his inaugural address to deal with a branch of the subject as perhaps the recognized first living authority upon it. Several have announced and described in your proceedings their own inventions which made them famous. What a contrast the present occupant presents, who has no shadow of claim to rank either as inventor, chemist, investigator or mechanician. None know so well as you, fellow members, that his attention has been centered upon the business department, and that it is experience in this alone which entitles him to address you. It is the department which differs most, perhaps, from any other: at least an American humorist gives it as his opinion that the business instinct can no more be instilled in men by teachers than the homing instinct could be developed by feeding them upon pigeon pie. I invite your attention this morning, therefore, to the important question of the organization and management of that most complicated of all pieces of machinery—man—which has been my province.

Great as is the contrast between the pioneer and the modern manufacturing plant, it is scarcely less between the business methods of the past and the present. Both have changed, and changed for the better, in the unceasing march of improvement.

It is to Britain we must come for the starting point, for here the iron industry began through the operation of her own inventions. We note how individualistic the various organizations were which established the manufacture. No trace of the corporation is seen, for that came later. Brown, Cammell, Jessop, Frith and others were the first captains of the industry, chiefly of the mechanical rather than the commercial order, and most of them, I believe, had worked with their hands in youth. Bessemer, Siemens, Thomas and others came later. It is not strange that the inventive and mechanical should have taken precedence of the commercial element in the beginning, since upon these success primarily depended. When the joint stock form came the business element naturally took first place.



Boiler and Economizer in Printing Office.

It may be doubted whether the superintendent of any works under joint stock management in these early days had a seat on the board or any reward beyond a fixed compensation, or was called to the main office for counsel upon any question not strictly mechanical. Probably there was not one foreman or important man recompensed in any form beyond fixed salary. The admission of young partners without capital was unheard of. The joint stock form does not lend itself readily to the substantial recognition of exceptional service from the exceptional man, or of payment based upon results in departments, yet it is in this direction that the most important changes have come in the business department.

Speaking from experience, we had not gone very far in manufacturing before discovering that perfect management in every department was needed, and that this depended upon the men in charge. Thus began the practice of interesting the young geniuses around us, as they proved their ability to achieve unusual results—the source of big dividends. These received small percentages in the firm, which were credited to them at the actual cash invested, no charge being made for good will. Upon this they were charged interest, and the surplus earned each year beyond this was credited to their account. By the terms of the agreement three-quarters of their colleagues had the right to cancel it, paying the party the sum then to his credit. This provision was meant to meet possible extreme cases of incompatibility of temper, or if the recipient should prove incapable of development, or of enduring prosperity. At death the interest reverted to the firm at its book value. The young men were not permitted to assume any financial obligation, and not until their share was fully paid by the profits, and there was no further liability upon it, was it transferred to them. Thus thoughts of possible loss never prevented concentration upon their daily duties. They were not absorbed in the daily quotations, for the shares were not upon the

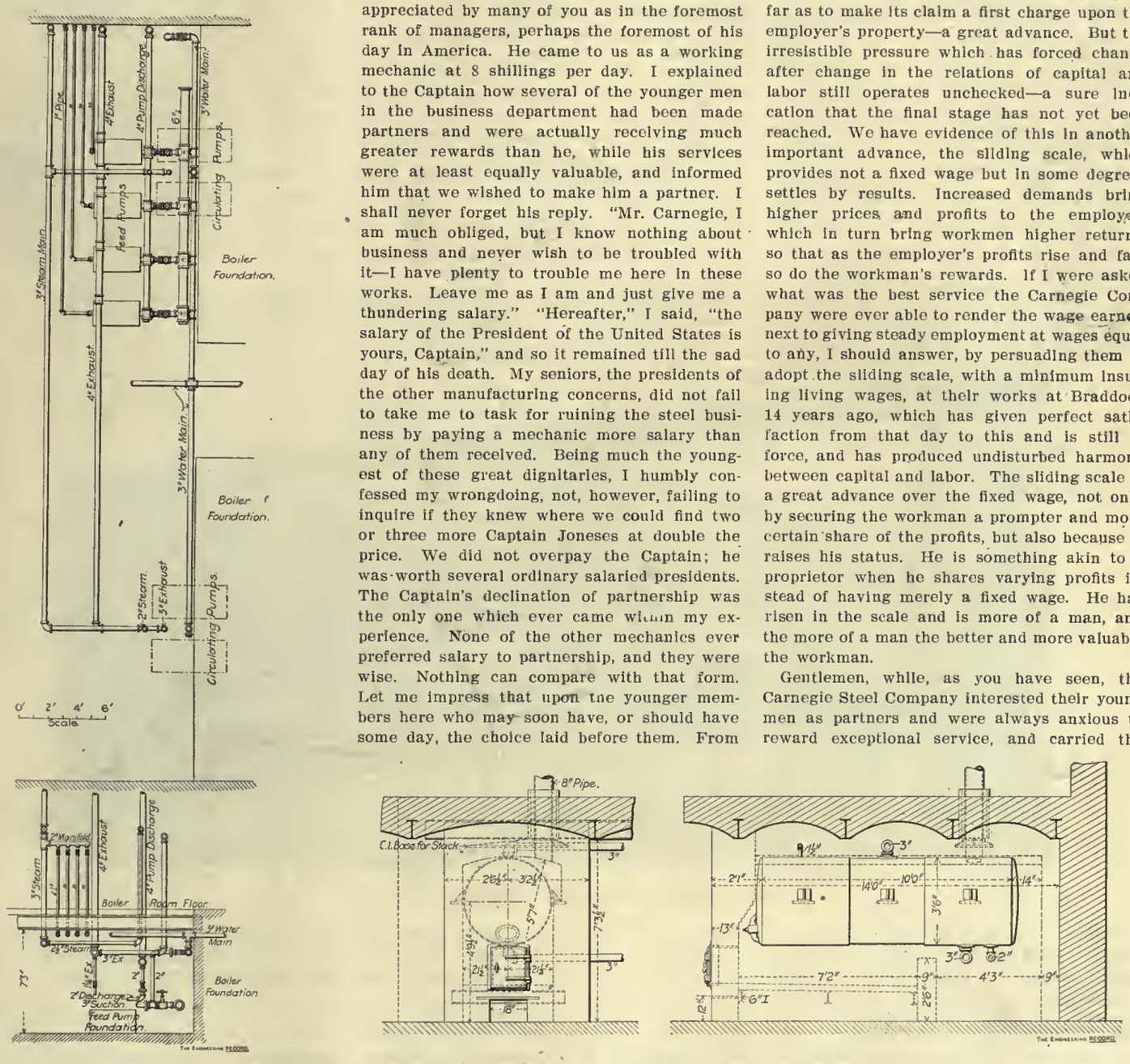
stock exchange or transferable. This policy resulted in making some forty odd young partners, a number which was increased at the beginning of each year.

By this plan they were rapidly paying for their interests and promising to become the millionaires of the then seemingly somewhat distant future, which, however, proved not so very distant. They are now rich men. You will not fall, however, to note that the plan kept them all in excellent training, as poor men still living upon their salaries, millionaires to his family and to himself arise. Money is properly only the means to an end.

We did not fail to see, as the works enlarged, how much success depended upon the mechanical men, the superintendents and foremen, yet not one of these had up to that time been admitted as partner. The business and the mechanical men—office and mill—were still widely separated. Well do I remember the first attempt to bring these two departments into closer relations. It was made with our Captain Jones, one of your members, well known and appreciated by many of you as in the foremost rank of managers, perhaps the foremost of his day in America. He came to us as a working mechanic at 8 shillings per day. I explained to the Captain how several of the younger men in the business department had been made partners and were actually receiving much greater rewards than he, while his services were at least equally valuable, and informed him that we wished to make him a partner. I shall never forget his reply. "Mr. Carnegie, I am much obliged, but I know nothing about business and never wish to be troubled with it—I have plenty to trouble me here in these works. Leave me as I am and just give me a thundering salary." "Hereafter," I said, "the salary of the President of the United States is yours, Captain," and so it remained till the sad day of his death. My seniors, the presidents of the other manufacturing concerns, did not fail to take me to task for ruining the steel business by paying a mechanic more salary than any of them received. Being much the youngest of these great dignitaries, I humbly confessed my wrongdoing, not, however, failing to inquire if they knew where we could find two or three more Captain Joneses at double the price. We did not overpay the Captain; he was worth several ordinary salaried presidents. The Captain's declination of partnership was the only one which ever came within my experience. None of the other mechanics ever preferred salary to partnership, and they were wise. Nothing can compare with that form. Let me impress that upon the younger members here who may soon have, or should have some day, the choice laid before them. From Where it was impossible to decide the limits of a department, the managers were rewarded by handsome bonuses beyond their salary, based upon the general profits of the year. Thus, as a rule, every man in authority became more than a mere wage earner. He felt himself on the first step of the ladder which led to partnership sooner or later, and was worth any two mere employes paid only a daily or monthly wage and denied special recognition.

Labor is worthy of its hire and is now paid this in coin, the law in many lands going so far as to make its claim a first charge upon the employer's property—a great advance. But the irresistible pressure which has forced change after change in the relations of capital and labor still operates unchecked—a sure indication that the final stage has not yet been reached. We have evidence of this in another important advance, the sliding scale, which provides not a fixed wage but in some degrees settles by results. Increased demands bring higher prices and profits to the employer, which in turn bring workmen higher returns, so that as the employer's profits rise and fall, so do the workman's rewards. If I were asked what was the best service the Carnegie Company were ever able to render the wage earner, next to giving steady employment at wages equal to any, I should answer, by persuading them to adopt the sliding scale, with a minimum insuring living wages, at their works at Braddock 14 years ago, which has given perfect satisfaction from that day to this and is still in force, and has produced undisturbed harmony between capital and labor. The sliding scale is a great advance over the fixed wage, not only by securing the workman a prompter and more certain share of the profits, but also because it raises his status. He is something akin to a proprietor when he shares varying profits instead of having merely a fixed wage. He has risen in the scale and is more of a man, and the more of a man the better and more valuable the workman.

Gentlemen, while, as you have seen, the Carnegie Steel Company interested their young men as partners and were always anxious to reward exceptional service, and carried the



Feed Piping and Crematory in the Government Printing Office at Washington.

in posse, indeed, but not in esse—quite a difference, for millionaires seem liable to develop when still very young so many hitherto unsuspected weak spots in their constitutions requiring careful nursing, and many absences and short hours, and a dozen other impediments to hard, continuous exertion, that it does not seem good for their robust health that they should be unduly burdened before reaching middle age. The zest of the chase is over too soon. It will be found the exception when a millionaire employe strains himself unduly by overexertion in the mill or office, nor should he be expected to do so. He has earned the right to some leisure for self improvement. When a man has achieved a competence, new duties that time forward the union of the mechanical and business partners went steadily forward until no manager of a mill was without his interest in the business, as pertaining to the position, and no board of management, or important committee, was without a mechanical representative. Thereafter mill and office conferred upon all important sales or contracts. The mechanic and the man of affairs were in constant consultation and fellow partners—one of the most profitable changes that ever we made.

There was another step taken in the same direction. Men having others under their charge, were given an interest in the proceeds, or savings in cost, in their department, bonus system to an extent, perhaps, unknown in any similar organization, the masses of the ordinary workmen could not be embraced under the limited partnership form even if it had been thought desirable that their savings should be so invested. The objection to this from the point of view of the workman, which always arose in our minds and which we were never able to surmount, was the sad and instructive history of the largest manufacturing concerns, especially those of iron and steel.

Bearing all this in mind, the thought of asking the workingman to risk his precious savings in the manufacturing or any form of business was always discarded by us as too dangerous for him. He was advised to buy a

home instead and save his rent. To facilitate this, money to build a home was lent to any of the employes who had the ground clear of debt. Their savings up to $2,000 each were taken by the company and placed in a special trust fund, entirely separate from the business. Interest at 6 per cent. was allowed, to encourage the workman to save part of his earnings for old age. The funds received were lent upon mortgage on real property, generally to such workmen as wished to build homes. It was believed that this was the safest, and therefore the wisest, use of their savings which workmen could make.

The most convincing proof of the steady march of labor to recompense more and more based upon profits, and in forms drawing capital and labor into the peaceful bonds of mutuality, is to be credited to the United States Steel Corporation, the largest of all industrial corporations, and for which they deserve unstinted praise, as proving a genuine interest in the workmen and sagacious thought for their own.

To this step I invite your earnest attention, for it may well prove of surpassing importance and mark an epoch in the history of the relations of capital and labor. It may even be looked back to as having furnished the solid foundation for the solution of most of the troublesome questions between them.

It is in this form: Twenty-five thousand of the $100 shares of preferred 7 per cent. stock were offered to their 168,000 employes at $82.50 per $100 share, in different amounts according to their earnings, which were subscribed for twice over; nearly one-sixth of the men subscribed—one-half being salaried men. Twenty thousand more shares of stock were afterward provided, making 45,000 in all, worth about $4,500,000. Monthly payments are received. Another distribution of shares is intended next year.

One valuable and praiseworthy feature is that for five years those holding their shares and still in the service are given a yearly bonus of $5 upon their shares, and during a second five year term a bonus, amount not yet fixed, is promised. The third feature equally praiseworthy is the resolve to set apart yearly from earnings, should these exceed $80,000,000 (say £16,000,000), 1 per cent. of the earnings, and for each $10,000,000 (£2,000,000) of earnings an additional one-fifth of 1 per cent., for a fund to be awarded to such of their officials and men as have in the opinion of the Finance Committee best deserved it, as a reward of merit and not pro rata. Such is the scope of this perhaps epoch-making advance which is rendered possible by the joint stock form with shares in small amounts, easily distributable among many thousands of workmen.

It will be noted that the investment is at the risk of the men. This seems a feature which we may, however, expect the corporation to change as experience is gained, as the plan is most wisely stated to be subject to future changes. In most of the States of the Union labor's precious earnings, surely the most precious of all capital, are a first charge upon property, and this I believe the only safe policy to follow. "Every workman a shareholder" would end most of the conflicts which sadden us between capital and labor. To effect this every corporation could well afford to offer to distribute part of their shares among the saving workmen, and, in case of disaster, give preference to repayment of principal as first charge. Any desired legislation with proper safeguards could be readily obtained authorizing corporations to make savings of employes up to a certain sum for each a deferred claim, ranking before mortgage or ordinary debts or the claims of shareholders, akin to the Mechanics' Lien and the Homestead exemption laws. This seems due to the workingman, who, necessarily unacquainted with business, takes his shares upon trust and becomes the beneficiary or the victim of his employers. He should be considered as an inexperienced youth in the affair; besides, he is asked to invest not solely for his own, but at least equally for the advantage of his employer. His adviser is not a disinterested party and therefore cannot be absolved from responsibility, which would, I am confident, lead the owners of the United States Steel Company to save their trusting workmen from loss through following their advice, intended to promote the mutual advanatage of the company and the workers. The responsibility is not small, since the circular assures the workmen they are offered "a safer and more profitable investment than the workman could possibly find for his savings elsewhere." Much better, therefore, that legal form be given to the moral claim.

Types and Details of Bridge Construction.—VI.

By Frank W. Skinner, C. E.

Arch Trusses.

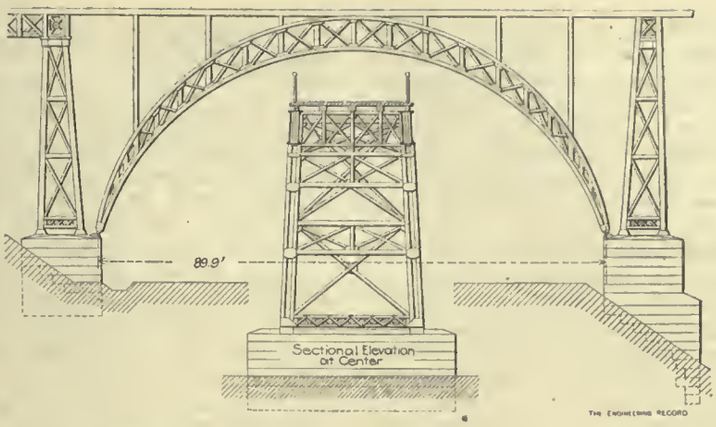
The Carlsburg Viaduct, Denmark, was described in "Engineering," London, July 14, 1899. It has two two-hinge steel truss arch spans, one of which has a length of 90 feet and rise of intrados of 38 feet, and the other has similar but smaller proportions. The intrados and extrados have different centers in the same vertical line, so that their curves intersect near the skewback pins and the chords have a crescent-shaped outline, and are divided by vertical members into X-braced panels of equal length but unequal horizontal projection. The trusses are battered, and are connected by sway brace frames in vertical transverse planes and by stiff lateral bracing in the plane of the lower chords. All connections are riveted except at the skewbacks, where castings are flange-bolted to the ends of the trusses and have open bearings for the horizontal hinge-pins which engage cast pedestals beveled transversely to correspond with the inclination of the trusses and seated on masonry surfaces normal to the center lines of the trusses. The 14½-foot roadway is supported from the arch trusses by six bents of battered posts continuous across the trusses to the lower chords, and X-braced between the trusses and the floor-beams.

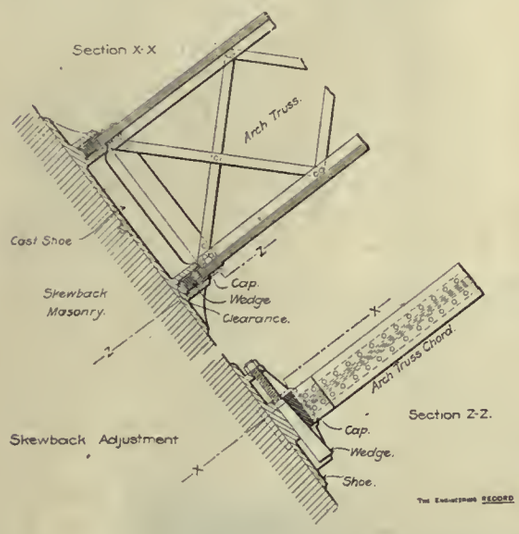


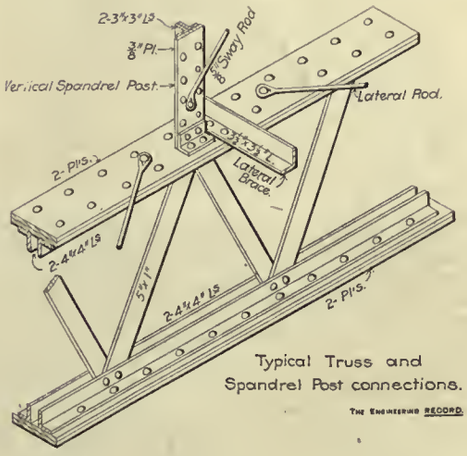
THE RIVERSIDE CEMETERY BRIDGE, CLEVELAND.

The Riverside Cemetery bridge at Cleveland, Ohio, was described in The Engineering Record of April 20, 1901. It has a graceful center span with two arch trusses in vertical planes which support at the crown and spandrel posts four equal spans of lattice girder roadway stringers about 60 feet above the water. The

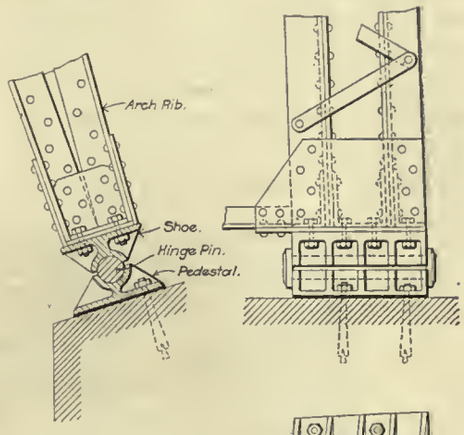
two-hinge arch trusses are 142 feet long, 27 feet rise and 20 feet apart on centers and are 2 feet deep at the ends and 5 feet deep at the crown. The chord angles are accurately bent to parabolic curves, and are connected by solid web plates at the ends and by X-bracing between the haunches. The diagonal members in the trusses and in the roadway girders are pairs of angles riveted together back to back to make T's with their webs turned outwards so that their flanges clear at intersections and are riveted there and at the ends to connection plates with tangentially curved edges. The 6-inch skewback pins have full hole bearings in the rounded ends of the trusses and in the



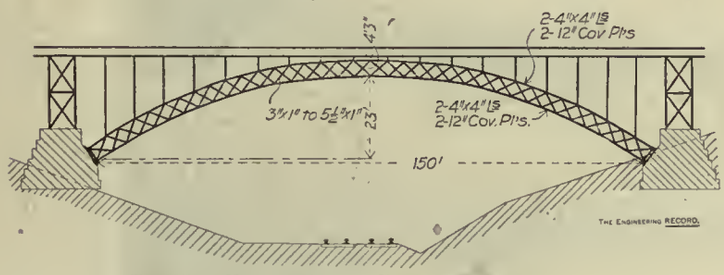




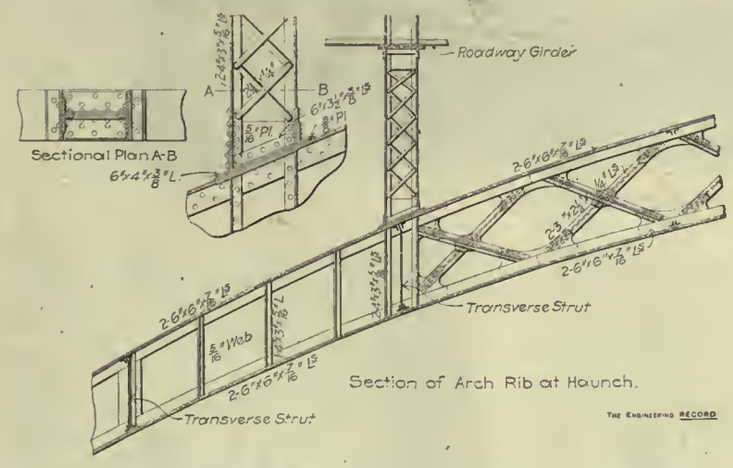
Typical Truss and Spandrel Post connections.



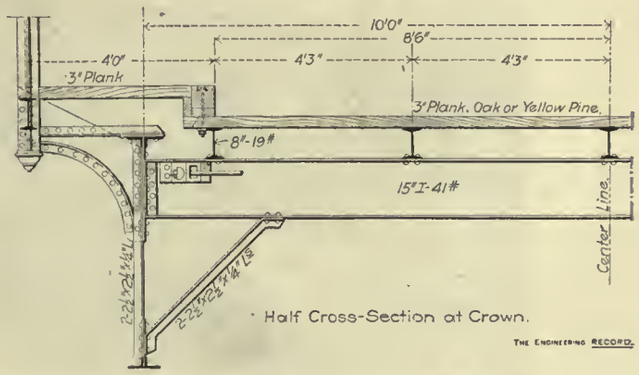
THE CARLSBURG VIADUCT, DENMARK.



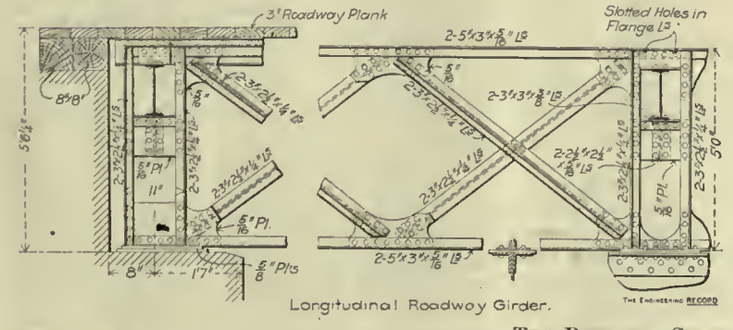
THE OLD FORBES STREET BRIDGE, PITTSBURG.



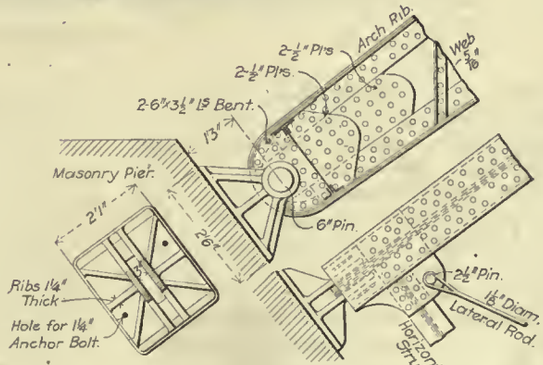
Section of Arch Rib at Haunch.



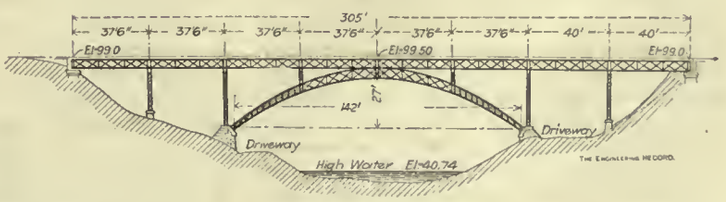
Half Cross-Section at Crown.



Longitudinal Roadway Girder.



Skewback Hinge.



THE RIVERSIDE CEMETERY BRIDGE, CLEVELAND.

DETAILS OF CARLSBURG VIADUCT AND OLD FORBES STREET AND RIVERSIDE CEMETERY BRIDGES.

cast pedestals seated on inclined pier surfaces normal to the center line of the truss. The trusses are sway braced by thirteen lattice girder struts in vertical planes. Their flanges are in the planes of the truss flanges, and have oblique connection plates bent on opposite sides of their webs. They are X-braced in all panels by pin-connected top and bottom lateral rods.

The spandrel posts have oblique base plates riveted to the top flanges of the trusses and horizontal cap plates riveted to the roadway girders. The roadway trusses are rigidly connected to the arch trusses at the crown, and have sliding seats on the abutments, the vertical posts on the skewback piers being rocker bents with top and bottom pin connections. The 15-inch floorbeams, 12½ feet apart, are supported at the ends of the roadway girders on horizontal flange angles riveted to tie plates connecting the end verticals of adjacent girders; at intermediate points they are web-connected to the vertical members. They have knee-brace angles to the lower flanges of the girders, and holes through the upper parts of their webs for the screw ended lateral rods, with adjustable nut bearings on convex washers seated in concave vertical angle plates. The sidewalks are carried outside the roadway girders on brackets, in the planes of the floorbeams, peculiar for their oblique web plates and their anchorage to the top flanges of the girders.

The old Forbes Street bridge, Pittsburg, was described in The Engineering Record of July 15, 1899. It had a 150-foot segmental arch span with three light lattice girder ribs 13⅓ feet apart. These had parallel flanges 51 inches apart with a rise of 23 feet and were braced together by light struts and diagonals in the plane of the top flanges only. The transverse struts were single small angles, and the diagonals were slender rods with flattened ends with one small rivet in each. The vertical spandrel posts had T-shaped cross sections made with single bars or pairs of angles and web plates, and were riveted to the top flanges of the arch trusses with single oblique angle clips. They carried three lines of longitudinal 12-inch I-beams supporting the wooden floorbeams of the double plank roadway and the cantilever sidewalks.

The arch trusses had no hinges, and their ends were cut off square on radial lines. The ends of the chords engaged cast-iron blocks with beveled bearings on transverse horizontal wedges between the flanges of cast-iron abutment plates. The plates were bolted to the inclined pier masonry, and each received both chords of one arch rib. The wedges were arranged to be moved by screws to adjust the arch ribs, probably for making the center joint in erection. The bridge was built in 1874, and after 24 years' use was replaced by a plate girder arch.

The Brooklyn-Brighton viaduct, Cleveland, O., has a 29½-foot roadway and two 7-foot sidewalks, and consists of a long trestle with 28-foot towers and 56-foot connecting spans and one 168-foot main arch span. This has two peculiar three-hinge arch trusses in vertical planes 26 feet apart on centers. The lower chords are composed of chords of a circular arch with a rise of 48 feet and a height of about 73 feet above water level. The top chord is horizontal for 42 feet each side of the center, and thence slopes at an inclination of about 45 degrees to its intersections with the vertical end posts 19½ feet long. The trusses are 7½ feet deep at the center and 19½ feet deep at the ends of the horizontal portions, and are divided in twelve 14-foot panels by vertical posts, with single diagonals in each panel. All panel points are pin-connected and all web members except the vertical posts at the ends and haunches have I-shaped cross sections made with two pairs of angles riveted together back to back and latticed. The other vertical posts and the top chords are made with pairs of channels, latticed.

The bottom chord is the principal member, and has a trough shaped section made with 20-inch web plates, a 24-inch bottom cover plate and 3½x3½ and 5x3½-inch angles. It is made in single panel lengths with beveled butt joints spliced with web plates and bent bottom cover plates. All its pins are below the center line of the web, and at the crown there are half hole bearings with wedge-shaped clearances above and below. The pins at the center and ends of the bottom chord are 6 inches in diameter; the remainder of the bottom chord pins and those at the hip points are 5 inches, and the other top chord pins are 4 inches in diameter. The skewback pins engage full holes in the ends of the lower chords, vertical posts and cast-iron pedestals. The pedestals have one web in the plane of the axis of the pin and lower chord, and three webs at right angles to it, and have bases about 4 feet square seated on the inclined surfaces of masonry piers 24½ feet high.

The end vertical posts are continuous above the top chords to the roadway level and carry one end of longitudinal roadway girders, which are supported at the opposite end on the top chords of the arch trusses, at the hips. The bottom chords of the arch trusses are connected by transverse struts at panel points and by X-braces in every panel, all of which are made with I-shaped cross sections with two pairs of angles back to back, latticed, and have riveted connection plates engaging their flanges and the chord flanges. The top chords are X-braced by single angles, but have no transverse struts. The 42-inch plate girder floorbeams are seated directly across the horizontal top chords and have tapered ends cantilevered about 8½ feet beyond them to carry the sidewalks.

The five lines of longitudinal 12-inch I-beams and channels which carry the roadway and sidewalk floors and the fascia girders are seated across the top flanges of the floorbeams, and the middle ones are raised on bent plate chairs to crown the roadway floor. Provision is made for two street car tracks, the outer rail of each being in the center of the truss. Each rail is carried in a trough made with three 12-inch channels, two having vertical and one a horizontal web, riveted together to make an H-shaped cross-section with the flanges down and out. These troughs also help carry the two layers of 3-inch floor planks. The span was erected by an overhead traveler which assembled it from one end and, moving on the top chords, the trestle falsework one panel in advance. (To be continued.)



THE BROOKLYN-BRIGHTON VIADUCT, CLEVELAND.

The Action of the Septic Tank on Acid Iron Sewage.

In the third annual report of the Connecticut Sewerage Commission there was given a valuable report by Prof. Leonard P. Kinnicutt and Mr. Harrison P. Eddy on the action of the septic tank on acid iron sewage, an abstract of this report appearing in The Engineering Record of May 10, 1902. These investigations were continued during the past year, and the complete results are given in the fourth report of the commission, recently made public. The later experiments have in the main confirmed the general conclusions which were given tentatively in the former paper. An abstract of the second paper on this very important subject follows.

To briefly review the conditions of the experiments it may be stated that the septic tank used was a discarded iron pressure tank 14 feet long and 5 feet in diameter, with a 2½-inch inlet tube, entirely closed in, and with arrangements for measuring the quantity of gas given off. The quantity of sewage in the tank at any time was 1,762 gallons, and the time of passage through the tank was 18 hours. The ordinary sewage of the city of Worcester, Mass., as it reaches the disposal plant was used in the experiments. The general character of the sewage was the same in 1902 as in 1901, containing, however, a little more iron sulphate and a little less free acid in 1902, and the amount of organic matter as indicated by the albuminoid ammonia was 13 per cent. greater in 1902 than in 1901.

During the past year the amount of free acid in the sewage has never exceeded 7½ parts per 100,000, and the decomposition of the organic matter has been continuous, although its amount was greatest in the summer. The average composition of the sewage for both 1901 and 1902 is given in tabular form.

Analysis of Worcester Sewage.

	Parts per 100,000. 1901.	1902.
Total solid matter	74.20	83.22
Suspended solid matter	16.50	31.01
Soluble solid matter	57.70	52.21
Free ammonia	1.85	2.02
Total albuminoid ammonia	0.6484	0.837
Suspended albuminoid ammonia	0.4006	0.600
Soluble albuminoid ammonia	0.2478	0.237
Total oxygen consumed	....	11.07
Oxygen consumed by solids in suspension	....	4.97
Oxygen consumed by solids in solution	....	6.10
Iron in solution	5.78	7.35
Iron in suspension	3.51	8.35
Aluminum in solution	0.07	....
Aluminum in suspension	0.15	....
By calculation from above results.		
Ferrous sulphate in solution $FeSO_4$	15.77	19.95
Aluminum sulphate in solution $Al_2(SO_4)_3$	0.44	....
Ammonium sulphate in solution $(NH_4)_2SO_4$	4.33*	7.84
Free acid in terms sulphuric acid in solution H_2SO_4	10.12	7.47

*The free ammonia, averaged in the half-hour weekly samples, in which the total iron, aluminum and sulphur trioxide were determined, was 1.12 and not 1.85, which was the average of the whole year.

In the accompanying table is given a comparative statement of the amount of solids removed in 1901 and 1902. Values for the total solids in the sewage are given in parts per 100,000, all other values being the per cent. removed. The results agree closely with those obtained at Exeter and Manchester and are only about 8 per cent. lower than those obtained at Leeds. The sewage at Exeter would be classed as a domestic sewage, that at Manchester and Leeds as manufacturing sewage, containing, however, more wool washings and dye stuffs, and much less iron in solution and free acid than Worcester sewage. Taking the results obtained in these four cases, it would appear that the total amount of solid matter removed from sewage by the action of the septic tank is about 25 per cent. of the total amount of solid matter in the sewage.

The proportion of soluble and suspended substances removed from a sewage by the septic tank seems to be much more dependent on the character of the sewage than does the amount of total solid matter removed. With Exeter sewage there is no percentage reduction of the solids in solution. With Manchester sewage 15.45 per cent. of the solids in solution and 57 per cent. of the suspended solids were removed, while with Leeds sewage the amounts were 12.05 and 70.37 per cent. respectively. Worcester experiments gave in 1901, 21.13 per cent. of soluble solids and 24.02 per cent. of suspended solids removed; in 1902, 24.41 and 30.86 per cents. The cause of the difference in results can be explained by the character of the sewage. Exeter sewage does not contain iron salts in solution, and the sewage of Worcester contains a very much larger amount of iron in solution than the sewage of Manchester or of Leeds.

Removal of Solid Matter, Worcester Experimental Septic Tank.

	Total in sewage.		Per cent. removed.— Total solids.		In solution.		In suspension.	
	1901.	1902.	1901.	1902.	1901.	1902.	1901.	1902.
Jan.	78.80	73.12	11.42	30.80	—2.45	28.30	47.98	36.22
Feb.	68.85	75.27	32.75	22.42	14.00	9.68	66.74	43.34
Mar.	86.60	59.30	32.33	15.52	17.28	16.68	58.28	12.39
Apr.	57.40	68.97	17.07	27.75	8.68	24.74	36.61	35.07
May	59.73	76.56	20.97	26.80	24.61	22.25	10.43	34.65
Jun.	76.15	101.40	14.51	32.25	26.71	26.16	14.04	41.89
Jul.	82.10	91.00	27.53	22.41	27.41	16.61	27.81	33.43
Aug.	85.76	91.60	23.41	23.14	26.80	24.49	13.53	20.67
Sep.	83.90	105.20	24.13	26.80	34.31	14.86	—6.16	40.45
Oct.	91.06	94.70	26.58	27.87	32.99	32.09	15.93	20.94
Nov.	85.88	83.10	20.40	21.66	18.47	14.02	22.29	32.37
Dec.	65.55	78.50	8.92	17.83	16.54	24.27	—3.39	9.41
Mean	76.81	83.23	22.06	24.95	21.13	24.41	24.02	30.86

The soluble iron in Worcester sewage is in the form of sulphate of iron. By the reducing action of the tank this is changed to insoluble sulphide of iron, and thus reduces the amount of soluble matter that otherwise would be found in the effluent. Further, the iron sulphide thus formed does not settle readily, and after it has settled to the bottom of the tank is easily brought again to the surface by the gas generated in the sludge and is carried along to a greater or less extent with the current in the tank, and so increases the amount of suspended matter in the effluent. While the amount of total solids removed by the septic tank from various kinds of sewage may not vary greatly, the ratio between the soluble and insoluble solids will depend largely on the amount of soluble iron salts in solution. With sewage containing as much iron sulphate in solution as occurs in Worcester sewage the results certainly indicate that unless special mechanical devices are used, the total amount of solid matter removed will be about equally divided between soluble and suspended solids.

The action of anaerobic bacteria on organic matter containing nitrogen must cause the liberation of nitrogen, partly in the form of free nitrogen and partly in the form of ammonia. The nitrogen would be found in the gases given off and the ammonia should be found in the effluent as free or saline ammonia. It would, therefore, be expected that the amount of free or saline ammonia found in the effluent would be greater than the amount found in the sewage. In Worcester this has been the case in every analysis made during the past two years, except in one month, March, 1901. In 1901 the effluent contained 20.52 per cent. more free ammonia than the sewage, and in 1902, 28.21 per cent.

At Exeter, Leeds and Manchester, less free ammonia is found in the effluent than in the sewage, and while Clark in his experiments at Lawrence in 1898 and 1899 found a larger amount in the effluent than in the sewage, in 1900 and 1901 he found a loss averaging about 9 per cent. This difference in results may be due in part to so-called septic action in the sewers before the sewage enters the tank; in part to the fact that more free nitrogen and less ammonia is formed in certain cases than in others by the decomposition that takes place in the tank; and in part to the degree of acidity of the sewage. In a neutral or alkaline sewage the ammonia would tend to escape from the liquid, while in a strong acid sewage the ammonia, as soon as formed, would unite with the acid to form salts, and thus be retained in the liquid.

The total amount of organic matter removed from Worcester sewage as shown by the determinations of total albuminoid ammonia in sewage and effluent was in 1901 23.26 per cent.; in 1902, 33.21 per cent. The amount of organic matter removed from Lawrence sewage, by the action of the septic tank, determined in the same way, was, according to Mr. Clark, 60.2 per cent. in 1900 and 50 per cent. in 1901.

Worcester and Lawrence sewage contain about the same amount of organic matter, represented by about 0.85 parts per 100,000 of albuminoid ammonia. The sewage at Lawrence, however, is taken from a main sewer above the entrance of manufacturing waste, and consequently is a typical domestic sewage. The sewage used at Worcester is a typical manufacturing iron acid sewage. We thus have an excellent comparison of the action of the septic tank on these two types of sewage, and the results certainly seem to show that the action of the septic tank removes about twice as much of the organic matter from domestic sewage as it does from manufacturing sewage, containing iron salts and free acid, and that when the organic matter in the sewage is represented by about one part of albuminoid ammonia in 100,000, the septic tank will remove one-half of the organic matter from domestic sewage, and not over one-third from a manufacturing sewage containing iron salts and free acid.

The results of the past year at Worcester show that the resultant action of the tank was to remove 8 per cent. of the soluble organic matter and 43 per cent. of the insoluble organic matter. During three months, however, April, May and September, a larger amount of insoluble matter was brought into solution than the amount of soluble matter changed into insoluble or gaseous compounds.

The amount of gas given off in 1902 averaged nearly 4 gallons for every 100 gallons of sewage passed through the tank or about 5 cubic feet for every 1,000 gallons, nearly twice the amount given off in 1901. This difference is partly accounted for by the fact that in January, February, March and April, 1901, practically no gas was given off, while during the same months in 1902 the amount averaged 1.9 gallons per month, per 100 gallons of sewage. The amount of sewage passed through the tank was 2,350 gallons per 24 hours.

In the 1901 report special attention was called to the fact that during the first four months of 1901 there appeared to be very little septic action. The low results, we now believe, were due chiefly to the high acidity of the sewage, and experiments made in the laboratory confirm the statement that when the sewage has a much greater acidity than is represented by 20 parts of free sulphuric acid in 100,000, the sewage is practically germicidal.

The results of this year show that the amount of gas given off is directly dependent on the temperature and that about twice the amount of gas is evolved in the warm as in the cold months. Further, the amount of gas evolved is the only method of determining the amount of decomposition and liquefaction of the sludge at any given time, and consequently the results also indicate that the amount decomposed in summer is twice the amount decomposed in winter.

Measurements of the depth of the sludge have been made at least twice a year since the

tank was put into operation and, as was to be expected, the depth has gradually increased, and with the increase in depth the density of the sludge has increased. On October 29, 1901, the depth was 16¼ inches, equaling 60.14 cubic feet. Its density was 1.043 and the amount of water it contained equalled 90.03 per cent. This gives as the amount of dry solid matter remaining in the tank at the end of the first year 384.1 pounds. The total amount of suspended matter taken out of the sewage was 534.4 pounds, giving 150.3 pounds, or 28.12 per cent., as the amount of solid matter liquefied or converted into gaseous compounds during the year.

On October 16, 1902, the depth of the sludge was 23 inches, equalling 96.99 cubic feet. The density was 1.047 and the amount of water it contained equalled 88.57 per cent. This gives as the amount of dry solid matter remaining in the tank at the end of two years, 729.1 pounds. The total amount of sewage passed through the tank from July 10, 1900, to October 16, 1902, was 1,863,550 gallons; 1,036,350 gallons of which contained 3.61 grains of suspended matter per gallon, and 827,200 gallons, the flow from October 29, 1901, to October 16, 1902, which contained 5.58 grains per gallon, making the total amount of dry suspended matter removed from the sewage during the two years 1193.7 pounds. The difference or 464.6 pounds gives 38.91 per cent. as the amount of solid matter liquefied or changed into gas as the result of the two years' experiments. The amount of suspended matter liquefied or changed into gas during the past year was 47.7 per cent.

That the percentage decomposition of the sludge during the second period is decidedly greater than the percentage decomposition of sludge during the first period, is not surprising, as it required at least two months of the first period to bring the tank into full septic action, and also, as is shown by the amount of gas evolved, the action of the tank was much more energetic during the second period than during the first period. Taking into account all the data obtained, the loss in weight which will take place in the sludge deposited in a septic tank from an acid iron sewage cannot be safely taken as over 35 per cent. of the weight of the total suspended matter removed from the sewage.

The sludge, as is shown in the table, has gradually increased in density. In May, 1901, it contained 9.70 per cent. of solid matter; in October, 1901, 9.93 per cent., and in October, 1902, 11.43 per cent. The amount of volatile matter in the sludge has also increased since May, 1901, when it equalled 40.36 per cent. of the dried sludge. In October, 1901, it equalled 42.47 per cent., and in October, 1902, 46.98 per cent. From the results obtained by weighing the carbon dioxide formed on ignition, it would appear that the proportion of organic to mineral matter was about the same in October, 1902, as in October, 1901, while the larger amount of carbon found in May, 1901, indicates that the sludge contains a larger proportion of organic matter at the end of the colder months than it does at the end of the warmer months; a confirmation of the results obtained by measuring the amount of gas evolved each day. Further, the organic matter which remains in the sludge at the end of the warmer months seems to have a fairly constant composition. A marked change in the composition of the sludge is the increase in amount of iron sulphide it contains. During the past year it has increased from 19.54 to 23.54 per cent. This is what would be expected in a sludge formed from a sewage containing iron sulphate, insoluble iron sulphide being formed from the soluble iron sulphate by the reducing action of the tank.

The decrease in weight and volume of the sludge due to loss of water, may be at least a partial explanation of the statement often made, that after the first few months the amount of sludge in a septic tank does not apparently increase in volume, and also account for the observation noted by H. W. Clark in his paper on "Septic Sewage," in the thirty-third annual report of the Massachusetts State Board of Health: "At the end of the year the accumulation of sediment in the tank was no greater than at the end of the previous year, being about 22 per cent. of the tank capacity." During the past year the tank at Worcester has been opened and inspected a number of times and every time the liquid was free from crust.

General Conclusions.—The results of the past year's work have shown that the preliminary conclusions stated in the 1901 report were in the main correct, and the results which may be expected from the slow passage of an acid iron sewage containing an amount of organic matter, represented by about 1 part of albuminoid ammonia in 100,000 parts, an amount of iron in solution from 5 to 8 parts and the free acid in terms of sulphuric acid about 10 parts in 100,000 parts may be stated more emphatically. These conclusions are:

That about one-fourth of the total solid matter contained in the sewage will be removed. That the effluent from the tank will contain about 20 per cent. less soluble matter than the crude sewage, owing to the soluble matter in the sewage being decomposed or changed into insoluble substances. That the amount of suspended matter removed from the sewage will not greatly exceed 30 per cent. unless special precautions are taken to retain in the tank the finely divided iron sulphide, formed by the reduction of the soluble iron sulphate in the sewage.

That the amount of organic matter removed from the sewage as determined from the albuminoid ammonia will average from 20 to 25 per cent. That of the suspended organic matter, the amount removed will average a little under 50 per cent., and that the amount of soluble organic matter removed will not average much more than 10 per cent. of the soluble organic matter in the sewage.

That of the suspended matter taken out of the sewage in its passage through the tank, from 60 to 70 per cent. will remain in the tank and have to be removed; only from 30 to 40 per cent. of the arrested suspended matter being changed by the action of the bacteria into soluble or gaseous substances.

That the amount of sludge that will have to be handled when it is necessary to clean out the tank will not, however, equal 60 or 70 per cent. of the weight of the sludge that would be formed from the removal of the same amount of suspended matter in a sedimentation tank, but will not be more than 50 per cent. of this amount, owing to the fact that the sludge in a septic tank contains less water than the sludge in a sedimentation tank.

That with an acid iron sewage containing street washings the amount of mineral matter in the sludge will be about 50 per cent. of the total solid matter in the sludge, and of this mineral matter over one-third will be found to be iron sulphide.

That decomposition of the sludge, as shown by the evolution of gas, will take place in winter as well as in summer, if the temperature of the sewage in the tank does not fall below 45 degrees Fahrenheit, but the rate of decomposition will be much slower, one-half of what it is in summer.

That the amount of gas evolved from the septic tank with a sewage similar to Worcester sewage and having about the same range temperature as Worcester sewage, will average a little over one-half a cubic foot for every 100 gallons of sewage passed through the tank, the time of flow of the sewage through the tank being 18 hours. In the warmest months the amount evolved will, however, be about one cubic foot, in the coldest months about one-fourth of a cubic foot.

That the gas given off from a septic tank with acid iron sewage does not contain hydrogen or sulphide of hydrogen, but is a mixture of marsh gas, carbon dioxide and nitrogen, in about the following proportions: Marsh gas, 75 per cent.; carbon dioxide, 6 per cent.; nitrogen, 19 per cent.

Structural Details of the Medical Building, Cornell University.

The new building for the accommodation at Ithaca of the medical college of Cornell University has extreme dimensions of about 154x92 feet with a 72x40-foot open court, and is three stories or about 50 feet high from the ground to the eaves. The 7-foot cellar has a solid concrete floor about 10 feet below the surface of the ground. The 12-foot basement is nearly all abve the ground level, and is occupied by the engine room, heating apparatus, store rooms, crematory, embalming room, storage rooms, preparation room, amphitheatre, photographic room, janitor's rooms and several recitation and lecture rooms. The first floor has the upper part of the amphitheatre, the museum, library, office, faculty room, waiting and cloak rooms, assembly room and recitation rooms arranged on both sides of a central longitudinal hall. The second floor is devoted entirely to general and special laboratories, and the third floor has an amphitheatre, assistants' rooms, department office and work rooms, general and special dissecting rooms and a general work room.

The cellar walls are of large rubble stones 32 inches thick carried up 2½ feet above the surface of the ground and seated on footings 3½ feet wide and 12 inches thick. They are plastered on the outside with Portland cement mortar, and are faced above grade with gray canyon sandstone from quarry No. 6 of the Cleveland Stone Company. Above the basement story the walls are of hard burned red brick faced the same as the cellar wall and having projecting courses of Indiana limestone. The interior walls are of brick and they and the outer walls support the floorbeams, girders and roof trusses which, except where otherwise noted, are of pine and hemlock timber. There is a 2-inch air space between the 4-inch inside brick wall and the stone facing, which are bonded together with galvanized iron anchors. Both stone and brick masonry are laid with mortar with one part lime, seven parts sand, mixed and tempered with one part Portland cement.

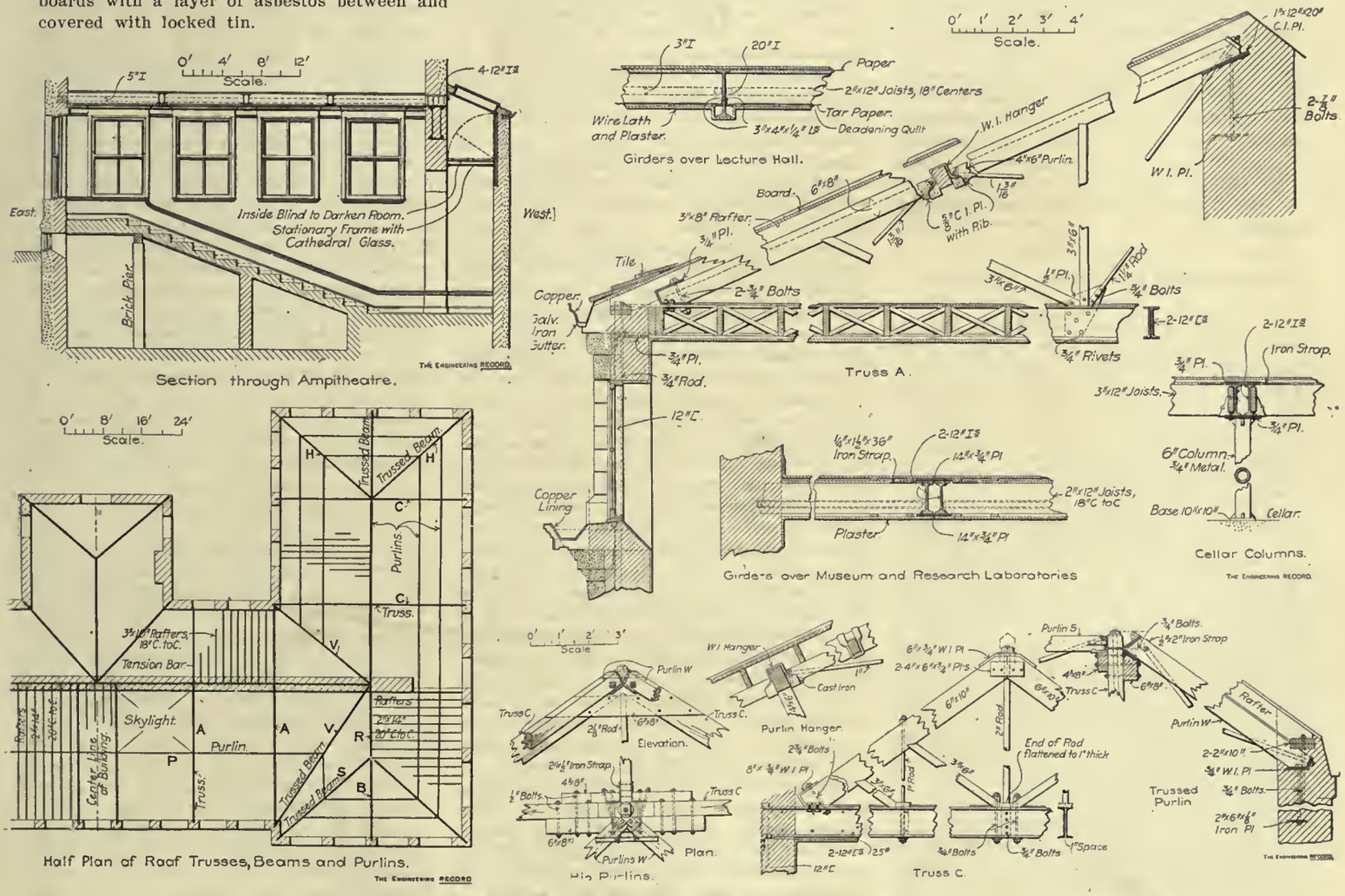
Where the floor joists are parallel to the walls, the three outer ones have anchors 6 feet apart turned down 3 inches at both ends and built into the brick work. Joists transverse to the walls have their ends beveled, and to every fifth one is spiked a ½x1½-inch anchor 2½ feet long which is built 8 inches into the wall. The joists are floored with diagonal matched boards covered with two thicknesses of 2 ply heavy tarred paper and one thickness of No. 2 deadening felt. Over this a finished floor of matched white oak or maple is laid. The undersides of the floor joists are covered with one thickness of No. 2 deadening felt, over which furring strips are nailed to receive the metallic laths for the ceiling plaster. The

first coat of plaster is made one part lime, one part sand, six parts long hair and one part Portland cement finished with American Keene's cement. The plastering on the brick work is done with Keene's Windsor cement. The inside trim is chestnut varnished, all base boards being made with sanitary cove pieces tongued and grooved to the floor and to the wall boards.

In the second story two 7x7-foot triangular incubator rooms are enclosed in the angles outside the main walls of the entrance wing by diagonal brick walls which are bonded into the main walls by railroad iron reaching through them from end to end. These rooms are of fireproof construction with brick arched floors and roof leveled up with concrete, and having walls faced with selected brick with rubbed joints. They have double doors, the inside one being made of a double thickness of matched boards with a layer of asbestos between and covered with locked tin.

in the pitched portions, has one thickness of 2-ply asphaltum felt and glazed tiles laid in cement mortar and secured with galvanized iron nails. The flat portions of the roof have 1½ inches of deadening felt, one thickness of black Neponset paper and a covering of painted tin on the sheathing boards. The storage rooms in the basement, which are intended for the preservation of anatomical specimens, are of special construction with double walls and multiple layers of insulating materials, as described and illustrated in The Engineering Record of March 21.

The roof is pitched in both directions from ridges in the longitudinal and transverse axes of the building, and is hipped at the ends of all the wings, as indicated in the diagram of roof trusses. The construction is somewhat unusual, in that the longitudinal ridge is eccentric from the longitudinal axis, and is supported throughout on a solid interior wall which carries the ends of the roof trusses, which slope in one direction only. There are hip and valley trussed beams at all intersections of the roof planes, and transverse trusses elsewhere which support one or two lines of horizontal purlins carrying rafter beams parallel to the transverse trusses. The longest trusses are those in the transverse wings marked C, and have spans of about 38 feet in the clear. They are symmetrical triangular trusses with a rise of about 12 feet and are made, as shown in the detailed elevation, with yellow pine compression members and steel tension members with bolted and screw end connections for the latter. The stiff bottom chords are made with pairs of 12-inch channels riveted together back to back to serve as beams supporting the attic floor on their upper flanges. The lower ends of the top chords are seated in bent wrought iron heel plates bolted to the top flanges of the lower chord channel bars. The trusses AA, etc., over the large halls have clear spans of about 28 feet, and are virtually single trusses with their lower chords extended beyond the apex of the main post and made continuous through the main interior wall to the opposite outer wall where they are connected to the feet of the rafters in the roof and serve to take their thrusts. The details of these trusses correspond to those of truss C, and the purlins are connected to them in the same manner with ribbed cast iron pockets suspended over the tops of the rafters. The gable trusses B are similar to trusses C, except that they have only two panels each and support at their apexes horizontal double 2x8-inch ribbed beams R. The inner end of the lower chord is an-



STRUCTURAL DETAILS OF THE CORNELL MEDICAL BUILDING.

The basement amphitheatre has an inclined floor supported on masonry piers and a fireproof ceiling carried by the I-beam girders and joists of the floor above. It is lighted by outside windows at the rear of the room which are arranged to be completely darkened during demonstrations, and the demonstration platform is situated in an alcove projecting beyond the main wall and lighted from above through two skylights, the upper one being slightly inclined towards the west and the lower one being protected by hinged opaque blinds by which it can be entirely closed when it is necessary to darken the room.

The rafters are of hemlock plank from 2x14 inches, 20 inches centers, to 3x10 inches, 18 inches centers, according to length. They are covered with 1⅛-inch matched hemlock which,

chored by a horizontal rod, with one end flattened and riveted to the lower chord and the other end having a nut and washer bearing on the opposite face of the main partition wall.

The hip purlins HH are 6x8-inch beams king-post trussed with a 1⅞-inch rod having nut bearings on cast iron caps at the ends of the beam, and passing over cruciform cast iron saddle posts 3 feet long at the centers of the beams. They are connected to the truss C with special bolts and bearing blocks, as shown in the detail plan and elevation. The side elevation and the supports at the lower end on the brick wall are shown in the detached elevation marked "trussed purlins." The hip purlins of the opposite end of the same wing and the valley purlins B are similar, and the horizontal purlins P are 4x6-inch timbers trussed

with 1¼-inch rods with similar end connections and center struts. The wooden joists of the basement floor are supported on pairs of 12-inch I-beams carried by cast iron cellar columns, as shown in the sectional elevation. Ten-inch planks are countersunk bolted to the webs of the I-beams, and the ends of the joists are received in steel hanger plates which are set on them.

The floors over the museum and research laboratories are also carried on lines of double 12-inch I-beams similarly riveted together with top and bottom cover plates, and having 3-inch I-beams web-connected to them and anchored into the main walls. The ends of the transverse joists are coped to fit the lower flanges of these girders, and their upper edges are connected over the tops of the girders by bent 1½-inch steel bars. The 12-inch joists of the floor over the lecture hall are carried on angle shelves riveted to the web of a 20-inch longitudinal girder which has web connections to 3-inch transverse I-beams anchored at the opposite ends of the main walls. The section of the floor at this point clearly shows the protection for the lower flange of the steel girder, and the standard construction of the floor and ceiling with furring and deadening.

Mr. W. H. Miller was the architect, and Driscoll Brothers & Company were the contractors.

Determining the Density of Smoke.

Among the interesting papers read at the recent convention of the New England Cotton Manufacturers' Association was one by Mr. Albert A. Cary, of New York, on smoke and the determination of its density. In beginning his discussion, he referred at considerable length to the actual composition of the smoke given out by the chimneys of plants where bituminous coal is used as fuel. The main facts which he gave showed smoke to consist of, (1) carbon particles escaping unconsumed and constituting the soot, (2) tar vapors, (3) steam, (4) particles of dust carried up mechanically by the draft. The proportions in which they are mixed depend on the condition of the surface of the fire. When fuel is first put on, tar vapor and steam escape from the fire below, together with the products of complete and incomplete combustion, as Professor Lewes has pointed out. As the heat works upward through the new fuel, the products of distillation from the coal catch fire and are partially burned, the carbon or soot in the smoke resulting. As the fire burns clearer and clearer and the upper portions become incandescent, practically nothing but the products of complete combustion find their way up the chimney.

The only accurate method for determining the amount of carbon, tar and dirt in smoke which is mentioned by Mr. Cary is to weigh the solids in a measured quantity of smoke drawn from the boiler outlet, a process which is of course beyond the resources of the practicing engineer. The practical methods involve some kind of comparison.

In some cases plates have been hung for definite periods of time in the path of the escaping products of combustion; the plates can be smeared with a sticky substance to catch all the particles in the gases, or the sticky tar can be relied upon alone to cause the particles to adhere to the plates. By placing the plates in the flue during the different conditions under investigation, and then comparing their appearance and the weight of the solids collected on them, some idea of the relative amounts of smoke given off can be obtained.

The camera has been used in such work, but gives misleading results. The shades produced on the prints are influenced by the position of the camera respecting the sun, the clouds and the method of developing the negative and making the print, so that the effect of the smoke may be eliminated by other causes in the final photograph.

The Prussian Smoke Commission of 1894 employed a photometric instrument. One leg of the apparatus was set so that it enabled the observer to see through the smoke-laden gases in the boiler flue, while the other leg was directed at a standard candle in the usual manner.

The direct observation of the smoke as it issues from a chimney and the comparison of its shade with some arbitrary scale together form the usual method of determination at the present time. Many causes affect the values assigned to any particular smoke by the observer, such as the relative positions of the sun, the chimney and the observer, and the cloudiness of the sky. As it is almost impossible to avoid comparing the smoke with its background, it is desirable to have all observations made from the same position as respects the sun and with the same amount of clouds behind the chimney.

The various scales proposed from time to time by which to measure the shade of smoke are very numerous. The gradations between a dense black opaque smoke and the invisible vapor which all boiler attendants wish to attain have been grouped by different observers in three, four, five, six or ten divisions. Mr. Cary states that he has found a scale of five or six degrees will express with sufficient clearness the shades of appearance which it is desirable to record, and at the same time the differences between these degrees are not too fine to prevent easy and rapid determinations.

Among the devices employed to assist the observer in determining the density of smoke, is one consisting of a tube into which a number of pieces of smoked glass can be dropped one after the other. The outer closed end of this tube is provided with a plane mirror set at 45 degrees so as to reflect light from above through the pieces of glass. By placing the tube to one eye and using the other to watch the chimney, it is possible to obtain a fair comparison and measure of the smoke. Another device which Mr. Cary mentioned is a triangular prism having two of its sides of glass and the remaining parts of metal. The interior is filled with water or alcohol colored black, and the observer looks through the two glass sides across the prism along lines parallel with the base. By shifting the line of sight from the apex downward it is possible to obtain as many shades as desired, and to express the desired shade by the ratio of the thickness of the prism at the line of sight to the thickness of the base.

Two forms of charts have also been employed in estimating the shade of smoke. That originated by Professor Ringelman, of Paris, comprising six rectangles cross-sectioned with lines of various widths and spacings. The character of the lines proposed by the originator of the chart is as follows:

No.	Black lines.	Spacing.
0.....	All white	.....
1.....	1.0 millimeter thick	9.0 millimeter
2.....	2.3 " "	7.7 "
3.....	3.7 " "	6.3 "
4.....	5.5 " "	4.5 "
5.....	All black	.....

With a scale constructed according to these directions, Mr. Cary states, the observer will be obliged to place the chart over 60 feet away in order to obtain a blending of the lines into the desired tints. For that reason, similar charts in several American reports and books have been plotted on half the scale originally advised. The late Bryan Donkin modified this scale by substituting for the cross-hatching uniform flat washes of gray, the tints corresponding with the effect of the shading on the rectangles of the older chart. The Donkin chart can be placed close to the observer and employed on this account in situations where the Ringelman chart is useless.

Smoke determinations should be made at frequent and regular intervals, every half minute being a good period for this purpose. On important tests it is desirable to employ two independent observers. At the same time somebody in the boiler-room should note the time of each firing and cleaning and any other conditions likely to influence the amount of smoke, such as forcing the boilers, running light and the like. If analyses of the gases are also made and the results recorded in connection with the exact time when the samples were taken, it will be possible to make a fairly satisfactory investigation of the conditions influencing the production of smoke in the plant.

A simple form of chronograph has been employed in France for plotting the results of the observations. A sheet of paper is wrapped about a cylinder driven by clockwork, so that a given distance along one edge of the paper represents a period of one minute. A pencil pressing against the face of the paper can be moved from one end of the cylinder to the other by the operator, its position at any instant being such that its distance from one side of the paper is a measure of the operator's estimate of the shade of smoke at the time. Mr. Cary's paper contains illustrations of an improved form of this apparatus which he has employed in his work.

Railway Maintenance-of-Way.

In an address before the Western Society of Engineers, on railway maintenance-of-way, on May 6, Mr. H. J. Slifer, general superintendent of the Chicago, Rock Island & Pacific Railway, discussed the means to be used in securing the best talent and for obtaining the best results with the least expenditure. He made a plea for better organization and a better class of men in this department, and deplored the fact that under existing conditions the maintenance-of-way department holds out no prospects to induce the young man to take up that branch of work. The matter is further aggravated by the fact that at present the men usually employed in this department are either foreigners or such as cannot be entrusted with the supervision of work, and consequently it is almost impossible to find capable, intelligent men to fill vacancies among the track foremen. For the young man taking up this work, a technical education is not essential, but, rather, a liberal allowance of common sense.

He outlined a scheme whereby a young technical or high-school graduate could enter the maintenance-of-way corps of men, and after passing through successive positions, become road-master, division superintendent, and finally gain the higher offices. At present, with the organization of the maintenance-of-way department as now constituted, this is not possible, because the position of road-master is the highest to be gained.

Mr. Slifer would start in the young man as chainman or rodman. After spending one or two years in this capacity, he would become assistant to some competent road-master, requiring him to learn first office work, then the

field work, and in time advancing him to road-master. As regards ability, he should certainly be on a par with the young man who is pursuing the mechanical lines, and for that reason should be advanced to higher responsibilities and be entitled to the same increase in compensation as the other. An examination before a committee of examiners representing the accounting, engineering and maintenance-of-way departments would be indicative of his practical knowledge and also be an incentive to better work. A repetition of this would result in the dropping out of those making no real progress, and the advancement of the more proficient ones in position and increased compensation would be a reward for faithful application.

He then discussed several methods of organization of a maintenance-of-way department, claiming that the supervision of this work by the division superintendent rather than placing the work under the engineering department or under the control of the general road-master would result in the greatest efficiency of the department. As most railroad managements concede the supervision over a certain territory to the superintendent, his authority extending to every department in this district, it would follow that this would be the best method to be pursued. Such a system would be in direct line with the training of young men as previously advocated, and would provide a line of promotion which would serve as an incentive to young men to enter this department.

Mr. Slifer discussed the various features that make the modern roadbed a perfect riding railroad. He took up in detail the size, the location and the construction of ditches, and was of the opinion that the time, money and attention given to this all-important question are not wasted. As regards the ballasting, too much cannot be used, especially as a great amount of poor ballast is used by a great number of roads. It also seems well to provide a shoulder at the end of the ties, as the friction of the latter on the ballast is not sufficient to keep the track in good alignment in the case of rock ballast. Good drainage is necessary, and to a great extent depends upon the nature of the ballast used.

The matter of the supply of timber for ties is becoming a more serious proposition from year to year, and the question of a metal tie is one that is attracting attention more and more. It does not seem advisable to mix soft wood ties with those of harder oak, as presenting an imperfect riding track, even if the softer tie be protected with tie plates.

The question of frogs and switches received quite a little attention at the hands of both the author of the paper and in the discussion which followed. Mr. Slifer was of the opinion that any frog or switch is a detriment to a perfect riding track, and maintaining them is a source of expense; therefore, the fewer the frogs and switches on the main track, the better opportunity there is for making a perfect track. All openings in the track, such as frogs, switches and guard rails are to be blocked to prevent the possibility of train men being injured, although there is some disagreement on this subject among men of acknowledged standing.

In renewing all ballast, stakes should be set at regular intervals, although it does not seem necessary in the case of the ordinary surfacing of track, which, even in the case of the most perfect type, should be done at stated intervals. In the speaker's opinion, the widening of gauge on curves of long radius, as usually found on the best railroads, was of greater theoretical than practical use. In conclusion, he considered that it was advisable to police the track so that all objectionable matter would be removed, which would not only be a satisfaction to the managing officers of the railroad, but also pleasant to the traveling public.

In the discussion which followed, there seemed to be a divergence of opinion as to the necessity of widening track at curves, and on the blocking of frogs. However, it seemed to be the general opinion of those present that in the case of a perfect railroad the opening of the gauge at curves is a matter depending upon the condition of the roadbed and upon the opinion of the individual in charge. Although within the last few years, in several important law suits, the opinions of experts have been given to the contrary, nevertheless, it was the consensus of opinion of the meeting that it is even criminal not to block all openings in tracks, such as frogs, switches and guard rails.

A Large Shop Roof in Paris.

The new shops of the Electric Light Company, Lecourbe Street, Paris, cover an approximately rectangular area about 340 feet long and 131 feet wide, and have self-supporting walls and a steel roof carried partly on the walls and partly by six longitudinal rows of columns. The general arrangement and structural features closely resemble those usually adopted for similar structures recently built in this country. There are two main aisles about 33 and 39 feet wide, each having a narrower aisle on each side, the adjacent side aisles 13 feet wide uniting on a center line of columns in the axis of the shop. The outer side aisles are respectively 13 and 30 feet wide, and all of them differ from ordinary American practice in having flat horizontal roofs instead of shed roofs. The main aisles have riveted triangular trusses with horizontal bottom chords, vertical members and single diagonals, and have glazed clere-stories about 12 feet high above the roofs of the side aisles.

The shops have two stories throughout, the upper one being carried in the main aisles by deep transverse plate girders and in the side aisles by transverse box girders. The columns all have I-shaped cross sections with solid plate webs up to the second floor and lattice webs above. In each aisle, except the two center ones, there are traveling girder cranes, which in the main aisles have capacities of 10 and 15 tons each, and have their track girders supported across the tops of, and are knee-braced to, independent columns adjacent to the roof columns. These girders have in some cases double and in other cases single webs and all support on their reinforced upper flanges solid rectangular steel rails. In the side aisles the track girders are in the lower stories and are supported on brackets from the wall columns, except in the 20-foot aisle, where the outer wall has no columns, and special buttresses are provided in it for the girders.

The arrangement of skylights in the roofs of the main aisles is peculiar, in that the center of the roof is covered with a tile surface and the glazing extends from the eaves one-third of the distance to the ridge.

The building is braced longitudinally by the track girders for the traveling cranes and by the second-story floor girders, which have rectangular box sections in the outer and center lines of columns and are ordinary plate girders elsewhere. Longitudinal struts at the eaves are braced to the girders below them with zigzag angles, thus approximately forming deep lattice-girders in the upper parts of the walls. Bents are 26¼ feet apart, and each panel of the roof is braced with two zigzag angles each side of the ridge.

The roof trusses and purlins, the box girders and the track girders for the 10 and 15-ton cranes are of steel, calculated for a maximum working stress of 16,300 pounds per square inch. The columns and their beams and girders are of iron calculated for a maximum working stress of 6,170 pounds per square inch. The assumed loads per square foot are 100 pounds and 160 pounds for the galleries, 60 pounds for the flat slag roofs, 27 pounds for the tiled pitched roofs and 16 pounds for the glazed skylights.

The columns and track girders for the crane service are calculated for the heaviest loading, which gives reactions of about 26,450 pounds and 14,325 pounds for each end of each of the two largest cranes. The roof columns have 11-inch webs and 8½-inch flange plates, and have their bases 20 inches below the shop floor. The wall columns, with maximum loads of 25 tons each, have 30x18½-inch base plates seated on 33x50-inch stone pedestals on concrete piers 70.7 inches in diameter. This gives maximum pressures of about 374 pounds per square inch on the stone, 128 pounds per square inch on the concrete, and 8,200 pounds per square foot on the earth.

The shops were designed and constructed under direction of Mr. M. M. Robard, and were illustrated and described in a recent issue of the Paris "Nouvelles Annales de la Construction."

A Cold Storage Warehouse.

The buildings in Rochester, N. Y., formerly owned and operated as a brewery by the Rochester Brewing Company, were last summer purchased by the E. M. Upton Cold Storage Company, of that city, and after a thorough renovation, converted into a cold storage plant. The plant is of interest not so much on account of its size as because of the system of refrigeration employed, which is said to be the first of its kind to be put into operation in this country, although for several years it has been successfully used in Canada, Europe and the British possessions. The system makes use of a circulation of chilled air to the rooms to be cooled, instead of equipping them with brine coils or direct expansion ammonia coils. The cooling of the air prior to its delivery to the rooms is accomplished by passing it over ammonia coils which are continuously subjected to a rain of non-congealing brine to prevent them from becoming encrusted with snow or ice, the insulating effect of which would produce a reduction of efficiency. This cooling by air possesses the advantage of combining ventilation with refrigeration, thereby removing the odors from freshly killed meat, or other noxious materials, instead of allowing them to pollute neighboring stored goods or to impregnate the walls. Inasmuch as the same air is used repeatedly it is evident that this would be no gain unless a provision were made for purifying the air in the course of its circulation. In the system under discussion the purification of the air is effected by the washing process which it undergoes in passing through the spray of brine that descends over the ammonia coils, while the resulting contamination of the brine is removed by frequently sterilizing it by boiling. The continual moving of the air also allows a more rapid and uniform chilling of an originally warm room, or articles newly introduced into a cold room, than is possible in still air, this being simply a reverse application of the old established principle that the dissemination of heat through air by con-

vection is many times more effective than by radiation.

A very fair idea of the size of the plant and its convenient location on the tracks of the Rome, Watertown & Ogdensburg Railroad, offering facilities for receiving and removing goods, may be had from the exterior view herewith. The total storage capacity is about 610,000 cubic feet divided among nineteen rooms of various sizes and maintained at temperatures ranging from 10 to 30 degrees Fahr., according to the nature of the articles stored, such as fruit, vegetables, meat, poultry, butter, cheese and eggs. The mechanical equipment for the refrigeration of the rooms and the supply of attendant requirements such as lighting, water supply, elevator service, etc., includes the following: Five boilers, two refrigerating machines, an ammonia condenser, three air coolers, fans, pumps, motors, steam-driven pumping sets, steam-driven electric generating sets, electrically-operated hoists and accessories. The boilers furnish steam for operating the refrigerating machines, generating sets and water pumps, the latter situated at the bottom of a cliff below the plant at the river side. The boilers are of the return tubular type, each of 125 horse-power, and were built by the Pennsylvania Boiler Works, Erie, Pa. Any two of them are capable of furnishing sufficient steam for the lighting and refrigerating plants when both are working at their full capacity. The two refrigerating machines are of 100 and 50 tons refrigerating capacity, respectively, and with the boilers and condensers, were installed for the brewery ten years ago by the De La Vergne Refrigerating Company.

The air cooling is done by three American Linde patent air coolers, one of 30 tons capacity being used for the chilling of meat and game where temperatures of from 10 to 25 degrees are desired, and the other two of 70 and 60 tons capacity each, used for fruit and general cooling at a temperature of about 30 degrees. The latter are so arranged that they can be operated together or separately, and being cross-connected may be used interchangeably. In fact the equipment throughout is arranged in duplicate to guard against the serious consequences of stopping on account of break-down, as that would mean the loss of much of the perishable material in storage. Each cooler consists of the refrigerating coils in which the ammonia expansion takes place, mounted in racks above a shallow rectangular wrought iron tank to receive the brine, and below a header for scattering the brine over the coils. The complementary equipment includes a Gould centrifugal pump for returning the brine from the catch basin to the spraying header, and an American Blower Company's fan, drawing the air through the suction ducts and expelling it through the discharge ducts. The refrigerating coils consist of a series of banks of extra heavy wrought iron pipe wound in continuous lengths in a special form to present a large amount of surface to contact with the air.

The sterilizing process to which the brine is subjected periodically with a frequency depending upon the amount of fresh material placed in storage, is an interesting one from the provisions made for accomplishing it with a minimum expenditure of energy. The air in its passage through the rooms takes up a certain percentage of moisture, exuded from the contained products, and when once more cooled by contact with the coils, becoming supersaturated, loses the moisture to the brine. The result is a gradual increase in the level of the liquid in the catch basin in excess of that regularly maintained by the circulation of the brine, which causes it to overflow to a second or storage tank. After a certain accumulation is received by the storage tank, it is pumped to a third tank containing a steam coil. Here the brine is boiled, vaporizing the excess of moisture and the volatile impurities. Finally in its concentrated state it passes through a coil in the storage tank where it imparts heat to the brine then waiting for purification in the tank outside of the coils. This serves the doubly useful purpose of partially heating the impure brine and cooling that which is purified, both of which processes result in the conservation of much of the energy.

The accompanying plan of the main floor of the warehouse and the view of the interior of one of the cooling rooms, show the general scheme for the air distribution to the rooms. The form of the rooms being generally that of a long rectangle, a favorable and uniform distribution was possible with but one supply and one exhaust duct to a room. As will be seen the ducts are supported from the ceiling at the intersection with the side walls. The reasons for having both the discharge and suction openings near the top of the room are obvious, for since warm air rises it may be the more thoroughly removed near the ceiling and since cold air descends it becomes more thoroughly distributed by admitting it from above. The trunk ducts which form the communication between the coolers and the branch ducts, are indicated in the two elevations, one showing the supplies and the other the returns. On all of the drawings the suction ducts and delivery ducts may be readily distinguished as the former are designated by dotted shading and the latter by hatching. The ducts are constructed of ¾ or 1-inch tongue-and-grooved boards planed smooth and laid close together, and are supported by knee frames about 2 inches by 1 inch, every 10 feet, and fillets attached to the side wall and ceiling. The insides of the ducts are left perfectly smooth to avoid friction and eddy currents. The air is admitted and discharged through 10x6-inch openings conveniently spaced along the ducts, the deliveries being in the bottom of the supply ducts and the suction duct holes on the side as shown in the photograph. The openings are fitted with hardwood doors sliding in rebated runners and afford an opportunity for regulating the amount of air and consequently the degree of cold in any room, irrespective of another, without the necessity of altering the speed of the fans or the temperature of the brine.

An interesting experiment was made at this plant on the storage of eggs, which was a severe test of the system as to its purifying qualities, and its ability to prevent the odor of one substance from contaminating another substance in the same room. Three separate cardboard boxes of the usual style for handling eggs in retail quantities, were each filled with a dozen eggs and one box placed in storage in each of three separate rooms. One was placed in a room containing cabbages and lemons, pears and other fruit, another was placed among barrels of apples, while the third was placed on top of the canvas covering of a barrel of onions. The eggs were placed in their respective positions early in last November, and no precautions whatsoever were taken to protect them. In the latter part of last March,



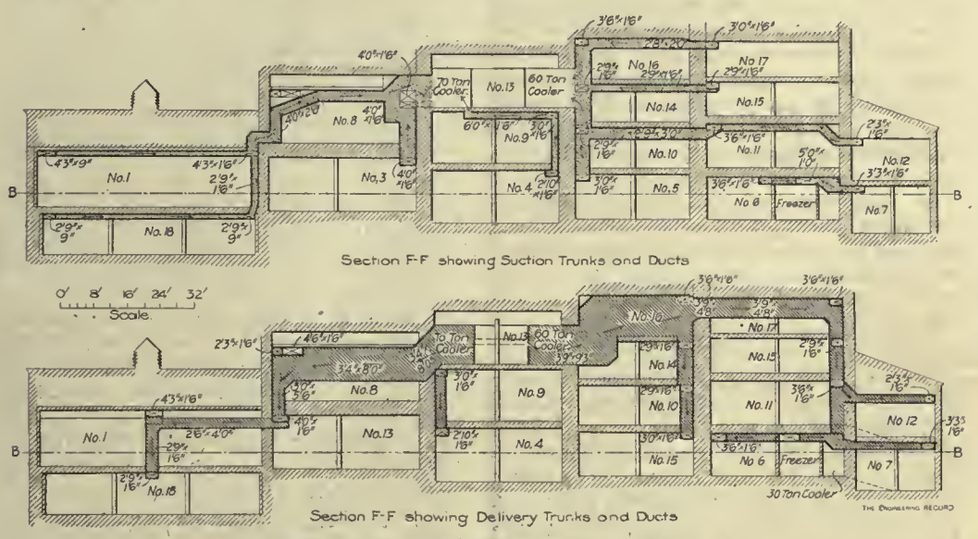
The E. M. Upton Cold Storage Warehouse.



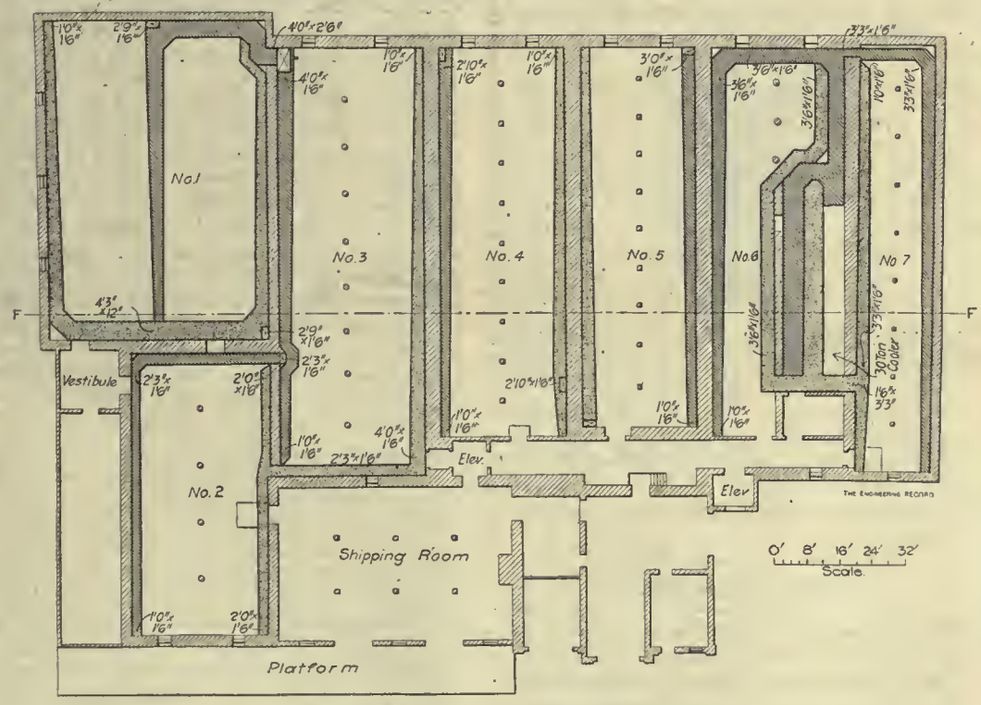
Interior of a Typical Cold Room.

two of the eggs from the box placed over the onions were broken and eaten and were found to be entirely free from the taste or smell of onions. An examination of the onions in the barrel showed that this result was not due to their deodorization, for they were found to possess all of their original strength, demonstrating that the system while preserving the eggs from taint, had not impaired the quality of the onions. The test was made merely to investigate the possibilities and limitations of the system and not to determine the practicability of storing eggs and onions together, for the plant is amply large enough to allow for classified storage of materials. While satisfaction is not guaranteed where there is such an indiscriminate mixing of goods, nevertheless, it is of some moment to the man who operates a small cold storage in connection with a retail business to know that, if the case be urgent, he may put anything into his store room.

For all ordinary purposes of cold storage a temperature anywhere below 32 degrees is sufficient, but for meat it is generally necessary to run as low as 8 or 10 degrees, while fish for its perfect preservation requires a temperature still lower, usually about 10 or 15 degrees below zero. This is known as sharp freezing, that is quick freezing at low temperatures, and is popularly believed to be out of the question where the air circulation system of refrigeration is employed. So far, however, the results in this plant have proved the contrary, for in the sharp freezer here contained, no difficulty has been found in reaching and maintaining a temperature of 10 degrees below zero. For fruit storage 30 degrees is considered the proper temperature. During the recent fruit season, when the plant was nearly full constantly, the 50 ton machine was able to carry the entire load, while the coal consumption for all purposes was but three tons per day. Even better economy is possible in the winter months, when the outside temperature is sufficiently low to produce the desired refrigerating effect, for by a special provision in the duct connections, not shown on the accompanying drawings, it is possible to connect the fans with the outdoor air and suspend the operation of the refrigerating machines altogether. The fresh air is taken through one side of the monitor, shown on the roof at the left side of the elevations, and after its passage through the cooler, where for the cleaning of the air the brine circulation is continued, it is circulated through the rooms and finally discharged out-of-doors through the other side of the monitor.



Longitudinal Elevations, Showing Trunk Ducts.



Plan of Main Floor, Showing Branch Ducts.

The conversion of the brewery into a cold storage plant, and the electric lighting, cold insulation, elevators, etc., were installed from the plans and under the supervision of the architect, Mr. James R. Tyler, of Rochester, now the manager of the plant. The machinery was designed and installed by the American Linde Refrigerating Company, of New York City, under the direction of its engineer, Mr. Llewellyn Williams.

A Small Lighting and Pumping Plant.

Gaffney, S. C., has its own lighting and pumping plant. The air lift is used, connected to a well 12 inches in diameter and 565 feet deep and delivering to a cement-mortar lined brick reservoir, through the center of which rises the well. The well and reservoir lie just outside the station, and the reservoir is about 20 feet in inside diameter and 12 feet deep. The air compressor is of the Laidlaw-Dunn-Gordon horizontal flywheel type, 14x14x18 inches in cylinder sizes, and to start the water, compresses to 120 pounds. The normal operating air pressure is 80 pounds. From the reservoir the water is pumped to a 120-foot standpipe, 15 feet in diameter, by means of a Worthington 14x8½x10-inch duplex direct-acting steam pump. The plant is operated about 10 hours every night. A constant-current alternating system of arc lighting is in use, with a duplicate installation of machinery. There are two General Electric 60-cycle alternators, rated at 39 amperes and 2,300 volts at 900 revolutions per minute, each belted to a simple engine built by the Slater Engine Company, of Warren, Mass. Each generator has a 125-volt exciter driven by belt from the generator shaft, of 1.5 kilowatts capacity. The lighting transformer is of 32 kilowatts capacity, and gives a current of 6.6 amperes. The building is of brick with a concrete floor and mortar plastered walls inside.

A Twenty-Ton Storage Battery Switching Engine.

It frequently happens in manufacturing establishments that a single car load of raw material has to be distributed at various parts of the works, and, in such cases, expensive rehandling can be saved by shifting the entire car from point to point and discharging each portion of the load exactly where it is required. A similar economy can be effected by collecting the finished product at the different buildings, and loading each consignment directly into its proper car. The locomotive described in this article is used for shifting cars while loading or unloading in this manner, and also for transferring material in course of construction, from one shop to another. The disastrous consequences which can result from the sparks of a steam locomotive when used near highly inflammable materials are illustrated by the recent explosion at the plant of the Northwestern Star Oil Company in Minneapolis, in which eight men and two women lost their lives.

A locomotive of this type has recently been installed at the works of the Massachusetts Cotton Mills in Lowell, Mass. The original buildings have been improved and extended until the entire plant covers a considerable area. The freight siding is separated from one of the two principal storehouses by the main business street of the city, and from the second of these storehouses by the canal which supplies the turbines of the mill. It is necessary to deliver car loads of baled cotton at either or both of these buildings. Neither a steam nor a trolley elec-

tric locomotive is permissible in the storerooms on account of the fire risk.

Before installing the locomotive, the cars were shifted, one at a time, by three horses harnessed up tandem. The storeroom at the canal is so constructed that the horses had no means of exit if driven in ahead of the car, and this necessitated sending it in on the fly. The bridge across the canal is just wide enough for the car tracks, and the horses had to turn out before reaching it. To get up speed, it was necessary to start some distance up the track, the tag holder or man at the coupling, the driver and the horses all traveling at their best gait. At the proper moment, the tag holder unhooked the tag or rope fastened to the traces, and ran out from in front of the car. The consequences of a slip or false step are self evident. In the case of a heavily loaded car, the horses were unable to give it sufficient momentum, and the operation had to be completed by the loading gang.

This locomotive is built for standard gauge and fitted with M. C. B. standard couplings, making it suitable for use with any ordinary railroad car, and on any standard railroad track. The length over the bumpers is 21 feet, 4 inches, and the height from the railhead to the top of the cab is 12 feet, 1 inch. The wheel base is 7 feet, 6 inches, and permits the operating of the locomotive over a comparatively small turntable. It weighs about twenty tons, and runs at a speed of from two to four miles per hour on level track.

The cab is located in the center, making a desirable arrangement for switching work, which calls for operation in both directions with equal facility. The batteries are contained in sloping compartments at either end. This symmetrical disposition distributes the weight evenly on the four wheels, and, as each of these is a driver, the entire weight of the locomotive is usefully employed in traction. The wheels and axles are driven from the gear cases in the cab by means of Renolds silent chains suitably enclosed. These chains are the only portion of the driving gear situated below the car body, the motors and gear cases being mounted in the cab where they are readily accessible, and always under the immediate notice of the operator. Under these favorable conditions, any reasonably reliable man can be depended upon to maintain the electrical equipment in proper working condition.

The battery was furnished by the Electric Storage Battery Company, the elements being mounted in tanks of extra depth to prevent the electrolyte from splashing over the top. In mounting the battery special attention has been paid to protecting it against injury due to the shocks to which the locomotive is exposed in switching. There are two motors, specially wound for the service. By connecting the two motors in series or parallel and by varying the arrangement of the fields, an efficient speed control is obtained without wasting any of the energy of the battery by passing it through a resistance.

The controller is of the standard vehicle type, and has two levers which control every desired motion of the locomotive. The reversing lever is set to point in the direction in which the locomotive is to move, and the second lever controls the speed. These levers are mechanically interlocked, as in the case of a trolley car controller, so that the motors can only be reversed when the speed lever is in the off position. The locomotive may be run with the controller in any notch, there being no transition point on which a careless operator might leave his lever and burn out the apparatus. All gears are machine cut, and run in a bath of oil, in fully enclosed gear cases, one for each of the motors. In an emergency, one motor can be cut out entirely, and the locomotive operated by the remaining motor, but with a reduction of hauling capacity. The driving axles are made to the M. C. B. standard dimensions, and run in patent roller bearings, which reduce the friction at these points to an inappreciable amount. The wheels are shrunk in place, and have chilled treads and flanges of M. C. B. standard size and shape. A powerful brake is conveniently located in the cab. An alarm gong is also provided.

Experience has shown that in light switching service, the batteries can be recharged at various times during the day while the locomotive is waiting between hauls. For heavier service, it may be necessary to charge during the noon hour or after working hours in the evening. The battery is automatically protected during charging by safety appliances. This locomotive is placed on the market by the C. W. Hunt Company of West New Brighton, N. Y. Smaller locomotives intended for use on the Hunt narrow gauge track have been built by the same company for a number of years, and have been described in a former issue of this paper.

A New Acetylene Burner.

Persistent efforts are being put forth to make the use of acetylene gas for illumination safe, convenient and efficient. A recently designed burner, shown in the accompanying illustration at nearly full size, consists of a rolled brass pillar with short, strong arms which cannot be gotten out of alignment, and steatite tips uniformly machined and mounted on the arms so as to make removal difficult without



breaking. The metal parts are nickel-plated. This burner, it is claimed, retains the good qualities of the lava fork burner, such as non-carbonization, correct proportion of gas and air and perfect alignment and impingement, while admitting certain economies in manufacture. The burner described is made by the Sunlight Lava Manufacturing Company, of Chattanooga, Tennessee.

Letters to the Editor.

The Proposition for a Union Engineering Building.

Sir:—The generous offer of Mr. Andrew Carnegie to contribute one million dollars toward the erection of a building for the joint occupancy of four technical societies and a social club, which was made on February 14th and first announced to the recipients of the proposed donation on May 3d through the medium of the public press, is deserving of the warmest thanks of the members of the various associations to whom it was addressed, for the kindly spirit manifested by the offer. It is a free and hearty tender of a noble gift.

It is unfortunate that this tender was made without any previous acquaintance on the donor's part, of the feeling existing among the recipients of the proposed bounty as to the desirability of the joint ownership and occupation of the building suggested. No consultation was had with the governing boards of the societies affected and not until three months later was even the slightest intimation given to the members of such Boards of the action proposed to be taken. The whole procedure was carried on by a small self-appointed committee of members of the various organizations who placed the most stringent obligations of silence on everybody to whom they communicated their scheme.

Mr. Carnegie was prompted by generous impulses and acted in good faith on the representations made to him. Those representations appear from the documents which have been allowed to see the light, to have been imperfect and incorrect as to facts. He relied upon them, however, and addressed his offer to The American Society of Civil Engineers, The American Society of Mechanical Engineers, The American Institute of Mining Engineers, The American Institute of Electrical Engineers and the Engineers Club.

It is not likely that he would have so addressed his offer if he had been made acquainted with the fact that The American Society of Civil Engineers had at various times during the last twenty years considered the question of joint occupancy of a building with other societies, had always rejected the proposition, the last time by a unanimous vote at an annual convention, and now possessed a commodious home of its own, and no one authorized or qualified to speak for the Society had been given any intimation that such a step as this was now under consideration.

He would doubtless have hesitated to address his letter as he did, if he had been informed of the fact that The American Society of Civil Engineers includes in its membership, members of all the other organizations and is the only one which prescribes and requires definite qualifications for membership and obliges applicants for membership to pass at the hands of the Committee on Membership what is almost equivalent to a Civil Service examination, that it possesses a large and carefully selected library thoroughly indexed and always open to members or others, which is what none of the other organizations possesses, that it is in a prosperous financial condition and that its main end and aim is to maintain a high professional standard and not to lend by implication even, the prestige of its name and standing to other Associations of persons who are either unable or unwilling to join it and submit to its restrictions and its mode of government.

All honor to Mr. Carnegie for his noble and generous offer, but the manner in which it has been brought about and in which it is attempted to force its acceptance as framed, constitutes one of the most audacious and impertinent attempts by irresponsible outsiders to overthrow and reverse the well established policy and purpose of a prosperous and well organized institution, that was ever heard of.

The American Society of Civil Engineers has everything to lose and nothing to gain by giving up its home and taking a flat in which it would have only one-fifth interest and control, at the best, and possibly even less, if the elaborate device for evading taxation evolved by the counsel to the promoters is carried to its legitimate conclusion and every additional society of specialists which may be taken in, is made a "tenant in common, share and share alike" in the control of the property.

The proposed building would be a great advantage and an inestimable boon to the various societies of special branches of Engineering, and it is to be hoped for them, Mr. Carnegie's offer may be carried out. But the American

Society of Civil Engineers does not need the gift and will be better off in every way without the surrender of its individuality and the risk of an entangling alliance with a number of other organizations in an office apartment house speculation with a Club attachment, with a strong probability that an entirely new and distinct corporation would have to be formed to hold and manage the property, and in this corporation the Society would necessarily hold a small minority interest.

Yours truly, J. J. R. Croes.

New York, May 12, 1903.

The Levels of the Great Lakes.

Sir:—In the article "Damming the Niagara River at Buffalo," by Mr. J. H. Massie, published in your issue of April 18, appears the following statement: "That in the judgment of the Lake Survey officials the lake has become permanently lowered is demonstrated by the fact that a proposition has been made, and will be carried out, to adopt a new datum plane for charts, since it is realized that depths shown on the present charts have become misleading. For Lake Erie it is proposed to lower the datum plane from 572.86 to 570 feet, nearly 3 feet." As the officer at present in charge of the United States Lake Survey, and the one upon whose recommendation new datum planes for Lake Survey charts of all the Great Lakes and connecting waters were adopted, I beg to say the reason given by Mr. Massie is incorrect.

The real reason for all the changes is that the Lake Survey proposes to establish at all the principal harbors, and at the critical points in the channels, large display gauges which shall show continuously the actual depth of water above the datum plane for the charts of that vicinity, and in order that these readings may always be applied as corrections with the + sign (that is added) to the chart soundings, these new datum planes were taken for each lake at the even foot next below the lowest monthly mean of any navigation season of which we have record. It is for this reason the new datum plane for Lake Superior charts has been lowered from 601.19 to 600 feet, although the level of the lake has averaged something over half a foot higher during the ten year period 1893-1902 than during the similar period 1883-1892.

Very respectfully, W. L. Fisk.

Major, Corps of Engineers, U. S. A.

Detroit, Mich., April 30, 1903.

Reinforced Concrete Buildings.

Sir:—We note in your issue of May 9th an article upon reinforced concrete construction in Egypt, wherein is noticed the continuation of floors to the outside of the walls. In this connection the enclosed specification, forming part of Letters Patent No. 694580, may prove of interest. You will note this patent covers the point referred to in your article.

Very truly yours, Ransome & Smith Co.

New York, May 11, 1903. A. W. Ransome.

[The patent above referred to is for a reinforced concrete floor extending to the exterior face of a building, capping its piers and having upward or downward extensions which form window lintels, sills, wall faces or belt courses.]

Wide Tires for Good Roads.

Sir:—In your issue of April 25, on page 421, you say: "The gospel of wide tires has been widely preached, and so nothing need be said on that subject here." You print about thirty-three columns of general road matter in the same number, and it is good to have so much of your space devoted to a subject of such importance. But the two lines quoted above are all that I can find as to wheels, which bear so important and disastrous a part in creating the road question. Now, this proportion of 2 to 2,500 lines is about the usual space devoted to broad wheels,—i. e., "light-traffic" wheels.

The use of properly wide wheels must be a condition precedent to the acquisition and maintenance of the best roads. It seems to me that you are essentially in error in not giving the first place to the advocacy of such wider wheels as would save about one-half of the present cost of roads and streets. Where do you find anything said about the immense useless cost of putting roads *into* bad shape, in addition to the great cost of having them so, when wider wheels would save both costs to a large extent? We know that the horse turns the grindstone, or rolls the tools (wheels) ground, over it; and we know that we might stop a large part of the grinding, greatly to the easement of the horse, and more than correspondingly cheapening vehicles and road surfaces.

Mr. James Owen, on page 422 of the same issue, states very confidently that "less than 6 inches is not a reasonable thickness for macadam," etc. Evidently he has not heeded, if he has heard, the preaching on wide tires. What we want to do is to decrease the sub-grade —or earth-foundation—pressure, by widening wheels, instead of making the road unnecessarily thick simply because the narrow wheels, used from bad choice or bad habit, work unnecessary hardship on the road and on themselves. This would work a double saving—a saving in thickness of road, or in first cost, and a saving in repair, maintenance and renewal cost of surface. In fact, the saving would be general. We would save cost of vehicles and power. The idea of an expenditure to produce a saving is well understood, but here we have a saving produced in the act and process of making another saving. The wrong theory that wider wheels are harder to pull is the important thing to tackle first. Of course, it is absurd to think that wheels which are generally admitted to be less hard on roads and on themselves, can be harder on horses, but this is thought by the vast majority. To do away with the road "question," we have only to do away with the "heavy-traffic" producing wheel. By using "light-traffic" wheels—those of proper width per ton of load—we could lessen first cost of roads, repair and renewal cost, cost of vehicles and cost of horses.

Yours truly, J. M. Heiskell.

Memphis, Tenn., May 5, 1903.

Trade Publications.

A new catalogue, No. 23, on pile driving, has been issued by the Vulcan Iron Works, 59 Milwaukee Ave., Chicago. Pile drivers of several forms are described together with a wide range of accessories, drop hammers, pile points, bands and caps, band pullers, sheaves, followers for driving below the ground, saws for cutting off piles below the water, rollers and roller spools. The Warrington improved steam pile hammer, with its chief characteristics briefly explained, is also illustrated.

The Pittsburg Blue Print Co., Inc., 1505 Park Building, Pittsburg, Pa., is distributing an interesting illustrated circular describing a new automatic lamp controller for use in connection with cylindrical copiers. The apparatus raises and lowers the lamp automatically, at a speed which may be regulated, and at the end of its trip cuts out the current to the operating motor and the lamp.

A line of steam asphalt rollers in seven sizes ranging in weight from 2½ to 12 tons, is illustrated and described in catalogue No. 23 from Julian Scholl & Co., 126 Liberty St., New York. Other road machines listed are: a topping mixer, a semi-portable concrete mixer direct-driven by an upright engine, a fire wagon, a portable melting kettle, hand rollers, a portable stone-crushing outfit, and a road scarifier.

The American Air Compressor Works, 26 Cortlandt St., New York, have prepared a complete catalogue of their standard types of air compressors, vacuum pumps, liquid gas apparatus, receivers, air lift appliances and accessory supplies. Steam and power compressors, both duplex and single acting, and in single, double and triple stages, are listed, and there are some notes on interesting small belt-driven machines for use in shops and other places where a little compressor is occasionally needed. The company states that it is prepared to make machines having many other combinations of steam and air cylinder dimensions than those listed.

The New York Continental Jewell Filtration Co., 15 Broad St., New York, has prepared a useful catalogue of small filtering plants for residences, hotels, public buildings and like places. It makes a number of different types of such apparatus, which are described with the aid of numerous illustrations and unusually full tables of dimensions, capacity and other data valuable to the designer of such buildings.

The Edson Mfg. Co., 255 Atlantic Ave., Boston, Mass., has prepared a useful folder giving dimensions of its diaphragm pumps for prospecting, cesspool cleaning and trench draining, purposes for which this style of pump has proved particularly adapted. The folder also gives some notes concerning the protection of suction hose by cotton duck, which every contractor will find of value.

The Austin Mfg. Co., Manhattan Building, Chicago, has published a large catalogue describing its types of gyratory rock crushers, with the screens, elevators, and other accessories needed in a complete rock-crushing outfit. The book will prove a serviceable handbook to engineers and contractors because of the many excellent engravings of crushing plants, and the numerous working drawings of such installations of various sizes made for contractors and dealers in broken stone.

For some time engineers and contractors have heard rumors of an interlocking system of piling constructed of channels, which has been employed in situations where ordinary sheeting would be very difficult to handle. The inventor of the steel piling, Mr. L. P. Friestedt, 1412 Tribune Building, Chicago, has issued a pamphlet describing its peculiarities and containing illustrations of several difficult undertakings in which it was employed.

The Atkins Wagon Works, Auburn, N. Y., describe a novel type of dumping and stone wagons in a well-illustrated pamphlet now being distributed. The wagons are marked by a special form of axle, which allows the wheels on one side to pass over an obstacle 28 inches high without wrenching the body, by a rigid pole, and, in the dump cars for broken stone and earth, by a dumping device which the driver can release without leaving his seat or stopping his team.

The naval coaling station at Frenchman's Bay, Me., is described in a brochure prepared by the John A. Mead Mfg. Co., 11 Broadway, New York, which drew the plans for the coal-handling installation. The same company has issued a particularly clear account of the special features of its belt conveying system in a handsomely illustrated pamphlet of interest to owners of power plants and industrial establish-

ments where it is necessary to move any kind of dry material not in large, heavy pieces.

The Sherwood Mfg. Co., 34 Washington St., Buffalo, N. Y., has issued a new edition of its catalogue of engine and boiler room supplies, including injectors, oiling devices, grease cups, flue scrapers, gauge cocks, pressure gauges and similar specialties. Not the least useful feature of the catalogue is a table of discounts, enabling the reader to take off at once such complicated rebates as 52½, 7½ and 2½ per cent.

The recent publications of the General Electric Co. include a bulletin on horizontal-cylinder air compressors for heavy cars, but also applicable to a number of industrial uses, supply catalogues of electric railway line material and of R-43, R-45 and R-47 controllers, and an unusually interesting pamphlet on the permanence of transformer insulation. This last gives an account of the defects of different insulating materials for transformers, and then explains the company's system of insulation by means of vacuum drying and other processes.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal Notes.

Mr. Edward Adams has been appointed city engineer of Springfield, Ill.

Mr. B. C. Bratt has been appointed city civil engineer of Portsmouth, O.

Mr. William Rumsey has been appointed assistant city engineer of San Diego, Cal.

Mr. George E. Dwyer has been elected city engineer of Marion, O., for a term of two years.

Mr. Otis F. Clapp, M. Am. Soc. C. E., has been reappointed city engineer of Providence, R. I.

Mr. A. S. Baldwin has been appointed engineer of construction of the Illinois Central Railroad.

Mr. Thomas H. James has been appointed to the new office of city engineer of Santa Monica, Cal.

Mr. G. W. Scott, consulting engineer, Chicago, has removed his offices to 1301-2 Security Building, in that city.

Mr. H. C. Bricker has been appointed assistant engineer of bridges and buildings on the Baltimore & Ohio Railroad.

Mr. George W. Tonson, city civil engineer of Toledo, O., has resigned to become general manager of the Toledo Construction and Supply Company.

Mr. E. W. Case has been re-elected city engineer of Colorado Springs, Col., and Mr. Will D. Waltman has been reappointed assistant city engineer.

Mr. Oscar E. B. Pfouts, formerly consulting engineer of the Lake Erie, Alliance & Wheeling Railroad, has been chosen city civil engineer of Cincinnati, O.

Civil Engineer Robert E. Peary has reported for duty at the Navy Department, Washington, but will not be assigned until he fully recovers from his recent operation.

Mr. Phillip T. Marye, of Newport News, Va., having submitted the most acceptable plans for the new union depot for Atlanta, Ga., has been chosen as its architect.

Messrs. Pattison Brothers, consulting engineers, New York City, have removed their offices to the Fuller Building, Broadway, Fifth Avenue and Twenty-third Street.

Professor R. C. Carpenter, of Cornell University, was in Chicago on Thursday of last week to award contracts for some cement plants to be built in Missouri and Louisiana.

Mr. John W. Alvord, M. Am. Soc. C. E., of Chicago, was chosen by the Omaha water board as appraiser for the city on the board of three to determine the value of the water works plant.

Mr. J. G. Platt has been appointed engineer of tests on the Erie Railroad, with headquarters at Meadville, Pa., succeeding Mr. A. G. Trumbull, who has been made mechanical engineer.

Mr. George Williams, president of the Building and Mason Contractors' Association of Chicago, has been made commissioner of buildings in that city to succeed Mr. Kiolbassa, who has resigned.

Mr. W. M. Torrance, C. E., has been appointed resident engineer in charge of construction of a bridge across the Tennessee River, at Gilbertsville, Tenn., for the Illinois Central Railroad Company.

Mr. Wendell H. Stillwell, former assistant general superintendent of the entire Rock Island system, has been made division superintendent of the Illinois Central, with headquarters at Fulton, Ky.

Mr. J. Y. McClintock, M. Am. Soc. C. E., whose resignation as commissioner of public works of Rochester, N. Y., was recently noted, has been appointed to the new office of county engineer of Monroe County.

Captain John Stephen Sewell, Corps of Engineers, U. S. A., has been detailed to assist the Secretary of Agriculture in the arranging of details for the erection of the proposed new building for the Department of Agriculture.

Mr. J. H. Bannerman, since 1888 master mechanic of the Springfield division of the Illinois Central Railroad, has been made superintendent of machinery and motive power for the Tennessee Central Railroad, with headquarters at Nashville, Tenn.

Lieut. Col. Charles J. Allen, Corps of Engineers, U. S. A., has been detailed to duty as a member of the river and harbor board to fill the vacancy made by the assignment of Col. Alexander Mackenzie, Corps of Engineers, as a member of the general staff.

Mr. Kenneth Allen, M. Am. Soc. C. E., engineer and superintendent of the water department of Atlantic City, N. J., delivered a lecture before the College of Civil Engineering of Cornell University, May 15, on "Investigations of the Baltimore Sewage Commission."

Admiral J. G. Walker, General Peter C. Hains and Prof. William H. Burr, who were recently requested by President Roosevelt to make an inspection of the work on the Panama Canal, have returned from the Isthmus. Major William M. Black, Corps of Engineers, U. S. A., will remain there some time longer.

Mr. J. M. Graham, chief engineer of the Baltimore & Ohio Railroad, will henceforth have supervision over a new sub-department made necessary by the installation of a new signal system near Pittsburg and other places. The work will be directly in charge of Mr. P. F. Patenall, signal engineer.

Mr. A. Rieppel, a prominent engineer of Germany and the managing director of the Augsburg-Nurnberg Machine Company, is in this country to visit the Allis-Chalmers plant, where the gas and liquid fuel engine, the patents of which are owned by the German firm, is to be manufactured. The Allis-Chalmers Company has been granted the American rights in the invention.

Gov. Wm. M. Crane of Massachusetts and William C. Whitney of New York have been added to the directorate of the General Electric Company, the other members being Gordon Abbott, Oliver Ames, C. A. Coffin, T. Jefferson Coolidge, Jr., Frederick P. Fish, George P. Gardner, Eugene Griffin, Henry L. Higginson, J. Pierpont Morgan, J. P. Ord, Robert Treat Paine, 2d, George Foster Peabody and Charles Steele.

A New Circuit Breaker has been brought out by the Stanley Electric Manufacturing Company, which has an independent opening action making it impossible to close the apparatus on an overload. Should an attempt be made to do so, the closing toggle will be automatically disconnected from the operating handle and the jaws will open, regardless of the pull on the handle, the instant sufficient current passes through the carbon contacts to operate the tripping device. Other special features are an arrangement of the arc-rupturing carbons which gives them a sliding contact and a new form of setting device.

The Taunton, Mass., Water report for 1902 contains some interesting statements about water meters. There are now 2,050 meters in use and the department has had in all 3,340 meters of 27 different kinds, of which 1,290 after a longer or shorter period of use have been finally rejected for various causes. In the past ten years 13,098 tests of meters have been made, the average of which showed an error slightly in favor of the consumer. The evidence seems conclusive, that on the whole, meters when properly cared for are fair and equitable in their record, both to the supplier and to the consumer, with a general leaning in favor of the latter. The leading manufacturers of water meters make good machines for measuring the consumption of water. They all make machines which on a general average are durable, accurate and trustworthy. There are individual cases of faulty machines of all types.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 23, 24 and 25.

WATER.

Ft. Rosecrans, Cal.—See "Government Work."

San Francisco, Cal.—It is stated that the Contra Costa Water Co. has increased its bonded indebtedness from $4,600,000 to $5,600,000, to be used for making improvements.

Santa Rosa, Cal.—Mayor M. J. Bower in a message to Council recommends that bonds be issued as follows: $40,000 for permanent street work, $30,000 for improvement to water works, part of which is for a new pump, and $5,000 for improving sewerage system.

San Diego, Cal.—It is stated that bids are wanted June 22 for $381,000 bonds, $199,000 of which are for water works. Geo. D. Goldman, City Clk.

Gilroy, Cal.—A press report states that Engr. C. B. Lewis is about to commence surveying for an irrigation plant to be established on Sargent ranch. A pumping station will be installed on Pajaro River, and a number of artesian wells furnishing about 1,000 gals. of water per minute will be made available for irrigation purposes.

Santa Barbara, Cal.—The citizens are reported to have voted May 6 in favor of the following improvements: For extension of municipal water tunnel through mountains to Santa Ynez River and construction of reservoir and pipe line, $200,000; for a paved boulevard a mile long to the ocean front, $50,000; for the additions to sewerage system, $20,000, and for 2 bridges, $14,000.

Ft. Logan, Colo.—See "Government Work."

Wethersfield, Conn.—The Wethersfield Water Co. has been organized, with a capital of $50,000. S. F. Willard, Pres.; E. S. Goodrich, Secy.

Bristol, Conn.—The Bristol Water Co. is stated to have awarded the contract for constructing an underground reservoir near the standpipe to Fred T. Ley & Co., of Springfield, Mass., the work to be finished about Sept. 1. It will be 75 ft. square and about 18 ft. deep. It will be used as a distributing reservoir for the Forestville system.

Shoshone, Idaho.—H. W. Anderson, Village Clk., writes that the question of water works is being considered here. He further states that it would be a good investment here for right parties.

Lewiston, Idaho.—Huber & Frazier is stated to have secured the contract for a reservoir for the city at $5,000, and 22 cts. per yd. for excavation.

The Lewiston-Waba Land, Water & Power Co. is about to be incorporated at Lewiston for power and irrigation purposes. Fred T. Dubois, of Blackfoot, and Jas. G. Trainer, of Chicago, Ill., are reported interested.

Rock Island, Ill.—P. T. Bancroft, Supt. Water Wks., in his annual report recommends that at least 200 meters be installed annually.

Carlinville, Ill.—John W. Alvord, Hartford Bldg., Chicago, Ill., has prepared plans for a reservoir of 8,000,000 gals. capacity, a low lift pumping plant, improvements to filters and a new pipe line to the city.

Kingsley, Ia.—It is stated that the City Council will soon let contracts for 15,000 ft. of water mains.

Maxwell, Ia.—L. Shepherd, City Recorder, writes that the water works improvements in contemplation will cost about $3,000.

Holyoke, Mass.—The Bd. of Aldermen is stated to have authorized the Water Comrs. to petition Legislature for permission to issue $50,000 bonds for completing the high-service reservoir.

Jas. L. Tighe, City Engr., writes that the following bids for furnishing 600 tons of (*a*) 20-in. c. i. pipe and (*b*) special castings were received by the Water Comrs. May 11, price given per net ton: R. D. Wood & Co., *a*, $32.90; *b*, $2.80. Warren Foundry Co., *a*, $31.70; *b*, $2.70. M. J. Drummond Co., *a*, $31.70; *b*, $2.88. U. S. C. Iron Pipe Co., *a*, $32.90; *b*, $3. Reading Fdy. Co., *a*, $38 and $28.50 (special bid); *b*, $2.75.

South Stillwater, Minn.—See "Power Plants, Gas and Electricity."

East Grand Forks, Minn.—E. Jacobi, City Treas., writes that the proposed water works will cost about $15,000. Engineer, W. H. Summers. According to press reports an election will be held on question July 2.

Minneapolis, Minn.—The Water Wks. Com. on May 5 voted to recommend the laying of a 30 in. distributing pipe from the reservoir to 25th Ave. n. e., and a 24 in. distributing pipe from the North Side pumping station to feed the North Side and Lowry Hill district. The contract for the pipe is stated to have been awarded to the U. S. Cast Iron Pipe & Fdy. Co., Chicago, Ill., at $32.60 a ton. The Northwestern Foundry Co. has secured the contract for furnishing special castings at $52 a ton, and Jas. B. Clow & Sons, Chicago, Ill., the contract for gate valves for 24 and 30 in. pipes at $220 and $425 per ton, respectively. R. D. Wood & Co., Philadelphia, Pa., will furnish 50 hydrants at $37 apiece.

St. Cloud, Minn.—Henry J. Lemperich, City Clk., writes that it was voted May 7 to purchase the water works.

St. Paul, Minn.—The Water Bd. on May 1 decided to lay new mains in 4 streets.

Milan, Minn.—The citizens are reported to have voted to construct water works.

Natchez, Miss.—Water and sewerage bonds amounting to $150,000 have been sold. They have been issued for the purchase of the water works and sewerage system owned by the Securities Co.

Kansas City, Mo.—Robt. E. King, Secy. Bd. Pub. Wks., writes that the following bids for a pipe line from Quindaro Station to Kaw Point were opened on May 2—*a*, 48-in. steel pipe in place (approximate length, 18,000 ft.); *b*, 36-in. steel pipe in place; *c*, 36-in. c. i. pipe in place; *d*, 66-in. conduit steel-concrete in place: The T. A. Gillespie Co., Pittsburg, Pa., *a*, $241,760; *b*, $168,200. W. W. Cook & Son, Junction City, Kan., *a*, $217,870; *b*, $152,734; *c*, $178,770. Parker-Washington Co., *a*, $215,600; *b*, $139,200; *d*, $194,400. R. J. & W. M. Boyd, *a*, $228,170; *b*, $166,390; *c*, $181,650. Cotter & McDonnell, *a*, $219,000; *b*, $155,576; *c*, $178,800. James Cotter, *a*, $198,835 (awarded contract); *b*, $146,667. McIntosh & Fyke, *a*, $232,968; *b*, $172,656; *c*, $180,160. Midland Bridge Co., *a*, $273,400; *b*, $164,540. R. L. Crump, *d*, $195,840. Bidders of Kansas City unless otherwise mentioned.

Bozeman, Mont.—Bids will be received until June 8 by F. W. Bull, Secy. of the Bozeman Creek Reservoir Co. for constructing a storage reservoir dam at Mystic Lake, Gallatin Co. C. M. Thorpe, Engr. in Charge.

Dillon, Mont.—Water bonds amounting to $65,000 are reported sold. Bids for construction will soon be asked. Frank Kelsey, of Salt Lake City, Utah, is Consulting Engr.

Newark, N. J.—The lowest bid received for constructing the gate house at Cedar Grove reservoir is stated to have been submitted by Stewart & Abbott for $31,730.

Jersey City, N. J.—M. T. Connelly, of Jersey City, is stated to have submitted the lowest bids for constructing the water main on west side of city, for $69,074.

Summit, N. J.—The Com. appointed to investigate the municipal ownership of water and light plants is stated to have recommended that the city purchase the water works but not the electric light plant.

Watertown, N. Y.—Allen Hazen, of New York, who has been employed by Bd. of Water Works to prepare plans and specifications for new mechanical filtration plant, has been in city looking over ground and preparing plans for the plant; probable cost of work is $100,000.

Roslyn, N. Y.—Bids will be received by Town Bd. of No. Hempstead at office of Town Clk. of Roslyn until May 18 for furnishing a water supply for fire purposes to Great Neck Water Supply Dist. and to Port Washington Water Supply Dist. In the 2 Dists. there will be required about 80 4-in. nozzle regulation fire hydrants, covering in all about 47,000 ft. of public highways. Monroe S. Wood, Town Clk.

Dunn, N. C.—The citizens are stated to have voted May 5 to issue $8,000 bonds to complete water works.

Fayetteville, N. C.—See "Power Plants, Gas and Electricity."

Kinston, N. C.—The citizens are reported to have voted May 4 to issue $150,000 bonds for water works, sewerage and street improvements.

Oberlin, O.—The village is stated to have purchased a site for a reservoir.

Springfield, O.—Ch. Engr. Powell, in his report to Water Bd., is stated to have recommended the installation of 10,000,000 gal. pumping engine and a 120-H.-P. boiler.

Temple, Okla. Ter.—A press report states that work will soon commence on water works to be constructed here by a company, of which J. C. Tandy is Pres. and Arthur L. Walker, Secy.

Pittsburg, Pa.—Local press reports state that the Council has passed an ordinance authorizing the procuring of bids for work on new water system in congested district, to cost about $91,000.

Reading, Pa.—The Reading Foundry Co. is stated to have secured the contract for furnishing c. i. pipe and specials (bids opened May 5) for $21,410.

Lehighton, Pa.—The Washington Water Supply Co., of Washington Township, has been incorporated, with a capital of $10,000. John W. Balliet, Slatington; Henry W. Boss, Slatedale, and N. A. Malliet, of Lehighton, are among the incorporators.

Coopersburg, Pa.—It is stated that surveys are being made for water works, to cost about $20,000.

Wilmot, S. D.—A. Minder, Town Clk., writes that it was voted May 4 to issue $6,000 bonds for water works.

Sioux Falls, S. D.—Mayor Burnside in his annual message to Council May 4 is stated to have recommended that immediate action be taken toward the construction of municipal water works.

Freeman, S. D.—C. Buechler, Town Clk., writes that it was voted May 4 to issue $9,000 bonds for the construction of water works.

Mt. Vernon, S. D.—M. J. Dougherty, Town Clk., writes that it was voted May 4 to construct water works.

Lake Preston, S. D.—W. Wright, City Clk., writes that the citizens voted May 5 to issue bonds for water works.

Harriman, Tenn.—Bids will be received May 26 by the Bd. of Water and Light Comrs. for furnishing approximately 3,040 ft. 8 and 10-in. c. i. water pipe, taking up and relaying 1,235 ft. 4 and 8-in. c. i. water pipe; also for constructing a 900,000 gal. concrete lined reservoir. Collier & Brown, Consulting Engrs.

Colorado, Tex.—It is stated that the Texas & Pacific Railway Co. will construct a reservoir or lake here this year by damming Lone Wolf Creek. B. S. Wathen, Ch. Engr., Dallas.

San Antonio, Tex.—The Meerscheidt & Steiren Irrigation Co., of San Antonio, has been incorporated; capital, $6,000. Incorporators: Alex. Meerscheidt, of San Antonio; Aug. Faltin, of Comfort, Tex., and others.

Ft. Stockton, Tex.—The Santa Rose Irrigation Co., of Ft. Stockton, has been incorporated; capital, $10,000. Incorporators: J. M. and Jas. McKenzie, of Ft. Stockton, and E. W. McKenzie, of Ft. Worth.

Austin, Tex.—See "Power Plants, Gas and Electricity."

Waco, Tex.—Press reports state that the Water Comm. on May 1st decided to at once take steps to carry out the wishes of City Council and get data upon which to submit a report as soon as possible. It also decided to make a new contract with the Bell Co., buy its plant, or build the new system.

Spanish Forks, Utah.—Henry Gardner writes in regard to work contemplated by the Spanish Forks Irrigation & Reservoir Co. that the company is not yet organized, but the work will probably cost $500,000. Engineers, Kelsey & Doremus.

Tacoma, Wash.—A site has been secured by the city for a reservoir of 4,000,000 gals.

Ellensburg, Wash.—It is reported that A. R. Black, of Lamar, Colo., proposes constructing an irrigation canal for Kittitas Valley.

West Allis, Wis.—See "Sewerage and Sewage Disposal."

Milwaukee, Wis.—Bids will be received May 19 by the Bd. of Pub. Wks. for furnishing 1,000 tons 6, 12 and 16-in. c. i. water pipe for the water mains; also furnishing the Water Dept. with 75 fire hydrants of the "Single Valve Matthews," or "Improved Stowell" pattern, each supplied with a single combination 4-in. steamer and 2½-in. hose nozzle. Chas. J. Poetsch, City Engr.

Muscoda, Wis.—This town is reported to be figuring on the installation of water works.

Port Washington, Wis.—Jacob Cloos, of Milwaukee, has been employed to prepare plans for water works; probable cost of work reported to be about $35,000.

Portage La Prairie, Man.—Willis Chipman, of Toronto, Ont., is stated to be preparing a report on proposed water works.

Maricville, Que.—It is stated that bids are wanted May 20 for constructing reservoir and pumping station, with gasoline engine. Dupont & Leduc, of Montreal, are Des. Engrs.; G. Bombardier, Secy.

SEWERAGE AND SEWAGE DISPOSAL.

Long Beach, Cal.—Wm. A. Foster, City Engr., writes that the following bids were opened May 4 for constructing the sewer which will pass through the city to the septic tank: H. C. Register, Los Angeles, $16,855 (awarded contract); Ramich & Marsh, Los Angeles, $22,845; Smith & Genella, Los Angeles, $18,000; C. D. Vincent, Oakland, $18,219. This work includes 6,623 ft. of vitrified salt-glazed pipe sewers 14 and 18 inches, and 19 manholes. The trench is expected to average 18 ft. in depth, and will be excavated in clay. The bids for the septic tank and outfall sewer below septic tank extending into the ocean have not yet been called for.

Ft. Rosecrans, Cal.—See "Government Work."

Santa Rosa, Cal.—See "Water."

Los Angeles, Cal.—It is stated that bids are wanted May 25 for furnishing about 20,000,000 brick and 30,000 bbls. of cement to be used to construct outfall sewer and storm drains.

Santa Barbara, Cal.—See "Water."

Denver, Colo.—The Bd. of Pub. Wks. is considering the building of a trunk sewer in that part of the city lying east, north and south of the City Park; probable cost of work, $100,000.

Hartford, Conn.—Bids are wanted May 20 for constructing the Franklin Ave. storm-water overflows and Maple Ave. sewer. Jos. Buths, Pres. Bd. of St. Comrs.

Aurora, Ill.—H. D. Hallet, of Aurora, Ill., has secured the contract for 2,020 lin. ft. of 10-in. and 725 ft. of 12-in. pipe sewers, 3 flush tanks, 9 manholes and 18 catch basins, for $4,195 (bids opened May 7).

Danville, Ill.—See "Paving and Roadmaking."

Belleville, Ill.—The contract for constructing the W. Main St. sewer is stated to have been awarded to Reeb Bros., for $13,650.

Springfield, Ill.—The Bd. of Local Improv. is stated to have recommended that an 18-in. vitrified sewer be built from Keys Ave. to a point near Eastmnn Ave. on 4th St.; also that 9th St. be paved with brick on a 6-in. concrete foundation.

Maywood, Ill.—The Bd. of Local Improv. is stated to have awarded the contract for the S. 15th St. sewer to Chas. M. Porter, River Forest, Ill., for $35,580.

Lafayette, Ind.—Bids are wanted May 25 for constructing 15, 18 and 24-in. pipe sewers in a portion of Hartford St. Chas. F. Williams, Jr., City Clk.

Anderson, Ind.—Bids will be received June 1 by Frank A. Sharp, City Clk., for constructing an 8 and 10-in. sewer in portions of Madison and Nichol Aves.

New Albany, Ind.—Riggs & Sherman, of Toledo, O., are stated to have been retained to prepare plans and specifications for a system of storm water and sanitary sewers.

Wabash, Ind.—See "Paving and Roadmaking."

Peru, Ind.—It is stated that Chas. C. Harris, Construction Comr., is receiving bids for the construction of various sections of the large drain in Miami, Cass and Fulton Counties. Lawrence & Rhodes, Attorneys.

Marion, Ind.—Bids will be received May 19 by C. G. Robbins, City Clk., for constructing a sewer in portions of 3 streets.

Burlington, Ia.—Bids are wanted June 15 for the Stony Lonesome sewer, about 3,340 ft. 4 to 8 ft. in diameter, and the Hawkeye sewer, 300 ft. about 18 in. in diameter. Emmet Steece, City Engr.

Olathe, Kan.—F. S. Pickering, City Engr., writes in regard to the construction of 4,980 ft. of 8 to 24-in. pipe sewers and 8 manholes in Lateral Dist. No. 2 (for which bids were to have been opened May 5) that no contract was entered into on that date, as plans were ordered changed.

Central Covington, Ky.—Sewer bonds amounting to $30,000 have been sold.

The Town Trus. are stated to have passed on May 6 an ordinance providing for the construction of a trunk sewer from Wood St. to the corporation line.

Belfast, Me.—Bids will be received June 1 by A. P. Mansfield, City Clk., for constructing sewers on 3 streets.

Sunderland, Mass.—Bids are wanted May 27 for constructing about 6,500 lin. ft. 10 and 18-in. pipe sewer with manholes, street inlets, etc., in portions of Main and Bridge Sts. Address W. L. Hubbard, Clk. of Bd. of Selectmen. J. E. Ostrander, Engr.

North Adams, Mass.—The Council is stated to have voted to issue $9,000 bonds for surface sewers.

South Hadley Falls, Mass.—Snow & Barber, of Boston, estimate the cost of constructing the proposed sewerage system at $15,000.

Worcester, Mass.—The City Council Com. on Sewers is stated to have voted to recommend an order for the construction of additional filter beds at the purification works, at an estimated cost of $25,000.

Grand Haven, Mich.—The Bd. of Pub. Wks. has engaged John W. Alvord, Hartford Bldg., Chicago, Ill., to prepare plans and specifications for a sewerage system to cover the entire city.

Richmond, Mich.—The Village Clk. writes that the cost of a pipe sewer for the western part of village is $2,500. O. B. Evans, Chmn. Sewer Com.

Natchez, Miss.—See "Water."

St. Louis, Mo.—E. A. Hermann, Sewer Comr., writes that the following are the contracts awarded for sewers, for which bids were opened by the Bd. of Pub. Improv. Apr. 28: To the Municipal Eng. Co., of Chicago, Ill., for constructing sewer in Cabanne Dist. (Letting No. 7,200), for $162,205, and to the Rich Constr. Co., 510 Pine St., for the 3 following contracts: Public sewer in Blackstone Sewer Dist. 1 (Letting No. 7,198), for $127,269; the Rock Spring sewer in Dist. No. 12 (Letting No. 7,201), $134,873, and for a sewer in Joint Sewer Dist. No. 1 (Letting No. 7,199), for $56,668.

Omaha, Neb.—See "Paving and Roadmaking."

Guttenberg, N. J.—The Council is stated to have authorized Town Engr. H. Prosser to prepare plans for a sewerage system, to cost about $40,000.

Jersey City, N. J.—Jas. J. Cogan is stated to have secured the contract for constructing a sewer in Ave. E and E. 21st St., for $13,448.

Watertown, N. Y.—Bids will be received May 18 by the Bd. of Pub. Wks. for constructing vitrified tile sewers in portions of Paddock and Pleasant Sts. C. O. McComb, City Engr.

New York, N. Y.—Bids will be received until May 25 by Jacob A. Cantor, Boro Pres., for furnishing and delivering 100 c. l. manhole heads, 500 c. l. manhole covers, 100 c. l. basin covers, 150 c. l. basin hoods, 50 straight and 50 curved c. l. herring-bone bars, 100 c. l. flat basin grates (corners) and 50 (straight).

Cuba, N. Y.—Bids are wanted June 1 for constructing sewers. The citizens recently voted to expend from $36,000 to $41,000 for a sewerage system. Address H. P. Morgan, Village Clk.

Brooklyn, N. Y.—Bids will be received May 27 (readvertisement) by J. Edw. Swanstrom, Boro. Pres., for constructing 62 sewer basins and appurtenances in several streets.

Saratoga Springs, N. Y.—Smith Robbins is stated to have secured the contract for constructing a sewer in George St. at 76 cts. for furnishing and laying 8-in. pipe, 37 cts. for 6-in. pipe and $36 for each manhole, and Edw. Ryall secured the contract for sewers in Nelson and Lincoln Aves. at $1.05 for furnishing and laying 10-in. pipe, 8-in. 90 cts. and 6-in. 40 cts., and $60 for each manhole and $80 for an automatic flushing tank.

Dansville, N. Y.—A petition is being circulated among the taxpayers requesting that plans be prepared at once for a sewerage system.

Cayuga, N. Y.—The City Surveyor, of Auburn, is reported to be surveying and making a map for the proposed sewerage system for Cayuga.

Poughkeepsie, N. Y.—Chas. E. Fowler, Supt. & Engr. Pub. Wks., writes that Peter Morgan, of Poughkeepsie, secured the contract for pipe sewers in 2 streets for $3,893, and Chas. Cooke, of Poughkeepsie, the contract for pipe sewers in 5 streets for $4,161 (bids opened May 5).

Alexandria Bay, N. Y.—Sewer bonds amounting to $75,000 are reported sold.

Kinston, N. C.—See "Water."

Delphos, O.—It is stated that the plans of Riggs & Sherman, of Toledo, have been adopted for a sewerage system, to cost about $114,725.

St. Bernard, O.—The Council is stated to have adopted the plans of Engineer Stewart for a sewerage system. The total cost of all 4 districts will amount to about $135,000.

Troy, O.—Sewer bonds amounting to $43,000 are reported sold.

Local press reports state that the following bids were opened May 6 for the construction of a sewerage system: John Reid & Co., $49,799; Hennessy & Bros., $44,776; Ulrick & Williams, Springfield, $43,677 (awarded contract), and Dorsey & Harris, $44,263.

Columbus, O.—The Bd. of Pub. Wks. is stated to have rejected the bid of F. D. Sullivan, submitted Apr 30, for the construction of Russell St. relief sewer, amounting to $40,385, being in excess of estimate about $5,000.

Oberlin, O.—It is reported that this city will expend about $50,000 for sewer and paving work.

Meadville, Pa.—Councils have asked for estimates of cost to equip sewage pumping station, with 2 gas engines and centrifugal or other low lift pumps; requirements, 8,000,000 gal. sewage and roof water per 24 hours; height of lift, 18 ft. W. A. Doane, City Engr.

Lewistown, Pa.—Wm. S. Settle, City Secy., writes that J. Murray Africa, of Huntingdon, Pa., is preparing plans for a sewerage system, to cost about $65,000, and bids for construction will be wanted in about 90 days.

Philadelphia, Pa.—The Council on May 7 passed an ordinance appropriating $125,000 from the $5,000,000 permanent loan for the construction of main sewers.

Danville, Pa.—The Boro. Council is stated to have adopted a resolution providing for the construction of a pipe sewer in Blizzard's Run.

Stroudsburg, Pa.—The citizens are stated to have voted May 9 to issue $29,000 bonds for the construction of a general system of sewerage.

Ebensburg, Pa.—See "Paving and Roadmaking."

Narbeth, Pa.—A. P. Redifer, Clk. of Council, writes that the Council has under consideration the construction of a sewerage system.

Ardmore, Pa.—According to press reports the following bids were opened on May 4 by the Health & Drainage Com. of Lower Merion Township for the construction of about 40 miles of sanitary sewers: H. B. Oliver, New Brunswick, N. J., Sec. 3, $18,500; Sec. 4, $30,806. David Peoples, Philadelphia, entire work, $248,000. Chas. D. Land & Co., Philadelphia, Sec. 6, $23,428; Sec. 7, $42,085. Municipal Eng. Co., Chicago, Ill., Sec. 1, $70,716. Bowman Bros., McKeesport, entire work, $232,032 (awarded contract). J. H. Jordan, Sec. 1, $76,805. Walter B. Stone, Philadelphia, Sec. 5, $19,588. Frech & Callan, Flemington, N. J., Sec. 2, $27,850. The bids received for the pumping station were: Smedley Constr. Co., Philadelphia, $29,491; J. H. Jordan, $33,535, and Bowman Bros., McKeesport, $24,891 (awarded contract).

Lancaster, Pa.—The Special Sewer Comn. is stated to have decided to accept the offer of Engr. Saml. M. Gray, of Providence, R. I., to prepare plans and specifications for the construction of sewers to be built from the $250,000 loan recently authorized by Councils.

Chester, Pa.—Bids will be received May 18 by Thos. W. Crowe, Chmn. Sewer Com., for constructing sewers in portions of 5 streets. Frank W. Harrison, City Clk.

Providence, R. I.—A resolution appropriating another $100,000 toward building the improved sewerage system was passed by City Council May 4. This money is to be expended in extending system introduced with station at Field's Point.

Warwick, R. I.—The Town Council is stated to have appointed two of its members a committee to secure expert professional advice as to the best method of draining Allen St. and adjacent parts of section of Riverpoint.

Harriman, Tenn.—Van D. H. Smith, of Knoxville, has secured the contract for 7,220 ft. of pipe sewers 8 to 12 in. in diameter, 18 manholes, 3 flush tanks and 1 catch basin, for $4,556. F. J. Manley, City Engr.

El Paso, Tex.—According to local press reports, City Engr. Wimberly estimates the cost of constructing a sewer in the Franklin Heights addition at $16,000, and a relief sewer main in 2d St., at $24,100.

Beaumont, Tex.—Merritt W. Yeates, City Engr., writes that the following bids for sewers were opened on May 5: H. W. Downey & Co., Beaumont, $72,710 (awarded contract), and Black & Laird, Beaumont, $85,516. This work includes about 24,000 ft. of brick and pipe sewers from 6.6 ft. x 4.4 ft. to 12 in. in diameter, 60 manholes, and 180 catch basins. The trench is expected to average 8 ft. in depth, and will be excavated in earth.

Seattle, Wash.—The Council is stated to have reported favorably on the resolution providing for the laying of sewer mains through all sections of Brooklyn, with an outlet into Lake Union, near Latona, where a big septic tank will purify the sewage; probable cost of work is about $108,500.

Tacoma, Wash.—E. B. Moore has secured the contract for constructing sewers in Local Improv. Dist. No. 133 for $8,712.

West Allis, Wis.—The Town Bd. is stated to have selected J. B. Davidson to establish a grade for streets, survey for sewers, and make plans for water works.

Milwaukee, Wis.—Bids will be received May 19 by the Bd. of Pub. Wks. for constructing brick and pipe sewers in portions of 10 streets. Chas. J. Poetsch, City Engr.

BRIDGES.

Bessemer, Ala.—It is stated that the Birmingham Railway, Light & Power Co. will build a bridge across the railroad tracks at 10th Ave.

Santa Barbara, Cal.—See "Water."

Waterbury, Conn.—The building of a bridge from Waterville across Naugatuck River, at the expense of the towns of Waterbury and Watertown, is reported under consideration.

Dover, Del.—Jas. A. Hirons, of Dover, is reported to have secured the contract to construct the Silver Lake Bridge at $7,600.

Chicago, Ill.—Bids for the construction of a concrete and granite bridge and a dam in Jackson Park will be received by the So. Park Comrs. May 30.

Winamac, Ind.—E. S. Rees, Co. Aud., writes that the contract for a 2-span truss bridge in Tippecanoe Township (bids opened May 5) has been awarded to the Rochester Bridge Co., of Rochester, Ind., for $8,998.

Terre Haute, Ind.—Bids are wanted by the Comrs. of Vigo County June 10 for constructing a steel bridge across Wabash River; estimated cost, $200,000.

Evansville, Ind.—The Co. Comrs. are considering the building of a bridge at Maryland St., estimated to cost about $75,000.

South Bend, Ind.—The Co. Comrs. have appropriated the following amounts for bridges: Colfax Ave., $120,000; Jefferson St., $116,000, and Cedar St., $51,000.

Burlington, Ia.—Bids are wanted June 15 for constructing a steel viaduct on 6th St. Emmet Steece, City Engr.

Taunton, Mass.—An appropriation of $23,000 is asked for a new drawbridge over Taunton River at Weir Village. Address City Engr. L. Deane.

Saginaw, Mich.—The Bd. of Pub. Wks. has decided in favor of the Scherzer rolling lift bridge plans for the Genesee Ave. bridge, said plans to cost the city $6,000. The cost of constructing this bridge is roughly estimated at $155,000.

St. Paul, Minn.—The following bids were opened on May 5 for the substructure of Grand Ave. bridge: Newman & Hoy, Chamber of Commerce Bldg., $11,164 (awarded contract); L. G. Washington, $11,966; Wm. Porter Co., $12,466; J. Nevin & Sons, $14,112.

Le Sueur, Minn.—Plans, specifications and bids will be received May 22 by the Common Council for constructing a 70-ft. steel bridge. Theo. G. Mabier, City Clk.

Henderson, Minn.—Bids will be received May 22 by the Bd. of Superv. of Kelso Township for constructing a steel bridge and stone abutments on the Kroll road; also May 23 for constructing a steel bridge over Rush River on Klappenbach Road. Florenz Seemann, Town Clk.

Vicksburg, Miss.—Bids will be received June 1 by J. D. Laughlin, Co. Clk., for constructing 1 steel and 1 white oak bridge over Hamer Bayou.

Atlantic City, N. J.—J. J. Albertson, Co. Engr., writes that the following bids for constructing 2 steel drawbridges were received by Bd. of Freeholders May 12: Fink & Co., Baltimore, Md., $26,552; N. J. Bridge Co., Newark, $27,760; Groton Bridge Co., Groton, N. Y., $27,900; O. A. Gutredge, Atlantic City, $27,453; C. H. Schweers, $25,540 (awarded contract); B. F. Sweeton & Son, Camden, $27,915.

Jersey City, N. J.—The Hudson Co. Bd. of Freeholders has appointed Frederick Dashe, of Arlington, as engineer to act in conjunction with Engr. Jas. Owen, of Essex Co., to prepare plans and specifications for rebuilding the new draw over the Passaic River at Bridge St.

Milltown, N. J.—The Bd. of Freeholders has adopted a resolution to include in the new budget $6,000 as the County's share toward the building of a bridge at Milltown.

New York, N. Y.—John C. Rodgers is reported to have secured the contract for constructing masonry pedestals on top of tower foundations in the Boros. of Manhattan and Brooklyn for Manhattan Bridge (No. 3) over the East River for $150,000.

Bids will be received until May 28 by Gustav Lindenthal, Comr. of Bridges, for furnishing material and plant necessary to construct the steel underflooring for the roadways of the Williamsburgh Bridge across the East River, between Manhattan and Brooklyn Boroughs.

Bids will be received May 21 (readvertisement) by the Bd. of Park Comrs. for constructing a concrete steel arch bridge, with stone parapet walls and stone arch facings over the Bronx River, at the crossing of the Bronx and Pelham parkway. Wm. R. Willcox, Chmn.

Corning, N. Y.—The Rochester Bridge & Construction Co., of Rochester, is reported to have submitted the lowest bid for constructing the Gibson bridge in the city at $29,000.

Glens Falls, N. Y.—The Climax Co. is reported to have received the contract to construct a bridge at The Glen for $9,500.

Lillington, N. C.—E. T. Young, Chmn. Co. Comrs., writes that the contract for a steel bridge at Aversasbero Ferry (bids opened May 4) has been awarded to Converse Bridge Co., of Chattanooga, Tenn. According to reports, the cost will be $10,000.

E. Liverpool, O.—The Newell Bridge Co., of W. Virginia, has submitted to the Secy. of War maps and plans for the proposed bridge to be built by this Co. across the Ohio River in this city.

Cleveland, O.—Press reports state that 2 bridges will be built across the Cuyahoga River, this summer, by the Newburg & South Shore R. R. Co., to accommodate the line being built from Newburg mills to Central furnace. One is to be a lift bridge, the other a low level structure.

Cincinnati, O.—The residents of Carthage pike, in St. Bernard and Elmwood Pl., are reported to have under consideration the building of a viaduct near Spring Grove Ave.

Niles, O.—Bids will be received June 2 by the Co. Comrs. for furnishing material and constructing a steel bridge, either 28 ft. or 36 ft. roadway, with concrete floor over Mosquito Creek at Niles.

Astoria, Ore.—Ferguson & Houston, of Astoria, are stated to have secured the contract to construct a 70-ft. steel drawbridge, with about 1,600 ft. of trestle approaches, across the Lewis and Clark River, a short distance above its mouth, for $17,500.

Erie, Pa.—It is stated that bids are wanted May 18 for constructing abutments and piers for the Buffalo Road overhead bridge. B. E. Briggs, City Engr.

Ardmore, Pa.—The building of a bridge at a probable cost of $5,000 across Mill Creek, in Lower Merion Township, is reported agitated.

Bellevue, Pa.—The Co. Comrs. have been petitioned to contribute toward the building of a $20,000 bridge from Bellevue to Avalon.

Scranton, Pa.—It is stated that the construction of a bridge at Sanderson Ave. is under consideration.

Harrisburg, Pa.—Reports state that the building of a bridge across the Penn. R. R. tracks at Walnut St. is being agitated.

Auburn, Pa.—Local press reports state that the Canton Bridge Co., of Canton, O., submitted the lowest bid for constructing a bridge across Schuylkill River at Auburn, at $19,500.

Lewistown, Pa.—Plans have been submitted by Oscar Thompson for the bridge to be built across Susquehanna River at Lewistown, between the counties of Union and Northumberland.

Central Falls, R. I.—The Aldermanic Com. of Pawtucket and Central Falls at a joint meeting authorized the City Engrs. of respective cities to engage a bridge expert to examine Cross and Mill St. bridges, relative to their present safety.

Olivet, S. D.—Bids will be received June 22 by the Co. Comrs. for constructing 5 steel bridges. D. D. Wipf, Co. Aud.

Carthage, Tenn.—Press reports state that bids will be received in this city until May 25 for $50,000 bridge bonds.

Hallettsville, Tex.—The proposition to issue $25,000 bridge bonds is reported to have carried.

Spokane, Wash.—Bids will be received May 21 by the Bd. of Pub. Wks. for constructing the south approach to Monroe St. bridge; separate bids will be received for constructing piers and abutment walls under the south approach; estimated cost, $26,000. L. B. Handley, Secy.

Benwood, W. Va.—The American Bridge Co., according to press reports, has secured the contract to furnish and erect the channel spans of the Baltimore & Ohio R. R. Co.'s bridge across the Ohio River at Benwood, W. Va. The longest of these spans is 350 ft. The total length of the bridge is 2,416 ft.

Oshkosh, Wis.—Plans, specifications and bids will be received May 18 by the Bd. of Pub. Wks. for furnishing material and constructing a highway bridge in North Park. Michael Coffey, Chmn.

Milwaukee, Wis.—Local press reports state that on May 4 the Common Council awarded the contract for constructing a bridge at Muskego Ave. to the Milwaukee Bridge Co. at $93,800.

Hamilton, Ont.—Bids will be received May 23 by Thos. Yeo, Chmn. Co. Road and Bridge Com., for constructing an arch culvert and an embankment on the road between Hamilton and Waterdown.

Fletcher, Ont.—Bids will be received May 29 by the Municipal Council of the Township of Tilbury East for constructing a 7-span, 181-ft. steel pile trestle bridge over Jeannette's Creek in said Township. Alex. Farquharson, Clk., P. O., Fletcher.

PAVING AND ROADMAKING.

Montgomery, Ala.—The City Council has authorized the issue of $20,500 bonds for paving the sidewalks on Adams and Alabama Sts.

Santa Barbara, Cal.—See "Water."

Santa Rosa, Cal.—See "Water."

Denver, Colo.—Local press reports state that the only bid received May 6 for resurfacing a portion of 14th St. with asphalt is reported to have been submitted by the Colorado Paving Co. at $1.49 per sq. yd. Council has appropriated $25,000 for this work.

So. Norwalk, Conn.—Frank Pidgeon, of Saugerties, N. Y., is reported to have submitted the lowest bid for paving with Portis or Syracuse brick 3,100 sq. yds., on E. Washington St., at $8,393.

Tampa, Fla.—Bids will be received May 25 for $400,000 bonds, a portion to be used to pay for constructing roads. W. L. Hanks, Clk. Bd. Co. Comrs.

Atlanta, Ga.—The paving of Pryor St. with asphalt is reported contemplated.

Savannah, Ga.—The City Council has adopted resolutions to pave with brick on portions of Whitaker and W. Broad Sts.

Boise, Idaho.—John Pilmer is reported to have received the contract to pave with vitrified brick on a portion of 8th St. Estimated cost, $40,000 to $45,000.

Chicago, Ill.—There is a movement on foot to pave the downtown district with asphalt, about 13 miles of streets.

Taylorville, Ill.—The City Council has voted to lay 20 blocks of brick pavement during the coming summer.

Chicago, Ill.—Bids will be received by the Bd. of Local Improv. until May 20 for curbing and paving with brick, slag, granite block, and asphalt on portions of numerous streets. Andrew M. Lynch, Prea.

The Barber Asphalt Paving Co. is reported to have received the contract to pave about 5 miles of streets with asphalt. Cost reported to be over $300,000.

Danville, Ill.—W. H. Martin, City Engr., writes that all bids received Apr. 23 for 10,000 yds. pavement, 5,000 yds. stone curbing and 3,500 ft. of 8-in. sewer have been rejected.

Springfield, Ill.—See "Sewerage and Sewage Disposal."

Seymour, Ind.—Bids will be received June 11 by the Common Council for improving by paving with vitrified brick portions of 2d St.

Bloomington, Ind.—Bids will be received June 12 by City Clk. Browning for paving Kirkwood Ave.

Bluffton, Ind.—It is stated that bids are wanted June 2 for constructing 15,900 ft. of gravel road. D. O. North, Engr.

Wabash, Ind.—Bids are wanted May 25 for macadamizing Chestnut St. and 1st Alley S. of Noble St.; also for a sanitary sewer in Maple St. John Hilty, City Engr.

Anderson, Ind.—Bids will be received June 1 by Frank A. Sharp, City Clk., for improving and constructing sidewalks on portions of 10th St.

Hartford City, Ind.—The lowest bids received for paving 8,079 sq. yds. on Water St. are reported to have been from Philip Hipskind & Son, of Wabash, at $2.26 per sq. yd., mentioning the kind of brick to be used, and from W. H. Cox, of Hartford City, at $2.30 per sq. yd., allowing the Council to name the kind of brick to be used.

Marion, Ind.—Bids will be received May 19 by C. G. Robbins, City Clk., for paving with vitrified brick portions of 31st St. and Western Ave.

La Porte, Ind.—Bids will be received May 25 by the Common Council for improving with bitulithic pavement portions of Madison St. C. E. Wolfe, City Clk.

New Albany, Ind.—Bids will be received May 18 by the Common Council for improving with asphalt and vitrified brick portions of numerous streets. Eugene L. Brisby, City Clk.

Ft. Wayne, Ind.—Contracts for paving (bids opened Apr. 27) have been awarded as follows: To C. E. Moellering & Co., Ft. Wayne, for paving W. Main St. and Fairfield Ave. (north end) with Metropolitan block at $1.89 per sq. yd. and to the Barber Asphalt Co., New York, N. Y., for paving with Trinidad asphalt (per lin. ft. complete) Washington St. at $8.37; Harmer St. (intersection), $10.44; Fairfield Ave. (south end), $8.29, and Breckenridge St. (intersection), $10.70. F. M. Randall, City Engr.

Princeton, Ind.—Bids will be received by the Bd. of Co. Comrs. until June 2 for constructing 10 separate roads, comprising about 29 miles. S. R. Adams, Co. Aud.

Martinsville, Ind.—The Co. Comrs. are reported to be receiving bids for constructing 12 miles of gravel roads in Gregg Township.

Delphi, Ind.—The Comrs. of Carroll Co. have decided to build $50,000 worth of free gravel roads in Deer Creek Township.

No. Manchester, Ind.—Reports state that the contract recently awarded for paving ¾ of a mile on Main St. with brick was illegal, and new bids are to be received. The probable cost of the work is reported to be about $50,000.

Washington, Ia.—Hugh H. McClery, City Clk., writes that bids are wanted May 19 for 4 blocks of brick paving.

Burlington, Ia.—Bids are wanted June 15 for paving Arch St., 3,300 sq. yds., with asphalt and Franklin St., 5,200 sq. yds., with brick. Emmet Steece, City Engr.

Cedar Rapids, Ia.—The contract for paving with asphalt on a portion of First Ave. is reported to have been awarded to Budd Snoffer at $1.65 per sq. yd.

Marshalltown, Ia.—Wm. Brenner, City Engr., writes that no contract was awarded for asphalt paving on a concrete foundation on 2 streets (bids opened May 11). New bids will be called for.

Louisville, Ky.—Local press reports state that the Bd. of Pub. Wks. will receive bids until May 24 for paving with vitrified brick or block on portions of 8 streets.

Louisville, Ky.—An ordinance has been passed by the Bd. of Aldermen to pave with asphalt, a distance of about 7,000 ft. on Bway., at an estimated cost of $75,000.

Alexandria, La.—Epple & Hayes are stated to have secured the contract to construct 3 miles of artificial sidewalks for $15,000.

Baltimore, Md.—On May 6 the following street paving measures were finally passed by the City Council: Repaving streets around St. Joseph's Hospital with wooden blocks, appropriation $21,500; repaving the streets fronting the University of Maryland Hospital with wooden blocks, appropriation $24,100; repaving the streets around the court house with wooden blocks and vitrified brick, appropriation, $21,000.

Edw. Brady, Clk. Bd. of Awards, writes that the contract for 45,000 granite paving blocks (bids opened May 13) has been awarded to P. Flanigan & Co., Calvert and Lexington Sts., Baltimore, at $45.50 per M. f. o. b. Baltimore, and at $52 per M. delivered.

Annapolis, Md.—Jas. C. McGuire, of New York City, is reported to have submitted the lowest bid for paving work at the Naval Academy grounds, Annapolis, at $26,239.

Milford, Mass.—It is stated that bids are wanted May 19 for constructing brick gutters, curbing and granitoid pavements on Chestnut, Indiana and Walnut Sts.

Pittsfield, Mass.—The Common Council has adopted orders appropriating $100,000 for street paving and authorizing the Bd. of Pub. Wks. to immediately commence the preliminary work.

Newburyport, Mass.—T. F. O'Neill is reported to have secured the contract to furnish about 5,000 tons of crushed stone, at $1.25 per ton.

Boston, Mass.—Bids will be received May 18 by Jas. Donovan, Supt. of Streets, for constructing a telford macadam roadway on portions of Bennington St., E. Boston Dist.

Falmouth, Mass.—Wm. McDermott is reported to have submitted the lowest bid for constructing a road in this town for $5,900.

Detroit, Mich.—The following are the contracts awarded for paving bids opened May 11: To Julius Porath, 1493 18th St., for 5,320 yds. brick on Michigan Ave., between 26th St. and Scotten Ave., $10,370, and to H. Merdian & Co., 499 Chene St., for 16,098 yds. brick paving on Michigan Ave., between Grand Trunk R. R. crossing and city limits, $31,231.

Grand Rapids, Mich.—Plans and specifications for the resurfacing of State St. have been approved.

City Engr. Anderson estimates the improving a portion of LaGrave Ave. as follows: With sheet asphalt, at $26,298; bituminous macadam, $25,227; macadam, $15,390; asphalt block, $31,878.

Bay City, Mich.—The Bd. of Supervs. has granted the increase of one-half mill per $1 valuation asked by the Stone Road Bd., and nearly $40,000 annually will now be available to keep the stone road system in good repair.

Ann Arbor, Mich.—Bids will be received May 18 by the Bd. of Pub. Wks. for laying approximately 12,000 sq. yds. asphalt block pavement. E. W. Groves, City Engr.

Minneapolis, Minn.—Hugh R. Scott, County Aud., writes in regard to the furnishing of a power road roller, rock crusher, reversible road machine and a sprinkling wagon, bids for which were received by Bd. Co. Comrs. May 4, that no contracts were awarded, as it was found that no funds were available from which to pay for same this year.

St. Paul, Minn.—It is reported that bids are soon to be received for paving with brick on Burr St. bridge at a cost of about $6,000.

Omaha, Neb.—$100,000 paving and $100,000 sewer bonds are reported to have been sold.

Jersey City, N. J.—Bids will be received May 19 by the Bd. of Street and Water Comrs. for grading, etc., the additions to Columbia Park, requiring in all about 32,900 sq. ft. cement walks. Geo. T. Bouton, Clk.

Jersey City, N. J.—The Hudson Co. Freeholders on May 7 adopted a resolution to improve Newark Plank Road in conjunction with Essex Co., and appointed Jas. W. Leahy as Hudson Co. Engr. Specifications are to be prepared so that bids may be received on either granite or trap rock blocks.

Newton, N. J.—Press reports state that the following bids were received May 4 for building a macadam road from Sandusky Township to Normanock Inn, near Culvers Lake, a distance of about 8,945 ft.: Colfax & Steel, of Pompton, with telford, $23,267; without telford, $16,309. Augustus Munson Co., of Rockaway, $12,282. J. B. & H. K. Salmon, of Boonton, $19,000.

Camden, N. J.—Bids will be received May 18 by the Finance Com. of City Council for $75,000 repaving bonds. R. R. Miller, City Treas.

Paterson, N. J.—The Mayor, in a message to Council, suggests the appropriating of $25,000 for the repair and maintenance of the macadam streets.

Albany, N. Y.—Bids will be received May 18 by the Bd. of Contract and Supply for improving portions of Manning Boulevard by grading, paving the carriageway with macadam, laying cobble gutters, gravel sidewalks and constructing culverts, drains, sewers, etc.; estimated cost, $55,000. Also portions of Broadway by grading, curbing, paving the carriageway with sheet asphalt, repairing sidewalks, etc.; estimated cost, $25,000. Also for improving a portion of Delaware Ave. I. Wachsman, Clk.

Binghamton, N. Y.—City Engr. Monroe is preparing plans and specifications for paving, probably with brick, on portions of Conklin and Prospect Aves., and on Clinton, N. Depot and Fayette Sts.

Local press reports state that the City Engr. has been directed to receive bids until May 19 for repairing the asphalt pavements of the city.

Newburgh, N. Y.—Governor Odell has signed the bill increasing from $200,000 to $500,000 the limit of Orange Co. bonds for road improvement.

Oxford, N. Y.—The taxpayers have voted to pave with vitrified brick Lafayette Sq., at an estimated cost of about $10,000.

Oswego, N. Y.—The Dept. of Wks. has directed the Clk. to receive bids for asphalt, vitrified brick or bituminous macadam on portions of W. 3d, 4th and W. Mohawk Sts.

Ithaca, N. Y.—Governor Odell has signed a bill authorizing Ithaca to raise $10,000 annually for highway improvement.

Mamaroneck, N. Y.—Street paving bonds amounting to $10,000 are reported to have been sold.

Watervliet, N. Y.—City Engr. Thomas estimates the cost of macadamizing 8,021 sq. yds. on 19th St., at $7,460.

Buffalo, N. Y.—The Bd. of Aldermen, according to press reports, has awarded the contract to pave with brick on a portion of Lord St. to L. H. Gipp, at $14,170.

Nyack, N. Y.—The Hastings Paving Co. is stated to have received the contract to pave 2,500 yds. with asphalt block on a concrete foundation at $2.25 per sq. yd.

Watertown, N. Y.—Local press reports state that Warren Bros. Co., of Utica, N. Y., has secured the contract to pave with bituminous macadam, about 19,200 sq. yds. on State St., at $1.80 per sq. yd.; total, $41,895.

Buffalo, N. Y.—Governor Odell has signed a bill amending the charter of Buffalo so as to provide that when a street once paved is to be paved again, ⅔ of the cost shall be paid by local assessment and ⅓ charged to the general fund.

Rome, N. Y.—Paving bonds, amounting to $10,000, have been sold.

Utica, N. Y.—Local press reports state that contracts for paving with asphalt on portions of 10 streets have been awarded to the Barber Asphalt Paving Co., at a total cost of $85,072; also the contract for repairing asphalt pavements during this season at $3,380. The Syracuse Improvement Co., of Syracuse, is reported to have secured the contract to pave with asphalt on portions of 5 streets, at a total cost of $47,364.

Glens Falls, N. Y.—At the election held May 2 the proposition to issue $83,000 bonds for paving purposes, carried.

New York, N. Y.—Bids will be received until May 28 by Gustav Lindenthal, Comr. of Bridges, for furnishing the material, labor and plant for constructing the creosoted wood block pavement for the roadways of the Williamsburgh Bridge across the East River, between the Boros. of Manhattan and Brooklyn.

Gloversville, N. Y.—The following bids for 3,500 sq. yds. brick paving were opened May 11: Frank Pidgeon, Saugerties, $10,331; A. Sharp, Albany, $8,533; A. M. Banker, Gloversville, $8,396 (awarded contract).

White Plains, N. Y.—Bids will be received by the Village Bd. of Trus. until May 25 for paving New St. with wire-cut vitrified paving brick on sand foundation. Peter Paulding, Village Clk.

Kinston, N. C.—See "Water."

Elmwood Place, O.—Bids will be received June 13 by Harry G. Schaefer, Village Clk., for $6,500 Township Ave. improvement bonds.

Cincinnati, O.—Bids are wanted May 25 for improving by macadamizing portions of Grandin Road and Vine St. Robt. Allison, Pres. Bd. Pub. Service.

Oberlin, O.—See "Sewerage and Sewage Disposal."

Portsmouth, O.—The City Council has passed a resolution to pave 5 streets, in all about 1 8 10 miles, with vitrified brick.

Bowling Green, O.—Bids will be received June 10 by the Co. Comrs. for grading, draining, macadamizing and constructing an earth and dirt roadbed adjacent to macadam roadbed in portions of 3 highways. B. C. Harding, Co. Aud.

Harrisburg, Pa.—The Warren-Quinlan Asphalt Co., of Syracuse, N. Y., is reported to have secured the contract to pave about 1½ miles on 2d St. with sheet asphalt. The contract price is reported to be $110,000.

Bids were opened May 12 by Chas. McConkey, Highway Comr., for sheet asphalt, brick or bituminous macadam on 8 streets: For sheet asphalt the Barber Asphalt Co. was lowest in all cases, at an average price of $1.81¼ per sq. yd., $1.10 per ft. for granite curb, $.85 for bluestone curb, $.94 for Medina curb, and $.21 for resetting curb, the Warner-Quinlan Co. being the only other bidder. For brick, Jas. M. West, Philadelphia, bid uniformly $1.93, $1.99, and $1.98 per sq. yd. for Hickory Run, Clearfield and Pine Grove bricks; $1.21, $.95 and $1.10 for granite, bluestone and Medina curb, and $.23 for resetting. For bituminous macadam, Warren Bros. Co. bid on 4 contracts, $1.97 per sq. yd., and $1.19, $.98, and $1.15 for curb and $.23 for resetting, while Barber Asph. Co. bid $1.50 per sq. yd. on two contracts and was lowest on curbing and resetting.

Butler, Pa.—Herbert Crickis, of Butler, is stated to have secured the contract for paving W. Penn St. at $18,685.

Apollo, Pa.—Bids are wanted May 21 for grading, curbing, and paving about 3,700 sq. yds. W. F. Pauly, Chmn. of Com.

Ebensburg, Pa.—Costello & Neagle, of Elmira, N. Y., are reported to have secured the contract to pave 30,000 yds. with brick, set 16,000 ft. of stone curb and construct a sewer system in Ebensburg.

Scranton, Pa.—The Co. Comrs. are reported to be contemplating the macadamizing of Abington turnpike, at a cost of about $10,000.

Erie, Pa.—F. P. Coyle, according to local press reports, has secured the contract to pave on a portion of German St. with Mack brick at $1.60 per sq. yd. and 40 cts. for concrete curbing. Estimated cost, about $20,000.

Anderson, S. C.—Street paving bonds amounting to $25,000 are reported to have been sold.

The City Council has determined to elect an engineer to prepare plans and specifications for street improvements and to commence work as soon as possible.

Rapid City, S. Dak.—A resolution has been passed by the City Council to macadamize the principal streets of the city.

Knoxville, Tenn.—It is stated that bids are wanted May 19 for macadamizing about 4½ miles of pike. W. F. Park, Secy., Dandridge.

Beaumont, Tex.—Merritt W. Yeater, City Engr., writes that the following bids for (*a*) paving and (*b*) curbing were opened on May 5: H. W. Douney & Co., Beaumont (awarded contract), *a*, $175,054; *b*, $18,342. Black & Laird, Beaumont, *a*, $208,129; *b*, $13,827. Parker-Washington Co., Kansas City, Mo., *a*, $202,182; *b*, $22,374. Mally Eastham, Beaumont, *a*, $199,658; *b*, $23,985. Texas Constr. Co., Beaumont, *a*, $201,675; *b*, $15,802. Bids of Mally Eastham and Texas Constr. Co. were for concrete curb; other bids on brick curbing.

Charlottesville, Va.—Bids will be received May 19 by the Street Improv. Com. for laying 30,000 sq. yds. bituminous macadam, granite spall or vitrified brick pavement, and 45,000 sq. yds. macadam pavement. De Mott & Winfree, Engrs., City Hall.

Ballard, Wash.—Stirrat & Goetz, of Seattle, are reported to have received the contract to pave with brick, curb with granite and construct cement walks on Ballard Ave., for $38,177.

Spokane, Wash.—The paving with asphalt on a portion of First Ave. is being considered.

The Barber Asphalt Paving Co. is reported to have submitted the lowest bid for paving a portion of Monroe St., at $21,996.

Milwaukee, Wis.—Bids will be received May 20 by the Bd. of Pub. Wks. for improving by grading, macadamizing and cement curbing portions of numerous streets. Chas. Poetsch, City Engr.

Milwaukee, Wis.—The Park Comrs. are reported to be in favor of building a lake shore drive, and will, according to local press reports, request Warren H. Manning, of Boston, Mass., to prepare plans for same.

POWER PLANTS, GAS AND ELECTRICITY.

Paris, Ark.—The Paris Electric Light & Power Co., of Paris, has been incorporated; capital, $6,000. August Bartsch, Pres.; Ed. Bartsch, Secy.

Little Rock, Ark.—Arthur Neill, who recently secured a franchise for a heating plant, is about to petition the Council for a franchise for an electric light plant.

Placerville, Cal.—The San Francisco Constr. Co., of San Francisco, is stated to have secured the contract to construct a ditch and flume near Placerville for the American River Electrical Co.; probable cost of work is $150,000.

San Francisco, Cal.—The San Luis Gas & Electric Co., of San Francisco, has been incorporated; capital, $200,000. W. F. Boardman, Wm. Thomas and Woodley B. Smith, of San Francisco, are among the directors.

Corona, Cal.—H. A. Wood, City Clk., writes that bids will probably be received Sept. 1 for an electric light plant, to cost about $45,000.

Los Angeles, Cal.—Representatives of the Spreckels Independent Electric Lighting Co., of San Francisco, are reported to be in Los Angeles for the purpose of purchasing a site for the erection of an electric power plant.

New Britain, Conn.—The Connecticut Ry. & Lighting Co. is stated to have awarded to the H. Wales Lines Co., of Meriden, the contract to erect power plants in New Britain, Waterbury and Meriden, for about $105,000. The construction of these plants is a part of the scheme to utilize the motive power about to be generated at the water privileges along Housatonic River in Litchfield County by the New Milford Power Co.

Atlanta, Ga.—A contract is reported to have been signed with the Pope Electric Co., of Atlanta, to furnish the suburban towns of College Park and East Point with electric light. A plant will be built between the two towns.

Raymond, Ill.—It is reported that this city will install a municipal electric light plant, to cost about $8,000.

Centralia, Ill.—The Merchants' Co-operative Lighting Co., of Centralia, has been incorporated, with a capital of $5,000, to furnish electric light, heat, and power. Incorporators: Wm. B. Smith, O. V. Parkinson, and Wm. Benjamin.

Averyville, Ill.—The Council is stated to have granted a 99-yr. franchise to the Peoria Gas & Electric Co.

Normal, Ill.—The electric light plant at this place is reported to have been seriously damaged by an explosion on May 3.

Tamaroa, Ill.—The City Clk. writes that it was voted Apr. 21 to construct an electric light plant by private ownership. Population, 1,000.

Pekin, Ill.—The Pekin Electric Light Co. is stated to have decided to enlarge its plant on N. 3d St. A 300-H.-P. boiler and a 350-H.-P. engine will be installed.

Anderson, Ind.—The Alexandria Light & Power Co. is stated to have secured the contract for lighting the city for 10 yrs. at $80 per light per yr.

Logansport, Ind.—S. B. Boyer is reported to have a plan to construct a heating plant to use the waste heat and steam from the local electric light plant and water works.

Greencastle, Ind.—It is reported that the Trus. of De Pauw Univ. want estimates and cost of an electric plant, to consist of an 800-light direct-connected machine, to work against 10 lbs. back pressure; heat by exhaust steam. A. J. Corner, Supt.

Elkhart, Ind.—The City Council is stated to have granted a franchise to the National Mfg. Co. for an electric light, heat and power plant. Walter Brown, Pres.

Terre Haute, Ind.—Capt. A. C. Ford and W. H. Albrect, incorporators of the Citizens' Mutual Heating Co., have filed a petition with the Bd. of Wks. for a 50-yr. franchise for the construction, maintenance and operation of a plant for the manufacture and distribution of steam or water, or both, for heating and power purposes.

Greensburg, Ind.—A 10-yr. franchise is stated to have been granted the Greensburg Electric Co. by City Council, to take effect Apr. 1, 1904. The price is $69 per light on an all-night schedule.

Bluffton, Ind.—According to press reports the Council, after considering for several weeks a proposition from the C. L. Olds Constr. Co., of Ft. Wayne, to build an electric light plant for city, has finally rejected the bids and will readvertise.

Alta, Ia.—The Com. on Light of City Council is reported to have under consideration plans for enlarging the electric light plant.

Reinbeck, Ia.—The question of constructing an electric light plant is reported under consideration. Whether city will build plant or let a franchise to private parties is yet undecided.

Ashland, Ky.—R. C. Richardson, City Clk., writes that the contract for lighting the streets with electricity (bids opened May 4) has been awarded to the Ashland Electric Light & Power Co., of Ashland, at $51 per lamp per yr. on a 10-yr. contract.

Kennebunk, Me.—The municipal electric light plant is reported destroyed by fire on May 3d.

Houlton, Me.—Geo. Ingram is reported interested in the construction of an electric light plant.

Madison, Me.—The Village Council is stated to have instructed the Electrical Comn. to procure plans, estimates and bids for the establishment of an electric plant on Sandy River.

Hyattsville, Md.—The citizens are stated to have voted on May 11 to grant the Northern Electric Lighting Co., of New York, N. Y., a franchise to construct an electric light plant in Hyattsville.

Otis, Mass.—The Selectmen are stated to have awarded the contract for lighting the streets for one year to Leominster Electric Light & Power Co., at $72 per yr., for arc lights to burn till 1 a. m.; for all night arc lights, $110 and for 65 incandescent lights, $16 ea.

Calumet, Mich.—The Calumet Light, Heat & Power Co. has been organized by P. P. Roehm, John Burder and A. W. Kerr to conduct a central heating plant in connection with its electric plant; capital, $80,000.

Vulcan, Mich.—A press report states that the Wisconsin State Assembly has passed a bill permitting the construction of a dam on Menominee River, near Vulcan. The power of Sturgeon Falls will be harnessed and turned into electricity, to be used in operating mines in the vicinity of Norway and Vulcan.

Detroit, Mich.—The Council Com. on franchises is stated to have decided to report favorably on the ordinance giving the Central Heating Co., represented by Bingley R. Faics, a franchise to establish a steam-heating plant.

South Stillwater, Minn.—Electric light and water bonds amounting to $23,000 are reported sold.

Cottonwood, Minn.—The citizens are reported to have voted May 4 to construct a gas plant.

Pelican Rapids, Minn.—The Council is reported to have voted to issue bonds for an electric light plant.

Calcdonia, Minn.—J. Kenny, Village Recorder, writes that bids are wanted May 20 for an electric light plant; probable cost, $8,000. Engineer, S. G. Reque, Westby, Wis.

Jackson, Miss.—Bids will be received May 25 by the Bldg. Com. of the Capitol Light & Power Co. at the office of Kirkpatrick & Johnson, Engrs., for furnishing 3 boilers, engines, dynamos, wire and supplies for the new electric light plant; boilers are to be 150-H.-P. each, of Scotch marine type, with corrugated furnaces, for a steam pressure of 150 lbs. per sq. in. Bids will be received for both simple and compound types. For further information apply to Kirkpatrick & Johnson, Engrs.

St. Louis, Mo.—The Carondelet Electric Light Co. has petitioned the St. Louis County Court for a franchise to string wires along Lemay Ferry Road, south of St. Louis, in Carondelet Township.

Hackettstown, N. J.—The Electric Light Co. is stated to have secured the contract for 116 20-c.-p. lights for 1 yr. at $1,700 per yr.

Fredonia, N. Y.—A press report states that the Fredonia Natural Gas Light Co. will construct a new gasometer, and extend the gas mains.

Saugerties, N. Y.—The Ulster Electric Light, Heat & Power Co., of Saugerties, has been incorporated; capital, $30,000. Directors: Wm. A. Hanna, Ada H. Eckert, and Jennie G. Hanna, of Saugerties.

Fayetteville, N. C.—The citizens are reported to have voted May 4 to issue bonds for water works and an electric light plant.

Henderson, N. C.—H. T. Powell, Town Clk., writes that the contract for lighting the town for a period of 10 yrs. has been awarded to Henderson Lighting & Power Co., of Henderson, for $2,700 per yr.

Columbus, O.—The Erner Hopkins Co., of Columbus, is stated to have secured the contract for furnishing wire, pole line, sundries, etc., for municipal electric light plant (bids opened Apr. 24) for $18,183.

Sandusky, O.—Chas. S. Ashley and Jos. F. Grosswiler, of Toledo, are reported interested in the Sandusky Hltg. & Lighting Co., which proposes constructing a plant at once at Sandusky.

Napoleon, O.—F. Hilgendorff, City Clk., writes that it is proposed to develop the water power of State Canal; about $10,000 will be expended for the work, and city will be ready to receive bids in June.

Dayton, O.—Engr. C. P. Folsom, of Dayton, writes that preliminary work is now being done for the development of power on Cumberland River for electrical purposes; probable cost of work is $2,000,000.

Athens, O.—It is stated that bids are wanted May 25 by W. B. Golden, Village Clk., for $15,000 electric light bonds.

Sanger, Ore.—J. K. Romig, Supt. Sanger Gold Mining Co., writes that surveys and plans are being prepared for the construction of an electric power and light plant; probable cost of plant, $60,000.

Homestead, Pa.—The Mifflin Light & Power Co. is about to petition for a franchise in Homestead.

Montoursville, Pa.—The Boro. Council is stated to have accepted the proposition of the Montoursville Electric Co. to furnish 53 lights of 25 c. p. each, contract to go into effect July 1.

Lebanon, Pa.—Bids will be received until June 1 by I. L. Beckley, City Clk., for lighting the streets with electricity. There will be required about 135 open or closed arc lights, and not less than 50 incandescent lights, to burn from twilight to dawn. The bids are to be for a period of 1, 5 and 10 yrs.

Gaffney, S. C.—Ladshaw & Ladshaw, Spartanburg, S. C., are preparing plans for a 10,000-H.-P. water-power development on Broad River, 11 or 12 miles from this place, estimated to cost $500,000. A dam about 59.5 ft. high will be required.

Austin, Tex.—The Governor is stated to have approved the bill appropriating $155,000 with which to install a water, light and power plant for the State institutions located in Austin.

Sourlake, Tex.—The Light & Power Co., of Sourlake, has been incorporated; capital, $10,000. Incorporators: D. O. Lively, T. J. Douglas and T. W. Freeman.

Vernal, Utah.—E. W. Davis writes in regard to electric plant for Vernal Light & Power Co. that the company is not yet organized, and no engineer has been selected. The work will cost about $35,000, and bids for the work will probably be received about July 15.

Richmond, Va.—Saml. Cohn has petitioned the Council for a franchise to construct and operate an electric light plant.

Wytheville, Va.—A press report states that the Town Council has offered for sale an electric light franchise for Wytheville; also the old plant owned by town. Bids for both to be opened June 5.

Ellensburg, Wash.—The city contemplates improving its municipal light plant, either by increasing its present steam plant, or by constructing a water power, diverting water from Yakima River. A. McL. Hawks, of Tacoma, has been selected to advise upon the project. Geo. Sayles, City Clk.

Lancaster, Wis.—John Schreiner and others, of Lancaster, are stated to have purchased the local electric light plant, and propose changing the present system from a direct to an alternating current, and also the installation of a steam heating plant.

Marshfield, Wis.—Thos. Rankin, of Chicago, Ill., is stated to have secured a franchise for a gas plant.

Durango, Mex.—P. E. Stahlknecht, of Durango, writes that it is proposed to develop the power of Tunal River; probable cost of work, $700,000. He is now ready to receive bids for the construction of dam, but will not be ready to receive bids for the electric plant for about 6 months. No engineer in charge yet.

ELECTRIC RAILWAYS.

Salem, Ark.—Surveys are being made by the Salem & Eastern Ry. Co., for an electric railway to connect Salem, Afton, Fayetteville, Poplar and Bluff. R. A. Youngblood, of Salem, is reported interested.

Bakersfield, Cal.—The Bakersfield & Ventura Ry. Co. has been incorporated to construct 125 miles of road; capital, $500,000. Principal office to be in Los Angeles. Incorporators: H. M. Russell, Eben Smith and J. W. Swanwick.

Los Angeles, Cal.—The Los Angeles and Glendale Electric Ry. Co. has been incorporated, with a capital of $1,000,000, by L. C. Brand, R. H. Howell and others, to build an electric railway from Los Angeles to Glendale, a distance of 10 miles.

Norwich, Conn.—Preliminary surveys for the electric railway which has just been chartered to run between Norwich and Westerly, R. I., have been begun. The road will be built by the Norwich, Mystic & Westerly St. Ry. Co.; capital, $700,000. Incorporators: State Treas. Henry H. Gallup, Costello Lippitt and others.

Coeur d'Alene, Idaho.—The Coeur d'Alene & Spokane Ry. Co., organized in Oct., with a capital of $500,000, is to construct a 34-mile electric railway between Coeur d'Alene and Spokane, Wash. F. A. Blackwell, Pres.; J. C. White, Engr.

Aledo, Ill.—The Western Illinois Ry. Co. is stated to have completed the survey of its line from Aledo to Moline, a distance of 47½ miles.

Dixon, Ill.—The Dixon, Rock Falls & Southwestern Electric Ry. Co. has secured a franchise through Coloma Township to Hume Township.

Chicago, Ill.—The Lake Street Elevated R. R. Co. is about to construct a transformer station at Lombard Ave. The building will be 3 stories high, 40x 1,000 ft., of pressed brick and stone; estimated cost of building and equipment, $75,000. E. C. Noe, Gen. Supt., Chicago.

Chicago, Ill.—It is reported that the Northwestern Elevated R. R. Co. is about to petition City Council for a franchise to build a line to Ravenswood.

Cartersville, Ill.—An electric railway is projected to extend to Cartersville. E. Sponseler, of Harrisburg, is interested.

Decatur, Ill.—Surveys are being made of the route of the Corn Belt Interurban system, which is to run from Decatur or Bloomington, thence to Pekin and Peoria.

Indianapolis, Ind.—The Ft. Wayne & Northeastern Traction Co., of Ft. Wayne, has been incorporated, with a capital of $100,000, to build an electric railway from Ft. Wayne to Hicksville and Bryan, O. Directors: C. S. Karoly, R. S. Robertson and others.

Michigan City, Ind.—The City Council has granted a 50-year franchise to the Chicago & Indiana Air Line Ry. Co.

Vernon, Ind.—The Co. Comrs. have granted a franchise to Keach, Hubbard and others for an electric railway through Jennings County, connecting with Madison and Indianapolis.

Kokomo, Ind.—The Kokomo, Marion & Western Interurban Co. has secured a franchise through Howard County.

Martinsville, Ind.—An ordinance has been presented to City Council permitting the Indianapolis, Martinsville & Southern Ry. Co. to lay tracks through Martinsville.

Logansport, Ind.—The Logansport, Hammond & Chicago Traction Co. has been incorporated, with a capital of $1,000,000, as an extension of the Union Traction Company's system now being built from Indianapolis to Logansport, and when completed will connect Indianapolis with Chicago. Geo. F. McCulloch, of Indianapolis, is one of the incorporators.

Davenport, Ia.—It is reported that the International Construction Co. has secured the contract for building the Davenport Suburban Electric R. R. running from Davenport to Muscatine, Ia., a distance of 34 miles; contract price reported to be $950,000.

Charles City, Ia.—It is reported that the Rapid Transit Co., of Waterloo, will extend its line to Charles City.

Burlington, Ia.—The Burlington & Keosauqua Ry. & Power Co. is projected to build an interurban electric railway to Keosauqua.

Brunswick, Me.—Plans are being discussed for building an electric railway from Brunswick to Harpsville. J. T. Small, of Lewiston, is said to be interested.

Augusta, Me.—The Lincoln County St. Ry. has been organized, with Luther Maddocks, Pres., and H. M. Heath, Secy. The proposed road will run from Wiscasset to Boothbay Harbor, with a branch to Newcastle.

Hagerstown, Md.—The Hagerstown Ry. Co. is securing rights of way for an extension to Myersville, via either Smoketown or Boonsboro.

Alma, Mich.—A. D. Prosser, an attorney of Detroit, has secured a franchise for an electric railway east and west through Alma. The line is to run from Grand Rapids to Saginaw.

Columbia, Mo.—The Boone County Circuit Court has granted permission to the Missouri Central Electric Ry. Co. to construct its lines through the county.

Newark, N. J.—The Public Service Corporation of New Jersey has been incorporated to carry out the plan for amalgamating the street railway and lighting companies of Northern New Jersey; capital, $25,000,000. Incorporators: Thos. N. McCarter, Newark; Thomas Dolan, of Philadelphia, Pa., and John I. Waterbury, of Morristown.

Ellicottville, N. Y.—It is reported to be the purpose of the Ellicottville, Mansfield & East Otto R. R. Co., recently incorporated, to build an electric railway from Ellicottville to East Otto, a distance of 12 miles; capital, $300,000. John S. Rockwell, of Buffalo; Chas. G. Locks, of Randolph, and Wm. G. Laidlaw, of Ellicottville, are among the incorporators.

Burlington, N. J.—An ordinance has been passed granting the People's Traction Co. a franchise through Burlington Township.

Newburgh, N. Y.—The Albany & Catskill Co., of Newburgh, has been incorporated to construct an electric road 35 miles long from Catskill to Albany along the west bank of Hudson River, taking in the villages of Coxsackie, Athens, New Baltimore, Coeymans, Raven and Cedar Hill; capital, $350,000. Directors: J. M. Sheehan and Polk Delany, of Newburgh, and others.

Lakewood, N. Y.—This village has granted a franchise to the Chautauqua Traction Co.

Albany, N. Y.—The Dunkirk and Fredonia R. R. Co. has secured permission to increase its capital from $150,000 to $200,000, to be used for new construction.

Dayton, O.—The City Ry Co. will extend its line on Bway. and Lexington Ave. through University Heights.

The Dayton Southwestern Traction Co., with a capital of $10,000, has been incorporated by M. L. Weaver, V. J. Drayer and T. E. Marshall, of Dayton. The company proposes to build from Dayton to Camden.

Wauseon, O.—Riggs & Sherman, of Toledo, Engrs. for the Toledo & Indiana Ry., have completed surveys and profiles for the extension of the road from Wauseon to Bryan.

New Lexington, O.—The Perry County Electric Ry. & Light Co. has been incorporated, with a capital of $10,000, by M. H. Donahue, A. Brindgardner and others, to build an electric railway through Perry, Muskingum, Coshocton, Licking and Knox Counties.

Cleveland, O.—The Eastern Ohio Traction Co. has decided to sell $500,000 bonds, the proceeds to be used for extensions and betterments. The extensions will include the building of 15 miles of track between Garrettsville and Leavittsburg. Jos. O'Hara, Supt., Cleveland.

The Lake Shore Electric Ry. Co. has decided to expend $125,000 for immediate improvements to the roadbed of the property. F. J. Stout, Gen. Supt., Toledo.

Bowling Green, O.—The Dirs. of the Lake Erie, Bowling Green & Napoleon Ry. Co. have voted to increase the capital stock from $300,000 to $1,000,000. The additional capital will be used for the extension of the road from Pemberville to Port Clinton.

Kittanning, Pa.—Surveys have been made for an extension of the Kittanning & Ford City St. Ry. from Wick Borough to Mossgrove, a distance of about 5 miles. It is also proposed to increase the capacity of the power plant; cost of improvements placed at $100,000.

Darby, Pa.—The Boro. Council is considering an ordinance granting a franchise to the Philadelphia, Morton & Swarthmore St. Ry. Co. The company will shortly construct lines to Media, Clifton and Philadelphia. A. H. Engstrom, Ch. Engr., Philadelphia.

Pittsburg, Pa.—The Pittsburg, McKeesport & Connellsville Ry. Co. proposes extending its line to the W. Va. State line. W. A. Bishop, Ch. Engr., Pittsburg.

Philadelphia, Pa.—An ordinance to extend the line of the Rapid Transit Co. on Wayne Ave. has been approved by Bd. of City Surveyors. It will be over one mile long, extending to Pelham.

Pittsburg, Pa.—Councils have granted the Central Valley Ry. Co. a right of way through the city.

Scranton, Pa.—The Dalton St. Ry. Co. has been organized, with a capital stock of $500,000, to build a line from Providence Corners to Clark's Summit and Factoryville. Abram Nesbitt, of Kingston, Pres.; Jas. Ashley, of Ashley, Secy.

Stroudsburg, Pa.—A charter has been granted to the Stroudsburg & Wind Gap Electric Ry. Co., capital $100,000, to build a line 16½ miles long to connect Stroudsburg with the system of street railways in Northampton County. Incorporators: John S. Osterstock, Herman O'Beigler and others.

Deadwood, S. D.—The Burlington & Missouri River Ry., which has been operating a branch of its system between Deadwood and Spearfish, is reported to be contemplating changing the motive power from steam to electricity.

RAILROADS.

San Francisco, Cal.—The San Francisco & Northwestern R. R. Co. has been incorporated, with a capital of $15,000,000, by Capt. A. H. Payson, of San Francisco, Asst. to Pres. of Santa Fe, and others, to construct a railroad from Alton to Point Richmond, the terminus of the Santa Fe.

Chicago, Ill.—The Chicago & Momence R. R. Co., of Chicago, has been incorporated, with a capital of $100,000, to construct a line from Chicago, Ill., in a southerly direction through Chicago Heights, Ill., and the counties of Cook, Will and Kankakee, and from a point between the limits of Chicago and Chicago Heights, Ill., in a westerly direction to Harvey and to the State line near Hammond. Incorporators: Howard M. Carter, Sidney W. Worthy, Arthur Dyrenforth and others, all of Chicago, Ill.

Pittsburg, Kan.—It is reported that the White River line of the Missouri Pacific R. R. (H. Rohwer, Ch. Engr., St. Louis, Mo.) is to be extended to Pittsburg, Kan., to connect with a Missouri Pacific line running into Topeka.

Louisville, Ky.—It is stated that the Chicago, Indianapolis & Louisville R. R. Co. will at once make an important addition to its freight terminals here. B. E. Taylor, Gen. Mgr., Chicago.

Kalamazoo, Mich.—Patton & Gibson, of Pittsburg, Pa., are stated to have secured the contract for constructing about 15 miles of railroad from Kalamazoo to Lawson for the Michigan Central R. R. Co. The work involves considerable heavy excavating, and it will also be necessary to reconstruct a large portion of present road; probable cost of work about $3,000,000.

Minneapolis, Minn.—The Minneapolis, Sault Ste. Marie Ry. Co. is stated to have filed an amendment to its charter providing for an extension of its line 19 miles into the Court O'Reilles Indian Reservation, in Sawyer County.

St. Louis, Mo.—The Burlington R. R. (Geo. P. Harris, Pres., Chicago, Ill.) and the Chicago & Alton R. R. (H. F. Baldwin, Ch. Engr., Chicago, Ill.) are stated to have decided to make a joint line between St. Louis and Kansas City by using the Burlington tracks from St. Louis to Old Monroe, 51 miles and by building from Old Monroe to Mexico on the Alton, 63 miles.

Brooklyn, N. Y.—Mayor Low has approved the Legislative bill providing for the abolishment of grade crossings in Brooklyn on the Long Island R. R. (P. D. Ford, Engr. M. of W., Long Island City) and Brooklyn Heights R. R. (H. S. Swain, Engr. M. of W., 168 Montague St.).

Bellaire, O.—The Cleveland, Lorain & Wheeling Ry. Co. is stated to have filed two amendments to its charter providing for the construction of a line through Bellaire, O., to connect with the Baltimore & Ohio, and for a branch from Sheffield Township to lake at mouth of Black River. U. B. Williams, Div. Supt., Wheeling, W. Va.

Columbus, O.—Bids will be received until June 2 by the Scioto Valley Pool, 42 Board of Trade Bldg., Columbus, for the grading and masonry for the extension of their line, a distance of about 9 miles, from Circleville to Kingston. A. W. Jones, Ch. Engr.

Youngstown, O.—It is stated that the Youngstown & Southern Ry. Co. has applied for an increase in its capital stock, making the total $1,800,000. As soon as the increase is authorized the work of construction will be started. The line is to be built from Youngstown to East Liverpool. A. W. Jones, Pres.

Toledo, O.—A press report states that the stockholders of the Wabash R. R., at a meeting here May 5, authorized the company to issue its coupon bonds not to exceed $10,000,000, for the purpose of acquiring additional and adequate terminal facilities in Toledo, St. Louis, Chicago, Quincy, Kansas City, Detroit and other points. W. S. Newhall, Ch. Engr., St. Louis, Mo.

York, Pa.—According to local press reports the Pennsylvania R. R. Co. will expend about $100,000 in improvements in York, which includes the erection of a 4-story freight warehouse. W. H. Brown, Ch. Engr., Philadelphia.

Harrisburg, Pa.—A charter has been granted to the New York Short Line R. R. Co. to build a cut-off across 35th Ward and a portion of Bucks County from a connection on the Philadelphia & Newtown division of Reading Ry. to a connection with Bound Brook at Neshaminy; capital, $250,000. Geo. F. Baer, Pres.; W. R. Taylor, Secy.

Philadelphia, Pa.—The passage of an ordinance to build a tunnel under the crossing of the Reading Ry. (Wm. Hunter, Ch. Engr., Philadelphia) at Tioga Station was recommended by Councils' Survey Com. May 5; estimated cost of tunnel, $10,000.

Pittsburg, Pa.—A press report states that about $2,000,000 will be expended at once by the Pittsburg & Lake Erie R. R. Co. One of the principal projects will be the completion of a 4-track system between Pittsburg and Youngstown, involving the laying of about 70 miles of track. J. A. Atwood, Ch. Engr., Pittsburg.

Echo, Tex.—Bids will be received May 20 by E. B. Cushing, Engr. M. of W., T. & N. O. R. R., for furnishing material for erecting the following terminal buildings: 16 stall brick round house, 2-story brick sand house, frame and corrugated iron blacksmith shop, etc.

Covington, Va.—The Chesapeake & Ohio Ry. Co. is reported to have decided to enlarge Alleghany tunnel, west of Covington, so as to build a double track through it. This tunnel is 4,703 ft. in length, and the work will require 6 or 8 months. F. I. Cabell, Constr. Engr., Richmond, Va.

Whatcom, Wash.—The Bellingham Bay & British Columbia R. R. Co. (J. J. Donovan, Ch. Engr., Whatcom, Wash.) has completed a survey for a branch line from Hampton to Lynden, 5⅓ miles. Steam motive power. Capital for construction has been secured, right of way partially obtained, and contracts probably let about June 1.

Belington, W. Va.—The Wabash R. R. Co. is stated to have completed plans for an extension of its line from Pittsburg, Pa., to Belington, a distance of about 110 miles. W. S. Newhall, Ch. Engr., St. Louis, Mo.

PUBLIC BUILDINGS.

Hamburg, Ark.—It is stated that bids are wanted June 2 for erecting a court house. F. W. Gibbs, Archt., Little Rock.

Little Rock, Ark.—The Legislature has appropriated $175,000 for additions and improvements to the Asylum for Insane at Little Rock.

Pueblo, Colo.—Bids will be received June 2 by the Bd. of Lunacy Comrs. for erecting and installing an electric light plant and wiring system for the asylum buildings. E. G. Middelkamp, Secy.

New Britain, Conn.—Bids are wanted by the Bldg. Com. May 27 for erecting the Swedish Lutheran Church. Address W. H. Cadwell, New Britain.

Albany, Ga.—T. F. Lockwood, Archt., Columbus, Ga., writes that the contract for erecting a court house (bids opened May 4) has been awarded to W. T. Hadlow Co., of Jacksonville, Fla., for $38,400.

Abbeville, Ga.—Frank P. Milburn, Archt., Columbia, S. C., writes that the following bids were received May 4 for erecting the Wilcox County Court House: J. H. McKenzie & Son, Augusta, Ga., $49,380 (awarded contract); Miles & Bradt, Atlanta, $52,000, and the Savannah Contr. Co., Savannah, $49,660.

Springfield, Ill.—The House is stated to have passed a bill providing for an appropriation of $235,833 for alterations to the Capitol.

Danville, Ill.—Bids are wanted June 2 for erecting the Danville Pub. Library. Liese & Ludwick, Archts., 128 North Vermillion St.

Richmond, Ind.—It is stated that a United Presbyterian Church will be erected in this city; estimated cost, $75,000.

Alexandria, Ky.—Geo. H. Fennel & Co., of Newport, Ky., are stated to have received the contract for installing the heating system in the court house, for $7,821.

Newport, Ky.—H. D. Phillips, Chmn. Com., writes that the contract for heating Campbell County Court House (bids opened May 4) has been awarded to Geo. H. Fennel, of Newport, for $7,800.

New Orleans, La.—An ordinance is stated to have passed authorizing the City Engineer to have plans prepared for the annex to the City Hall; probable cost, $150,000.

Taunton, Mass.—An appropriation of $60,000 is asked for the erection of a police station. Address Mayor R. E. Warner.

Melrose, Mass.—The plans of J. W. Beal, of Boston, are stated to have been accepted for the erection of a brick edifice for the Methodist Episcopal Society, on the site of the building recently destroyed by fire; estimated cost, $60,000.

Menominee, Mich.—August Spies, of Menominee, is stated to have offered this city $30,000 for a library.

Corunna, Mich.—It is stated that bids are wanted by A. H. Northway, of Corunna, until June 1 for $75,000 court house and jail bonds.

St. Ignace, Mich.—It is stated that bids are wanted May 20 for erecting St. Ignatius Church. H. J. Hill, Archt., Detroit, Mich.

Anoka, Minn.—It is stated that a building will be erected here for the insane hospital, to cost $40,000. Clarence Johnson, Archt.

St. Paul, Minn.—The lowest bids opened by the State Capitol Comrs. May 5 are stated to have been submitted as follows: For elevators, Kiekhofer Elevator Co., of Milwaukee, Wis., $18,125, and for painting and glazing, Bazille & Partridge, of St. Paul (awarded contract), for $29,189.

Meridian, Miss.—Krause & Hutchinson, of Meridian, are preparing plans for a court house for Lauderdale County, to cost about $75,000.

Concord, N. H.—Plans are stated to have been prepared for an edifice for the Christian Scientists of this city; probable cost, $100,000.

Jersey City, N. J.—It is stated that contracts were awarded as follows for the Public Bath to be erected at Coles and 1st Sts.: Mason work, Connolly Contr. Co., 238 17th St., for $17,879; plumbing, Heatherton Bros., 686 Ocean Ave., for $6,856; ventilating and heating, Baldwin Engine Co., of New York City, for $5,790.

Albany, N. Y.—The Governor is stated to have signed the bill providing for an appropriation for a hospital for the N. E. section of the State.

Ray Brook, N. Y.—The Governor is stated to have signed a bill providing an appropriation of $115,000 for the erection of the State Consumptive Hospital here.

Potsdam, N. Y.—It is stated that the contract will soon be let for the erection of a 70x90-ft. edifice for the Congregation of the Methodist Church. Geo. W. Kralmer, Archt., 1 Madison Ave., New York City.

Saratoga, N. Y.—Plans are stated to have been prepared for the erection of a 12-story hotel and sanitarium to be erected at William St. and Bway. C. C. Lester is reported interested.

Brooklyn, N. Y.—The following bids were opened May 6 by J. Edw. Swanstrom, Boro. Pres., for building an interior public bath on Montrose Ave., near Union Ave.: John J. Cashman, $89,900; Snare & Trieste, $99,834; W. & T. Lamb, $89,005; Fuller & O'Connor, 44 Court St., $87,426; Thos. Dwyer, $94,500; Lust-Bader & Glautz, $102,235; D. J. Ryan, $88,500.

Bids will be received June 1 by Homer Folks, Comr. Dept. Pub. Charities, N. Y. City, for furnishing material for erecting a dining room and kitchen building for the Kings Co. Hospital.

New York, N. Y.—Herman F. Lipper & Bro., 1788 1st Ave., have secured the contract for erecting a reception hospital at Randalls Island, for $41,565. J. McKee Borden, Secy. Dept. Pub. Charities.

Bids will be received May 25 by Thos. Sturgis, Fire Comr., for furnishing material and erecting a building for Hook and Ladder Co. No. 26.

Edmonton, Alberta, N. W. T.—Bids will be received May 28 by Fred Gelinas, Secy. Dept. of Pub. Wks., Ottawa, Ont., for erecting a jail.

Cleveland, O.—Bids are wanted June 1 for furnishing material and erecting the addition to public library on Woodland Ave. W. R. Watterson, Archt., 1203 New England Bldg.; Harry Dixon, Secy. Pub. Library Bd.

Marietta, O.—It is stated that bids will soon be received for the erection of the edifice for the Congregation of the St. Mary's Catholic Church; estimated cost, $50,000. Rev. F. M. Woesman, Pastor.

Marion, O.—Chas. F. Schweinfurth, of Cleveland, is stated to have prepared plans for an edifice for the Congregation of the Baptist Church on S. Main St.; probable cost, $25,000.

Dayton, O.—It is stated that bids are wanted June 1 for erecting a brick barrack building at the N. H. for D. V. S. A. J. Clark, Treas.

Harrisburg, Pa.—Bids will be received May 21 by the Bd. of Comrs. of Pub. Grounds and Bldgs. for erecting a brick boiler house and installing a steam-heating plant at the Pennsylvania State Arsenal. John E. Scott, Secy.

Wilkinsburg, Pa.—Andrew Carnegie is stated to have offered this city $50,000 for a library.

Pittsburg, Pa.—Carpenter & Crocker are stated to have prepared plans for an edifice for the Congregation of St. James' Protestant Episcopal Church to be erected at Kelly and Collier Sts.; probable cost, $75,000.

Charleston, S. C.—It is stated that Jas. Gibbes has given this city $100,000 toward the erection of an Art Institute.

Mitchell, S. D.—Press reports state that bids will be received about June 1 by the City Aud. for erecting a City Hall, to cost about $35,000.

Nashville, Tenn.—Bids will be received May 23 by the Davidson Co. Asylum Comrs. for erecting an annex building at said asylum. Thompson & Ferguson, Archts., 5 Noel Blk., Church St. H. J. McCool, Chmn.

Memphis, Tenn.—T. B. Haynes, Chmn. Co. Comrs., writes that the contract for furnishing and installing 2 boilers and a heating plant in the Court House (bids opened May 12) has been awarded to T. J. Mooney Co., of Nashville, Tenn., for $11,987.

Galveston, Tex.—It is stated that the Congregation of the Sacred Heart will erect an edifice, at a cost of $50,000.

Waxahachie, Tex.—Plans and specifications will be received June 1 by the Library Trus. for erecting the Sims Library, including electric light wiring and fixtures, plumbing, sewer connections and hot-water heating system, including boiler, radiators, etc., to cost not exceeding $25,000. O. E. Dunlap, Chmn.

Hauston, Tex.—Press reports state that plans and specifications will be received June 22 by the Mayor for erecting a central fire station, cost not to exceed $30,000.

Wheeling, W. Va.—Bids will be received May 21 by the Bd. of Pub. Wks. for the following work in the State Capitol building in the Capitol annex: New power plant, tunnel connecting old and new buildings, changing engines, etc., to new power plant, steam heating, plumbing, electric wiring, etc. Giesey & Faris, Archts. Address Wm. M. O. Dawson, Secy. of State, Charleston.

Paris, Ont.—Bids will be received May 21 by R. C. Macpherson, Chmn. Pub. Library Bd., for erecting a library. A. Frank Wickson, Archt., Toronto.

Long Island City, N. Y.—Bids will be received May 19 by Francis V. Greene, Police Comr., for furnishing material and erecting station house, prison and stable for the 75th Precinct, Boro. Queens.

BUSINESS BUILDINGS AND DWELLINGS.

Alameda, Cal.—It is stated that the West End Bldg. Assoc. (C. R. Smith, Pres.) is considering the erection of a theater on Webster St.; estimated cost, $25,000.

Pasadena, Cal.—Matthew Slavin, 774 N. Marengo St., is reported to have received the contract for erecting an addition to the Green Hotel, for $176,-633. E. O. Nay & Co., 25 S. Fair Oakes Ave., is stated to have received the plumbing contract, for $29,990.

Sacramento, Cal.—The building at 221 J St., reported destroyed by fire May 3, will be rebuilt at once. H. Holbrook and Wm. E. Wheeler are stated to be interested.

Washington, D. C.—Appleton P. Clark, 605 F St., N. W., is reported to be preparing plans for a 5-story, 70x100-ft. apartment house to be erected at Rhode Island Ave. and 13th St., for Levi Woodbury.

March & Peter, 520 13th St., N. W., are stated to be preparing plans for a residence for R. D. Jewett, to be erected at Connecticut Ave. and S St.; probable cost, $60,000.

Atlanta, Ga.—The plans of P. Thornton Marye, of Newport News, Va., are stated to have been accepted for the depot for the Atlanta Terminal Co.; probable cost, $1,500,000.

Evanston, Ill.—Plans are stated to have been prepared by J. Wollacott, 109 Randolph St., for the erection of a 3-story apartment house at Oak and Grove Sts., at a cost of $60,000.

Chicago, Ill.—The 6-story building at 151 Wabash Ave. is reported destroyed by fire May 3. Owner, The Kimbark Estate.

Plans are stated to have been completed for a 3-story brick station for the Lake St. Elevated Ry. Co (E. C. Noe, Gen. Supt.) at Lombard and Lake Sts., to cost $75,000.

It is stated that Sheppard Brooks will erect a 5-story, 100x100 ft. building at Clark and Van Buren Sts., at a cost of $230,000.

It is stated that the Campbell Investment Co. will remodel the building at the n. e. corner of Wabash Ave. and Lake St., at a cost of $50,000.

Amboy, Ind.—The Amboy Investment Co., with a capital of $50,000, will erect a business building here. J. A. Baldwin, Pres.

Frankfort, Ind.—The Frankfort Theater Co. will soon receive bids for the erection of a theater here, to cost $30,000.

Winona, Ind.—The Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr. Philadelphia, Pa.) will erect a depot here, to cost $25,000.

Logansport, Ind.—The Odd Fellows' Hall Assoc. is reported incorporated to erect a building, to cost $40,-000. Directors: John E. Barnes, Marion Flory and others.

Cedar Rapids, Ia.—Plans are stated to have been prepared for a 120x140 ft. hotel to be erected at 3d St. and 3d Ave., to cost about $40,000. A. T. Averill is reported interested.

Shelbyville, Ky.—L. C. Willis and Jas. C. Burnett are reported interested in the erection of a 3-story opera house here, to cost $20,000.

Baltimore, Md.—T. B. Ghequler, 227 St. Paul St., is stated to be preparing plans for a 0-story apartment house to be erected here; estimated cost, $50,-000.

Negaunee, Mich.—John D. Chubb, 112 Clark St., Chicago, Ill., is stated to have prepared plans for a $20,000 building for the Odd Fellows Assoc.

Deckerville, Mich.—It is stated that Maurice Peplow, of Bay City, will erect a hotel here, to cost $50,-000.

Flushing, Mich.—Clark & Munger, of Bay City, are preparing plans for a block of store buildings to be erected, 68x100 ft., at Flushing, Mich., for Jas. B. French and others.

Detroit, Mich.—It is stated that the Century Assoc. will erect a building at Columbia and Witherell Sts., at a cost of $50,000.

St. Paul, Minn.—Frye & Jenkins are reported to be considering the erection of a 4-story brick apartment house to be erected at 6th and Summit Ave., at a cost of $50,000.

Minneapolis, Minn.—Wm. C. Whitney, Loan & Trust Bldg., is stated to have prepared plans for a residence for Frank T. Heffelfinger, to be erected at Park Ave. and 22d St.; estimated cost, $30,000.

St. Louis, Mo.—G. P. Wuest, 105 N. 7th St., is stated to have prepared plans for a brick hotel to be erected at 8th and Chestnut Sts., to cost about $30,000.

Lewiston, Mont.—J. H. Kent, of Helena, is stated to have prepared plans for a 3-story hotel to be erected here, at a cost of $50,000. Chas. and Edward Wright are reported interested.

Auburn, N. Y.—It is stated that the Auburn City Club will erect a building here, to cost $27,000.

New York, N. Y.—A. W. Bruner, 33 Union Sq. E., is reported to be preparing plans for a 17-story building to be erected at Exchange Pl. and New St., for W. F. Havemeyer.

R. Napier Anderson, 63 5th Ave., is stated to have prepared plans for a 75x150-ft. theater to be erected at 147th St. and Bergen Ave.; estimated cost, $75,000. Benj. H. Irving and Wm. H. Alden are reported interested.

Brooklyn, N. Y.—It is stated that A. I. Mann will erect a 7-story building at Fulton St. and Elm Pl. Helme, Huberty & Hudswell, Archts., Temple Bar Bldg.

Albuquerque, N. M.—D. J. Rankin, Chmn. Bldg. Com., writes that the contract for erecting the Elks Opera House (bids opened Apr. 23) has been awarded to W. W. Strong, of Albuquerque, $34,000, exclusive of plumbing, heating and wiring.

Wilmington, N. C.—It is stated that the Odd Fellows, of this city, will erect a temple at 3d and Princess St., to cost $25,000.

Cincinnati, O.—It is stated that a Union depot will be erected at 3d and Walnut Sts.; probable cost, $6,000,000. The Cincinnati Traction Co. (W. K. Schoepf, Gen. Mgr.) and the Pennsylvania R. R. Co. is reported interested.

Berwick, Pa.—It is stated that the Delaware & Lackawanna R. R. (L. Bush, Ch. Engr., Hoboken, N. J.) will erect a freight depot here.

Allegheny, Pa.—T. Buckler Ghegneir is reported to be preparing plans for a 6-story apartment house to be erected here, to cost $50,000.

The Allegheny Fire Insurance Co. is stated to have selected R. Maurice Trimble to prepare plans for a 4-story brick building to be erected on Beaver Ave., at a cost of $35,000.

York, Pa.—See "Railroads."

Deadwood, S. D.—It is stated that F. D. Smith will erect an apartment house at Lincoln and Van Buren Aves., at a cost of $40,000.

Memphis, Tenn.—It is stated that plans are being prepared for an 8-story, 85x100-ft. building to be erected at Court and 2d Sts.; estimated cost, $200,-000. G. A. Macon, Pres.

Houston, Tex.—O. J. Lorehn, Binz Bldg., has prepared plans for an $18,000 business block for Levy Bros., and a $10,000 residence for Jameson E. Lester.

Dallas, Tex.—It is stated that the Chicago, Indianapolis & Louisville R. R. Co. (W. H. McDoel, Gen. Mgr., Chicago, Ill.) and the Monon Route will erect a depot at Market and Main Sts., plans for which have been prepared; estimated cost, $50,000.

Richmond, Va.—J. E. & A. L. Pennock, of Philadelphia, Pa., have secured the contract for erecting a 7-story steel building at Main and 10th Sts. for the American Nati. Bank, of Richmond, for $160,000. Architects, Wyatt & Nolting, Baltimore, Md.

Wheeling, W. Va.—Geisey & Farris are stated to be preparing plans for a theater to be erected on Market St. for Henry Schmulbach; probable cost, $125,000.

La Crosse, Wis.—Wm. Doerflinger is reported interested in the erection of a 140x105-ft. building at 4th and Main Sts., to cost $100,000. Schick & Roth, Archts.

Fond du Lac, Wis.—The Helmer Milling Co. will rebuild its plant recently burned. Power plant was not damaged.

SCHOOLS.

Carbondale, Ill.—The House is stated to have passed a bill providing for an appropriation of $25,-000 to erect a library for the Southern Illinois Univ.

Peoria, Ill.—Reeves & Baillie, Y. M. C. A. Bldg., are stated to have prepared plans for an 8-room school to be erected at Enton and Jefferson Sts., to cost about $25,000.

Carroll, Ia.—Bids are wanted May 18 for erecting an addition to high school. S. P. Hart, Archt. J. W. Kennebeck, Pres. of School Bd.

Oelwein, Ia.—Bids will be received May 22 by A. L. Hunter, Secy. Bd. of Dirs. of Independent Dist., for erecting a high school.

South Boston, Mass.—Bids will be received May 18 by the Schoolhouse Comrs. for mason, carpentry and other work in the Shurtleff School; bids will also be received for installing a plumbing system in said school. R. Clipston Sturgis, Chmn.

Cambridge, Mass.—H. D. Goll, of Cambridge, is preparing plans for a new school to be erected on Elm St.; estimated cost about $61,000.

Plainfield, Minn.—Chaudler & Park, of Racine, Wis., are stated to be preparing plans for a 12-room brick school to be erected here, to cost $30,000.

Meridian, Miss.—Krause & Hutchinson, of Meridian, are preparing plans for a 3-story brick college for J. W. Beeson, of Meridian.

Poplar, Mont.—Bids will be received May 28 by the Bd. of Trus. for erecting a 2-story brick school, including plumbing and furnace plant. Address A. O. Davis, Chmn.

Vailsburg, N. J.—Bids will be received May 21 by the Bd. of Educ. for furnishing material and erecting an addition to the Vailsburg Pub. School; separate bids will be received for ventilating, heating, plumbing, stone and iron work, electric work, etc. D. Minor Lake, Clk.

New York, N. Y.—Contracts for school work, bids opened May 11, have been awarded as follows: To Jas. Fay, 205 E. 51st St., for sanitary work in School No. 145, Boro. of Bronx, $11,473; to Herbert S. Brower, for ventilating and heating School No. 34, Boro. of Richmond, $5,683; and to Wm. Sheehan, for sanitary work of addition to and alteration in School No. 84, Boro. of Brooklyn, $5,759.

Bids will be received May 25 by C. B. J. Snyder, Supt. School Bldgs., for sanitary work in school No. 190; also until May 25 for sanitary work in school No. 183; also for installing a ventilating and heating apparatus in said school.

Hankinson, N. D.—Bids will be received June 10 by the Bd. of Educ. of Brightwood Independent School Dist. No. 1 for erecting a brick addition to the Hankinson high school. W. C. Forman, Jr., Secy.

Grand Forks, N. D.—Bids will be received May 27 by the Bd. of Trus. of the Univ. of North Dakota for erecting a gymnasium and an administration building at said university. Jos. Bell De Remer, Archt.; A. E. Morrison, Secy.

Ridgeville Corners, O.—Bids are wanted May 22 for erecting an addition to school in Ridgeville Union School Dist. H. L. Chapman, Clk. Bd. of Educ.

Celina, O.—It is stated that bids are wanted May 25 for a steam heating apparatus, boiler room, etc., for the West Side High School. J. E. Hattery, Clk.

Akron, O.—Bids are wanted May 28 for erecting a 4-room brick school. H. C. Spicer, Clk. Bd. of Educ. of Coventry Township.

Scotch Ridge, O.—Bids will be received June 15 by the Bd. of Educ. in Webster Township for erecting a school in School Dist. No. 9. R. L. Dunnipace, Clk.

Salem, Ore.—Bids will be received June 21 by the Bd. of Trus. of Oregon State Reform School at the State Capitol for furnishing material for erecting additions and alterations to the industrial building and main building of State Reform School. D. C. Lewis, Archt., Chambers Bldg., Portland.

Allegheny, Pa.—Bids will be received by the School Bd. of the 3d Ward until May 19 for furnishing and installing a gas engine, approximately 100-H.-P. capacity, in the school at James St. and North Ave. Robt. Voegtly, Secy., 916 Ohio St.

Williamsport, Pa.—Bids will be received May 27 by J. H. McMinn, Chmn. of Bldg. Com., for erecting a 10-room school on Mulberry St. Meade B. Ritter, Archt.

Philadelphia, Pa.—Plans are stated to have been completed for the 3-story, 300x160-ft. brick engineering building for the Univ. of Pennsylvania.

Memphis, Tenn.—It is stated that Macon & Andrews, of the Macon & Andrews Business College will erect an 8-story brick building here, to cost $200,000.

Elkins, W. Va.—The plans of Harding & Upmore are stated to have been accepted for the erection of a 3-story brick building for the Davis and Elkins College; probable cost, $45,000.

Tigerton, Wis.—Bids will be received until May 22 by the Village School Bd. for erecting an 8-room high school. T. Gaastra, Archt., Kenosha, Wis.; Chas. Hille, Dist. Clk.

Belmont, Man.—Bids will be received May 22 by A. Tumoth, Secy.-Treas., for erecting a solid brick school. H. S. Griffith, Archt., Winnipeg.

Toronto, Ont.—Bids will be received May 25 by the Secy. Toronto Collegiate Institute Bd., City Hall, for constructing a steam heating plant, including brick and carpentering work, etc., in the Harvard St. Collegiate Institute.

STREET CLEANING AND GARBAGE DISPOSAL.

Ann Arbor, Mich.—The Bd. of Health (Nelson Garlinghouse, Pres.) has recommended to Council that some system of garbage disposal be installed.

St. Joseph, Mo.—According to local press reports, bids will be received by the City Clk. June 12 for hauling garbage.

Brooklyn, N. Y.—The only bids received May 12 and 13 by J. McG. Woodbury, Comr. Street Cleaning Dept., for collection and removal of garbage from Sept. 1, 1903, to Jan. 1, 1904, with privilege of renewal, and for completing abandoned contract for the year ending Sept. 1, 1903, were those of the Brooklyn Sanitary Co. for $11,500 and $11,300 per month respectively.

Jamestown, N. Y.—The Bd. of Pub. Wks. is stated to have rejected bids recently received for the collection and disposal of garbage and will receive new bids.

McKeesport, Pa.—It is proposed to construct a garbage crematory, to cost about $9,000.

Washington, Pa.—The question of constructing a garbage crematory will probably be taken up in the near future. J. K. Weir, Secy. of Council.

Reading, Pa.—Bids will be received by the Bd. of Pub. Wks. until May 21 for cleaning the streets paved with sheet asphaltum, asphalt or granite blocks or vitrified brick for a period of 1, 3 or 5 years. Elmer H. Beard, Ch. Comr. of Highways & Sewers.

GOVERNMENT WORK.

Phoenix, Ariz.—Bids will be received June 3 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing an addition, including plumbing and electric light, to the brick hospital at the Phoenix Indian School. For further information apply to C. W. Goodman, Supt. of School.

Ft. Rosecrans, Cal.—Bids are wanted June 1 for constructing storage cisterns, water distributing system, sewer system and rain-water cisterns at this post. Address Capt. R. H. Rolfe, Q. M., San Diego.

San Francisco, Cal.—C. P. Miller, Ch. Q. M., writes that the contract for hot water heating plants at Ft. Miley and Ft. Baker (bids opened Apr. 24) has been awarded to John G. Sutton, 331 Montgomery St., San Francisco.

Bids are wanted June 1 for constructing a gymnasium and post exchange building at the Presidio of San Francisco. Address C. P. Miller, Ch. Q. M.

Bids are wanted June 4 for constructing brick quarters for bachelor officers at the Presidio of San Francisco. C. P. Miller, Ch. Q. M.

Ft. Logan, Colo.—Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, writes that bids received on Apr. 23 for sinking a 6-in. well at this fort have been rejected, and new bids will be received May 22.

New London, Conn.—Bids will be received May 25 by Maj. Wm. T. Rossell, U. S. A., Engr., 3d Lighthouse Dist., Tompkinsville, N. Y., for extending and repairing wharf at New London Lighthouse Depot.

Norwich, Conn.—The following bids were opened at the Treas. Dept., Washington, D. C., May 6 for the construction (except heating apparatus and electric wiring and conduits) of U. S. Post Office at Norwich: Bulkley Conatr. Co., Plattsburg, N. Y., $73,887; Congress Constr. Co., Chicago, Ill., $83,473; Fissel & Wagner, Newark, N. J., $86,500; Richardson & Burgess, Washington, D. C., $88,300; Connors Bros., Lowell, Mass., $89,000; A. B. Stannard, New York, N. Y., $89,780; Carpenter & Williams, Norwich, $98,880; R. S. Fosburg & Son, Boston, Mass., $97,865; T. W. Rogers, Washington, D. C., $101,620; Wheaton Bld. & Lumber Co., Wheaton, Conn., $97,097.

Washington, D. C.—Bids will be received May 26 at the Bureau of Supplies and Accounts, Navy Dept., for furnishing at the following navy yards: Norfolk, Va.; Boston, Mass.; New York; League Island, Pa., and Portsmouth, N. H., a quantity of motors, brass furnaces, traveling crane, brick, etc. A. S. Kenny, Paymaster Gen., U. S. N., Washington.

Bids will be received May 19 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the following navy yards: Portsmouth, N. H.; Boston, Mass.; New York; League Island, Pa.; Norfolk, Va., and Pensacola, Fla., a quantity of electrical supplies, iron, steel, rails, pipe, asbestos, etc. A. S. Kenny, Paymaster-Gen., U. S. N.

Brunswick, Ga.—Bids are wanted May 29 for furnishing and installing certain combination gas and electric light fixtures in the U. S. Custom House, Brunswick. H. A. Taylor, Acting Secy., Treas. Dept., Washington, D. C.

Ft. Sheridan, Ill.—Maj. W. H. Miller, Q. M., U. S. A., Chicago, writes that the contract for wiring, installing fixtures, etc., in buildings at this post (bids opened Apr. 3) has been awarded to the Sanborn-Marsh Electric Co., 8 W. Market St., Indianapolis, Ind., for $19,201.

Jeffersonville, Ind.—Bids are wanted May 20 for constructing 4 storage buildings at Jeffersonville Depot. Sam. R. Jones, Q. M., U. S. A.

Baltimore, Md.—Bids are wanted May 26 for fireproof 1-story addition to old U. S. Court House. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Boston, Mass.—Bids will be received May 29 by Mordecai T. Endicott, Ch. of Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing a fireproof floor, stairway, etc., in building 103; also for furnishing and installing 6 direct-connected electric elevators in buildings 43, 103, and 107 Navy Yard, Boston.

Grand Rapids, Mich.—The following bids for repair of piers at (*a*) Black Lake, and (*b*) St. Joseph, Mich., were received by Maj. J. G. Warren, Corps Engrs., U. S. A., May 6: Robt. Love & Co., *a*, $23,306. Burk, Smith & Nelson, *a*, $23,579; *b*, $11,932. T. J. Bennett & Co., *a*, $25,935. Chicago & Great Lake Dredge & Dock Co., Chicago, Ill., *b*, $11,191. A. J. Beauvais, *b*, $11,560. Bidders of Muskegon unless otherwise mentioned.

Ft. Shaw, Mont.—Bids will be received May 29 by the Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing water and sewer system and 2 storehouses, including plumbing at the Ft. Shaw School. For further information apply to F. C. Campbell, Supt. of School.

Ft. Missoula, Mont.—The lowest bid received on May 5 for constructing water works and a sewerage system at this post is stated to have been submitted by the Allan Black Co., of St. Paul, Minn., for $15,365.

Ft. Mott, N. J.—Bids are wanted June 6 for constructing about 16,000 sq. ft. concrete walks. Address Quartermaster, Ft. Mott.

Ft. Slocum, N. Y.—Bids are wanted May 25 for taking up and relaying brick walks at this post. Address Edw. T. Donnelly, Quarter Master.

Elmira, N. Y.—The lowest bid opened at Washington, D. C., on May 11 for approaches at the U. S. Post Office, Elmira, was submitted by A. B. Stannard, St. James Bldg., N. Y. City, for $5,500.

Cherokee, N. C.—Bids will be received May 27 by the Comrs. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing a frame dormitory, including a steam heating plant, at the Cherokee School. For further information apply to Henry W. Spran, Supt. of School.

Merrill, Pa.—The following bids for building and erecting in place 2 steel lock gates at Lock 6, Ohio River, Merrill, Pa., were opened May 13 by Capt. Wm. L. Sibert, Corps Engrs., U. S. A., Pittsburg: Penn Bridge Co., Pittsburg, Pa., $36,000, and the Evansville Contract Co., Parkersburg, W. Va., submitted three bids—$49,240, $41,160, and $43,684.

Philadelphia, Pa.—Bids will be received May 26 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing power plant equipment at the Navy Yard, League Island, Pa. A. S. Kenny, Paymaster-Gen., U. S. Navy, Washington.

Bids will be received May 29 by Mordecai T. Endicott, Ch. of Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing a retaining wall on the Delaware water front, Navy Yard, League Island, Pa.; amount available, $48,500.

Bids are wanted June 12 for constructing a 2½-story brick and steel building, 54x143-ft. Maj. Frank Heath, Ord. Dept., Frankford Arsenal.

Ft. Ringgold, Tex.—The following bids are stated to have been opened on May 1st by Col. J. L. Clem, Ch. Q. M., San Antonio, for extending the sewerage system at Ft. Ringgold: E. G. Trueheart, San Antonio, $10,810; John E. Mix, Rio Grande City, $11,500; Jos. Netzer, Laredo, $12,200; Adolph Deutz, Laredo, $12,449; Wm. G. Schuwirth & Co., San Antonio, $13,900, and A. H. Shafer, San Antonio, $14,000.

Beaumont, Tex.—The following bids were opened at Washington, D. C., May 12 for the construction, including plumbing, heating and electric wiring and conduits extension to U. S. Post Office Bldg. at Beaumont: Wm. Webber, Beaumont, $51,867; C. C. Wetzel, Houston, $56,532; Thos. Lovell, Denton, $61,451; David Getaz, Beaumont, $62,700; A. Skoog, Shreveport, La., $63,700; Congress Constr. Co., Chicago, Ill., $65,473; John Barden, Ft. Worth, $66,500; Stafford Bldg. & Constr. Co., St. Louis, Mo., $71,431.

Ft. Douglas, Utah.—Capt. S. V. Ham, Q. M., Salt Lake City, writes that the following awards have been recommended for work at Ft. Douglas, for which bids were opened on May 4: Harris & Algar, Camden, N. J., heating, $8,712; Thos. G. Allen, Salt Lake City, electric wiring, $1,300, and Carthey & Dumbeck, Salt Lake City, plumbing and gas piping, for $10,790.

Vancouver Barracks, Wash.—Bids are wanted June 1 for constructing a gymnasium and post exchange building at this post. F. H. Hathaway, Ch. Q. M.

Ft. Lawton, Wash.—G. S. Bingham, Q. M., U. S. A., at Seattle writes in regard to bids opened Apr. 23 for ings at this post, that R. M. Henningsen & Co., of Seattle, secured the contract for $46,500.

Ft. Worden, Wash.—Contracts for work at Ft. Worden are stated to have been awarded as follows (bids opened Apr. 8): Buildings, to Andrew Stegerwald, of Port Townsend, for $71,750; heating to Harris & Alger, of Camden, N. J., $5,436, and for plumbing, to R. Dalziel, of San Francisco, Cal.

Juneau, Alaska.—Jas. M. Shoup, U. S. Marshal at Juneau, writes that the contract for a jail and court house here (bids opened Apr. 20) has been awarded to Anton Berens, of Tacoma, Wash., for $50,000. Building to be completed by Nov. 1, 1903.

NEW INDUSTRIAL PLANTS.

The Hays Mfg. Co., Erie, Pa., maker of water and gas specialties, is having plans prepared for a 2-story and basement, 60x200-ft. machine shop; a 70x160-ft. foundry, part one story and part two stories; and a 40x60-ft. power house. The buildings will be of steel and brick on a concrete foundation and as nearly fireproof as possible. A 125 or 150-H.-P. engine, a lighting dynamo and an air compressor will probably be installed.

The Farmers' Cotton Oil Co., Okolona, Ark., will erect a 40-ton mill and install a 100-H.-P. power plant Chas. E. Cobb, Secy. and Mgr.

The Diamond Match Co., Chico, Cal., will erect ten or twelve buildings next year and use power of about 3,000 H.-P.

W. B. Bertels, Son & Co., Wilkesbarre, Pa., makers of tinware, will erect a 3-story, 75x150-ft. brick building with concrete floor to be used for pressroom, machine shop, lithographing and storage; a 25x100-ft. brick storage building with cement roof, a 25x43-ft. office building, and otherwise improve their plant.

J. F. Wilder, Epps, Miss., has completed dry kiln and will erect a 32x100-ft. planing mill to replace plant recently burned.

The U. S. Steam Turbine Co. has opened offices in New London, Conn., and will erect a plant to cost $60,000, location of which has not been decided.

The La Belle Iron Works, Steubenville, O., is erecting blast furnace No. 2, which will be a 400-ton furnace and an exact duplicate of No. 1, placed in operation recently.

MISCELLANEOUS.

Point San Pablo, Cal.—Frank J. Baker, of San Francisco, Ch. Engr. Richmond Belt Ry. Co., writes that the contract for constructing a pile wharf here for this company has been awarded to Healy & Tibbitts, 22 Market St., San Francisco.

Springfield, Ill.—The House is stated to have passed the bill appropriating $121,000 for improvements at State Fair grounds.

Terre Haute, Ind.—It is stated that bids are wanted May 27 for constructing a levee in Sugar Creek Dist. E. B. Sheets, Clk. Bd. of Directors, 329½ Ohio St.

Nevada, Ia.—Bids will be received by the Co. Bd. of Superv. until June 9 for constructing a drain ditch in Grant Township; approximately 51,929 cu. yds. to be excavated. O. B. Peterson, Co. Aud.

Crowley, La.—The Secy. Rice Irrigation & Improv. Assoc. writes that the contract for constructing a system of locks near mouth of Mermentan River in Cameron Parish, for which bids were received Apr. 21, has been awarded to Serrett & Maze, of Beaumont, Tex.

Shreveport, La.—S. M. Kerley, Secy. Caddo Levee Bd., writes that bids received May 6 for constructing Cavitte levee (110,000 cu. yds.); Wild Lucia levee (55,000 cu. yds.); Cedar Bluff levee (25,000 cu. yds.); Cross Keys levee (95,000 cu. yds.), all in Caddo Parish, have been rejected, being too high.

Beverly, Mass.—Stewart & Son, of Newton, are stated to have secured the contract for constructing the dams above Elliott St., for $38,000.

Newark, N. J.—The Essex County Park Comn. is stated to have passed a resolution authorizing the Secy. to communicate with the Bd. of Freeholders requesting that $500,000 worth of park bonds be disposed of to obtain money for park purposes.

New Rochelle, N. Y.—Bids are wanted May 19 for constructing a stone dock in Hudson Park. Chas. Kammermeyer, City Clk.

Brooklyn, N. Y.—Bids will be received May 22 by McDougall Hawkes, Comr. of Docks, N. Y. City, for constructing pier with appurtenances at foot of Bay Ridge Ave.; also 1 between 51st and 52d Sts.

New York, N. Y.—Bids will be received May 26 by McDougall Hawkes, Comr. of Docks, for furnishing material and constructing a pier, with appurtenances, to be known as Pier No. 20, East River; also May 27 for furnishing material and putting in place small cobble and riprap stone, dredging at the Peck Slip, section of East River, and Cedar St., section of North River; also constructing pier, with appurtenances, to be known as Pier No. 36, East River; also until May 25 for furnishing and delivering granite stones for bulkhead on river wall; also for furnishing material and dredging on the Harlem and East Rivers.

Allegheny, Pa.—The Pittsburg & Allegheny Subway & Tunnel Co., of Allegheny, is reported incorporated to construct a tunnel between Pittsburg and Allegheny; capital, $250,000. Mayor Jas. G. Wyman, of Allegheny, is reported to be one of the incorporators.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Northern Electrical Mfg. Co., Madison, Wis., a 300-H.-P. cross-compound, self-oiling engine arranged for direct connection to two 75-Kw. Northern generators; Perry-Buskirk-Matthews Stone Co., Bedford, Ind., a 200-H.-P. engine arranged for direct connection to a 125-Kw. Western generator.

The Robert A. Keasbey Co., New York, has removed to 100 North Moore Street, where it will have room for carrying a large stock of 85% carbonate of magnesia and other coverings.

The Rand Drill Co. reports the removal of its San Francisco office to the Rialto Building, additional space being needed because of the rapidly expanding business of this company on the coast.

The firm of Elliot & Loomis, operating the National Paint Works, Williamsport, Pa., has been dissolved. W. H. Loomis disposing of his interest to Frank P. Cheesman, of New York. Mr. Elliot continues as manager of the works and Mr. Cheesman has charge of the sales department.

The Lunkenheimer Co., Cincinnati, reports that on account of the demand for its brass and iron steam specialties, it has been compelled to increase the foundry output 50 per cent. Machine tools of the most improved type are being installed in various departments as fast as they can be obtained.

The Otis Elevator Co. will move its offices to the Whitehall Building, New York, because of the necessity for increased office facilities. The company is to install eight high-pressure inverted plunger hydraulic passenger elevators in the Bessemer Building, Pittsburg, and in the Phipps power house adjacent thereto, the latter building supplying power to the various buildings in the neighborhood owned by Henry Phipps. These elevators are of the same type as those in the Prudential Building in Newark and those to be installed in the new Metropolitan Life Building in New York.

The Power Specialty Co., 126 Liberty Street, New York, has furnished sixteen 10-ft. Seymour fans for the cooling towers at the St. Louis Exposition through Westinghouse, Church, Kerr & Co. The combined delivery of these fans is over 2,000,000 cu. ft. of air per minute, requiring less than 20 H.-P. each to drive them.

The Atlas Tack Co., Fairhaven, Mass., has recently installed a large number of Nernst lamps, made by the Nernst Lamp Co. of Pittsburg, in its factory. Swift & Co., Union Stock Yards, Chicago, are lighting their temporary offices with the Nernst lamp. Two hundred and eighty-five 3-glower lamps are used, doing away with all desk lights and other local units. It is understood that they will be used throughout the large permanent office building now under course of construction. The Ringling Brothers have arranged for the use of Nernst lamps to illuminate the pavilions of their circus.

The Union Iron Works, of San Francisco, are installing a power transmission plant near Reward, Inyo Co., Cal., from which they will transmit power electrically about two miles to the mill of the Reward Gold Mining Co., where induction motors will be used to drive a 20-stamp mill, an air compressor, and a rock breaker. The apparatus, which has been purchased from the Westinghouse Electric & Mfg. Co., includes a 120-Kw., three-phase alternator; a 2-H.-P. exciter; a type 6 switchboard panel, including voltmeters, ammeters, rheostats, etc.; two 50-H.-P. type C induction motors, complete with auto-starters, slide rails, etc.; a 15-H.-P. induction motor; three 7½-Kw., O. D. transformers; two 1-Kw., O. D. transformers, and eight lightning arrester units. The transmission will be at 2,200 volts. The Westinghouse company has recently sold to the Union City, Winchester & Muncie Traction Co. two alternating current generators.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
May 18.	Engine, Burlington, Ia. Adv. May 2 to 16.	May 2
May 18.	Roslyn, N. Y.	May 16
May 18.	Pipe, etc., Sacramento, Cal. Adv. May 2, 9.	May 2
May 18.	Sterling, Colo. Adv. Apr. 25 to May 16.	Apr. 25
May 19.	Milwaukee, Wis.	May 16
May 19.	New York, N. Y.	May 9
May 19.	New Brighton, N. Y.	May 9
May 19.	Long Island City, N. Y.	May 9
May 19.	Greene, N. Y.	May 9
May 19.	New Bremen, O., Adv. Apr. 25, May 2.	Apr. 25
May 20.	Marieville, Que.	May 16
May 20.	Fayette, Ia.	May 2
May 20.	Tucson, Ariz.	May 2
May 20.	Pipe, Tacoma, Wash.	Apr. 25
May 21.	Yonkers, N. Y., Adv. May 2.	May 2
May 21.	Martinsburg, W. Va.	Apr. 25
May 22.	Washington, D. C. Adv. Apr. 25 to May 16.	Apr. 25
May 23.	New Haven, Conn., Adv. May 16.	May 16
May 23.	Washington, D. C., Adv. May 16.	May 16
May 25.	Condo, N. Dak., Adv. May 2 to 16.	May 2
May 26.	Harriman, Tenn.	May 16
May 26.	Alva, Okla. Ter.	May 9
Jun. 1.	Gouverneur, N. Y.	May 2
Jun. 6.	Washington, D. C., Adv. May 16.	May 16
Jun. 8.	Lancaster, Pa., Adv. May 16.	May 16
Jun. 8.	Bozeman, Mont.	May 16
Jun. —	Pump, Niagara Falls, Ont.	May 9
———	Alexandria Bay, N. Y.	May 9
	SEWERAGE AND SEWAGE DISPOSAL.	
May 18.	Chester, Pa.	May 16
May 18.	Watertown, N. Y.	May 16
May 19.	Marion, Ind.	May 16
May 19.	Milwaukee, Wis.	May 16
May 20.	Hartford, Conn.	May 16
May 20.	South Bend, Ind.	May 9
May 20.	Bond Hill, O.	May 2
May 20.	Amsterdam, N. Y., Adv. May 9.	Apr. 25
May 21.	Waterloo, Ia.	May 9
May 22.	Fairhaven, Vt., Adv. May 9, 16.	May 9
May 22.	Wilmington, Del., Adv. May 9, 16.	May 9
May 25.	Wabash, Ind.	May 16
May 25.	Lafayette, Ind.	May 16
May 25.	Los Angeles, Cal.	May 16
May 25.	Estherville, Ia.	May 2
May 26.	New York, N. Y.	May 16
May 27.	Sunderland, Mass.	May 16
May 27.	Brooklyn, N. Y.	May 16
May 29.	Aberdeen, S. D.	May 9
Jun. 1.	Lestershire, N. Y., Adv. May 16.	May 16
Jun. 1.	Belfast, Me.	May 16
Jun. 1.	Anderson, Ind.	May 16
Jun. 1.	Cuba, N. Y.	May 16
Jun. 6.	Washington, D. C. Adv. Apr. 25, May 9, 16.	Apr. 25
Jun. 15.	Burlington, Ia.	May 16
Jun. 20.	Washington, D. C., Adv. May 16.	May 16
Jun. —	Ballard, Wash.	May 9
———	Alexandria Bay, N. Y.	May 9
	BRIDGES.	
May 18.	Oshkosh, Wis.	May 16
May 18.	Erie, Pa.	May 16
May 19.	Woonsocket, S. D.	May 2
May 19.	Langdon, N. D.	May 2
May 19.	Milwaukee, Wis.	Apr. 18
May 20.	Jacksonville, Fla., Adv. May 2 to 16.	May 2
May 21.	Spokane, Wash.	May 16
May 21.	Omaha, Neb.	May 9
May 21.	New York, N. Y.	May 9
May 21.	Hoxie, Kan.	May 9
May 22.	Le Sueur, Minn.	May 16
May 22.	Henderson, Minn.	May 16
May 22.	Indianapolis, Ind.	May 9
May 23.	Henderson, Minn.	May 16
May 23.	Hamilton, Ont.	May 16
May 23.	Birmingham, Ala.	May 2
May 25.	Brookings, S. D.	May 9
May 25.	Carleton Place, Ont.	May 9
May 28.	New York, N. Y.	May 16
May 29.	Fletcher, Ont.	May 16
May 30.	Chicago, Ill.	May 16
Jun. 1.	Vicksburg, Miss.	May 16
Jun. 1.	Gettysburg, Pa.	Apr. 25
Jun. 2.	Niles, O.	May 16
Jun. 3.	Oak Ridge, La.	May 2
Jun. 3.	Livingston, Mont.	May 2
Jun. 4.	Ft. Benton, Mont.	May 9
Jun. 10.	Terre Haute, Ind.	May 16
Jun. 15.	Burlington, Ia.	May 16
Jun. 22.	Olivet, S. D.	May 16
Jul. 10.	Castlewood, S. D.	May 2
	PAVING AND ROADMAKING.	
May 18.	Little Falls, N. Y., Adv. May 9.	May 9
May 18.	Boston, Mass.	May 16
May 18.	New Albany, Ind.	May 16
May 18.	Albany, N. Y.	May 16
May 18.	Ann Arbor, Mich.	May 16
May 18.	Toledo, O.	Apr. 25
May 19.	Charlottesville, Va.	May 16
May 19.	Washington, Ia.	May 16
May 19.	Marion, Ind.	May 16
May 19.	Jersey City, N. J.	May 16
May 19.	Milford, Mass.	May 16
May 19.	Knoxville, Tenn.	May 16
May 19.	Bluffton, Ind.	Apr. 25
May 20.	Walden, N. Y., Adv. May 9, 16.	May 9
May 20.	Milwaukee, Wis.	May 16
May 20.	Chicago, Ill.	May 16
May 20.	Honolulu, H. I.	May 2
May 20.	Waynesburg, Pa.	Apr. 25
May 21.	North Adams, Mass., Adv. May 16.	May 16
May 21.	Apollo, Pa.	May 16
May 22.	Madison, Wis.	May 9
May 22.	Saginaw, Mich.	May 9
May 23.	Cumberland, Md.	May 9
May 24.	Louisville, Ky.	May 16
May 25.	La Porte, Ind.	May 16
May 25.	Wabash, Ind.	May 16
May 25.	Elmira, N. Y., Adv. May 16.	May 16
May 25.	Plymouth, Ind.	May 9
May 25.	Cincinnati, O.	May 16
May 25.	White Plains, N. Y.	May 16
May 28.	New York, N. Y.	May 16
May 28.	Salem, Ind.	May 9
May 29.	Lorain, O.	May 9
Jun. 1.	Anderson, Ind.	May 16
Jun. 1.	Augusta, Ga., Adv. May 16.	May 16
Jun. 1.	Huntingburg, Ind.	May 9
Jun. 2.	Princeton, Ind.	May 16
Jun. 2.	Bluffton, Ind.	May 16
Jun. 2.	Bowling Green, O.	May 9
Jun. 8.	Albany, N. Y., Adv. May 16.	May 16
Jun. 10.	Terra Haute, Ind., Adv. May 16.	May 16
Jun. 10.	Bowling Green, O.	May 16
Jun. 11.	Seymour, Ind.	May 16
Jun. 12.	Bloomington, Ind.	May 16
Jun. 15.	Burlington, Ia.	May 16
———	Concord, N. H.	May 9
———	Albany, N. Y., Adv. May 2.	May 2
———	Pittsburg, Kan., Adv., May 2.	May 2
———	Union, S. C.	May 2
	POWER, GAS AND ELECTRICITY.	
May 19.	New York, N. Y.	May 9
May 20.	Caledonia, Minn.	May 16
May 23.	Martinsville, Va.	May 9
May 25.	Jackson, Miss.	May 16
May 27.	Rochester, N. Y., Adv. May 16.	May 16
Jun. 1.	Corry, Pa., Adv. May 9, 16.	May 9
Jun. 1.	Lebanon, Pa.	May 16
Jun. 1.	San Diego, Cal.	Apr. 18
Jun. 5.	Franchise, Wytheville, Va.	May 16
Jun. 18.	Portland, Ore., Adv. Apr. 18 to May 2.	Apr. 18
Jun. 15.	Vernal, Utah	May 16
Jun. —	Napoleon, O.	May 16
Jun. —	North Yamkill, Ore.	Apr. 4
Sep. 1.	Corona, Cal.	May 16
	GOVERNMENT WORK.	
May 18.	Zaneaville, O., Adv. Apr. 18 to May 9.	Apr. 18
May 18.	Ft. Totten, N. Y.	May 9
May 19.	Washington, D. C.	May 16
May 19.	Ft. Keogh, Mont.	May 9
May 20.	Jeffersonville, Ind.	May 16
May 20.	Ft. Greble, R. I. Adv. Apr. 25 to May 16.	Apr. 25
May 21.	Washington, D. C.	May 9
May 21.	Chamberlain, S. D.	May 2
May 21.	Wheeling, W. Va.	Apr. 25
May 22.	Ft. Logan, Colo.	May 16
May 22.	Pipestone, Minn.	May 2
May 22.	Washington, D. C.	May 2
May 22.	Philadelphia, Pa. Adv. Apr. 25 to May 16.	Apr. 25
May 23.	Washington, D. C.	May 9
May 23.	Charleston, S. C.	Apr. 25
May 23.	Norfolk, Va.	Apr. 25
May 25.	Ft. Slocum, N. Y.	May 16
May 25.	New London, Conn.	May 16
May 25.	Ft. Monroe, Va., Adv. May 9.	May 9
May 25.	Plattsburg Barracks, N. Y. Adv. May 9, 16.	May 9
May 25.	Chattanooga, Tenn.	May 9
May 25.	Norfolk, Va., Adv. May 2, 16.	May 2
May 25.	New York, N. Y. Adv. Apr. 25 to May 16.	Apr. 25
May 25.	Ft. Morgan, Ala., Adv. Apr. 25.	Apr. 25
May 25.	Lockport, N. Y., Adv. Apr. 18, 25.	Apr. 18
May 26.	Washington, D. C.	May 16
May 26.	Baltimore, Md.	May 16
May 26.	Philadelphia, Pa.	May 16
May 26.	Des Moines, Ia.	May 2
May 26.	Boston, Mass., Adv. Apr. 25 to May 9.	Apr. 25
May 27.	Cherokee, N. C.	May 16
May 27.	Rock Island, Ill., Adv. May 2 to 16.	May 2
May 27.	Norfolk, Va., Adv. May 2, 16.	May 2
May 28.	Ft. Banks, Mass.	May 9
May 28.	Chattanooga, Tenn., Adv. May 2 to 16.	May 2
May 28.	Ft. Wadsworth, N. Y.	May 2
May 28.	Tompkinsville, N. Y., Adv. May 2, 9.	May 2
May 29.	Ft. Shaw, Mont.	May 16
May 29.	Philadelphia, Pa.	May 16
May 29.	Boston, Mass.	May 16
May 29.	Brunswick, Ga.	May 16
May 29.	Duluth, Minn., Adv. May 9, 16.	May 9
May 29.	Ft. Myer, Va., Adv. May 2 to 16.	May 2
May 30.	Mobile, Ala.	May 9
Jun. 1.	Ft. Rosecrans, Cal.	May 16
Jun. 1.	Vancouver Barracks, Wash.	May 16
Jun. 1.	San Francisco, Cal.	May 16
Jun. 1.	Ft. Logan, Colo.	May 9
Jun. 1.	Montgomery, Ala.	May 2
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 2.	Springfield, S. D.	May 9
Jun. 3.	Phoenix, Ariz.	May 16
Jun. 3.	Ft. Greble, R. I., Adv. May 16.	May 16
Jun. 3.	Milwaukee, Wis., Adv. May 9, 16.	May 9
Jun. 3.	Springfield, Ill., Adv. May 2, 9.	May 2
Jun. 4.	San Francisco, Cal.	May 16
June 4.	Metal Work, Baltimore, Md. Adv. May 9.	May 9
Jun. 4.	Light House, Baltimore, Md. Adv. May 9.	May 9
Jun. 4.	Scranton, Pa.	May 2
Jun. 5.	Grand Rapids, Mich., Adv. May 9, 16.	May 9
Jun. 6.	Ft. Mott, N. J.	May 16
Jun. 6.	Ft. Leavenworth, Kan., Adv. May, 9, 16.	May 9
Jun. 8.	Cleveland, O., Adv. May 2, 9.	May 2
Jun. 8.	Portland, Ore.	May 2
Jun. 8.	Sitka, Alaska	Apr. 25
Jun. 9.	St. Augustine, Fla., Adv. May 16.	May 16
Jun. 9.	Htg. P. O., Paducah, Ky. Adv. May 9, 16.	May 9
Jun. 10.	New York, N. Y., Adv. May 16. Adv. May 9, 16.	May 16
Jun. 10.	St. Paul, Minn.	May 2
Jun. 11.	Bldg. P. O., Paducah, Ky. Adv. May 9, 16.	May 9
Jun. 12.	Philadelphia, Pa.	May 16
Jun. 15.	Manila, P. I., Adv. Mar. 14 to May 9.	Mar. 14
Jun. 16.	Alexandria, Va., Adv. May 16.	May 16
Jun. 30.	Philadelphia, Pa., Adv. May 16.	May 16
Jun. 30.	New Orleans, La., Adv. May 9, 16.	May 9
	BUILDINGS.	
May 18.	School, South Boston, Mass.	May 16
May 18.	School, Carroll, Ia.	May 16
May 18.	Hospital, Albany, N. Y.	May 9
May 18.	School, Brooklyn, N. Y.	May 9
May 18.	School, New York, N. Y.	May 9
May 18.	School, Long Island City, N. Y.	May 9
May 18.	Hempstead, L. I., N. Y., Htg. School. Adv. May 2.	May 2
May 19.	School, Allegheny, Pa.	May 16
May 19.	School, Bedford, Ind.	May 9
May 19.	Library, Jackson, Mich.	May 2
May 19.	Jail, Elizabethtown, N. C.	Apr. 18
May 20.	Pub. Bldg., Brooklyn, N. Y.	May 9
May 20.	Library, Clinton, Ia.	May 9
May 20.	School, Covington, Ky.	May 9
May 20.	School, Alleghany, Pa.	May 9
May 20.	Police Station, Washington, D. C.	May 16
May 20.	Church, St. Ignace, Mich.	May 16
May 21.	School, Vallsburg, N. J.	May 16
May 21.	School, Salem, Ore.	May 16
May 21.	Pub. Bldg., Wheeling, W. Va.	May 16
May 21.	Pub. Bldg., Harrisburg, Pa.	May 16
May 21.	Library, Paris, Ont.	May 16
May 21.	Htg. Home, Lafayette, Ind.	May 9
May 21.	School, Glenville, O.	May 2
May 21.	Pub. Bldg., Columbus, O.	May 2
May 21.	School, Marietta, O.	May 2
May 22.	School, Ridgeville Corners, O.	May 16
May 22.	School, Oelwein, Ia.	May 16
May 22.	School, Tigerton, Wis.	May 16
May 22.	School, Belmont, Man.	May 16
May 23.	School, Toledo, O.	May 9
May 23.	Fire Station, Youngstown, O.	May 9
May 23.	School, Ladora, Ind.	May 9
May 23.	School, Columbus, O.	May 2
May 23.	Annex, Nashville, Tenn.	May 16
May 25.	School, Toronto, Ont.	May 16
May 25.	Schools, New York, N. Y.	May 16
May 25.	Bldg., New York, N. Y.	May 16
May 25.	School, Celina, O.	May 16
May 27.	School, Grand Forks, N. D.	May 16
May 27.	School, Williamsport, Pa.	May 16
May 27.	Church, New Britain, Conn.	May 16
May 27.	Library, Cleveland, O.	May 9
May 28.	Jail, Edmonton, Alberta, N. W. T.	May 16
May 28.	School, Poplar, Mont.	May 16
May 28.	School, Akron, O.	May 16
Jun. 1.	Library, Waxachie, Tex.	May 16
Jun. 1.	Library, Cleveland, O.	May 16
Jun. 1.	City Hall, Mitchell, S. D.	May 16
Jun. 1.	Hospital, Brooklyn, N. Y.	May 16
Jun. 1.	Pub. Bldg., Dayton, O.	May 16
Jun. 1.	Jail, Monticello, Miss.	May 2
Jun. 1.	Church, Liberty, Ind.	Apr. 25
Jun. 2.	Library, Danville, Ill.	May 16
Jun. 2.	Pub. Bldg., Pueblo, Colo.	May 16
Jun. 2.	Court house, Hamburg, Ark.	May 16
Jun. 4.	School, College Hill, O.	May 16
Jun. 5.	Plans, Moscow, Idaho	May 2
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jun. 10.	School, Hankinson, N. D.	May 16
Jul. 13.	Court House, La Grange, Ga.	May 9
Jun. 15.	School, Scotch Ridge, O.	May 16
Jun. 16.	School, Bedford, Ind.	May 2
Jun. 22.	Fire Station, Houston, Tex.	May 16
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May 18.	Garbage Plant, Shreveport, La. Adv. Apr. 18 to May 2, 16.	Apr. 18
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May 19.	Piling, etc., New Orleans, La.	May 9
May 20.	R. R. Work, Echa, Tex.	May 16
May 20.	El. Ry., Youngstown, O.	May 9
May 20.	Dredging, Falmouth, Jamaica	Apr. 11
May 21.	St. Cleaning, Reading, Pa.	May 16
May 22.	Piers, Brooklyn, N. Y.	May 16
May 22.	Subway work, Montreal, Que.	May 9
May 25.	Dredging, etc., New York, N. Y.	May 16
May 25.	Ditch, Council Bluffs, Ia.	May 2
May 26.	Pier, New York, N. Y.	May 16
May 27.	Levee, Terre Haute, Ind.	May 16
May 27.	Dredging, etc., New York, N. Y.	May 16
May 27.	Garb. Disp., Hoboken, N. J.	May 9
Jun. 1.	R. R. work, Whatcom, Wash.	May 16
Jun. 1.	El. Ry. franchise, Whittier, Cal.	May 9
Jun. 1.	El. Ry. franchise, Redwood City, Cal.	Apr. 18
Jun. 1.	El. Ry. franchise, San Mateo, Cal.	Apr. 25
Jun. 2.	R. R. Work, Columbus, O.	May 16
Jun. 9.	Ditch, Nevada, Ia.	May 16
Jun. 12.	Garbage, St. Joseph, Mo.	May 16
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21

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The Sanitary Conditions Attending the Construction of the Panama Canal.

Although there is yet some doubt regarding the action of the Colombian congress on the treaty to be put before it for consideration when it is convened on June 20, the chances for ratification are so favorable that it becomes of the highest interest to consider the sanitary conditions now prevailing on the Isthmus, as well as the probable scheme of procedure if the construction of the canal should be undertaken. In the popular mind in this country the Isthmus of Panama is probably considered to be one of the most unhealthful localities in the world. This is far from being the case, although it is not far from the truth to say that there is probably as little knowledge of, or as little esteem for, true sanitary conditions as in any other place in the civilized world. The climate is tropical and the conditions which induce malarial ailments will generate more malaria there than in a temperate climate, but that is about the worst that can be said. There is no more reason why there should be yellow fever on the Isthmus than in the city of New York, as recent experiences in Havana and in Santiago conclusively demonstrate. A rigid quarantine is required both at Panama and at Colon and the installation of reasonable sanitary conditions along the entire line of transit, but that is all.

The population of the city of Panama is now probably a little under 25,000 people, while Colon, as nearly as can be estimated, contains between 5,000 and 6,000 people. Between those termini of the canal route there is a succession of villages containing in the aggregate possibly 7,000 or 8,000 more. Panama is located generally on elevated and dry ground, and is thus naturally favored by topography lending itself admirably to drainage and sewerage. Its water front on the Bay of Panama offers an easy and suitable discharge for its sewage. At the present time some of its streets contain drains or crude sewers of varying rectangular section covered by stones forming parts of the street surface, laid or built under no municipal regulation and with little or no regard to grades or requisite areas of section. These covered drains therefore frequently contain pools of water and organic matter decomposing in the most noxious manner under the rays of a tropical sun. These sewers have been properly termed elongated cesspools. There is no system of sewers correctly speaking nor anything even approximating such a system. The city simply has no sewers, nor has it any system of water supply whatever. Water is brought to the city from some point in the suburbs, in single barrels placed on pairs of wheels and drawn by donkeys or small ponies. It is peddled about the city in this manner and sold in small quantities at exceedingly high rates. These conditions obviously form a most favorable environment for all sorts of diseases that flourish in the tropics and constitute precisely the lodgment needed for the beginnings of yellow fever epidemics. They are the more inexcusable because the city is by its location and natural features admirably adapted to easy and effective sewerage and may be readily served with a gravity supply of pure water from a mountain stream. Under the conditions prescribed in the proposed treaty between the United States and Colombia for the construction of the Panama canal, with its wholesome water and system of sewers, it should be a perfectly healthful city.

The city of Colon is built upon a low, sandy and marshy island and is not favored by a sanitary location. It has absolutely neither sewers nor water supply. The greater portion of its buildings are cheap wooden structures, many of them supported on short timber piles at a height two or three feet above water-soaked and partially submerged marshy ground, a steaming filthy soil receiving the household refuse and worse. These houses are most of them crowded with a squalid population of negroes and natives living without the slightest sanitary regulation and unrelieved by any sanitary administration except such as is rendered by the buzzards. Under such circumstances it is a matter of small wonder that malarial fevers flourish in the tropical cities at the extremities of the canal route.

The villages along the railroad line, which is essentially the canal line also, are practically all on elevated or dry ground, and where little expense and less effort if well directed, would afford all that could be desired in the way of effective sanitary conditions. They can be readily drained wherever necessary, and their refuse matter could easily be taken care of by simple but effective means. In these villages, and particularly in the cities of Panama and Colon, there should be reasonable provisions governing the construction of inexpensive houses for the poorer portions of the communities as well as similar regulations for the more expensive buildings in cities. This, like all the features of sanitary construction on the Isthmus, has been absolutely neglected in every particular.

Should the Colombian government ratify the treaty now before it, the first measure imperatively necessary to be taken by the United States government would be supplying the cities of Panama and Colon with wholesome water and the construction of systems of sewerage and drainage for both cities, accompanied by stringent quarantine provisions at both ends of the canal. A complete system of sanitary regulations for the two terminal cities and for all the population on the ten-kilometer strip of intervening territory should then be promulgated and so administered that every individual of the population would be compelled to respect them. This latter feature of administration will have to be carefully considered, for the great majority of the people affected have no appreciation of the significance of sanitary regulations. It is to be remembered that after the beginning of the construction of the canal the Isthmian population will probably be doubled within a short time and that the sanitary measures will actually be imperative for the safe, uninterrupted and effective prosecution of the work. If such measures are promptly taken and vigorously administered there is no reason why the Isthmus should not become entirely free from epidemics or dangerous malaria, and satisfactorily healthful.

Man to Man.

The near approach of the college commencement season again directs thought to the mental equipment of embryo engineers. A conference in Chicago on the second Friday and Saturday of the month, attended by a hundred representative educators, including more than forty presidents, directed attention especially to the commonness of the demand for speedy preparation for professional work. The very great development of knowledge of things and forces physical and their applications to the service of mankind demand for the mastery of even that portion which constitutes the body of information belonging to any one profession, the full space of a brief technical course, with close application on the part of the student. In the over ambitious haste to get an early start at productive practice, the so-called liberal branches are pushed aside as unnecessary or even too delicate for the sturdy scientific man. For some young men this short-cut preparation may be sufficient; in the economy of engineering there are and, doubtless, always will be, places for human technical machines. But some men have larger capacities and need correspondingly broader and deeper education; they need to understand much of the human element in the problem of life, to have clear comprehension of the laws of economics and some sensible conceptions of the commercial mechanism, and for such there is still room.

One of the most distressing and bodeful phenomena of the passing years, and especially of recent months, is the unrest of labor—the frequent and sometimes at least seemingly unreasonable interruptions of activity, with the many concurrent evils. The sovereign remedy for these and similar diseases of the social body was stated very clearly about nineteen centuries ago, but has been persistently adulterated or rejected by selfish and self-seeking men. The broad man, the great engineer, has laid upon him a large measure of the responsibility for the elaboration of the details of the practical application to present day relations of man to man, of the principle of doing to others as one would have others do. Neither the narrow-minded nor the ignorant, nor the small-

souled man can put himself at the view-point of the man on the other side of the question.

It is also quite difficult if not impossible, for obvious reasons, for the laborer to understand the life and views of the man with larger resources and greater opportunities. Rarely, if ever, can he "cross over to the other side." But the more favored man can and should "go over to the other side," not alone to get the juster and more comprehensive view of "a problem," but to impart somewhat of his larger information and clearer ideas. To this end a liberal training is necessary; much of which may come in the course of active experience, but the foundations of which must be laid in the schools. As President Frank W. Gunsaulus, of Armour Institute, put it at the conference mentioned, educators should resist the commercialism of the age so far as to refuse to turn out from the technical schools machines in place of men. "Hustling has come to be a positive disease. God save us from strenuosity in education. Twenty-five years hence, when we get our poise, we are going to ask some awful questions with regard to the positive ferocity with which we are seeking for students in some of our schools, and with regard to the criminal velocity with which we are pushing them out into life. Schools of technology must give the culture of soul and brain; the whole man is our man. We can't afford to cut off the top in instruction; rather let us broaden the bottom. Let all point toward manhood; intellectual method is better than information."

From many sensible statements by Dr. Harry W. Tyler, of the Massachusetts Institute of Technology, made in the course of a paper presented at the same conference, the following have been chosen: "The development of pure and applied science, the increasing complexity of applications of the physical science in engineering and industry render it wholly out of the question to give the essential training in a thorough manner in less than four years, assuming that the candidate has at the outset the best preparation which a boy of 17 can expect to have obtained. The average boy will very often find it important, if not essential, to give five years to the professional course. The boy can be presented by the secondary school adequately prepared for a professional course at about 18 years of age; a professional course of normal scope can be given him during four years of earnest work; it is desirable that he should be ready to enter his profession at 22, or, with some margin for advanced study or interruptions, at 23. Out of ten students who graduate in the scientific school, perhaps four would have been greatly benefited by an antecedent academic course; three more would have derived some benefit, but hardly enough to offset the expenditure of time; the remaining three would have suffered harm from the demoralizing possibilities of the college, or would have failed on account of natural unfitness for its work."

Furthermore, these relationships of man to man are very prominent factors in the dealings of engineers with clients, contractors and their engineering assistants. Much friction and many delays resulting not infrequently in physical injury to the work and considerable financial losses could be avoided, and are avoided, by engineers of broad sympathies, keen understanding of men and clear perception of what is essential. For men of such training and calibre there is large demand and liberal rewards; but for them life will not be easy, although it will be well "worth while." And men of this stamp will accomplish more toward commanding for the profession the sincere respect of all the people than any number of resolutions and codes of etiquette or even imposing society edifices, important as these latter are.

The Value of Indicator Diagrams in Complicated Engine Diagnoses.

The value of the indicator as an instrument for diagnosing the conditions which exist in engine cylinders is too firmly established to merit mention. Its diagrams are replete with information when examined by an experienced expert, and some of the deductions which can be drawn from them are remarkable, even to men familiar with cards of the usual type. An instance of their service in an unusual case is worth consideration as showing to young engineers the value of becoming acquainted with all classes of such cards and the causes of their peculiarities.

Some time ago a 15x23x15-inch automatic compound horizontal receiver engine, running at 260 revolutions a minute, developed a persistent knocking and grinding in the cylinders. The condition was bad at 55 pounds steam pressure and serious at 75 pounds. Indicator cards were taken, which showed unusually complicated lines. With a friction load of 53 horse-power, the low-pressure cylinder developed 100 horse-power and the high-pressure cylinder offered a resistance of 47 horse-power. When 114 horse-power was furnished by the engine, the low-pressure cylinder developed 113 horse-power and the other but a single unit. When the load was raised to a 165-horse-power, the high-pressure cylinder was serving as a drag on the low-pressure side to the extent of 24 horse-power more.

The diagrams were carefully examined by a well-known steam engineering specialist, and from them he came to the conclusion that the casting of the cylinders must be broken, so as to permit steam to pass from the chest of one cylinder to that of the other without taking its usual course. The cover of the high-pressure chest was removed and both valves set at the center position so as to cover all ports. While in this condition steam was admitted to the low-pressure cylinder, and was at once discharged from the open chest, although there was no appearance of leakage backward through the high-pressure valve, the end of which could be seen. Although the test proved the occurrence of some break, it gave no indication of its place, so the same procedure was followed with the chest of the low-pressure cylinder. By paying special attention to the direction in which the steam was escaping, the source of the trouble was finally discovered.

At the junction of the diaphragm between the two steam chests with the main casting, there was a crack about 6 inches long, so situated that the steam in the high-pressure chest tended to open it. The higher the boiler pressure, the greater the opening and the more serious the result. The effect of this opening, admitting live steam directly into the receiver, was to increase the pressure in the latter and make the low-pressure cylinder perform an unduly large proportion of the work. This produced an excessive compression in the high-pressure cylinder. The governor acting on the high-pressure valve cut off the steam at an early point, so that there was a loop in the top of the indicator diagram. When the engine was carrying the heaviest load, with a boiler pressure of 75 pounds, the compression ran up to 120 pounds and steam was apparently cut off at the beginning of the stroke.

While such diagrams are probably rare, yet every steam power specialist finds them in the course of his investigations, and their publication would be of general interest. Such exceptional occurrences are too often regarded as engineering freaks of little permanent value, while the contrary is true. Examples of such complicated cards with statements of their causes will always be welcomed by this journal for publication in its columns.

The National Irrigation Works.

Members of the American Society of Civil Engineers who attended the convention at Washington a year ago, will recall the many strong statements by members from the West concerning the desirability of the national irrigation act which was then practically certain of becoming a law. The bill was finally approved on June 17, and the Department of the Interior has taken up five great enterprises under its provisions. National aid toward irrigation has been extended so frequently and on such a large scale in other countries that the present instance of it is not an experiment in any sense of the word, and the only question which can arise is the financial one of the advisability of a loan of national money or credit for a given project. Consequently the fate of these five initial projects deserves to be watched with special attention, as they will serve as an indication of the value of the particular form of national assistance to which the country is now committed.

The act applies only to Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming. All funds received from the sale of public lands in these states and territories, except certain percentages already appropriated for other purposes, are set aside for a reclamation fund. Its purpose is stated in the act to be the payments for "the examination and survey for and the construction and maintenance of irrigation works for the storage, diversion and development of waters for the reclamation of the arid and semi-arid lands in the said states and territories." The entire execution of the works is apparently left wholly in the hands of the Secretary of the Interior, who is required to file an annual report on the work with Congress, but seems to be left without other control in his management of this great undertaking. Whenever he feels assured that a project is practicable, he is authorized to let contracts for its execution, provided there is sufficient money in the reclamation fund; when the contracts are let notice must also be given of the area of public land which the works will render arable and of the charges which will be collected from the settlers upon this land. There will be not more than ten annual payments permitted to meet these charges, and until the last is paid, title to the land will not be given. The amount of the charges is to be so fixed that their total sum for any one district will recoup the government for all its expense in constructing the irrigation works for its use. The lands necessary for the works themselves may be obtained either by withdrawing them from entry or by condemnation proceedings. The lands to be irrigated are not subject to the land laws generally, save the homestead act, and filings made under the latter act are also subject to the reclamation act.

While the conditions governing the choice of locations for these government works and the methods to be followed in their construction seem to be noticeable for their absence, the act is specific enough regarding the manner in which the settler must pay for the works and the steps he must take before their control is turned over to him. No water will be fur-

nished for more than 160 acres belonging to a single owner, nor to land on which the owner does not reside, either immediately or in the vicinity. The maintenance of the minor irrigation works remains in the hands of the Interior Department until the payments have been made for the major portion of the lands. When this time arrives the management passes to the irrigated lands, to be conducted at their expense, under a form of organization and governed by rules and regulations acceptable to the Secretary of the Interior. The title to and management of the reservoirs remain with the government until Congress provides otherwise.

The main restrictions on the Secretary's action in applying the provisions of this act are two in number; he must use the money from the sale of lands in one state or territory for irrigation enterprises beneficial to that division of the country so far as possible, and nothing he does under the reclamation act must be contrary to the laws of any state or territory relating to the control, appropriation, use or distribution of water used in irrigation or adverse to vested rights acquired under these laws.

Under this act, the Secretary of the Interior has organized an engineering corps of which Mr. F. H. Newell, M. Am. Soc. C. E., is the chief, and Mr. George Y. Wisner, M. Am. Soc. C. E., the consulting engineer. Messrs. A. P. Davis, M. Am. Soc. C. E., J. H. Quinton, M. Am. Soc. C. E., H. A. Storrs and W. E. Swift are among the leading members of the staff, which has been drafted mainly from engineers whose work with the U. S. Geological Survey and in connection with irrigation enterprises has demonstrated their fitness for the service. The five projects which have been undertaken are the Sweetwater development in Wyoming, the Milk River development in Montana, the Gunnison development in Colorado, the Truckee development in Nevada, and the Salt River development in Arizona. There is a sixth project which is slated for immediate consideration, the Gray Bull reservoir development in Wyoming.

The construction of these works has not been definitely determined, for there are necessary rights to be secured and private claims to be adjusted in a manner complying with the act, before contracts can be executed. Each of these projects presents features which differentiate it strongly from the others, so that by the time all of them are carried out, the operation of the act will have been subjected to a quite serious test.

This national irrigation act has been criticised very strongly. Its passage has been attributed to the most powerful railway lobby ever sent to Congress. It has been claimed that engineers lent their assistance to its passage in consideration of future rewards in the shape of engagements for professional services. Such assertions are still made, but The Engineering Record hopes that the last of them has been uttered. Now that the bill has become a law, it is the duty of all engineers and others who favored it to assist in all ways in making its operations serve the welfare of the great arid and semi-arid regions. It is the duty of those who fought the bill to refrain from obstructing the operation of the act; it is possible that their objections were founded on erroneous data or were due to hasty consideration. Now that the bill is a law it is certainly the duty of everyone to allow its friends to show that they can accomplish under its very liberal provisions the good results which they promised. It is deeply to be desired that these results can be secured, for the occupation of the country's present extent of arable land is rapidly becoming an accomplished fact.

Notes and Comments.

The General Asphalt Company filed its incorporation papers at Trenton on May 19, the incorporators and temporary directors being Messrs. Samuel B. Lawrence, John B. Summerfield, Alfred T. Davidson, R. J. Wortendyke and Henry A. Bingham. These gentlemen met on the same day and elected Mr. Lawrence president, Mr. Wortendyke secretary, and Mr. Arthur W. Sewall treasurer. This is the corporation which is to take over the assets of the National Asphalt Company and the Asphalt Company of America, which were recently bought by Mr. Henry C. Everdell, acting in its interests.

The Stand-Pipe forming a part of the water works of Attleborough, Mass., was emptied, cleaned out and inspected in July, 1902. According to the annual report of the board of water commissioners, it was found to be somewhat pitted with rust, but seemed sound, with no signs of settling of the foundations. This stand-pipe, which was described in The Engineering Record of February 27, 1892, was built in 1890, so that it has now been in use for over 12 years. It is 30 feet in diameter and 125 feet high.

Investigations of Underground Waters in two States have been undertaken by the United States Geological Survey. All available data relating to springs, wells and geologic conditions affecting subsurface supplies will be collected and studied with the idea of securing results of practical value to present or prospective well owners. The work in Connecticut will be in charge of Dr. Herbert E. Gregory, of Yale University, and that in Michigan will be done by Mr. W. F. Cooper under the supervision of Dr. A. C. Lane, State geologist. The value of such investigations and studies, when well done, is so great that it is gratifying to notice the broad way in which the Survey is taking up the undertaking. Ground water supplies are unpopular in this country, compared with Great Britain and Germany, yet they are a source which must eventually be developed.

The New Engineering Building of the University of Pennsylvania is to be a three-story and basement brick structure, 300 feet long, 160 feet deep and provided with 40 and 50-foot wings. The total floor space in the building will be 127,000 square feet. The basement will contain the mechanical plant for warming and ventilating, together with locker rooms and a few laboratories and storage spaces. On the first floor will be the main offices, a small foundry, metal and wood-working shops, and laboratories for electric, mechanical, cement and hydraulic investigations. The last-named will include an 8-inch well 100 feet deep, for testing various forms of deep well pumps and air lifts. The second floor will contain the library, recitation and drawing rooms, a small electrical laboratory for alternating-current work exclusively, and an assembly room for the students. The third floor will contain museums, drafting rooms and small assembly halls for the engineering societies, together with private rooms for the instructors. It is expected that the building will be ready for use in eighteen months.

A Remarkable Series of Rainfalls flooded a large part of Jacksonville, Fla., last week, so that one of the streets was submerged to such a depth that boats alone could furnish transportation. The precipitation is given by Mr. A. J. Mitchell, the local Weather Bureau Director, as follows: May 6, 0.89 inch; 7, 0.8 inch; 8, 0.85 inch; 9, 0.19 inch; 10, 0.31 inch; 11, 0.55 inch; 12, 1.17 inches; 13, 8.42 inches up to noon. The greater part of the last day's rainfall, 4.21 inches, fell within 2½ hours, and coming at a time when all the streams were already full, it produced the floods mentioned. Some other authentic records given by Mr. Mitchell, are the following: Washington, D. C., June 1881, 2.34 inches in 37 minutes. Indianapolis, July, 1876, 2.4 inches in 25 minutes; Biscayne Bay, Fla., March, 1874, 4.1 inches in 30 minutes; Newton, Pa., August, 1843, 5.5 inches in 40 minutes; Sandusky, O., July, 1879, 2.25 inches in 15 minutes; Embarrass, Wis., May, 1881, 2.3 inches in 15 minutes; Galveston, Tex., June, 1871, 3.95 inches in 14 minutes; Concordia, Pa., August, 1843, 16 inches in 3 hours. Such enormous downpours are of rare occurence, and it is rather important to recall in considering them that the courts of final resort in several states have ruled that an engineer is not called upon to provide drainage facilities for such extremely rare storms.

The Gas Engine Plant at the large cement works at Iola, Kan., operated by the Iola Portland Cement Company, is to be increased, a fact which merits particular notice because it was asserted at the time the mills were built, a few years ago, that this type of prime motor would surely fail to answer the severe requirements of cement manufacture. The recent placing of an order for additional equipment completely disproves this assertion. When the addition is completed the power plant will comprise six engines of 280 horse-power each, driving crushers, five of 125-horse-power each driving kilns, and two smaller engines. All are of the Westinghouse type and use natural gas. The machinery in general is arranged in groups on sections of countershafting driven by a single engine, either direct-connected or used with a rope drive. This installation is unusual in size as well as difficulty of service, and its success must be equally pleasing to the builders of the mills who undertook what many critics termed great risks and to the makers of the engines.

The Technolexicon, the technical dictionary in English, German and French, which the Society of German Engineers undertook in 1901 to compile and publish, is progressing very satisfactorily. Dr. Hubert Jansen, the editor, states that 42 English and American societies, 272 German and 27 French are now helping in the work in one way or another, and 2,185 individuals or corporations have furnished assistance. Among the American companies which are taking part in the work may be mentioned the Westinghouse Air Brake Company, the Trenton Iron Company, the B. F. Sturtevant Company, the Thomas D. West Company, Manning, Maxwell & Moore, and the Fairbanks Company. The time for receiving contributions will not close until next year, so all who feel disposed to assist in this useful undertaking but have not yet done so, still have an opportunity for giving their aid. The scope and method of compilation of the dictionary have been explained in past issues of this journal, so it is only necessary to remind the reader that contributions in one language are acceptable, although those in two or three languages are of the most service. Contributions of words and trade catalogues in all technical branches and handicrafts are welcomed. Full information on this head, together with books for filling out with words and their definitions can be obtained from Dr. Jansen, whose address is Dorotheenstrasse 49, Berlin.

A Tall Concrete-Steel Office Building.

The development of the steel-framed tall office building has been followed in these columns by numerous articles since the first examples were constructed, less than twenty years ago. Cast-iron columns and independent walls have practically disappeared, and the framework is made up of rows of columns from 10 to 20 feet apart. The walls are mere curtains carried at every story by girders on the exterior columns, and the floors and roofs are made with various kinds of fireproof arches and slabs supported by steel beams and girders. To secure strength, durability and resistance to fire the steel framework is designed to carry the entire live and dead loads of the building and contents, and the stresses due to wind, vibration and impact are provided for by additional systems of bracing between the columns and girders or by specific excesses of section in the steel members. In order to protect the steel against corrosion, flame and water it is also necessary to provide throughout complete insulation. This system of construction thus includes at least three classes of members and materials with different functions and a great multiplicity of parts and connections.

Reinforced concrete has recently made rapid progress in applications to factories, warehouses and heavy floors, and the results have been such that it is deemed by some to be suitable for tall office buildings. The advantage claimed for this work is that the structure is practically a monolith of artificial stone, forming continuous surfaces throughout all parts of the building, without other joints and separations than are requisite for the architectural features and for temperature movements. The foundations, columns, beams, girders, floor surfaces, walls, principal partitions and roof will be built of concrete with steel reinforcement.

The Ingalls building, Cincinnati, is designed for ordinary commercial purposes with a bank and stores in the lower portion and offices above. Preliminary comparative estimates and designs for skeleton steel construction and for reinforced concrete construction indicated that the latter was somewhat cheaper, and after consideration of the intrinsic merits of both systems, competitive bids were received, and the contract was awarded, by Elzner and Anderson, the designing and supervising architects, to the lowest bidder, W. H. Ellis & Company, of Cincinnati, for a structure entirely of reinforced concrete, equaling in every respect the requirements for a steel frame building. The building will be about 50 feet wide and 100 feet deep with fifteen stories, besides the basement and attic, and will have a height of about 210 feet above the curb. The contract price for the building and interior finish and trim complete, exclusive of the mechanical installation, is about $400,000. The details of the concrete construction have been worked out by Mr. Henry N. Hooper, engineer for the Ferro-Concrete Construction Company, of Cincinnati, who are building the concrete work under the Ransome patents. Operations at the site were commenced in October, 1902, and the building has been carried up to the eighth story above the ground, and is now progressing at the rate of one story every twelve days. The work is of great interest and importance on account of the features of design and the special details, and because it is the first tall building of this type. It will therefore be fully described and illustrated from data recently received from the architects and contractors.

The construction is simple. It consists of solid columns, beams and slabs of concrete carefully bonded together at joints of successive operations and reinforced throughout with square cold-twisted steel rods, calculated and arranged to take tensile stresses and proportioned to develop the full compressive strength of the concrete, as well as to form bonds between consecutive portions of the concrete. In general, the character of the columns, beams and slabs corresponds with those illustrated in the descriptions of the Pacific Coast Borax Factory, the Mineola Court House and the St. James Church, all of which were built under the Ransome system and were described in the issue of The Engineering Record of July 30, 1898; December 7, 1901, and May 5, 1900. The principal difference between this building and those mentioned is that here the walls are, in most places, solid without air spaces or flues, that the floors above the basement are uniformly covered with a wooden wearing surface, except in halls, corridors and lavatories, and that the walls are many of them finished with marble facing and marble, brick and terra cotta exterior mouldings, anchored and bonded to the concrete. The exterior window casings and sashes are of sheet iron and the interior trim of the upper stories is of Keene's cement finished in white enamel paint, differing from the usual finish of office buildings. The main interior partitions are built with hollow tile to avoid unnecessary weight, and the other partitions are made in the usual manner with wooden panels and glazed windows. The elevator shafts and stair wells are enclosed by tile partitions and the stairs are built of reinforced concrete.

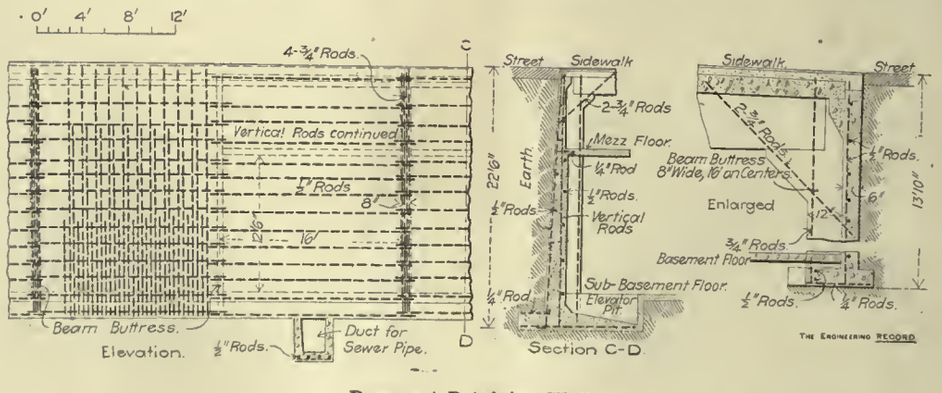


Ingalls Building.

The building was calculated to resist an assumed horizontal wind pressure of 30 pounds per square foot on the exterior wall surface more than 50 feet above the street level, but no pressure was assumed below that height. The roof was calculated for a live load of 40 pounds per square foot, and all the floors above the second story were calculated for 60 pounds per square foot. The first floor was calculated for 200, and the second floor for 80 pounds. In the attic and fifteenth story the full floor load was assumed to be carried by the columns. For each succeeding floor downwards the columns were assumed to carry 5 pounds less per square foot of floor surface, so as to have loads reduced finally to 5 pounds for the fourth story and to nothing additional for the third story. The second floor was, however, assumed to transmit a live load of 40 pounds per square foot to the columns, and the first and mezzanine floors to transmit their full loads of 200 pounds and 60 pounds respectively to the columns which, of course, were calculated to carry the full dead load of all floors.

The 1:2:4 Portland cement concrete was considered to have enough mortar to give an excess of 15 per cent. above the volume of all the voids between the pieces of crushed stone, which were required to pass a 1-inch screen. The concrete was calculated to be subject to compressive strains only and to work under unit loads of 600 pounds per square inch for the floor slabs, 750 pounds for the columns up to the tenth floor and 500 pounds for the columns in the upper stories. The cement had tensile strengths of 175, 500 and 600 pounds per square inch for one, seven and thirty-day samples respectively. The concrete was required to have a compressive strength of 2,000 pounds per square inch when thirty days old.

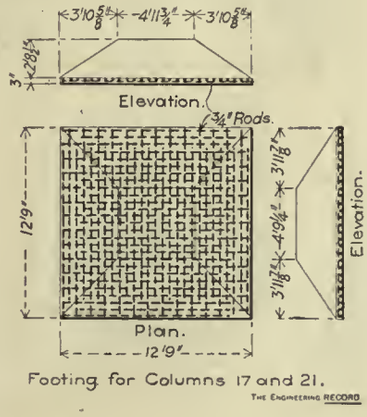
Mild steel was used throughout and the adhesion of the concrete to it was assumed to have a value of 100 pounds per square inch for working stress and 500 pounds for ultimate strength. The compression rods in the columns and the untwisted tension rods were proportioned for working stresses of 16,000 pounds per square inch and an ultimate strength of 64,000 pounds. The Ransome twisted square steel bars were proportioned for working stresses of 20,000 pounds per square inch and for an ultimate



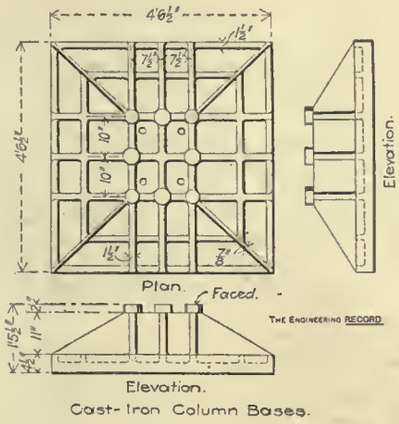
Basement Retaining Walls.

strength of 80,000 pounds per square inch, which it was assumed had been developed by the cold twisting process.

The solid concrete slabs forming the sidewalk and some of the basement rooms were finished with a 1-inch coat of 2:3 mortar made with Portland cement and fine granite screenings. The surfaces were troweled smooth, divided into 4-foot squares with rounded V-joints

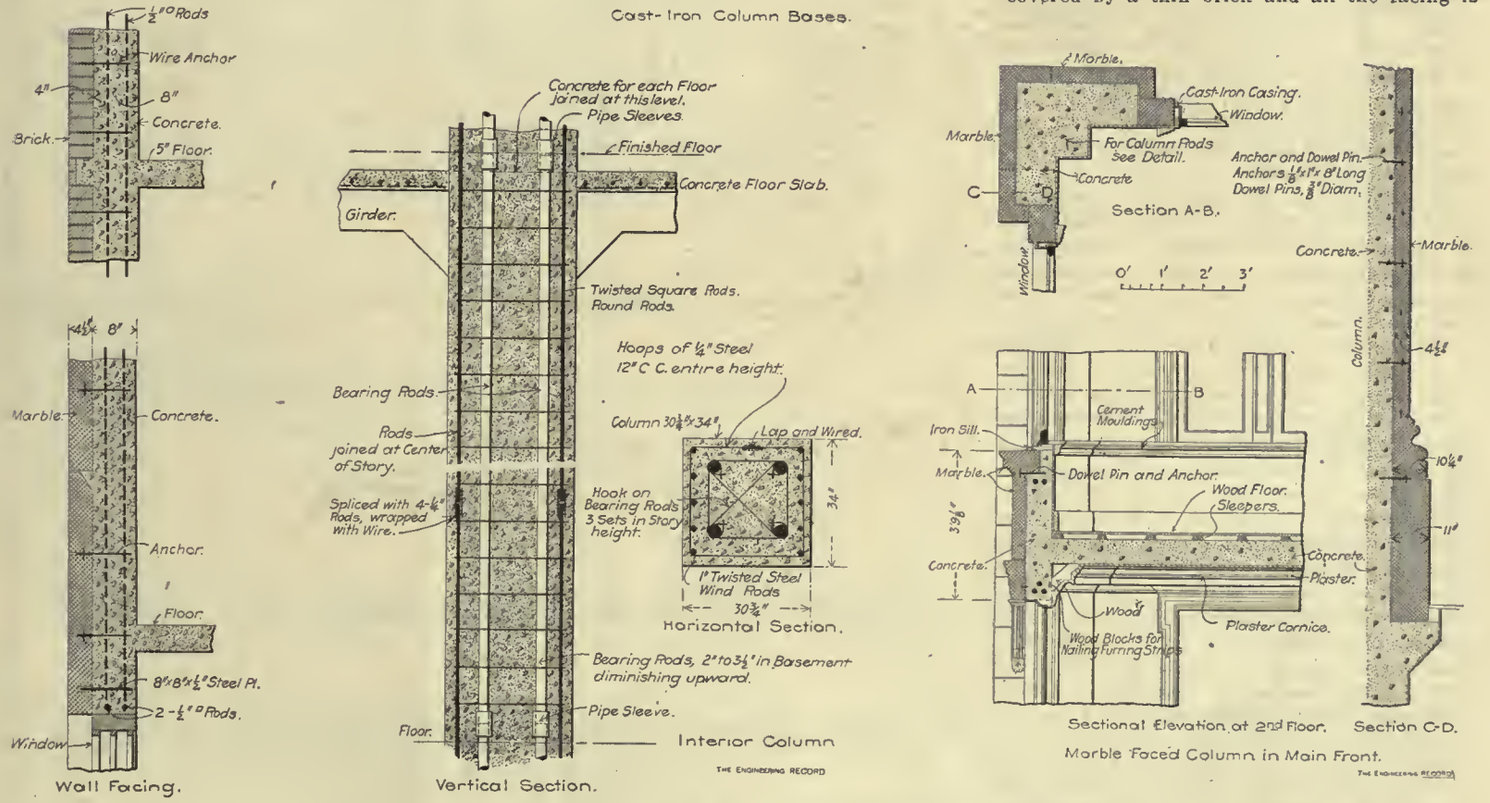


All of the footings are of reinforced concrete on the level surface of sand and gravel with a calculated bearing capacity of about 20,000 pounds per square foot, but loaded to a maximum of only 10,000 pounds of dead and live load. The footings of the party walls are continuous beds of concrete 7½ feet wide on the inner sides, where they are 6 inches thick at the toe, and slope at a flat angle to the base of the wall, where they are 2 feet thick. They carry 20-inch concrete walls 3½ feet high to



½-inch horizontal bars near the outer and inner surfaces of the wall 1½ inches above and below the window openings. The bars are made in 27-foot lengths with the ends lapped 21 inches and wired together. Single ½-inch square vertical bars 27 feet long are placed near the front and rear surfaces of the concrete 2 inches from each edge of each window opening. Those between the windows extend through two stories and lap joints at the floor lines. The alternate sets at the columns or piers between windows are of the same length, but have their joints staggered with the first sets and terminate in the middles of the stories where the ends do not lap but are spliced by short bars wired to them.

The first three stories are faced with white Vermont marble secured to the concrete by wrought iron anchors and resting on concrete projections reinforced by horizontal anchor rods bedded in the concrete, as shown in the detail section. A similar construction is provided for the projecting belt-course, 26 inches wide, at the third floor. Above this point the walls are faced with 3x9-inch grey enameled bricks 4 inches thick resting on similar concrete ledges made at each story by a 3-inch projection of the floor slab: the remaining inch is covered by a thin brick and all the facing is



Details of Concrete-Steel Walls and Columns, Ingalls Building, Cincinnati.

⅛ inch wide made with a special tool and filled with asphalt, and the entire surface was sprinkled with granite screenings before the cement had set. The concrete roof surface will be covered with four layers of heavy tar felt laid in coal tar pitch and covered with 1½ inches of cement mortar, as above described, having a ½-inch finishing coat of 1:2 Portland cement mortar.

The floors are carried partly by the exterior walls, but mainly by concrete columns adjacent to the party walls, by concrete columns and piers in the street walls and by a longitudinal row of interior concrete columns from 16 to 17 feet apart. The foundations extend down to a uniform depth of about 24 feet below the curb, except at one end, where a few of them are a little higher and the excavation is not so deep. the level of the cellar floor, and support the concrete side walls of the new building, which are about 4 inches thick, up to the tops of the adjacent buildings, and are laid close against their walls. The other exterior walls have a uniform thickness from top to bottom of 8 inches of concrete faced with about 4 inches of marble or brick.

The walls of the two street fronts have nearly half of their area composed of windows about 5 feet wide, 7½ feet high and 1 foot apart in the clear, arranged in pairs in panels formed by the floors and wall columns, thus reducing the wall substantially to a series of piers connected by comparatively narrow horizontal zones of concrete at the floor lines and with narrow vertical strips of concrete between the windows. This concrete is reinforced by single secured by wire anchors built into the concrete as the latter is laid. The column footings are rectangular in plan, and those for single columns are from 9½ to 12¾ feet square with pyramidal sides, as shown in the detail drawing. The lower surface is reinforced by two tiers of ¾-inch longitudinal and transverse bars about 6 inches apart in each direction. The footings vary from about 28 to 40 inches in depth, and have horizontal upper faces from 3½ to 5 feet square to receive the cast iron pedestals for the columns. Footings employed at a number of points to carry two columns each and designed as inverted beams are constructed with a rectangular base with a wide batter on the long sides and a narrow one on one or both ends and having a center wall or rib with a horizontal surface on which

the cast iron column pedestals are seated. Both the base and upper surface are reinforced by longitudinal and transverse horizontal rods and the rib is further strengthened by short vertical rods, as indicated in the enlarged cross-section through the upper part.

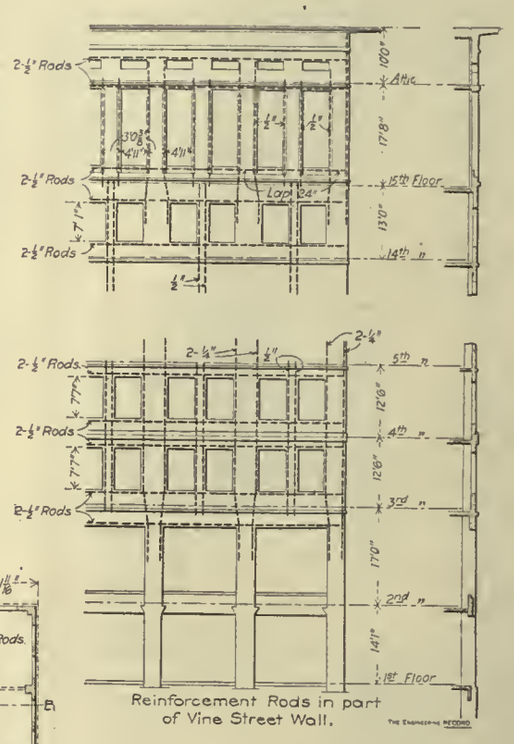
Cast-iron pedestals with transverse, longitudinal and diagonal webs have solid bases as indicated in the detail, which is a drawing for ten pedestals, the remaining thirteen being similar to these but varying in their dimensions. These pedestals are seated on the tops of the concrete footings, and the spaces between their webs are filled solid with concrete, which seals them and is integral with that in the body of the columns. The columns have rectangular cross-sections with vertical twisted steel reinforcement rods and large round rods, intended to take part of the compression, and seated on the planed upper surfaces of circular discs projecting from the tops of the cast-iron pedestals. The twisted column rods for tension developed by wind stresses are mainly 1 inch square, and are cut in 27-foot lengths lapping 21 inches, and wired together at splices so as to be continuous from foundation to roof. The columns are also reinforced by horizontal bars ½-inch square and about 6 inches apart. These are bent to form rectangles about 3 inches' smaller than the outside dimensions of the column and have their ends lapped about 12 inches and wired together. The columns are from 30 to 38 inches wide at the bottom and are of uniform size up to the tenth floor, above which they are all 12 inches square. Their reinforcement bars diminish in size up to the tenth floor, above which they are omitted.

The longitudinal line of interior columns divides the building into unequal portions, one of which is 17½ feet wide and is chiefly occupied by the elevator shaft, stair halls and main corridor, and has a special arrangement of floor beams and girders to provide for this construction. The remainder of the floor area is a rectangle about 33 feet wide and 100 feet long. Here the floors are supported by the walls and by five main transverse girders and longitudinal girders on the column lines and at the centers of the transverse girders, as indicated in the general floor plan, which is typical of all floors from the first to the attic inclusive. The main girders have at their ends vertical extensions like kneebraces built integral with them and with the columns and walls so as to provide strength for shearing stress and give rigidity to the structure. They are finished with coved surfaces so as to form part of the ceiling panels and are reinforced by diagonal rods built into the walls, columns and girders, as indicated in the diagram.

The girders are reinforced with top and bottom horizontal tension bars and vertical stirrups, which differ somewhat in arrangement and dimensions for different girders, but substantially conform to the sizes and positions shown. The longitudinal girders are similar to the transverse ones, but smaller as shown in the general transverse section. Both longitudinal and transverse girders are made monolithic with the floor slabs and have the angles with them filleted so as to reduce them to 45 degrees. The floor slab has a varying thickness of from 3 to 5 inches, and is reinforced with different sets of horizontal transverse and longitudinal ¾-inch steel bars, arranged as indicated in the general diagram and spaced differently in the different numbered panels. Most of them are 12 inches apart on centers transversely and 15 inches apart longitudinally. The transverse girders are from 16 to 20 inches in width and are all 27 inches deep, including the thickness of the floor slab, except in the basement where they are 36 inches deep. The longitudinal girders are from 9 to 12 inches in width and are 18 inches deep including the thickness of the floor slab. The vertical U-bars in the beams and girders are of three sorts, those with plain ends which have their loops turned upwards alternating with those having the loops turned downwards and with others which have the ends projecting nearly at right angles so as to engage the floor slab, as shown in the enlarged cross-section.

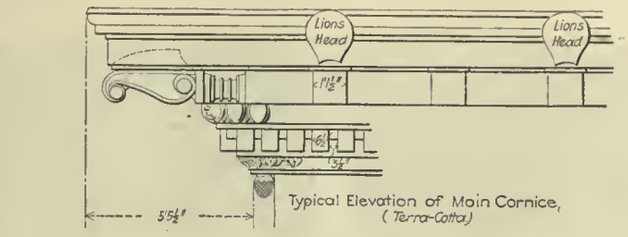
On the street fronts, the basement, floor cantilevers about 1 foot beyond the face of the exterior wall to support the marble facing and the edge of the sidewalk floor which is composed of glass lenses set in a frame of reinforced concrete and carried at the opposite side on a reinforced concrete girder in the vault roof. The concrete outer walls of the sidewalk vaults are strongly reinforced with vertical and transverse rods, as shown in the diagram, and are buttressed to serve as retaining walls for a heavy earth pressure. At the corners of the building these walls are locked together by bent anchor bolts engaging the vertical bars and bedded in the concrete of both faces.

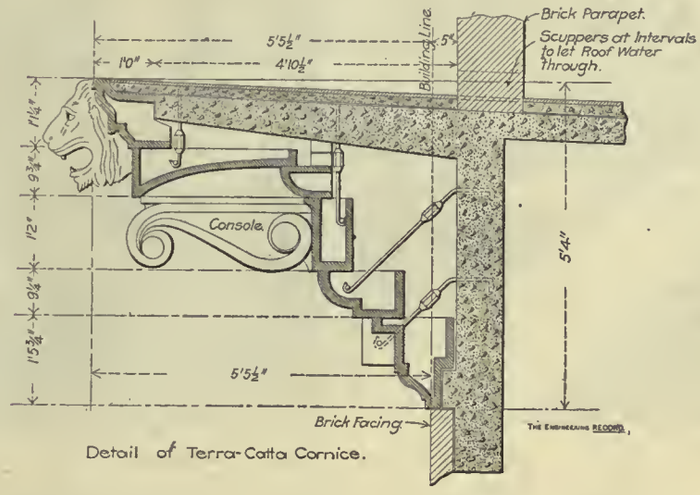
The stairs are made with solid masses of concrete offset for the risers and sloped and curved on the under side to form a regular soffit for the ceiling below. At the sides, the concrete is carried up in vertical parapets to form the equivalent of string pieces and is reinforced with longitudinal steel rods and short bars normal to them. The steps are also reinforced with horizontal rods, as shown in the

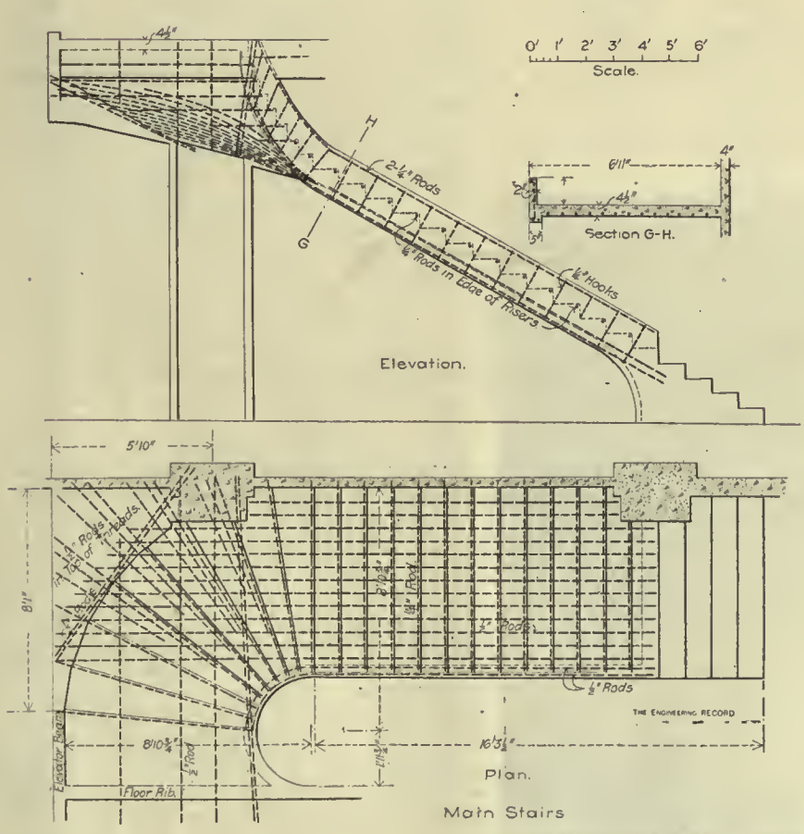


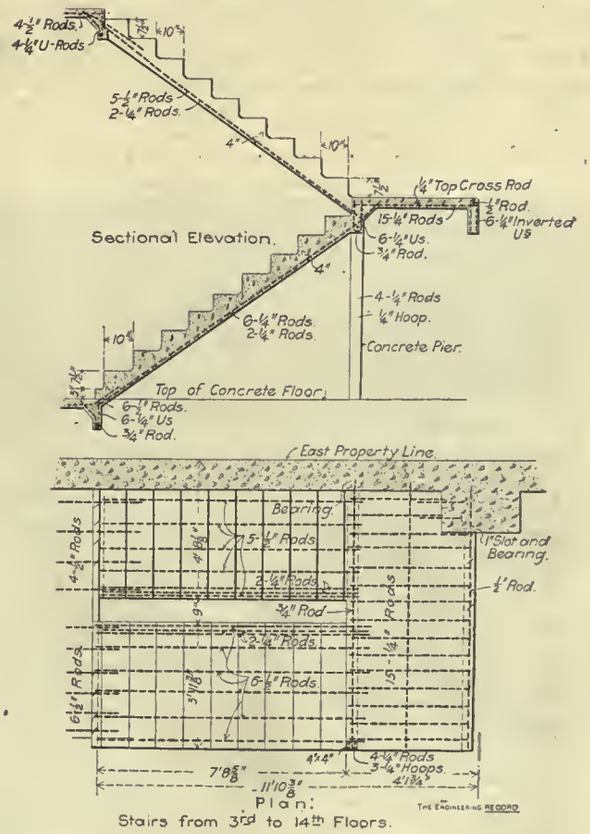
Details of Girder and Floors, Ingalls Building.

plan. The main stairs are made with reverse curves so as to form warped surfaces in the ceiling below, for which the stair rods are curved elements. The basement stairs are straight flights with corner steps at the foot. The corridors and some of the lower floors have tile or marble pavements, elsewhere wooden nailing strips are laid on them and the spaces between are filled with cinder concrete and covered with hard wood floors laid solid so that there is no air space left there. The attic floor is finished with cement and the roof is similar to it and is slightly pitched to inside gutters. The cornice on the street fronts projects about 4 feet and is carried by concrete cantilever beams in the upper part, which have steel reinforcement rods and also support the projecting roof slabs. The estimated quantities for the building include about 4,000 cubic yards of concrete and 400 tons of twisted steel.









Details of Stairs and Cornice, Ingalls Building.

Loose Stones are hereafter not to be allowed on New Hampshire roads if a recently approved law is enforced. This law states that "Every highway agent and street commissioner in this state shall cause all loose stones lying within the traveled part of every highway in his town or city to be removed at least once in every sixty days from May 1 to October 1.

Power Plant of the Government Printing Office at Washington.

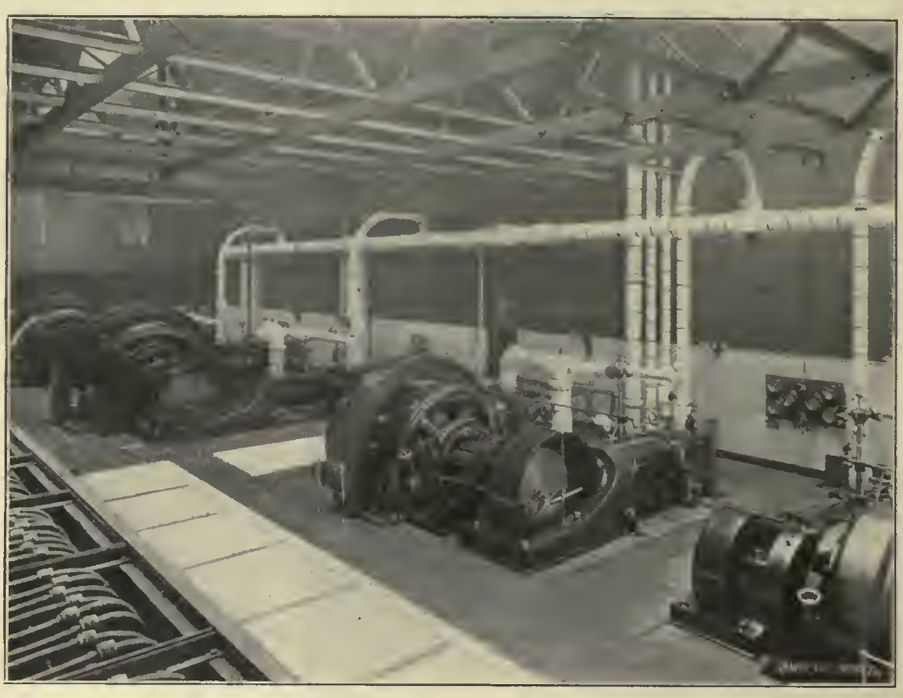
PART II.—ENGINES AND GENERATORS.

The construction and general arrangement of the power house and the details of the boiler plant of the new Government Printing Office were described in the preceding issue.. The general arrangement of steam piping can be seen from an accompanying drawing and one of the drawings in Part. I. The main steam outlet from each boiler is connected into the top of a horizontal main by means of a 180-degree bend of 8-inch inside diameter piping of 5/16-inch copper, with a single valve in the branch pipe, this placed between the boiler and the copper bend with valve stem horizontal. The main system of steam mains may be described as consisting of two parallel lines of 12-inch extra heavy wrought-iron piping, one line forming the steam header in the engine room and the other located along the outside boiler-house wall, and of four cross lines of the same size piping connecting the two longer parallel lines. The steam loop thus takes the form of a rectangle, with maximum dimensions of 56x103 feet. Although there are the two intermediate cross-connections in this rectangle, no expansion joints were used, and it is stated that the expansion does not exceed ¼ inch in the longer direction of the piping.

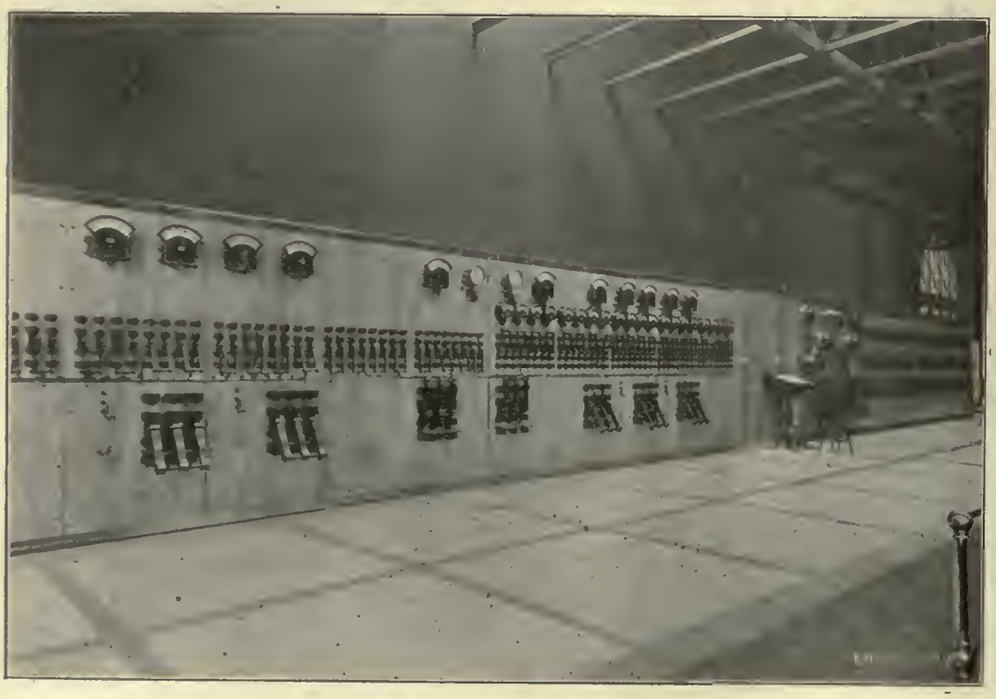
The fittings throughout the system are of cast-steel, made by the Bethlehem Steel Company. The valves are the design of Mr. H. K. Collins, the mechanical engineer of the Government Printing Office and designer of the power plant, and, as indicated in an accompanying detail, secure a full area of opening of about 1.22 per cent. of the pipe area. Although there is but one valve in each boiler supply connection, the valves in the main piping are so disposed that they can be closed in each case as a second valve to ensure safety in connection, for example, with an inspection of the boiler interior. Any boiler can thus be cut out without affecting any other desired method of distribution. Each

of the four cross-connections has two valves, so that in case of a rupture, the pipe can be cut out at both ends. It will be noted that the boilers at the outside boiler house wall can supply steam in either of two directions, while this is not so with the opposite row of boilers; otherwise, with similar connections, a more rigid system of mains would have resulted. The valves have their stems upward and vertical and are reached from a system of light, iron walks, or galleries, which like the piping in the boiler room not near the walls are suspended by means of iron straps, rods and clamps from the roof trusses. There are between 725 and 750 feet of these walks, which are built with a flooring of ⅝-inch rods held on 2-inch centers by ½x2½-inch longitudinal bars. The walks are 3 feet wide and have railings of ½-inch pipe. Along the side walls of the boiler room the mains are supported by cast-iron wall brackets on which the piping is allowed to move. As indicated in the accompanying drawings, a cast-iron saddle with a faced surface is fastened to the bottom of the pipe by means of wrought-iron bands over the top, the bearing surface of the bracket is likewise faced and between the two faces is placed a 2-inch wrought steel roller by means of which the pipe with the saddle is free to move with respect to the bracket. The brackets are spaced at various distances apart as required, averaging about 8 feet. The steam piping throughout is protected with Keasbey & Mattison magnesia sectional covering.

The generating units comprise cross-compound engines, as stated, built by the Edward P. Allis Company, and direct-connected Crocker-Wheeler direct-current multipolar 125-volt dynamos. There are two 600-kilowatt units employing 22 and 44x42-inch engines, one 300-kilowatt set with a 16 and 30x30-inch engine and one 125-kilowatt set with a 10 and 19x30-inch engine. Their normal ratings are 800, 450 and 200 horse-power, respectively, so that they bear ratio to the horse-power equivalents of the dynamo ratings of 1 to 1, 1.11 to 1 and 1.18 to 1, respectively. The larger units run at 100 revolutions per minute and the smaller ones at 150 revolutions, so that the piston speeds are 700 and 750 feet per minute. It will be noticed that the ratios of the volumes of the cylinders in the three sizes of engines are 4, 3.6 and 3.5 to 1. The two smaller units were in use in the older plant, one end wall of which was torn down and the building extended to receive the larger engines; and they are provided with the slack belt system of protection against racing in the event of the break of the governor belt. The two later engines have a second flyball governor to actuate a butterfly valve above the throttle valve as an automatic stop when the speed becomes too great. Each generating-unit foundation contains an opening by which a man may reach the anchor-bearing plate and end of bolt. The electric traveling crane in the engine room is of 25 tons capacity, built by Messrs. Pawling & Harnischfeger, of Milwaukee. It is supported by columns of 6-inch double extra heavy wrought-iron pipe, filled with concrete. These are located about 14 feet apart and the girders are braced to the structural framework of the building. The steam header in the engine room is hung from these lateral braces.



Engine Room, Government Printing Office.

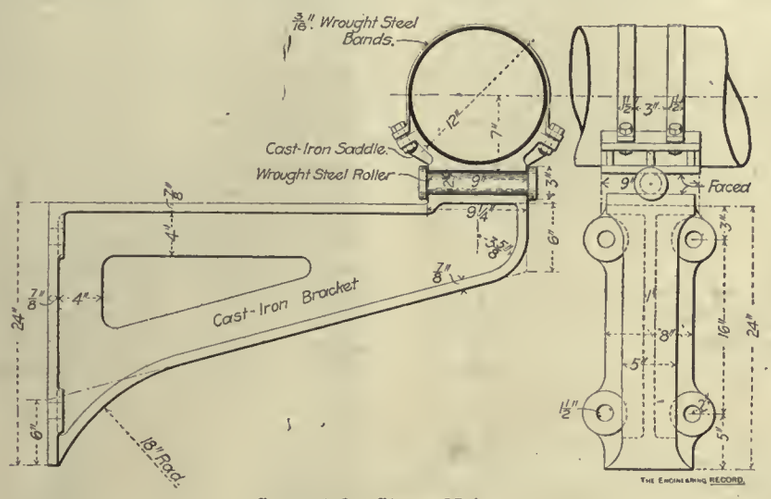


Switchboard, Government Printing Office.

The receivers between cylinders of the engines are located in the basement, but the piping connections to the low-pressure cylinders are largely above the engine room floor. The exhaust pipe between high-pressure cylinder and receiver is in the basement, but the pipe from the receiver rises into the engine room and there the passage of steam into the low pressure cylinder is controlled. The live steam connection to the low-pressure cylinder is joined into this pipe and has a stop and a reducing valve. The exhaust line from the low-pressure cylinder of each engine is run in the basement to the partition wall and rises in each case to an independent condenser above the roof, where each is fitted with a back-pressure or relief valve for the escape of steam, should the corresponding condenser be out of commission. The Knowles type of syphon condenser is used, maintaining 27 inches of vacuum, and there are accordingly three lines of piping rising against the partition wall opposite each engine, all wrapped in white-canvas covered brass-banded non-conducting covering: One pipe the exhaust; another the injection water, which is taken from the District of Columbia supply and is lifted to the condensers by virtue of the pressure of the supply; and the third, the discharge from the condenser, this going ordinarily to a tank, or so-called hot well in the basement of the new printing office where it is pumped to tanks in the attic of the printing office. As already explained, this water is used for house purposes, principally in the toilet rooms, containing some 219 closets, 82 urinals and 267 wash basins. There are 6 of these tanks, built of ⅜-inch steel plate, with an aggregate capacity of about 4,000 gallons, which gives a good reserve supply at all times, besides being of sufficient volume to allow for a considerable amount of cooling of the condenser discharge. The use of several tanks is, of course, to distribute the load more readily and to avoid a tank of cumbersome dimensions, and they are, of course, all connected together so that in case a leak should develop in one, that one can be cut out during repairs.

In passing it should be stated that water for drinking purposes is taken independently from the city mains through Loomis filters and usually cooled and circulated throughout the building to some 70 aluminum-bronzed cast-

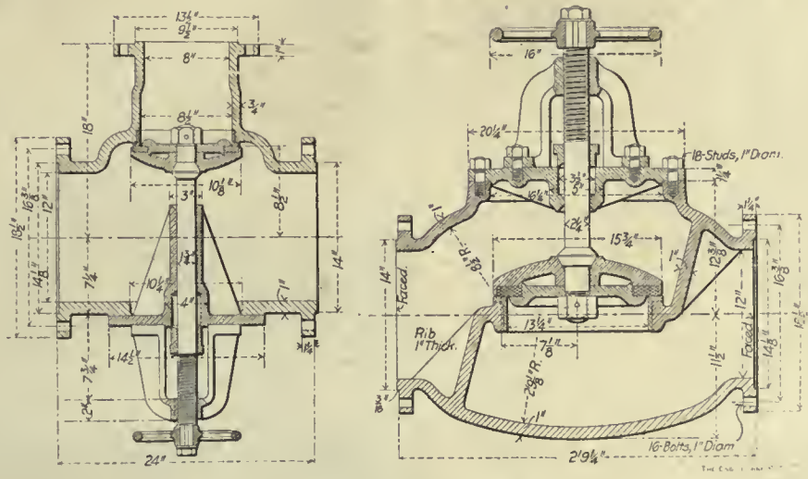
iron founts recessed in the walls. For cooling a Steele & Condict ammonia absorption refrigerating plant of 9 tons refrigerating capacity is installed in the new printing-office basement and the water is circulated through the building by means of a Knowles triplex 5x6-inch pump driven by a 5-horse-power Crocker-Wheeler motor. It is estimated that the plant in summer weather will be called on to cool 4,000 gallons of water daily about 40 degrees.



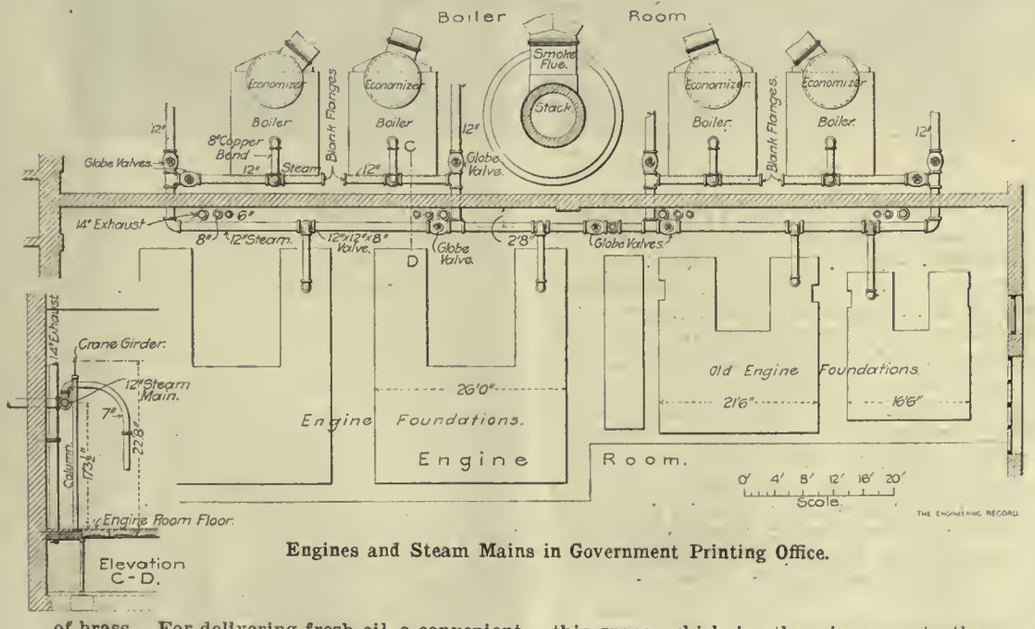
Support for Steam Main.

An interesting oiling system has been provided for the generating machinery, consisting of overhead reservoir tanks, distributing piping to journals, collecting piping from the bearings, a filter to receive the oil and a centrifugal pump for lifting the filtered oil to the reservoirs. The filter, which is of the Warden type, made in Akron, O., is located in the engine room basement and drains into two tanks connected together, in one of which, submerged, is the pump. This is placed with vertical shaft with direct attached 3-horse-power Northern electric motor on the top of the suction tank. The pump has a 1½-inch discharge and delivers to three tanks supported overhead in the boiler room. These tanks have a combined capacity of about 500 gallons. The piping system is of brass. For delivering fresh oil, a convenient device has been fitted up in the boiler room. The barrel of oil is lifted by a chain pull with clamps for catching the barrel, and is placed horizontally over a tank having a strainer bottom and an outlet connected with the two suction tanks.

The switchboard is an elaborate production of marble and copper with wide possibilities for cross-connection, in keeping with the general policy of the station for meeting emergencies. It is 82 feet long, of pink Tennessee marble, and carries some 15,000 pounds of copper. It stands about 6 feet from the wall and there is a rubber covered walk extending along the middle of this space, which is otherwise open to the engine room basement. The connections to the board and the run of conductors to the basement space have been made in a notably workmanlike manner. There are two sets of bus bars, one ordinarily for power, from which the power feeders are taken, and the other for light, from which the light feeders are taken. The generator switches are accordingly double-throw, so that any generator can supply either branch of electric demand. They are double-pole, the equalizer switches being separate. A tie-in switch has been provided, of the circuit breaker type minus the automatic tripper, for connecting the two sets of busses together, and there is a large single-pole single-throw switch for connecting the light and the power equalizer busses together, should two generators be operating one on the light and the other on the power busses and the tie-in switch be in closed position. In addition to this, each of the feeder switches, which are double-pole, are also double-throw, so they may independently be thrown on either set of bus bars. In the latest section of the board, built for the control of the new building, the feeder switches are arranged in two rows. One set of busses extends along the middle of the panels, behind the board, and is fitted with connections to feed both rows of switches, the upper ones when the switches are in the down position, and the lower ones when the switches are in the up position. The other set of bus bars subdivides into two sets, one for the upper position of the upper row of switches and the other, containing less copper, being installed only as a safety or emergency provision, for the lower position of the lower row. All feeders are protected by circuit breakers mounted on marble panels in the rear space.



Details of Steam Valves.



Engines and Steam Mains in Government Printing Office.

The generators are likewise protected by circuit breakers at the back of the board, and these may be thrown by means of a push button on the front of the board. The two large generators are provided with recording watt meters, and there is an indicating ammeter reading total current supply. A daily log is kept, based on fifteen-minute readings, and each power feeder also has an ammeter, so that the lighting load is obtained by the difference between the total reading and the sum of the various power feeder readings. It should be mentioned that the conductors are generally mounted in a fashion that makes them easily accessible, and this applies to the generator pit which has white, glazed brick walls and bottom.

The steam plant was designed by Mr. H. K. Collins, chief engineer of the Government Printing Office, and the switchboard and electric distribution by Mr. W. H. Tapley, electrical engineer of the Printing Office. This work so far as it affected the power house construction was done under the supervision of Capt. John Stephen Sewell, Corps of Engineers, U. S. A., who had charge of the construction of the new building, and of Hon. F. W. Palmer, the public printer and head of the Government Printing Office.

Ornamental Bridges in a Private Park.

The estate of Mr. Daniel O'Day, at Deal, New Jersey, includes a large park surrounding his residence, a stock farm, stables, conservatories, and other buildings, and is traversed by several miles of winding roads. There is a diversity of lawn and forest and rolling surface which has been carefully studied by landscape gardeners to produce artistic effects and attractive vistas. Great pains have been taken to retain and improve the natural effects of the landscape, and special designs have been made for bridges to carry the driveways over small streams and valleys. These are of simple engineering construction and have been studied to secure solidity and durability without the angular lines and uncompromising appearance often found when economic considerations only are recognized.

In one case the road is carried for about 150 feet at an elevation of about 20 feet above the sunken Italian flower gardens crossing under the main entrance driveway. Here there is a massive masonry bridge with its axis curved to a radius of 200 feet. It has a roadway 22 feet wide in the clear between parapet walls, and is carried on a solid fill between the retaining walls of the approach and over the haunches of a small middle arch and two main arches flanked at the ends of the bridge with buttress piers accentuating the abutment and forming, with their ornamental terra cotta entablatures, scrolls and flower vases, portals for the driveway. The arches are circular segments with a radius of 30 feet and rise of 4 feet, built with six courses of common hard burned red brick, leveled on top, laid with Flemish bond in 1:1 Portland cement mortar, and seated on special pressed brick skewbacks. The face rings are laid with pressed brick arranged in radial panels to give relief work having the effect at a little distance of massive stone voussoirs, as shown in the engraving. The arch soffits are formed of selected brick and the spandrel walls, 16 inches thick at the bottom are of common red brick, in stretcher courses, and alternate black and red headers in header courses, laid in cement mortar.

The main arches have separate piers 6 feet thick and their thrusts are balanced on the center arch, which has a semi-circular span of 8 feet over a narrow path of the flower garden. This arch is made with four courses of brickwork and is finished to correspond with the main arches. Between it and them the piers are buttressed with very wide brick walls sloping up to intersect the haunch walls at the level of the crown of the center arch, and serving more to diversify the face of the masonry than for any necessary purpose of bracing it. The face walls are coped with terra cotta, and the macadam road is carried across the bridge on a fill of rolled earth, sand and concrete 16 inches deep over the crown of the main arches. The bridge pitches with the roadway and is crowned to correspond with the regular section in the park, to a height of about 6 inches in the center. There are granolithic copings and walls 2 feet wide, making the total width of the bridge 26 feet outside parapet walls. The foundations for the piers are offset concrete footings carried down in the solid clay about 12 feet below the garden surface on one side and 5 feet on the other. The great depth of footings was necessary on account of quicksand and hidden springs. This part of the garden was an old ravine, filled in and leveled off. The materials are quicksand and a hard black clay. The entire sunken garden was drained to the lake by a 15-inch underground pipe. The bridge contains about 500 yards of brick masonry and cost about $3,000.

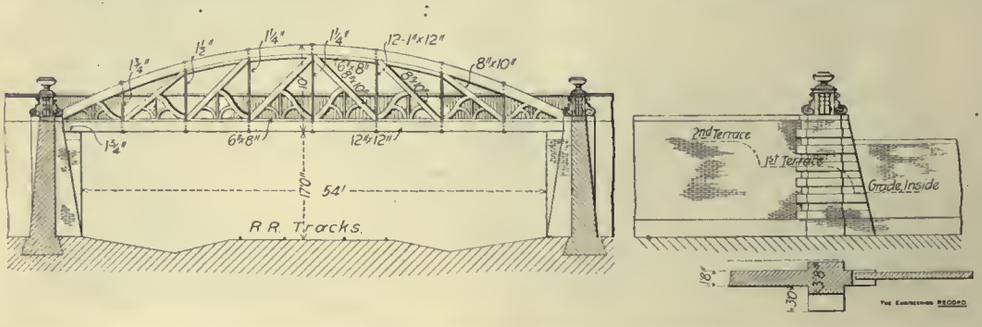
Another bridge on the same estate carries the 20 feet driveway across the railroad tracks and the full right of way of the New Jersey Central Railroad. This structure is at right angles to the property line at the entrance of the grounds and at the summit of the incline by which the road is elevated on embankments to the required height of crossing, namely about 16 feet above the general surface of the adjacent country. The embankments have turf slopes of about 1½:1, up to within about 100 feet from each side of the center of the bridge, where they terminate, and the fill is retained between brick walls battered on the face and offset on the rear. These walls are terraced, with the upper parts of each vertical down to the grade line, and have buttresses at each change of level so as to panel the face of the wall as well as strengthen it.

The wall has a minimum thickness of 8 inches at the top which increases to 20 inches in the panel next to the bridge and is widened to a base of 60 inches where it has a maximum height of 20 feet. It is seated on concrete footings carried 4 feet below the surface of the clay and sand. The panels next to the bridge are treated so as to give the effect of wide abutment piers, and at the bridge seats have very wide transverse walls or buttresses giving the effect of wing walls enclosing the railway tracks, but not serving as retaining walls. These are crowned, as shown in the perspective, with ornamental terracotta mouldings and vases filled with foliage plants and flowers. The ends of the retaining walls have posts and terracotta caps connected to heavy framed oak entrance gates weighing about 2 tons on 500-pound wrought iron hangers. Similar ornamented brick walls about 8 feet high, 8 to 12 inches thick, enclose the right of way for the railroad about 800 feet each side of the bridge and are designed in consonance with the more conspicuous bridge walls.

The bridge has a clear span of 67 feet and vertical clearance of 17 feet above the tracks. It consists of two yellow pine trusses 25 feet apart on centers. The top chords are made up of eight 2-inch planks and three 2x8-inch planks bolted together in horizontal planes, breaking joints at 28 feet lengths, and notched and bolted at the ends to a built up 12x16-inch lower chord, which has seats about 3 feet long, buttressed out from the battered face of the abutment masonry. The web members consist of single 8x10-inch diagonals and single 1¼ to 1¾-inch vertical rods with upset nut bearings at both ends. The diagonals have their ends beveled at about 45 degrees both sides and abut against the chords and against bearing pieces bolted to the latter.

The diagonals are counterbraced at the center points by sub-diagonals which are cut down from wide timber and curved a little at the ends to present a more graceful appearance. From the intersection of these members with the diagonals, light vertical pieces are carried to the bottom chord and combined with short curved sub-braces which are not designed to take any stress but are provided to relieve the outlines of the truss and harmonize with the architecture of the house. The floor has 6x10-inch transverse beams 20 inches apart, crowned at center, with ends seated on bent steel stirrups attached directly over the lower chord. These are covered with a floor of 2-inch diagonal planks thoroughly spiked on to serve as lateral bracing for the bridge, and a top floor of 2-inch planks. The bridge is thus provided with a shallow floor encroaching as little as possible on the railroad clearance or the highway grade. The bridge has 4-inch camber at the center and the driveway 24 feet wide is enclosed on both sides by a wooden railing 3 feet high set on the guard curb, which is a 6x12-inch timber laid flat.

This bridge was designed to carry a load of 200 pounds per square foot over the entire surface, and the woodwork was finished in oil without painting. Mr. G. Kramer Thompson was the architect for all the buildings and grounds and for both bridges.





Wooden Bridge over Railroad Tracks.

An Examination for Draftsman in Charge, Department of Yards and Docks, will be held at the New York navy yard on May 28. The pay of the position is $6 per day.

The Proposed Union Building for Engineering Societies.

A meeting of the representatives of the five organizations named by Mr. Andrew Carnegie, in his proposition to give to the four national engineering societies and the Engineers' Club a building for their joint use and occupancy, was held pursuant to call at the Engineers' Club in New York, on the evening of May 15. There were present on behalf of the American Society of Civil Engineers, President Noble and Messrs. Wilgus and Pegram; on behalf of the American Institute of Electrical Engineers, President Scott and Mr. Martin; on behalf of the American Society of Mechanical Engineers, President Dodge and Messrs. Charles Wallace Hunt and Hutton; on behalf of the American Institute of Mining Engineers, President Ledoux and Messrs. Dwight and Kirchhoff; and on behalf of the Engineers' Club, President Kafer and Messrs. Redding and Fletcher.

The meeting was called to order by President Kafer, of the Engineers' Club; President Scott, of the Institute of Electrical Engineers, was elected chairman of the meeting, and Professor Hutton, secretary. The chairman opened the meeting by reference to the questions which were to be considered, and called on Mr. Redding for a presentation of some of its legal aspects. After a full and harmonious discussion, the meeting passed the following resolutions, a copy of which the secretary was directed to transmit to each chairman of the constituent committees present, with a request that the latter should transmit the action of the meeting to the governing body of each respective organization.

"Resolved, that this joint conference committee recommend to the respective governing bodies represented at this conference that the following resolutions be brought before the several organizations, to be acted on;

"Resolved, that (insert name of organization) unite with (insert the names of the other four organizations) or any of them, for the purpose of accepting the sum of $1,000,000 as a gift from Mr. Andrew Carnegie, for the purpose of erecting suitable buildings for occupancy by various societies of engineers and The Engineers' Club, on the sites secured for that purpose on the north side of Thirty-ninth Street and south side of Fortieth Street west of Fifth Avenue, in the City of New York, in the State of New York;

"And Resolved Further, that (insert name of organization) has a very high appreciation of this generous gift of Mr. Andrew Carnegie, and this additional evidence of his recognition of the engineering profession and his deep interest in the welfare of the national societies of engineers and The Engineers' Club;

"And Resolved Further, that a site on the north side of Thirty-ninth Street shall be purchased and held by trustees, or otherwise as shall be determined by the joint committee hereinafter mentioned, for The American Society of Civil Engineers, The American Society of Mechanical Engineers, The American Institute of Electrical Engineers, and the American Institute of Mining Engineers, or by such of them as shall vote in favor of coming into this enterprise;

"And Resolved Further, that a joint committee shall be created to be composed of three members of each organization that shall unite in accepting said gift of $1,000,000 from Mr. Andrew Carnegie; and that the governing body of (insert name of organization) shall elect three members of this organization to represent it on and be members of such joint committee; and that the governing body of (insert name of organization) shall have the right and power to remove any member of such joint committee who shall be elected by it and to elect any member of this organization to fill any vacancy that shall occur in such joint committee by reason of the death, resignation, refusal to act or removal of any member who shall have been elected by the governing body of this organization as a member of such joint committee;

"And Resolved Further, that the character and internal arrangement of the building to be erected on the site on Thirty-ninth Street, shall be determined upon by the affirmative vote of at least two-thirds of all of such of the members of said joint committee as shall represent all of the organizations, other than The Engineers' Club, on such joint committee; and that the character and internal arrangement of the club building to be erected on the site on Fortieth Street, shall be determined upon by the affirmative vote of all of the three members of such joint committee who shall represent The Engineers' Club on such joint committee;

"And Resolved Further, that said joint committee shall, by the affirmative vote of at least two-thirds of all the members thereof, select and employ an architect to prepare the plans and specifications for the building to be erected on the site on Thirty-ninth Street, and for the club building to be erected on the site of Fortieth Street; and shall also obtain proposals for the erection of both of such buildings; and shall have power to make and enter into such contract or contracts as shall be approved and authorized by the affirmative vote of at least two-thirds of all the members of said joint committee, for the erection of both of such buildings; and shall have charge of the erection of both of such buildings;

"And Resolved Further, that said joint committee shall continue in existence until all of the purpose set forth in these resolutions shall have been fully accomplished."



Brick Bridge over Sunken Flower Garden.

A Gas Engine Pumping Station.

The problem of securing a satisfactory water supply from the Ohio River and its tributaries has always been a troublesome one to engineers on account of the extreme variation in the river water level at different seasons of the year and the large amount of fine sand and silt in suspension. At some places the variations in the water level is as much as 70 feet, which, of course, necessitates the location of the suction wells for pumping stations far below the level reached by high water. It has been a common practice, in providing an intake for a pumping plant to extend a pipe or tunnel under the bed of the river to a point suitable for the location of the inlet, which it was necessary to protect by some form of strainer. Where clear water is particularly desired as for domestic purposes, this strainer takes the form of a filter crib built up from an excavation in the river bottom and covered with gravel. Such arrangements are satisfactory as long as they do not become clogged, and are especially suitable for small water supply systems.

The Pittsburg Plate Glass Company, in the plant for the No. 3 works at Ford City, Pa., has approached this problem from an entirely different standpoint. This plant is located on the Allegheny River, a short distance from the factory. The arrangement of the plant is shown in the accompanying illustrations, and is such that the water supply may be secured at any desired depth below the prevailing level in the river, and clarified by action of gravity only.

A further important feature of the station is that gas power is used exclusively for operating the pumps. The pump house stands upon the river bank with its suction pit immediately adjacent to the channel and sunk several feet below low water level. The building foundation upon three sides forms a concrete dam, 39 feet high, on the water front and tapering from 10 feet thickness at the bottom to 4 at the top. This wall, in connection with the concrete floors, furnishes a water-tight structure, which will prevent the river water from entering the basement. The building is approximately 60x80 feet in exterior dimensions, and the main floor, which is 3 feet above maximum high water level, is devoted to the power machinery and controlling apparatus for gates and racks, while the pump cylinders and pipe lines are in the pump basement, 15 feet below the main floor.

The intake well is divided by a concrete wall into three longitudinal compartments, each approximately 19x22 feet, and supplying two pumps. The floor of the suction well is 6 feet below low water and 31 feet below high water level. Water from the river is received in each compartment through four 30-inch cylindrical openings through the abutments arranged at different levels, as indicated in the plan and cross-

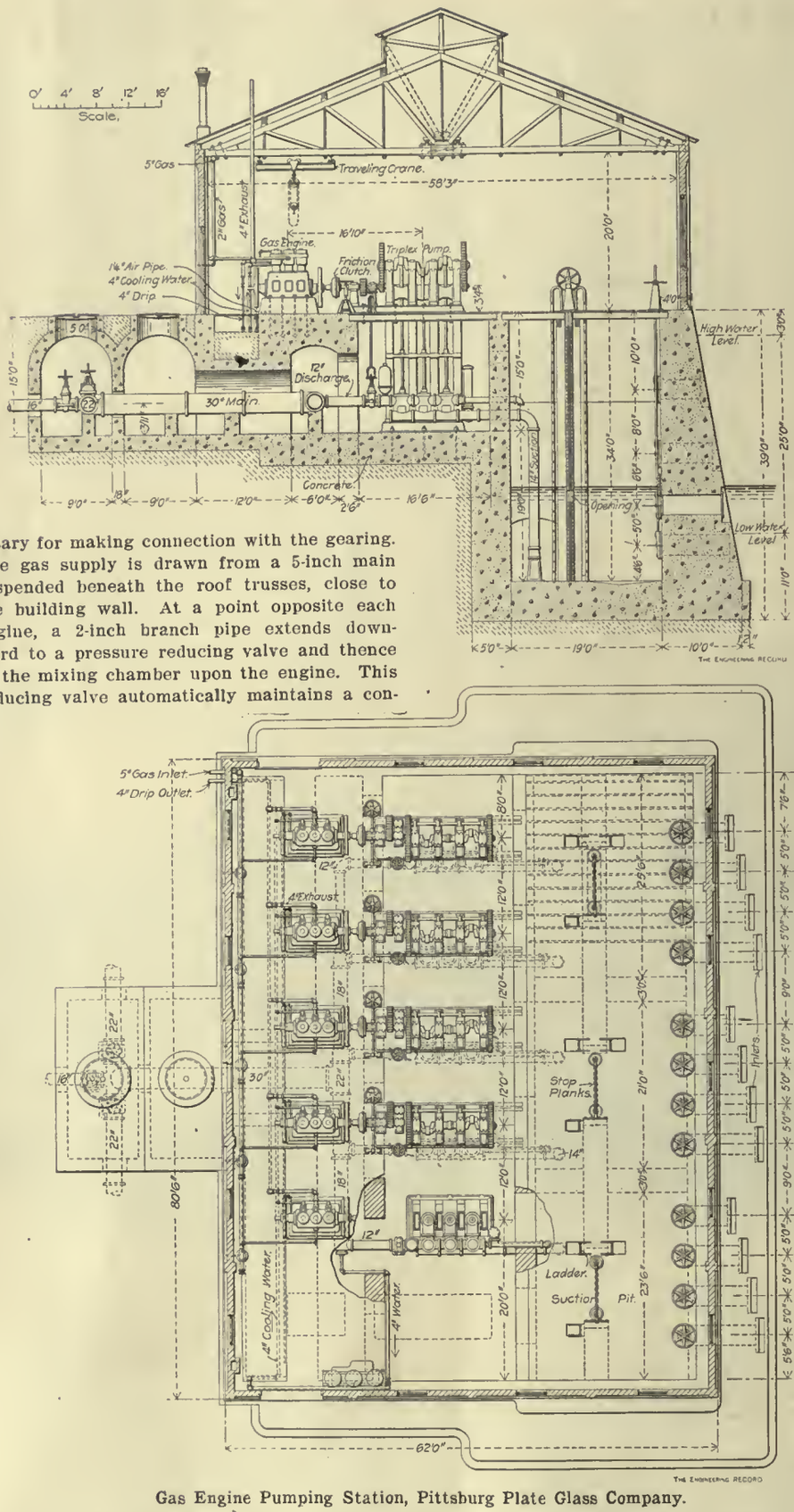
section. Each opening is of sufficient size to admit the full supply of water for the entire plant, and is fitted on the outside with an iron grating or debris rack, and on the inside with a special sluice gate, operated by means of a wheel stand on the floor above. It is the practice to admit water to the suction well only through those intakes which are just below the surface of the water at the then prevailing level. The effect of this is a skimming action, sub-surface water only being admitted, which is comparatively free from sand. In case the river should be filled with ice or debris that would tend to clog the intake gratings near the surface, the next tier immediately below may be used.

In the suction well a second skimming takes place. Each of the three compartments of the well is divided by a concrete division wall having a vertical opening 8 feet wide, which is controlled by jointed oak stop-planks sliding in vertical iron grooves, extending from the bottom of the pit to within 2 feet of the main operating floor. Each stop-plank is pierced at each end by a vertical strap extending from top to bottom of the pit and suspended from a hand wheel gearing located upon the floor above. The planks are not fastened together, but are permitted to slide freely up and down upon the iron straps, which are drilled at frequent intervals with small holes corresponding to holes also drilled in the ends of the planks. By inserting pins and raising the straps by means of the hand wheel gear upon the operating floor, the gate will be parted at the desired level, thus permitting a flow from the upper part of the water in the intake well into the pump suction pit, accompanied by a skimming action. With this arrangement the water entering the intake is received into a reservoir of large capacity, where its velocity is reduced and the foreign matter held in suspension deposited, and then flows through the skimming gate into the suction pit quite free from grit and sand. The three compartments of the suction well are interconnected by means of arched openings through the concrete partition walls, so that the pumps virtually draw their supply at all times from a single well, thus rendering the complete interruption of the water supply a very improbable occurrence. The division of the intake well into compartments permits the draining of any compartment for inspection, cleaning or repair while the others are in regular operation.

The pumping station is designed for six pumping units, five of which are at present being installed, with an aggregate capacity of 12,000,000 gallons in 24 hours. The means adopted for furnishing power for operating this plant are somewhat unusual outside of the natural gas districts, where practice differs considerably from that common in other parts of the country. As natural gas was available upon the premises gas engines were selected, resulting in a station arrangement peculiarly effective in appearance and operation. Each pumping unit consists of an 85-horse-power Westinghouse standard vertical three-cylinder gas engine, geared directly to a 16x15-inch single acting triplex pump built by the Stilwell-Bierce & Smith-Vaile Company. The pump head, or upper works, including gearing countershaft and guides, is located upon the main floor, while the pump cylinders and the suction and discharge pipes occupy the basement. Power is transmitted from engine to pump through a friction clutch operated by a hand wheel at one side.

The engines are mounted upon concrete piers extended above the floor level so as to raise the engine shaft to a height of 3 feet 4 inches, necessary for making connection with the gearing. The gas supply is drawn from a 5-inch main suspended beneath the roof trusses, close to the building wall. At a point opposite each engine, a 2-inch branch pipe extends downward to a pressure reducing valve and thence to the mixing chamber upon the engine. This reducing valve automatically maintains a constant atmospheric pressure upon the engine admission independent of outside fluctuations. The exhaust pipe from each engine connects with a 4-inch riser, passing through the roof, and is also provided with a short 4-inch extension terminating in an elbow and a vertical drop, as shown in the cross-section. The latter is drained by a small drip pipe discharging into the main passing underneath the floor. This arrangement of exhaust piping renders a muffler unnecessary and also serves to thoroughly drain the exhaust from cooling water issuing from the exhaust valves. Between the row of engines and the building wall a covered pipe-trench extends throughout the length of the building. Through this trench passes a 4-inch drip pipe, a 4-inch cooling water main and a 1¼-inch air pipe, from each of which branch risers are taken off to each engine at points opposite the foundation. The cooling water is drawn from the end of the water supply main, and after circulation through cylinders, covers and valves flows into the exhaust pipe and thence to the drain.

Compressed air is used in starting the engines and a sufficient quantity for starting several engines simultaneously is kept continually in storage in three steel tanks ranged along



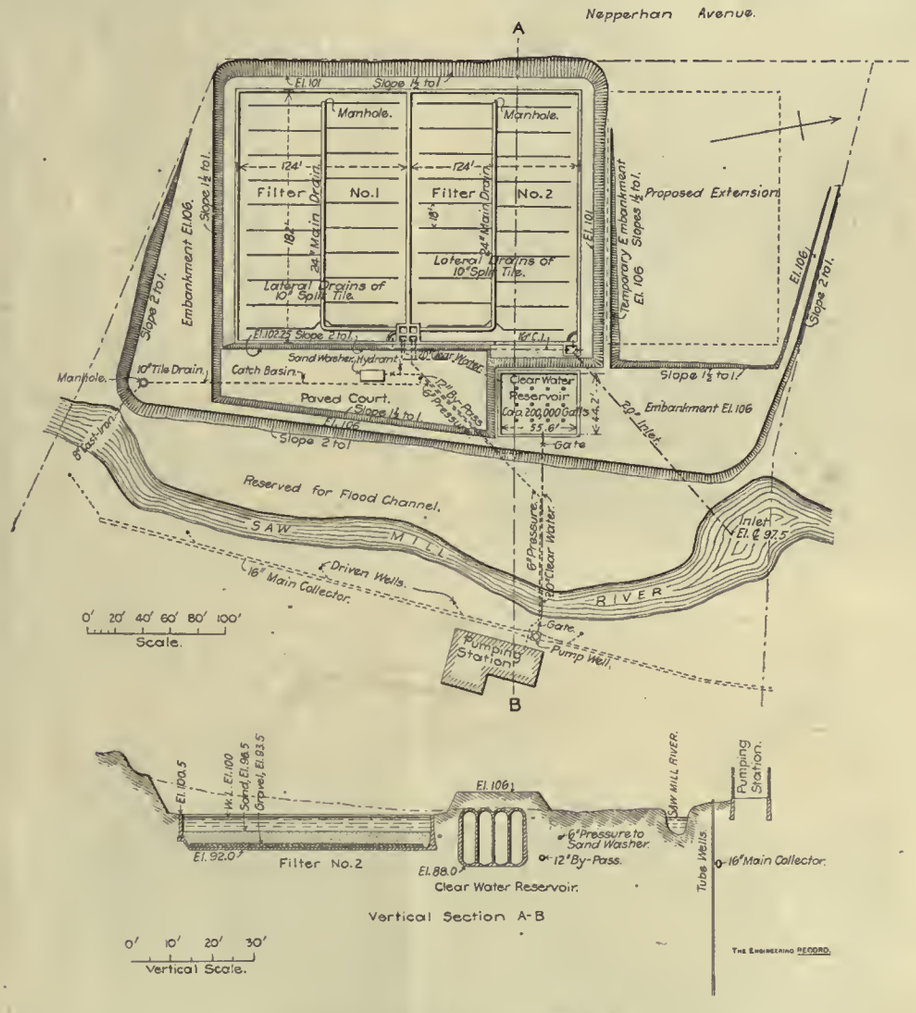
Gas Engine Pumping Station, Pittsburg Plate Glass Company.

the building wall. These are supplied from an independent air compressor. In starting the engine one of the cylinders is temporarily isolated by means of a special arrangement of the valve gear, so that this cylinder may be operated under air pressure as a single cylinder engine. After the first few revolutions the normal explosion cycle of the remaining two cylinders is started. The compressed air supply is then cut off and the air cylinder brought into service as an explosion cylinder. The engines operate upon natural gas of about 1,000 British thermal units per cubic foot and run at exceptionally uniform speed, with the result that wear and tear upon the pump gears and connections is minimized. The speed regulation is effected by a sensitive fly-ball governor, which admits a charge of explosive mixture at every two-thirds revolution, directly proportioned to the load upon the engine. The quality of the mixture is, however, maintained constant and may be accurately adjusted for any kind of gas, thus securing the maximum explosive effect and economy of gas fuel. The igniters are operated by storage batteries. In order to facilitate inspection and repairs upon the power equipment, a short span trolley crane with chain lift is provided, which travels throughout the length of the engine room.

The five pumping units discharge into a 30-inch main running under ground to a reservoir, from which the supply is drawn as required for use in the glass factory, for grinding, polishing and other purposes. As in the case of other parts of the plant all valves are operated entirely from the main floor. The plant was designed by Mr. W. D. Hartupre, chief engineer of the Pittsburg Plate Glass Company, and is now nearing completion.

Sand Filters at Yonkers.

For some years a part of the water supply of Yonkers, N. Y., has been drawn from a system of tube wells located along the eastern bank of the Saw Mill River, a tributary of the Hudson, which flows through the easterly and southerly parts of the city. The present water supply being insufficient in amount, the water commissioners decided to build a filter plant to filter water from the river. Mr. Allen Hazen, M. Am. Soc. C. E., of New York City, was retained to prepare plans and specifications and superintend construction, and bids for the work were received on May 21. The plant will include two open sand filters of about ½ acre area each and a clear-water reservoir of 200,000 gallons capacity, with a sand washer, the usual inlet and effluent controlling chambers and other appurtenances. The filters will be situated on the westerly bank of the river, opposite the existing pumping station and wells. Provision is made for an additional filter to be constructed in the future.



Slow Sand Filter Plant at Yonkers, N. Y.

Water will be taken from the river through an intake just upstream from the filters, and will flow by gravity through a 20-inch cast-iron pipe to the inlet chamber. The filters will have the usual 1-foot bottom layer of gravel, above which there will be 3 feet of sand. The ordinary depth of water above the sand will be 3½ feet. The collecting system will consist of 10-inch split tile laterals and 24-inch main drains. At the end of the division wall between the two beds, the effluent controlling chamber for both will be located and a 20-inch cast-iron main will connect it with the clear-water reservoir, from which another 20-inch cast-iron pipe will conduct the water across the river to the pumping station. From the pumping station water under pressure will be supplied through a 6-inch pipe to the sand washer. The clear-water reservoir will be covered and of the usual groined arch construction. Both the filters and the clear-water reservoir will be made of concrete mixed in the proportions of 1 barrel of American Portland cement, weighing 380 pounds net; 11 cubic feet of sand, measured loosely, and 19 cubic feet of ballast, also measured loosely.

The site chosen for the filtration plant is a low tract close to the river, and in order to have the water flow to and through the filters by gravity, they will be built wholly in excavation. It is expected that the pumping from the existing tube wells will keep the ground water at such a low level during the summer that the contractor's work in draining the excavations will be very materially lessened. The principal quantities involved in the construction of the plant are estimated to be 27,000 cubic yards of excavation, 2,100 cubic yards of concrete, 900 square yards of granolithic paving, 1,500 cubic yards of filter gravel and 5,000 cubic yards of sand.

Swampscott Sewerage System.

The town of Swampscott, Mass., is a residential community lying between the cities of Lynn and Salem on the shores of Massachusetts Bay. Summer residents comprise a considerable portion of its population. The larger portion of the territory that is settled lies at a low elevation above the sea. Back from the shore are rocky hills which are rapidly being taken up for summer residences, while the older part of the town occupies the low lying shore strip. Several small valleys lead through the town to the shore, and divide the territory topographically into several drainage areas. The problem of sewage disposal has been, first, to provide an outlet or outlets, which should be so located as to produce no annoyance to the town of Swampscott or its neighbors; and second, to conduct the drainage of the territory covered by the town to this outlet or outlets. Tidal currents of 3 or 4 miles an hour were found at a point about 3,600 feet out from the shore, and, careful study showing that pumping would be necessary, it was considered more economical to combine all the outlets in one and pump from one point, rather than maintain several pumping stations.

The question of uniting the drainage areas involved a comparison of pumping with deep gravity sewers through the rocky dividing ridges. It was found that the most economical method would be reached in the case of the western portion of the town by the construction of a gravity sewer in a rock tunnel, and in the central portions by intercepting all sewage which could be easily taken by shallow cutting to the main collecting point. This reduced the pumping area to a small section in the northeastern part of the town. The drainage from this area is to be pumped through an 8-inch cast-iron main into the intercepting sewer for the higher portions, through which it will flow by gravity to the main receiving basin. The eastern pumping section is not being constructed at present.

All the sewage is collected at a central point in a masonry storage tank or receiving basin, 40x100 feet in size and holding 250,000 gallons. It is intended to do away with night pumping, and probably, for the present, pumping will be necessary only for a small part of the day. Arrangements have been made for one or more additional basins of the same size when needed in the future. As the bottom of the basin

is about 12 feet below low tide, the rise and fall of which is about 10 feet, there is at times a 22-foot head on the basin from outside pressure. It is covered with concrete arches supported on rubble masonry walls and on a line of brick center piers, as shown in the photograph and section. The brick piers are 2 feet square and 10 feet apart, center to center, and the four-ring brick arches between them have a 2-foot rise. The pump well at one end of the basin is 7x22 feet, and about 2 feet deeper than the rest of the basin. The chimney foundation is 9 feet square.

Upon the top of the receiving basin, and supported by it, is the pumping station, which is built of brick. This station contains a duplicate pumping plant, composed of two 8-inch centrifugal pumps made by R. D. Wood & Company, which are set in a pump well divided from the main part of the basin by suitable screening apparatus. The pumps discharge into a 12-inch main, which in turn connects with the 18-inch outfall. They are operated by two 50-horse-power direct-acting cut-off engines made by The Valley Engine Company, of Williamsport, Pa.

Steam is supplied by two 50-horse-power boilers made by E. Hodge & Company, of Boston. The entire plant is being installed by the Holmes, Blanchard Company, of Boston. The screen chamber is provided with screen hoists operated by differential pulleys, and the opening to the screen chamber is in the boiler-room of the pumping station. All matter picked up upon the screens, paper, sticks, etc., is disposed of by burning under the boilers. The basin is ventilated through the brick stack connected with the station, being connected directly to it by a shaft. The sewage is pumped through a line of 18-inch cast-iron pipe 2,200 feet to the shore, and from there directly out to sea, 3,600 feet further. The discharge at this point is 43 feet below low water.

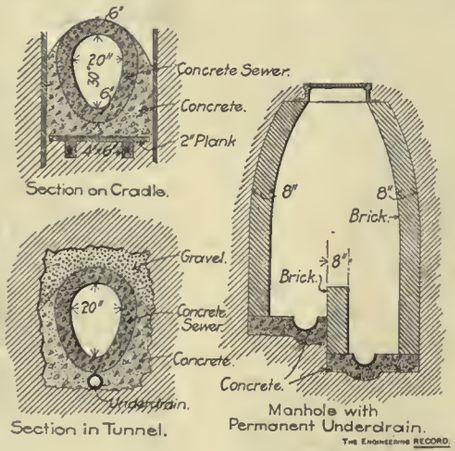
It will be noticed on the accompanying plan of the system that the 18-inch force main is laid in a curved line from the shore to the point of discharge. This was done because the rocky reefs projecting out from the shore would have necessitated an extremely irregular profile if a straight line had been chosen. There are also large boulders lying upon the reefs, and it would have been difficult to have laid the pipe line upon them. In laying this pipe line, which is not yet completed, the pipe is joined together in 50-foot lengths on a wharf at the shore, which are then rolled onto a lighter about 40 feet long, equipped with overhanging derricks at each end and steam hoisting apparatus, and the lighter is then towed to position and anchored. Frequently the 50-foot lengths are sent out from the shore without the lighter, being buoyed up by empty kerosene barrels. The lengths of pipe are lowered by the derricks on the lighter, and connected by a diver, using a flange on a flexible ball and socket joint. In swinging the pipe into position the lighter is manipulated to some extent by a tug. For a portion of the way this outfall pipe is in a dredged trench, and it is further secured by driving piles on either side, cutting them off at the top of the pipe, and in some places by iron straps lewised into the flat ledge on which the pipe lies. The extreme outfall end rests upon a platform with a special casting to throw the discharge upward.

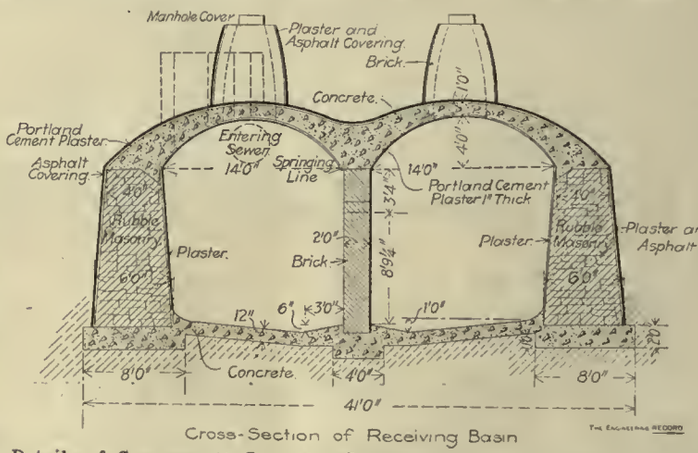
The whole line of the outfall main was carefully surveyed by triangulation and buoyed. In swinging the lengths of pipe into place the buoys are used, and in the final placing a series of ranges upon the shore are employed. These consist of tall signals placed upon the beach with the second range site as far back as practicable. They are arranged in different colors; that is to say, two red flags constitute one range, two blue flags the second, and so on. Only those range poles which are being used are kept in position.

A rock tunnel 1,800 feet long was necessary to carry the sewage of the western section to the main receiving basin. A section of this 20x30-inch concrete sewer accompanies this article. For a portion of the way the roof of the tunnel was soft and required timbering. The water encountered in the tunnel, a portion of which was below tide level and all below high tide, was taken care of by a pipe underdrain laid continuously under the concrete sewer. For about 200 feet at the upper end of the tunnel this underdrain was laid against the grade, and the water kept down by a steam pump. For the remainder of the distance the grade was with the sewer, and the pump was at the lower end. The concrete for the main body of the sewer was composed of 1 part Portland cement, 2 parts sand, and 4 parts gravel. After the foundation concrete had been laid, the invert was built, its outsides being braced against the sides and bottom of the tunnel. The concrete backing was then put in place, and the arch of the sewer put in. The lagging for the centers was composed of 1-inch boards covered with zinc for smoothness, and the sections were made 10 feet long. After the concrete had fully set, the rock and gravel filling was placed in the space between the sewer and the tunnel roof.

The total expense of the present construction work will be about $200,000. There are about 6 miles of lateral sewers in addition to the outfall work and the tunnel. The designing and constructing engineer is Mr. E. Worthington, of Dedham, Mass.







General Plan and Details of Swampscott Sewerage System.

The Great Antiquity of House Drainage, and even of some plumbing conveniences similar to those of modern days seems pretty well established by the results of the explorations by Dr. Evans, on the island of Crete, at the site of the palace of King Minos. Here have been found somewhat extensive systems of plumbing with terra cotta drain pipes having cement joints, and rooms, which seem to be toilet rooms attached to sleeping apartments, in one of which was the remains of a wooden water closet seat. The closet apparently had a drain pipe and a flushing pipe. These ruins are estimated to be at least 4,000 years old.

Directions to Pipe Inspectors.

Explicit and rigid printed instructions have recently been issued by the Bureau of Filtration, Philadelphia, for the guidance of inspectors of cast-iron pipes, special castings and stop valves required for the Lardner's Point distribution system. A copy of these instructions has been received from Chief Engineer John W. Hill, and they are reprinted with slight abridgment.

In accepting material under this contract inspectors are hereby directed to exact rigid compliance with all the requirements referring to the shape, size, thickness, eccentricity and soundness of all pipes, special castings and stop valves therein specified, and with the requirements referring to the quality and tests of metal to be used. No deviation whatever from these conditions will be permitted on the part of the inspectors, and in cases where material has been rejected which, in the opinion of the contractor might be used, the exact cause of rejection must be reported promptly to the chief engineer's office in order that it may be determined whether the rejected pieces can or cannot with safety be accepted. No deviation whatever from the contract requirements will be permitted by the inspector, except upon written orders, signed by the chief engineer.

All pipes, special castings and stop valves must be consecutively numbered, whether the pieces be accepted or rejected; the test bars must also be numbered and the series of numbers for each be connected with the numbers of the pipes, special castings or stop valves manufactured from the same heat. For other than 60-inch pipe there will be required from each heat two test bars for cross-breaking loads and two tensile test specimens. Not less than six test bars for cross-breaking load shall be made from every heat for 60-inch pipe and special castings. These test bars must be taken at different times during the heat in order to show the quality of the metal at the beginning, during and at the end of the heat, as represented by the material drawn into the ladles and poured into the flasks. Thus, if the heat for 60-inch pipe requires three hours to pour off, a test bar should be run from the first ladle and one every half hour thereafter during the heat until the proper number of bars are obtained. If the heat consumes six hours, a cross breaking test bar must be poured each hour, and a tensile test bar once each two hours of such heat, or in this order whatever the length of time to pour off the heat for each particular day. The test bars in each instance must be taken from the same ladle which carries the molten iron from the cupola to the flasks. If the special castings are not poured from the same cupola as that supplying material for pipe, then the test bars must be duplicated from the cupola supplying the material for special castings. Where the one cupola supplies the material at the same time for both pipe and special castings, the test bars will be held to apply to both the pipe and special castings.



Main Receiving Basin.

The inspector will be required to see that the bars for cross-breaking tests, and the three additional bars cast separately and milled for tensile tests, are boxed up and forwarded to the chief engineer's office regularly each day by express. The duplicate set of cross-breaking bars and tensile test bars which the foundry will make, will be broken and deflections determined on the testing machine at the foundry. The inspector will be required to be present when these tests are made and certify to the results, and any casting made from metal falling below the requirements of the contract, even though otherwise satisfactory, shall be rejected.

Inspectors will note that each pipe must be subjected to an internal hydrostatic pressure of 300 pounds to the square inch, for an interval of time not less than ten minutes, or longer if in their judgment it is necessary to prove that such pipe is tight and not sweating through the pores of the metal. This test must absolutely be made with every piece of pipe and special casting, excepting curves and breeches pipes, the inspection of which must be made to show absolute compliance with the other requirements of the contract, because these specials cannot conveniently be subjected to the hydrostatic test. In the case of rejection of curves or breeches pipes, because of their non-compliance with the requirements for form, uniformity of thickness of barrel, etc., if the contractor will arrange to subject such castings to the hydrostatic test, and they are found to meet such test satisfactorily, this fact must be reported to the office for such further action as the chief engineer may take with reference to such special castings.

Note the preparation of the coating bath and see that the same is kept at the proper consistency and at the required temperature, also that the castings before immersion are carefully cleaned and heated as required. See that the castings are kept in the bath long enough to become thoroughly coated inside and outside. The inspector shall see that in heating pipes in the oven before they are put into the bath of pitch and oil they are not brought to a temperature high enough to burn the material in the coating tank. The oven for heating pipe and special castings must be fired with coke or anthracite coal. The clause on "Defective Bead Ends" must be construed as applying only to pipe 48 inches and less in diameter. No provision is made for cut 60-inch pipe, and if occasion should arise where it might be advisable to cut such pipe, specific instructions with reference to banding will be furnished.

If the foundry should not be provided with calipers having a reach of 5 feet, with a self-reading scale whereby the thickness of the pipe at any point in its length or diameter can be quickly read, he shall notify this office and such calipers will be furnished, to be returned when he has completed his work. In calipering pipe for thickness of metal it must be taken near the bell and near the spigot, and at two points equidistant between the bell and spigot, and at four points, 90 degrees, apart around the circumference, and if upon this measurement there is reason to believe that the thickest and thinnest sections of the pipe have not been shown, then it will be necessary to continue until the extreme difference of thickness has been stated. In calipering pipe for diameter of bore, this should be taken at four points.

Upon inspection of special castings for all requirements with reference to thickness of flanges, barrels, dimensions, depths and condition of bells, sizes and condition of beads, facings of flanges, diameter of bolt circle, number and size of bolts and other ordinary conditions, a careful examination must be made for spongy spots where the flange joins the reinforcement of the casting, and the bell joins the barrel of pipe or casting. This can best be done with a blunt punch and hammer, and wherever such parts are suspected the punch and hammer must be applied until the inspector is satisfied that the metal is solid. Spongy spots in the iron where the flange joins the reinforcement or the bell joins the barrel, will be considered sufficient cause for rejection.

Where the flanges do not face up smooth and free from blow holes and sand holes, such castings will be rejected, and the facts reported to the chief engineer. In reporting castings so rejected the inspector should make a sketch of the flange and indicate on the same, the location, number and size of the spots which



Construction of Concrete Sewer in Tunnel.

do not face out in the lathe or in the boring machine. The back of all flanges shall be smooth, parallel to the faced surface, and furnish a proper seat for nuts, and bolt heads.

Submit daily reports to the office of all pipe, special castings and stop valves made under the contract either accepted or rejected, giving the data called for in the blanks furnished. If subsequent examination of castings, after arrival upon the work at Philadelphia should indicate neglect upon the part of the inspector at the foundry, it will be deemed sufficient cause for his removal.

Defective Work in the Cleveland Water-Works Intake Tunnel.

In order to provide a supply of potable water drawn from the bottom of Lake Erie at a point beyond the danger of contamination by sewage discharge, the city of Cleveland has been constructing a water-works intake which includes about 26,000 feet of tunnel, extending obliquely from the pumping station on the lake shore to a point nearly four miles from the old pumping station and 15,000 feet beyond the original intake. The tunnel has a three-ring brick cross-section, 9 feet in diameter inside, and is 109 feet below mean water level, at the lake end. Work on the tunnel was commenced in 1896, and it has recently been completed, part of the work having been done by contractors and part by the city. Much of the tunnel was driven through dense blue clay with thin horizontal seams of dry quicksand. The excavation and lining were conducted under pneumatic pressure, and the work progressed at a speed of from 12 to 27 feet of finished tunnel in 24 hours. Large quantities of gas were encountered in the excavation and caused two fatal explosions, one of which cost eleven lives.



Defective Brickwork in Cleveland Tunnel.

Special precautions were then adopted, improved ventilation was provided and frequent tests of the air were made by securing samples of it in sealed bottles carried into the tunnel full of water and, being emptied there, filled with air from different heights above the floor. The pressure of the air in the bottles of course corresponded to that in the tunnel, and in order to relieve it, when the bottles were carried out they were inverted and opened under water so as to allow the excess to escape. Analyses of these samples were then made, and the proportion of gas found determined whether or not the mixture was explosive. On August 14, 1901, the wooden superstructure on the lake crib was burned, and five men were killed in the flames and four by drowning. Descriptions of the tunnel, the method of construction and the accidents which befell it were published in the issues of The Engineering Record of May 22, 1897; May 7 and July 23, 1898, and August 31, 1901.

The tunnel was supposedly completed in December, 1902, and when the work of cleaning up and taking out the air locks was commenced, an examination made of the portion done under contract showed that much of the brick lining was poorly built and that a large quantity of sand and mud had penetrated through it and filled the bottom of the tunnel. An examination of a 7,200-foot section between two of the working shafts was attempted and found impossible on account of the great quantity of quicksand which had accumulated inside it, reaching in most cases nearly to the springing line and in some cases above it. At attempt to inspect another section 10,500 feet long was also found impossible for the same reason. All of the sand and silt had accumulated since the completion of the works by the contractors. One hundred and thirty test holes were cut through the brickwork and showed a great deal of bad work. In many cases the outside ring of brick was entirely missing, and in other cases the bricks to form it were laid dry or were even thrown in without being placed in courses. In the bottom of the tunnel there were many places in which no mortar was used in any of the rings.

Mr. G. H. Benzenberg was retained as consulting engineer by the city, and in an inspection which he made of one portion of the tunnel a section 7 feet long and four bricks high was opened in the side wall and showed that there were only half as many bricks as were required in the third ring and that they were in all sorts of positions. They had apparently been dumped in loose and when the pressure was removed in the tunnel the soft clay was forced through the interstices. At several points the outer ring was entirely absent, and there were breaches in the second ring.

The third or outer ring of brickwork is practically worthless for about 2,600 feet, where much of the outer ring is missing, and the two inner rings are poorly built, and 400 feet of it will have to be entirely rebuilt. If the clay through which the tunnel was driven had been softer at least 3,000 feet of the tunnel would have required complete rebuilding at great expense. In some places the crown of the arch consisted of a single ring of radial bricks laid edgewise in cement mortar and covered only with a second ring of bricks laid flatwise without mortar, no third ring being built there at all. Some of the 400 feet which is to be rebuilt has a diameter of only 6 feet instead of 9 feet as required. The removal of the sand from the tunnel is a dangerous matter on account of the large quantity of explosive gas which enters the tunnel through the brickwork. Notwithstanding that the tunnel is nominally finished, it is necessary to conduct the repair work under pneumatic pressure of 10 pounds per square inch, and 1,800 cubic feet of air are delivered to the tunnel every minute to dilute the gas which, at best, forms from 2 to 3 per cent. of the atmosphere there.

The contractors received a price of $18.15 per linear foot of the tunnel, and much of the trouble is thought to have been due to their requirement that 17½ linear feet of finished lining should constitute a day's work for one shift. The men consequently slighted the work in order to get done, and that part of the tunnel which was built under contract is, in general, in very bad condition and does not at all fulfil the specifications.

Acknowledgment is made to Mr. G. H. Benzenberg, C. E., for data concerning the condition of this tunnel and to Mr. E. W. Bemis, superintendent of the Water Works Department, for photographs from which the illustrations were prepared.

A New Material for Pipe Joints.

For many years the joint spaces in bell and spigot joints of cast-iron water, gas and plumbers' pipes have been most commonly filled with molten pig lead, which is calked after it has cooled. For several years a Philadelphia gentleman has been experimenting with mixtures of various common materials, seeking to produce a compound to be used not only for pipe joints but for many other common purposes. A few years ago his efforts were successful and the new material was patented. It has been given the name "leadite" because it replaces lead in many ordinary uses. The chief ingredients, as described in the letters patent, are sulphur, brick dust and sand, but various other materials are incorporated with these in varying proportions, according to the use to be made of the mixture. Some of the characteristics claimed for leadite are: "It weighs 118 pounds per cubic foot, or one-sixth as much as lead; it melts at 310 degrees Fahrenheit, while lead melts at 618 degrees; it is a good non-conductor of electricity and is not affected by acid; it can be remelted repeatedly without waste; it solidifies upon cooling and firmly adheres to metals, glass, wood and many other substances; it is impervious to water; it never corrodes, and it is not malleable."

As ordinarily prepared for making pipe joints, leadite is of a leaden gray color, but it can be colored during manufacture in a variety of ways if desired for ornamental purposes. When used as a jointing material it requires no calking and it is tight under high pressures. Owing to its lower specific gravity, a given weight of leadite will make six times as many pipe joints as the same number of pounds of lead, and consequently a great economy is claimed in its use for this purpose. Its efficiency in water-pipe joints has been tested by several years of actual use. In 1894 about half a dozen joints in 48-inch pipe were made with this material in Philadelphia, and in 1895 some 1,800 feet of 4-inch pipe, likewise connected with the Philadelphia water-works were also jointed with it. In addition to these, hundreds of joints have been made at various times, and it is stated by one of the prominent men of the department that these joints have been very satisfactory. The pressure in the pipes in some cases has been as great as 140 pounds per square inch. For making the joints an ordinary pipe jointer is used and the material is melted and poured in much the same way as lead is; but as soon as the leadite is

cool the joint is completed, as no calking is required. If, in further practical experience, this material justifies the claims made for it, considerable changes in methods of pipe laying may result and also in the amount of metal required in the pipe bells. The material is furnished by the Leadite Company of America, 2135 N. 29th Street, Philadelphia, for numerous other purposes than pipe joints.

Tar on Roads.

The use of oil in laying dust on macadam or earth roads has been quite extensively and successfully experimented with in several sections of this country, as has been noted from time to time in The Engineering Record. In France, however, the experimenters have gone further, owing to the high price of oil there, and have tried coatings of tar. The process employed at Champigny by M. Silvain Dreyfus, engineer of bridges and roads for the department of the Seine, was described in The Engineering Record of December 20, 1902, and some further information on this subject has recently been published in the "Bulletin de l'Association Général Automobile," from which as summarized in the London "Surveyor," the following notes have been taken.

The work in Champigny, which was done early last August, consisted in tarring about 650 feet of roadway, 16 to 20 feet wide, and a certain length was also treated with petroleum. The layer of tar withstood for months not only the vehicular traffic but also rain, frost and thaws. The treatment of the roads with various liquid residues of petroleum completely prevented dust, but was far less durable than the tar coating, which formed a solid crust on the surface of the road. M. Dreyfus states that the tar coating has only given good results when it was done in dry, warm weather, which seems to be essential to the success of the treatment. The macadamized road must also be in good condition, for if this is not the case the tar is inclined to collect in the depressions. While it is an advantage to have the surface loose and dusty when applying the liquid petroleum residues, it is essential that it should be absolutely clean when coated with tar. If the road is new, or has been recently rolled, a preliminary brushing will suffice; but otherwise it is better to wash it down, or brush it so that the stone bed is laid bare, it being remembered of course that all dampness should be allowed to dry out before the tar is applied. A few hours after coating, the surface should be sprinkled with sand and lightly rolled. For a road 6 meters (19.7 feet) wide the cost of the tarring is estimated by Mr. Dreyfus to be from $124 to $186 per mile, taking the price of tar as $9.65 per ton. In spite of warm weather, no softening of the tar was noticed. At times it rained continuously for a week without causing any injury to the tar coating, and the road was entirely free from mud.

M. Lavand, of the department of bridges and roads, states that in the department of Charente some 280 feet of road 19.7 feet wide, which was tarred, has given good results. The tar formed with the dust a hard, cement-like surface, which in warm weather becomes slightly elastic, much like asphalt. The cost was given in this case as 1.45 cents per square yard. M. Lavand states that 6 months may be assumed as the life of this coating, and on the basis of two coatings a year he considers that the cost of maintenance of the road would be reduced one-half by the use of the tar. At Dôle a trial was made on the full width of a road for 980 feet. This road was in a busy suburb where the traffic was heavy, and in addition the road had a grade of 3 to 4 in 100. The results were very satisfactory, even pedestrians preferring the road to the foot paths. The officials of the department of bridges and roads consider that the coating has reduced the cost of maintenance of the road. About 4,800 square yards of road near La Rochelle have been tarred, with good results.

M. Charbonnier, of Geneva, Switzerland, reports that the results of the first coating of tar on the very busy road to Lausanne were encouraging. The dust was not entirely prevented, as the superficial wear and tear of the single stones and uneven portions which are bound to occur, suffices to produce a very fine but heavy dust, which barely rises above the wheels. The amount of this dust is barely one-tenth of that which previously occurred.

A Steel Tape Base-Line Measurement.

During the summers of 1901 and 1902 a base line at Greensboro, Vt., about 2,600 feet long, was measured by students of the University of Vermont under the direction of Mr. Arthur D. Butterfield. The results seem to bear out the opinion that with proper care a base line can be measured with sufficient accuracy by the use of steel tapes, and that although the probable error of the tape measurement may be larger than that obtained by the use of more precise methods, the single advantage of being able to measure a longer line makes the tape measurement fully as effective in checking triangulations. The following description of the measurements at Greensboro has been condensed from an article by Mr. Butterfield in the "Journal" of the Worcester Polytechnic Institute for March:

A Gurley ribbon steel tape was used for the work; 301.4 feet long and weighing .2 pounds 6 ounces. It was graduated every 5 feet for a length of 300 feet, and the 10 feet at the zero end were graduated to feet. Its average width was 0.2491 inch, and average thickness, 0.0103 inch. Special small glass thermometers graduated to 150 degrees Fahr. were used, from which readings to the nearest quarter of a degree were easily obtainable. An improved Chatillon circular spring balance, weighing to 60 pounds by 2-ounce graduations was used for the tension. The dial of this balance is graduated to 20 pounds and the total tension is obtained by adding to the dial reading that on the extended hook of the balance, which records the multiples of 20 pounds. Since the balance was made to give correct readings when held vertical, it was necessary to correct the readings for the horizontal position. To do this the formula $T=T_1+\frac{1}{2}(W-R+r)$ was used, in which $W=$ weight of balance (2 pounds 8¾ ounces), $r=$ reading of dial when balance is held vertical (—2 ounces in this case since the reading was greater than zero), $R=$reading of dial when the balance is held inverted (21 ounces), $T=$ true tension when held horizontal, and $T_1=$the dial reading when held horizontal. For a pull of 30 pounds it was found that the dial reading should be 29 pounds 7 ounces. The apparatus for stretching the tape was very simple, consisting of a piece of iron 7½ inches long, 2 inches wide, with a vertical projection at each end through which a rod in line with the tape passed and was held in place by a small traveling crank butting against the further projection of the iron base. The tape supports at the end of every 300 feet consisted of two 2x3-inch posts with a wooden cross-piece on top. Three supports were set up at the end of each tape length, the two outside ones for the tape stretching apparatus and the middle one, which was set to grade, for the zinc strip on which was recorded the end of the tape length. The intermediate supports were stakes 1 inch square, with L-shaped pieces of wire hung from them by nails. These supports were spaced 25 feet apart in 1901 and 50 feet in 1902.

The terminal points of the base line were marked by brass bolts cemented in 6x6-inch granite monuments set 3 feet in the ground, a fine transverse line on each bolt marking the extreme terminals of the line. From the nature of the ground it was thought best to divide the base line into four different grades, the grades being continuously down hill, 6.44 feet in 804, 6 in 300, 13 in 600, and 4.5 in 900, respectively. The line having been all staked out to grade, the terminal points were brought up and marked upon the end zinc strips by means of a transit set at right angles to the line. In measuring, the tape was uncoiled and placed in its supporting hooks, a moderate tension was applied, and the tape was then allowed to remain 15 minutes or so in order to assume the temperature of the air; the thermometers were hung at the 100 and 200-foot points. In starting the measurement, the rear tape stretcher kept the zero end of the tape at the terminal mark by means of the movable crank and the forward tape stretcher applied the desired tension. When the rear man signaled "all right," usually by a whistle, and the tension was correct, the forward end of the tape was marked on the edge of the zinc with a needle and then a line was drawn across the zinc strip. The thermometers were read when the "all right" signal was given, and immediately after the tape length was marked the stretchers were lifted from their supports, the tape carried forward along its supporting hooks, the stretchers fixed in their new position, tension applied as before and the next tape length measured. The odd distance at the end was measured by a foot rule graduated to fiftieths of an inch.

Usually the men were distributed in the following manner: two or more at each end at the tape stretchers, and one at each thermometer, who also looked after the tape in transportation, seeing that it rested properly in its supports and was not twisted, and a recorder. The time of each measurement occupied usually a little less than an hour at the beginning, since the men were not accustomed to their duties, but after a few measurements had been taken it was possible to measure the distance in half an hour, or at the rate of one mile per hour.

Nine measurements of the base were made each year, and the average value in feet for the reduced length of line for 1901 was 2,604.153 ± .003. The average for 1902 was 2,604.153 ± .007. The values for the decimals of the reduced lengths for the two years were:

1901.... 158, 166, 157, 159, 153, 136, 170, 125, 158
1902.... 216, 186, 224, 124, 139, 154, 177, 133, 136

Three general conclusions are noted. First, those measurements where the temperature was about stationary accord nearest with the mean; second, measurements made under a falling temperature are large as compared with the mean; third, measurements made under a rising temperature are small as compared with the mean. These facts indicate that the thermometers do not respond as quickly to changes in the temperature as the tape; if the temperature is rising the thermometers read low, if falling they read high. This lag may be practically eliminated by an equal number of measurements taken under rising and falling temperatures. Since the majority of these measurements were made with a falling temperature the average is probably a little large.

That the measurements of the two years should happen to coincide can of course not

be regarded as a test of accuracy, for the probable errors are widely different in the two years. Taking an error of 1 in 500,000 as the maximum allowable probable error (as prescribed by the U. S. Coast and Geodetic Survey), the work of the first year is satisfactory, and that of the second year unsatisfactory. The results bear out the conclusion of others who have experimented, that the one great source of error is in the temperature reading, the inability to obtain the correct temperature of the tape.

Suspension Bridges in the Himalayas.

Suspension bridges in the Himalayas, made by the natives and called "jhulas," are described in a recent issue of "Indian Engineering" which gives two engravings of one of them. It is apparently nearly 200 feet long with two pairs of main cables which pass over the tops of forked tree limbs for towers and beyond them are separated into a number of anchorage strands attached to posts driven in the ground. The floor appears to consist of cross pieces lashed to longitudinal timbers suspended by vertical and diagonal ropes from the cables, and is approximately horizontal at the ends and nearly parallel to the catenary in the middle three fourths.

"Frequently these bridges consist merely of three ropes, one for the feet and two others for the hands of the traveler, kept asunder by pieces of wood placed at intervals. Although there is nothing to prevent side swing, the natives of the Himalayan districts use them with great freedom. In some out-of-the-way parts, where ropes cannot be obtained good twig cables are made from the freshly picked twigs of *Desmodium tilioefolium*, which make very strong cables, but are not very durable. Sometimes the native "jhula" consists simply of one single rope, stretching from bank to bank and made fast to trees on either side; a sort of cradle in which a passenger sits, is slung on a rope from the main cable, and pulled across by means of ropes worked from either side. Goats and sheep sometimes cross by this form of bridge, and it is certainly safer than the three-rope method."

Preservation of Iron in Concrete.

In 1890, there was built in Berlin, Germany, a revetment wall consisting of reinforced concrete slabs between I-beam posts resting on piles cut off below low water and held horizontally by backstays. The piles are survivals of a previous crib. In the spring of 1901 the Department of Public Works undertook a thorough investigation of the condition of the concrete slabs and the iron embedded in them, which is reported in a recent issue of the "Zentralblatt der Bauverwaltung." The reinforcing consists of horizontal ⅜-inch round iron rods in number depending upon the earth pressure acting on the slabs, and of vertical rods about 3/16 inch in diameter. The vertical and horizontal rods are tied together by wire so as to form a netting.

To investigate the condition of the slabs and the iron embedded in them, nine slabs were chosen which showed cracks and other injuries, and 12 slabs which had a perfectly good appearance. Thirty-two holes about 10x10 inches were chiseled out, completely uncovering the rods, and at all places also, where marked injuries were noticed, the concrete was removed completely from the rods. The horizontal rods were 0.04 to 0.4 inch, and the vertical rods 0.4 to 1 inch from the faces of the slabs. In an injured slab three horizontal and two vertical rods were uncovered. The greater part of the upper horizontal rod was covered by a thin layer of rust, and the mortar, from the rod to the face, was destroyed. The two lower rods were free of rust. The vertical rods were somewhat rusty at several spots. In another injured slab, the uncovered rods, four horizontal and four vertical, were all equally rusty.

In a slab, which appeared on the outside to be in perfectly good condition, three horizontal and four vertical rods were uncovered. The two upper rods were rusted the same as in the slab first mentioned, but the lower rod was free of rust. The four vertical rods showed slight rusting at several spots. In another uninjured slab, all the rods uncovered, four horizontal and three vertical, were found to be free of rust.

In a slab in the upper row, the concrete had scaled off for about 4 inches above the bed joint and for short distances each side of the post. The uncovered rods were much coated with rust on the face. In another slab the concrete had cracked off near the lower edge for about 4 inches. A horizontal rod laid 0.2 inch from the face had become loose and was much rusted on the face. In still another slab, seven horizontal rods became loose because the concrete layer covering them had cracked off. The rods were much rusted. Three other slabs showed the same injuries. The concrete layer, which was only 0.12 inches thick, had cracked off and the rods which were laid bare began to rust.

Some conclusions as to the building of reinforced concrete slabs of this type and the arrangement of the embedded rods may be based on these observations. Rods with incipient rust were found in a relatively great number in injured slabs and in slabs in good condition externally, but destruction of the concrete was found almost invariably only where the rods were near the external face. At such spots, having only a thin protecting layer of cement, it was found that the rod was much rusted on its front only while the rest of the surface remained clean. Apparently the injury to the slabs may have been caused partly by the improper location of the rods, even when free from rust, and partly by the use of rusted rods. Wherever rods free of rust protected by a good layer of cement of 0.3 to 0.4 inch and more in thickness were uncovered, the slabs showed no injury. It was also observed that the mortar adhered less strongly to the rusty rods than to the rods free of rust. From the latter the mortar had always to be removed by the point of the hammer.

Since the greatest bending stresses take place at the middle of the slab, it will be well to bend the rods so that they will be near the center of thickness at the supports and the requisite distance from the face in the middle. No greater difficulties will be encountered in tamping the concrete than are encountered with straight rods which have to be bent in at the ends because of the flanges of the I-beam post. No accuracy is required for the curve of the bent rod.

Letters to the Editor.

Measuring Flow of Water by Means of Recording-Pressure Gauges.

Sir:—Mr. Doane's article on the use of recording pressure gauges as aids in water works management, in your issue of May 9, is so complete that little more remains to be said on the subject. There is, however, one point to which attention may be directed, and that is the amplitude of the motion of the pen and the sensitiveness of the gauge to comparatively small variations of pressure. The movement of the pen or pencil point is usually limited to a range of only 2 or 3 inches, and if the difference between the extremes of pressure is large, the small variations become visible in the chart, if there be no retardation of the pen by its friction on the paper. In the case of a long gravity conduit, the record of such small variations of pressure, however, are sometimes of great importance to a manager, as they indicate abstractions of water from the pipe, and thus furnish a clew to an improper use of the air valves or blow-offs on the line. The instrument should, therefore, be very sensitive or possess the greatest practicable amplitude of motion, and the "drag," or frictional resistance of the pen or pencil point, should be determined frequently by trial.

Mr. Doane has also pointed out how the records of two such gauges located at some distance apart on a conduit, can be utilized to determine the approximate discharge of the pipe, either at any instant of time, or for any period. By carefully comparing the two charts, and knowing the difference of level between the two instruments, the loss of hydraulic head in the given length of pipe is found, whence it becomes easy to compute the discharge, if the proper value of the coefficient (c) in the Chezy formula $v=c\sqrt{rs}$ is chosen, or has been determined by actual experiment. This method of obtaining the discharge of a pipe conduit is, however, dependent on the accuracy of the two instruments, and the equality of the pen "drag" in each. If the actual difference in head is small, there will be much difficulty in determining it correctly from the two charts, owing to the short range of motion of the pens in gauges of the usual construction, and the measurement is furthermore affected by the "drag." In making use of a recording gauge as a water meter, it will therefore be preferable to use only one instrument which has a large range of motion, and is adapted to recording the differences of pressure in a length of 500 or 1,000 feet of the conduit, instead of the actual pressures at the two points; the instrument in this case being located preferably midway between the two points and connected to the conduit by two lines of small pipe.

A gauge of this kind is easily made in the form of a glass U tube partly filled with mercury, or some other liquid insoluble in water, and any desired degree of sensitiveness can thereby be obtained; but hitherto the only way of obtaining a continuous record has been by photographing the junction of the water and mercury columns in one leg of the U tube. This process is, however, somewhat expensive and troublesome, and hence it becomes desirable to accomplish the purpose mechanically with the usual diaphragm or Bourdon tube spring gauge. The writer has made several experiments in this direction which gave fairly satisfactory results, although much remains to be done in the way of minimizing the effects of changes of temperature on the springs and in getting a sufficiently large range of motion.

Yours very truly, E. Kuichling.

New York, May 13, 1903.

Pressure-Recording Gauges.

Sir:—In connection with the article by Mr. A. O. Doane on recording-gauges, in your issue of May 9, I take pleasure in writing a few lines by way of discussion. In any system of, say, exceeding 30,000 consumers, I should regard more than one pressure-recording gauge as highly desirable, not to say necessary. The city of Boston has about twenty of them, mainly in fire-engine houses, where they are wound and cared for ordinarily by the firemen attached to the houses. An incident indicating

the value of having many gauges occurred lately. It was known, from the excessive pumping, that a leak existed somewhere in the city. One of the gauges showed much the greatest deviation from the normal pressure, and the leak was found not far distant from it. Previous to the introduction of the closed pen, I had always preferred a hard pencil, provided with a spring to keep it up to the paper; and I still think that it is to be preferred to any pen, which is apt to convert the vibration into a wide band of blot, thus making the determination of the mean pressure a matter of some difficulty. I presume that no contrivance so far used, except that of an enlarged pipe carried above the highest point to which the water could rise, can prevent the hammer in the gauge-pipe, but there has been used, with some success at least, an air chamber near the gauge so connected as to be at all times easily kept full of air. I was wondering whether it would not be wiser to insert a slightly larger tap in the main rather than to allow the smaller one to project into the main as suggested by Mr. Doane.

Yours truly,

FREDERIC I. WINSLOW, Asst. Engr.

Boston, May 13, 1903.

THE ENGINEER AND THE PUBLIC.

Sir:—Engineers should be grateful to Mr. Charles F. Scott for his presentation of the "Engineer of the Twentieth Century." This address cannot help but awaken among engineers a keen interest; and it should do more, it should stimulate them to action. They should grasp the opportunity now before them to extend their usefulness to each other in such a large way and to command their proper position among professional men. This is the engineer's century. He controls the expenditure of vast sums of money, paid out in the main for the betterment of civilization. Yet he does not have a large voice in determining whether such expenditures shall or shall not be made. The engineer is not often represented upon the various boards or commissions which have to deal with large public problems. Yet no man is better fitted by education, training, or inclination to give his best services to such important matters. Again, we do not often find the engineer in our city councils, in the legislatures of the States, or in Congress. Furthermore, he does not often hold any prominent administrative position in City, State, or National Government—there are exceptions in private corporations, because the corporation understands the value of his services. Are not these conditions largely the fault of the engineer himself, from a lack of interest or of effort to better them? Engineering is a self-absorbing profession—we need to guard ourselves against being overwhelmed by the purely technical part of our work. If we become completely absorbed in our particular specialty—to the exclusion of everything else—we become narrow, we not only lose our interest in public matters, but soon we have nothing in common with our fellows, and finally we are even out of touch with engineering in its broadest sense. This should not be so. In order to render our best services as engineers, we should not forget that we should first and above all things be an engineer, then a specialist in engineering.

There are numerous engineering societies, civil, mechanical, electrical, mining, naval, municipal, irrigation, sanitary and others. It is inevitable that specialization in the practice of engineering as a profession will continue. In the future, also, are we going to differentiate further in our society organizations, and so become less and less in touch with each other? This would hardly seem the rational thing to do. Rather the engineers' effort should be directed to the bringing together of all engineers in one society, which would include all of the engineers of the future. They should stand before the community as a unit, as engineers. Their voice should be heard in the discussion of large public problems; no other class of men are better fitted to discuss such matters. They should take their proper position in the world of affairs. As Mr. Scott has put it: "The Engineer of the Twentieth Century is to deal with large affairs in a large way. He is to be closely related to every department of modern life. He is to become a chief factor in adjusting and operating the intricate mechanism of a new civilization. He is to advance to administrative positions for which his knowledge and training peculiarly fit him." Are the small things—exclusiveness, dissimilar standards, petty jealousies and such like—which may seem to stand in the way of anything that may lead to the consummation of such a destiny, going to prevail? I believe not. Sooner or later we must get together. Why not now? Why not accept gratefully the offer which has been made by Mr. Carnegie and build for all engineers with one standard of eligibility—an engineer—the American Institute of Engineers?

Very truly yours, DANIEL LAWRENCE TURNER, Assoc. M. Am. Soc. C. E.

New York, May 15, 1903.

REASONING OF A GOOD-ROADS ENTHUSIAST.

Sir:—A prominent and eloquent advocate of better roads having stated in a president's address at a good roads convention that the farmers of the United States were losing $900,000,000 annually by bad roads, I wrote to him asking how he determined the loss. His reply is interesting as showing the slender basis upon which one emphatic assertion rests. His answer is as follows, verbatim et literatum:

"1. There are 10,000,000 wagons in the United States.

"2. Probably 1/10 of these are constantly hauling on bad roads.

"3. The value of two horses and a wagon one day is $3.

"4. One million wagons for 300 days losing $3 per day is $900,000,000."

How easy! I asked him how he knew there were 10,000,000 wagons in the United States. I have waited three months, but have not yet heard from him. When I receive his answer I shall publish it.

However, let us examine his premises a little. None of the U. S. Census Reports give any direct data as to the number of farm wagons in the country; but the census does give the number of vehicles and also of farm wagons manufactured in 1890 and also in 1900. In 1890 there were 298,000 "farm wagons" manufactured, which was 21.9 per cent. of all the vehicles made that year; and in 1900 the "heavy wagons and trucks" amounted to 326,000, again 21.9 per cent. of all the vehicles manufactured that year. The tax assessors of Illinois reported 575,000 "wagons and carriages," and assuming that 22 per cent. of these were farm wagons, there were 126,500 farm wagons in Illinois in 1901. In 1900 Illinois had one-sixteenth of the population of the United States, and assuming that the number of farm wagons is proportional to the population, the number of farm wagons in the United States would be 126,500x16=1,024,000, which is practically one-tenth of the value stated by our road reformer. Again, if only 300,000 farm wagons were made per annum during the past decade, and if there are 10,000,000 in the country now, a wagon must have lasted 33⅓ years, which is obviously absurd. The conclusion is still further in error, since the number of wagons made during the last decade is very much greater than that during preceding years. But if the premise has approximately a tenfold error in it, it is not worth while wasting words over it.

Of course, neither our advocate of good roads nor anybody else knows anything definite about the truthfulness of his second premise. The third premise is absurd. It assumes that all of the wages of driver and team are lost while hauling upon bad roads, which is equivalent to saying that nothing is hauled! According to this, the roads of the United States are impassable one-tenth of the time; but nevertheless the farmers haul upon them! If the first factor is approximately ten times too great, and the second factor is a shot in the dark, and the third is absurd on the face of it, how unreliable is the conclusion? Is it any wonder that the so-called arguments of the good-roads enthusiast fail to convince the farmer, or that he is irritated thereby and becomes suspicious of the motives of many of those who get up good-roads conventions?

Yours truly, IRA O. BAKER.

Champaign, Ill., May 15, 1903.

Directory of National Engineering Societies.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 99 John Street, New York.

AMERICAN WATER WORKS ASSOCIATION. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

AMERICAN SOCIETY FOR TESTING MATERIALS. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal Notes.

Mr. A. F. Gill has been appointed city engineer of Spokane, Wash.

Mr. E. C. Dunn has been re-elected city engineer of Alexandria, Va.

Mr. F. S. Hazelton has been appointed city engineer of Paola, Kan.

Mr. S. B. Howe has been appointed city engineer of Sioux Falls, S. D.

Mr. Frank Powell has been reappointed city engineer of La Crosse, Wis.

Mr. H. H. Leith has been reappointed city engineer of East Liverpool, O.

Mr. Lester H. Robinson has been appointed city engineer and surveyor of Middletown, N.Y.

Mr. R. L. Ellis has been appointed city engineer of Great Falls, Mont., succeeding Mr. C. W. Swearingen.

Mr. W. J. Miller has been re-elected engineer and superintendent of the board of water commissioners of Red Wing, Minn.

Mr. Charles R. Wightman has been appointed city engineer of Benton Harbor, Mich., and Mr. R. L. Levin engineer of water works.

Mr. J. V. N. Williams has been appointed superintendent of streets of Binghamton, N. Y., succeeding Mr. J. M. Seabury, resigned.

Mr. Frank I. Consaul has been appointed as city engineer of Toledo, O., succeeding Mr. Tonson, whose resignation was noted last week.

Mr. William H. Sieverling has been reappointed city engineer of Springfield, O., and Mr. Robert J. Netts, assistant city engineer.

Mr. John L. Westbrook, engineer of East Stroudsburg, Pa., has been engaged as engineer for the sewer construction at Stroudsburg.

Mr. Matthew B. Cowden has been re-elected city engineer of Harrisburg, Pa., for three years. He was first elected to the position in 1874.

Mr. F. M. Turner has been reappointed city civil engineer of Dayton, O., for two years, which position he has filled for the last twelve years.

Mr. C. F. Martin, for twenty years superintendent of the water works of Bellefontaine, O., has resigned and will be succeeded by Mr. David Hennesey.

Mr. J. W. Pierce has been elected city engineer of Cambridge, Mass., to succeed Mr. Lewis M. Hastings, who has occupied that position since 1889.

Mr. Guy Hyde Chick has resigned as local manager of the Contra Costa Water Co., at Berkeley, Cal., and will engage in private practice in that city.

Civil Engineer Menocal, U. S. N., has been ordered to Washington for duty in connection with the plans for the naval station at Guantanamo and Bahia Honda.

Mr. J. A. Sague, mechanical engineer of the American Locomotive Co., sailed for Europe, May 16, to spend two months in a study of foreign-built locomotives.

Mr. C. W. Buchholz has resigned as chief engineer of the Erie Railroad, and has been appointed consulting engineer for all lines which the company operates and controls.

Col. A. C. Chase has retired as president of the Syracuse Chilled Plow Co., which position he has held for twenty years, and will be succeeded by his son, Mr. Carleton A. Chase.

Mr. Charles Russell, formerly superintendent of the Rocky Mountain division of the Northern Pacific Railway, has been made superintendent of the Illinois division of the Sante Fe system.

Mr. A. F. Doremus has dissolved his engineering partnership with Mr. F. C. Kelsey, at Salt Lake City, Utah, to give his time more fully to the irrigation work imposed under the new state law.

Mr. J. G. Palmer has been promoted from U. S. inspector to U. S. junior engineer and transferred from the Illinois and Mississippi canal to work on the reconstruction of the Washington barracks.

Mr. James A. Lister has been appointed chief inspector at Chicago for the Pittsburgh Testing Laboratory, Ltd., and will have charge of all work under the laboratory's inspection in the Chicago district.

Mr. Walter MacFarland, vice-president of the Westinghouse Electric & Manufacturing Company, of Pittsburg, delivered a lecture May 15 before the students of Sibley College, Cornell University, on "The Commercial Side of Engineering."

Mr. J. L. Thompson, of Salt Lake, superintendent of bridges and buildings of the Denver & Rio Grande Railroad, has had his title changed to supervisor of bridges and buildings and his jurisdiction extended to include the Rio Grande Western Railway.

Mr. H. C. Kieth, bridge engineer for the Mason City & Fort Dodge Railroad, will go to New York, where he will have headquarters as chief engineer of the eastern division with Messrs. McArthur Bros., railroad contractors. Mr. H. M. Harp, assistant bridge engineer, will succeed Mr. Kieth.

Mr. T. L. Condron, M. Am. Soc. C. E., has become the Chicago representative of the St. Louis Expanded Metal Fireproofing Co. for the states of Indiana, Illinois, Wisconsin and Michigan for the sale of its corrugated steel bars for reinforcing concrete. He will continue to represent the Pittsburgh Testing Laboratory, Ltd., in Chicago.

Mr. Fayette S. Curtis, fourth vice-president of the New York, New Haven & Hartford Railroad, will henceforth have general supervision of the engineering department and construction, including the electrical department, except operation; also maintenance of way, and construction and maintenance of buildings and signals, except operation of signals.

At the annual election of the Shelby Iron Co., of Alabama, Mr. Erskine Hewitt was elected a director to succeed his father, the late Abram S. Hewitt, and Walter P. Gardner to succeed the late Gen. Samuel Thomas. The other directors are: Emanuel Lebmann, Wm. Nelson Cromwell, A. C. Gurnee, B. G. Frost, J. D. Probst, Granville W. Garth and W. S. Gurnee, Jr.

The following officers have been appointed on the Naval Examining Board to examine candidates for admission to the service as civil engineers and assistant civil engineers: President, Civil Engineer Robert E. Peary, U. S. N.; members, Civil Engineers, F. T. Chambers, U. S. N., Fred Thompson, U. S. N., and Leonard M. Cox, U. S. N.; and recorder, Civil Engineer C. A. Wentworth, U. S. N.

At the annual business meeting of the American Institute of Electrical Engineers, held in New York City, May 19, the following officers were elected: Mr. Bion J. Arnold, president; Messrs. Calvin W. Rice, W. S. Barstow and Ralph D. Mershon, vice-presidents; Messrs. Samuel Sheldon, A. H. Armstrong, W. C. L. Eglin and George F. Sever, managers; Mr. George A. Hamilton, treasurer, and Mr. Ralph W. Pope, secretary.

The following have been appointed by the governor as members of the New Jersey Tenement House Commission, authorized by a recent act of the state legislature: Mr. Edward W. Gray, general manager of the "Advertiser," Newark; Mr. John A. Campbell, president Trenton Potteries' Association, Trenton; Mr. Clinton McKenzie, architect, Elizabeth; Dr. James W. Stewart, physician, Paterson, and Mr. George B. Bond, merchant, Camden.

Col. Thomas W. Symons, Corps of Engineers, U. S. A., who turned over the charge of the U. S. Engineer Office at Buffalo to Major T. A. Bingham last week, has been signally honored by the Merchants' Exchange of that city. Just before leaving he attended a reception tendered by that organization, and was presented with a gold and silver tea service and a gold watch and chain, as a mark of the appreciation of Buffalo for his work in improving its harbor and for deepening the Erie Canal. The presentation was made by Mr. Charles W. Goodyear, who said in part: "The greatest breakwater in the world has been completed by you. In the construction of this work you have been the means of inaugurating a new era in the commercial life of this city. But for this breakwater the great Lackawanna Steel Plant would have been impossible. But for this breakwater the numerous other industries that have sprung up along the shores of Lake Erie could not have been constructed. But for this breakwater the great extent of water front, available for shipping, railroad and canal transportation, would not have been available."

Obituary Notes.

Ezra Torrence Gilliland, the inventor of many of the improvements of the American Bell telephone, died of Bright's disease, at his home in Pelham Manor, N. Y., May 13, at the age of fifty-five years. He was an intimate friend of Thomas A. Edison and was associated with him in several inventions. He was a director in the Bell Telephone Co. for several years and was one of the organizers of the Western Electric Co. He was also interested in the Gilliland Electrical Co., with factories at Adrian, Mich., where most of his inventions were manufactured after the models were perfected in his private laboratories. Mr. Gilliland was a member of the American Institute of Electrical Engineers and a trustee and the president of Pelham Manor at the time of his death.

Benjamin Franklin Jones, founder of the business now conducted by the Jones & Laughlins Co., Ltd., died in Allegheny on May 19. He was essentially a financier, and before entering the iron business had achieved success as the manager of canal freighting lines. In 1847 he joined with Samuel M. Kier in buying an iron furnace near Armagh, Westmoreland County, Pa., but took little active part for several years in the management of the works or in the American Iron Works, which were built by the firm of Jones, Lauth & Co. In 1852, his personal interest in the business became greater, and soon afterward, subsequent to the entrance of James Laughlins into the firm, its rapid development into one of the country's foremost iron and steel establishments was begun. Last year Mr. Jones turned over the office of president to his son, B. F. Jones, Jr., but retained his seat in the board of directors.

Edmund D. Libby, lately U. S. assistant engineer on works for improvement of the Mississippi River, directed from U. S. Engineer office at St. Louis, died in Concord, N. H., of consumption on April 24. He graduated from Dartmouth College in 1879 and from the Thayer School of Civil Engineering in 1882. He was chiefly employed on the improvement of the Mississippi River, and was a most faithful and conscientious officer and engineer, never sparing himself and always efficient in his conduct of the very important works entrusted to him, being sometimes in command of large working forces. During a year he was manager of the bridge shops of the Edge Moor Iron Co. (1887-'88). Later he served as assistant engineer on the New York, Providence & Boston and New York, New Haven & Hartford Railroads, but went back to his preferred work in 1893. He was a member of the American Society of Civil Engineers since 1885.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 564, 21, 22, 25 and 26.

WATER.

Clayton, Ala.—See "Power Plants, Gas and Electricity."

Geneva, Ala.—See "Power Plants, Gas and Electricity."

Prescott, Ariz.—E. B. Moden, City Clk., writes that it is proposed to increase the capacity of the water works, at a probable cost of $100,000. No engineer engaged as yet.

Prescott, Ariz.—Bids will be received June 15 by the Mayor and Common Council for $100,000 water and sewerage bonds. E. B. Moden, City Clk.

Yreka, Cal.—C. E. Moore, of Santa Clara, is stated to be preparing plans for water works.

New Britain, Conn.—The following bids are reported to have been opened by the Water Bd. May 14 for the construction of the dam and dike at Wolcott Mountain for the reservoir: F. Stewart Son & Co., Newton, Mass., $53,300; Tracy & Larbin, Derby, $41,240; C. E. Trumbull & Co., Boston, Mass., $39,497; Frank Pidgeon, Saugerties, N. Y., $38,354; Fred. T. Leg, Springfield, Mass., $35,954; Troy Public Works Co., Utica, N. Y., $35,839; Eglee & Bunting Co., Boston, Mass., $29,352, and Jehiel Vaughn, Stamford, N. Y., $24,236 (awarded contract).

Atlanta, Ga.—The Bd. of Water Comrs. is stated to have authorized the Holly Mfg. Co. to prepare estimates of cost of constructing a new pump, with a capacity of 18,000,000 gals.

Macomb, Ill.—The Council is stated to have decided to construct water works, to cost about $5,000.

Odell, Ill.—Press reports state that bids are wanted June 1 for furnishing and laying 2,000 ft. 4 and 6-in. water mains.

Chicago, Ill.—Bids will be received May 27 by the Bd. of Local Improv. for laying water service pipes in numerous streets. Andrew M. Lynch, Pres.

Naperville, Ill.—The citizens are reported to have voted to construct water works.

Iowa City, Ia.—The Iowa City Water Co. will expend about $20,000 in improvements.

Parnell, Ia.—G. H. Meredith, of Cedar Rapids, Ia., is reported to have prepared plans for water works.

Earlville, Ia.—G. H. Meredith, of Cedar Rapids, Ia., is stated to have secured the contract for the construction of water works here, at $6,806.

Ft. Dodge, Kan.—Bids will be received June 3 by the Bd. of Mgrs. of the Kansas State Soldiers' Home for furnishing material and installing water works at said home, including steel superstructure for reservoir, c. i. pipes, fire hydrants, water mains, pump house, pump and boiler.

Paducah, Ky.—The stockholders of the Paducah Water Co. are stated to have voted to construct a filtration plant to cost about $100,000. The capacity of the power plant will be doubled.

Lancaster, Ky.—It is stated that J. Redfern, C. E., desires prices on a 60-ft. steel tower of 40,000 gals. capacity, 220 tons of 8-in. water mains, 78 tons of 6-in. and 53 tons of 4-in.; 2 40-H.-P. boilers and 2 pumps, standard make, daily capacity 250,000 gals. each.

Owensboro, Ky.—The City Council is stated to have decided to secure bids for sinking wells.

Baltimore, Md.—The new Reservoir Comn. on May 16 selected the Calloway site as the location of the new storage reservoir.

Newton, Mass.—It is proposed to construct a new pumping plant, at a cost of $25,000. J. C. Whitney, Water Comr.

Groveland, Mass.—H. W. Vaughan, Town Clk., writes that the construction of water works, at a cost of $40,000, is under consideration. L. A. Woodbury, Chmn. Com.

Spencer, Mass.—The Town Clk. writes that about $9,000 will be expended for water meters. D. Bullard and A. G. Pease are Water Comrs.

Shelburne Falls, Mass.—G. W. Jenks, Town Clk., writes that a committee has been appointed to investigate and report on the construction of a gravity system of water works. J. W. Thurber, Chmn. Com.

Holyoke, Mass.—The House and Senate are stated to have passed the bill authorizing the Water Dept. to issue $50,000 bonds to build a high pressure reservoir at Ashley Pond.

Grand Rapids, Mich.—Bids are wanted May 27 for c. i. pipe, specials, valves and hydrants, as advertised in The Engineering Record.

Freeport, Minn.—Bids will be received June 6 by the Common Council for constructing water works. G. Harren, Village Recorder.

Duluth, Minn.—Bids will be received June 2 by the Common Council for furnishing material for improving the water works. Louis Larson, City Clk.

Eveleth, Minn.—Bids will be received June 2 by Louis Larson, City Clk., for improving the water works.

Dassell, Minn.—Bids will be received May 27 by J. W. Norgren, Recorder, for about 2,500 ft. of 6-in. c. i. pipe and 6 4-in. hydrants.

Laurel, Miss.—A press report states that bids are wanted for a $15,000 bond issue, for extension of water works.

Montevideo, Minn.—Water bonds amounting to $15,000 are reported sold.

Hattiesburg, Miss.—The citizens are stated to have voted to issue $20,000 bonds to sink an artesian well and extend the water works and sewerage system.

Kansas City, Mo.—The Lower House of Council on May 11 confirmed the contract with the Barr Pumping Engine Co. for a 25,000,000 gal. pump at Quindaro, to cost $85,000.

Bozeman, Mont.—The Bozeman Creek Reservoir Co. has withdrawn its call for bids until June 8 for constructing a storage reservoir dam at Mystic Lake, Gallatin Co., Mont. No bids will be received and no contracts awarded on that date.

Dillon, Mont.—Bids will be received by the City Council until June 10 for furnishing material and constructing water works. Doremus & Kelsey, Engrs., Salt Lake City, Utah; B. F. White, Mayor.

Bayonne, N. J.—M. T. Connelly, of Jersey City, is stated to have secured the contract for constructing the water main along west side of city, for $69,074.

Atlantic City, N. J.—Kenneth Allen, Engr. and Supt. Water Wks., writes that the following bids for installing a plant for pumping 3,000,000 gals. per day from 12 artesian wells were received by Water Comrs. May 12—*a*, Air Lift Plant; *b*, Impulse Wheel Plant: F. S. Talnter, Far Hills, N. J., *a*, $13,500; *b*, $11,000. Pneumatic Eng. Co., N. Y. City, *a*, $7,935 (awarded contract). Bacon Air Lift Co, N. Y. City, *a*, $12,875; *b*, $9,650. The Currie Co., of Atlantic City, N. J., secured the contract for 1,525 ft. vitrified pipe, 250 yds. of embankment and 1½ cu. yds. rubble, for $2,642.

Bridgeton, N. J.—The City Council is reported to be discussing the question of increasing the capacity of the water works, at a cost of $50,000.

So. Jamaica, L. I., N. Y.—Bids will be received June 4 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing and delivering 5 automatic filter controllers at the pumping station, Springfield; also 10 at the pumping station, So. Jamaica.

Roslyn, L. I., N. Y.—Monroe S. Wood, Town Clk., writes that the Nassau Water Co., of Glen Cove, has received the contract for the Port Washington water supply, 40 fire hydrants at $30 ea. per yr. (bids opened May 18). The bids for the Great Neck water supply (opened at the same time) not yet acted upon.

Long Island City, L. I., N. Y.—It is stated that $160,000 has been appropriated for an increased water supply; $60,000 will be applied for pumping stations and the remainder for laying new mains.

Schenectady, N. Y.—Bids will be received by the Water Comrs. until June 8 for furnishing and erecting a pumping engine and 2 tubular boilers at the Rotterdam Pumping Station; also for erecting an engine room, constructing a collecting gallery, erecting a stand-pipe and foundation for same, and laying a 36-in. c. i. or steel riveter force main, as advertised in The Engineering Record.

Yonkers, N. Y.—Bids will be received by the Bd. of Water Wks. Comrs. until June 4 for furnishing c. i. pipe, specials, reservoir, water gates, etc., as advertised in The Engineering Record.

Ilion, N. Y.—Bids will be received by the Bd. of Water Comrs. until June 9 for furnishing and constructing the following improvements to the water supply system: A covered filter bed, 45x200 ft.; an impounding reservoir of about 63,000,000 gals. capacity; a masonry intake on Hawke's Creek, and the connecting pipe lines, consisting approximately of 12,150 ft. of 6 to 12-in. pipe, including valves, specials, etc. A. N. Russell, Secy.

New York, N. Y.—Bids will be received June 2 by Robt. Grier Monroe, Comr. Water Supply, Gas and Electricity, for furnishing and delivering double and single nozzle "New York" case hydrants.

North Tonawanda, N. Y.—Bids are wanted June 15 for pipe laying, as advertised in The Engineering Record.

Lockport, N. Y.—The Council has adopted the recommendation of Com. on Fire and Water to secure bids at once for a water supply. Wm. M. Foltz, Chmn. Com. J. Frehsee, City Engr.

Saranac Lake, N. Y.—S. A. Miller, City Clk., writes that the citizens voted May 12 to issue $40,000 bonds to procure a water supply from McKenzie Pond.

Syracuse, N. Y.—By lease the county on May 11 secured from the city possession of the old water works reservoir at Onondaga Hill for the purpose of providing an adequate water supply for the County House and Hospital. A pipe line will be constructed.

Arcade, N. Y.—David W. McNair, Pres. Cattaraugus & Wyoming Water Co., is reported to be here with a view of enlarging and improving the works of the company. The company is also reported to be considering the advisability of piping water to Buffalo, a distance of about 30 miles.

White Plains, N. Y.—Bids will be received May 28 by the Bd. of Water Comrs. for removing 2 boilers at pumping station and furnishing and installing 2 80-H.-P. water-tube boilers, 125-lb. steam pressure, with all flue connections and all necessary instruments, etc. Andrew J. Mathews, Pres.

Wilson, N. C.—The citizens are stated to have voted May 5 to issue $40,000 bonds for paving streets and for the extension of water works.

Elizabeth City, N. C.—R. T. Whitehurst, Corporation Clk., writes that the citizens voted Apr. 13 to grant a franchise to the Baltimore Water Wks. & Sewerage Co.

Cleveland, O.—Local press reports state that one of the first improvements recommended by Bd. of Pub. Service will be the extension of the present West Side water works tunnel; estimated cost of work is $600,000.

Corvallis, Ore.—According to press reports the only bid received May 11 for a franchise for water works was from the present water company, which offered to put in a system to cost $20,000, the same being an extension of the present system, provided the city would contract to pay $36 per yr. for 27 fire hydrants, for a period of 25 yrs., and pay $8 per block for street sprinkling.

Portland, Ore.—E. E. Lytle, Benton Killin and J. Thorburn Ross have filed articles of incorporation of the Central Oregon Irrigation Co.; capital, $5,000,000. The company intends to acquire by purchase, location and appropriation, water rights in the counties of Crook, Klamath and Wasco; to enter into contracts with State of Ore. and United States for the purpose of reclaiming lands, and to acquire contracts from other persons or corporations, to reclaim arid lands, and construct a system of irrigation works, etc.

Philadelphia, Pa.—Bids will be received by the American Pipe Mfg. Co. May 28 for constructing a reservoir, as advertised in The Engineering Record.

Reading, Pa.—The ordinance authorizing the work of increasing the capacity of the Maidencreek pumping station was passed by Select Council May 11.

Columbia, S. C.—W. B. Smith Whaley, W. A. Clark, and others, of Columbia, have applied for a charter for the Manufacturers' Water Works Co., with a capital of $25,000. The company proposes to build water works for the mill district of Columbia, bringing the water by a pipe line from Lexington County, a distance of about 6 miles.

Armour, S. D.—Otto Sharon, City Clk., writes that it was voted May 14 to issue $10,000 bonds for water works.

Memphis, Tenn.—The Legislative Council on May 9 passed on final reading the ordinance to purchase the plant of the Artesian Water Co., and issue $3,500,000 of bonds therefor. Bids for the purchase of the first bond issue of $1,250,000 will now be received.

Ft. Bliss, Tex.—See "Government Work."

Elgin, Tex.—Bids are wanted May 27 for constructing water works. L. A. Sessums, City Secy.

Davis, Ind. Ter.—H. H. Helen is stated to have commenced surveying here for water works. The water is to be brought 5 miles from Arbuckle Mountains.

West Point, Va.—H. D. Robinson writes that bids will be received by Town Council July 1 for water works, to cost about $15,000. The town proposes to put in a standpipe or tank and have plugs along the streets.

Tacoma, Wash.—The City Council on May 6 passed an ordinance providing for an appropriation of $40,000 for improving city water works.

The following bids for drilling and casing 2 wells, including air compressors, motors, etc., were received by Comr. Pub. Wks. May 9—*a*, 2 units, 75 H.-P. ea., with twin compressor; *b*, 1, 150 H.-P., with twin compressor: P. H. Keith, of Tacoma, for Laidlaw-Dunn-Gordon Co., *a*, $14,600; *b*, $14,750. S. F. McConike, of Tacoma, for Ingersoll-Sergeant Drill Co., *a*, $14,875 (awarded contract); *b*, $14,475. N. W. Taylor, City Engr.

Welch, W. Va.—See "Power Plants, Gas and Electricity."

Milwaukee, Wis.—It is stated that about $8,000 will be expended by the State Bd. of Agriculture for water works at the State Fair grounds.

Shawano, Wis.—The Bd. of Pub. Wks. is stated to have recommended the construction of a standpipe to cost $5,000, and a new main sewer to cost $6,000.

Fennimore, Wis.—The Village Trus. are stated to have employed Geo. C. Morgan, of Chicago, Ill., to prepare plans for water works.

Barron, Wis.—Bids will be received June 1 by M. H. McKee, City Clk., for water main extension.

SEWERAGE AND SEWAGE DISPOSAL.

Prescott, Ariz.—See "Water."

Prescott, Ariz.—E. B. Moden, City Clk., writes that it is proposed to extend the sewerage system about 2½ miles, at a probable cost of $15,000. Vitrified or iron pipe to be used.

Pine Bluff, Ark.—Bids will be received June 10 by the Bd. of Dist. Comrs. for constructing sewers in Sewer Dist. No. 2. S. C. Alexander, Jr., Secy.

San Diego, Cal.—It is stated that bids are wanted June 22 for $140,000 bonds, said bonds to be used to pay for constructing a sewerage system.

Pueblo, Colo.—The J. M. O'Rourke Constr. Co., of Denver, is stated to have secured the contract for constructing the storm and sanitary sewerage system, for $335,889.

Belleville, Ill.—H. D. Wylie, Chicago, is reported to have prepared plans for a system of septic sewage disposal. The plans contemplate 4 septic tanks at different points; probable cost, $50,000.

Washington, Ind.—Chas. H. Bareford, of Washington, writes that a sanitary sewer system of about 25 miles, costing about $150,000, is to be constructed on the franchise plan. Money from bonds will be available on completion of system. He further states that he is desirous of hearing from contractors who can finance construction, or take their pay in bonds.

Indianapolis, Ind.—It is stated that bids are wanted May 25 for constructing 52,120 ft. of 10 to 22-in. pipe sewer and furnishing 188 manholes. Cost, $117,000. J. B. Nelson, City Engr.

Sioux City, Ia.—Bids are wanted May 26 for construction of storm sewers, costing about $18,000, consisting of 2,000 lin. ft. of 60-in. 2 ring brick sewer and 5,000 ft. of pipe sewer, from 12 to 24 inches in diameter. J. M. Lewis, City Engr.

Harlan, Ia.—Prof. Marston, of Ames, Ia., is reported to have been engaged to make a survey for a sewerage and drainage ayatem.

Webster City, Ia.—Bids are wanted June 15 for constructing a drain, consisting of 6,148 ft. 12, 14 and 16-in. tile. J. A. Berggren, Co. Aud.

Des Moines, Ia.—Local press reports state that Engrs. Fiske & Morley are preparing plans for a sewerage system for Bradway Heights.

Des Moines, Ia.—See "Government Work."

Lawrence, Kan.—See "Government Work."

Mayville, Ky.—It is reported that plans are about to be prepared for a sewerage system.

Shreveport, La.—The citizens are stated to have voted May 12 to issue $20,000 bonds for a storm water sewer in Allendale.

Fitchburg, Mass.—The City Council Com. is investigating methods of sewage disposal, but will not be ready to report for 2 or 3 months. David A. Hartwell is City Engr.

Scompscott, Mass.—Sewer bonds amounting to $60,000 are reported sold.

Bay City, Mich.—City Engr. Lewis is stated to have prepared plans for storm water sewers, to cost about $16,000.

Brainerd, Minn.—The Council is stated to have instructed the City Engr. to make a survey of city with the idea of establishing a general plan of sewerage.

St. Paul, Minn.—Bids will be received by the Bd. of Pub. Wks. until May 28 for constructing a sewer in a portion of Belvidere St. It. L. Gorman, Clk.

Hattiesburg, Miss.—See "Water."

Kansas City, Mo.—One of the most important sewer improvements planned by City Engr. Pike is transforming the open channel sewer from 22d St. and Grand Ave. to Turkey Creek into a closed sewer, at a cost of about $175,000. Another improvement contemplated is in the sewer which extends from 15th and Askew to Elmwood Cemetery and to Blue River.

St. Louis, Mo.—The Bd. of Pub. Improv. on May 14 is stated to have adopted ordinances providing for the establishment of the following sewer districts and for the construction of sewers therein: Rock Spring, No. 14, No. 15 and No. 13, and 9th St., No. 3.

Omaha, Neb.—Local press reports state that plans are being prepared in City Engr.'s office for the Saddle Creek sewer.

Cape May, N. J.—The Council on May 12 awarded contracts as follows: Boardwalk, brenstwork and beach drive, Deitrich & Bowser, for $135,000; Sewer Contract No. 1, Jos. H. Hanes, for $3,975; No. 2, Harry A. Miller, for $68,497; Nos. 3, 4 and 6, William H. Church, for $21,081, and No. 5, Deitrich & Bowser, for $8,335.

Hoboken, N. J.—The Council is stated to have decided to secure bids for $35,000 bonds, to be used to clean present sewers.

West Hoboken, N. J.—The West Hoboken Council and the Township Com. of Weehawken at a joint meeting at West Hoboken, May 13, to consider the advisability of constructing a joint trunk sewer for the relief of the 3d Ward of West Hoboken and the greater portion of Weehawken Heights, authorized Engrs. Sebastian Maulbeck and Geo. W. Bond to prepare maps and profiles and furnish the joint Bds. with an estimate of cost, and also apportionment of cost for each municipality.

Atlantic City, N. J.—F. Herbert Snow, of Boston, Mass., is reported to be in consultation with the Bd. of Health and the engineers of the Sewerage Co., Hill & Dickerson, in regard to improvements about to be made to the syatem.

Millburn, N. J.—Bids are wanted June 8 for building a sewerage system for Short Hills Dist. of Township of Millburn, as advertised in The Engineering Record.

Ridgefield Park, N. J.—Bids will be received by the Village Bd. of Trus. until June 1 for constructing sewers and drains along certain streets and roads. Carl Hallberg, Village Clk.

Bound Brook, N. J.—Bids will be received June 9 by the Mayor and Boro. Council for constructing about 2,700 lin. ft. pipe sewer, with manholes, etc. Fred. N. Voorhees, Boro. Clk.

Amityville, L. I., N. Y.—The Village Trus. are stated to have granted the Brunswick Home Assoc. a franchise for a private sewer system; probable cost of work is $10,000.

Albany, N. Y.—Gov. Odell is stated to have signed the bill providing for the appointment of a commission to investigate the proposed discharge of sewage from Passaic Valley in New Jersey into New York Bay.

Schenectady, N. Y.—Bids are wanted May 27 for $125,000 sewer and $60,000 deficiency and improvement bonds. J. H. Barnardi, City Treas.

Yonkers, N. Y.—The Council is reported to be considering the construction of a sewerage syatem for certain sections of 7th Ward.

Salem, N. C.—Engr. J. L. Ludlow, of Winston-Salem, is stated to have completed a survey for a new line of sewerage. Some paving work is also in contemplation. H. F. Shaffner, Chmn. Com.

Elizabeth City, N. C.—See "Water."

Ansonia, O.—Bids will be received by C. A. Ackerman, Village Clk., until June 4th for constructing approximately $6,000 worth of pipe sewers and appurtenances. Justin M. DeFord, Engr.

Cleveland, O.—The Council on May 11 passed ordinances providing for an issue of $500,000 bonds for the completion of the intercepting sewer system and $470,000 sewer bonds.

Cuyahoga Falls, O.—The City Council has decided to lay ont and establish a sewer system. The surveys, plans and estimates are being prepared by Hosea Paul, 206 Wilcox Bldg., Akron.

Jersey Shore, Pa.—The citizens are stated to have voted May 17 to sewer and pave the streets of the borough.

Altoona, Pa.—Bids are wanted May 29 for reconstructing portion of main sewer in 18th St., as advertised in The Engineering Record.

Stroudsburg, Pa.—The Council is stated to have decided to employ John L. Westbrook as engineer in charge of proposed sewerage construction; probable cost of work is $29,000.

Harrisburg, Pa.—Bids are wanted May 25 for constructing a 48-in. brick and 30-in. c. i. pipe sewer in portions of Seneca St. Chas. B. McConkey, Comr. of Highway Dept.

Woonsocket, R. I.—Bids are wanted June 1 for constructing sewers, as advertised in The Engineering Record.

Nashville, Tenn.—The lowest bid opened May 16 by the Bd. Pub. Wks. for a circular brick trunk sewer from Lick Branch sewer is stated to have been submitted by Jeff. Davis, for $9,768.

Austin, Tex.—The Council on May 8 rejected the bid for the Congress Ave. sewer, and will receive new bids for the work; probable cost, $19,000.

Ft. Bliss, Tex.—See "Government Work."

Tacoma, Wash.—The City Engr. is reported to be preparing plans for a new sewer district to drain the property in the vicinity of Trafton, Sprague and State Sts., from 6th Ave. to S. 12th St.

Shawano, Wis.—See "Water."

Cudahy, Wis.—It is stated that it is proposed to issue about $35,000 bonds for the construction of sewers.

BRIDGES.

Gadsden, Ala.—See "Railroads."

Oroville, Cal.—It is stated that bids are wanted by the Co. Comrs. until June 6 for constructing a steel bridge across west branch of Feather River. H. T. Batchelder, Co. Clk.

Alma, Cal.—Bids are wanted June 2 for constructing a rubble stone and concrete bridge over Los Gatos Creek at Alma. Henry A. Pfister, Clk. Co. Bd. of Superv., San Jose.

Washington, D. C.—Local press reports state that Geo. S. Morrison, of N. Y. City, will at once prepare detailed drawings and specifications for the Connecticut Ave. bridge, and that bids for constructing same will soon be asked by the Comrs. D. C.

Chicago, Ill.—Press reports state that the Illinois Central It. R. Co. has been requested to build a viaduct at Monroe St. H. U. Wallace, Ch. Engr., Chicago.

Peoria, Ill.—The Crescent Stone Co., according to local press reports, submitted the lowest bid for improving the upper free bridge, at $18,739.

Mt. Carmel, Ill.—Geo. A. King, Co. Clk., writes that the question of constructing a bridge over Wabash River is being agitated.

Mishawaka, Ind.—Bids will be received June 11 by the Bd. of Co. Comrs. for constructing a 375-ft. Melan arch steel and concrete bridge over St. Joseph River; bids will also be received for a 375-ft. plate girder bridge having either stone or concrete piers and abutments. John M. Brown, Co. Aud.

Covington, Ind.—Bids will be received June 5 by the Bd. of Co. Comrs. for constructing 4 small iron county bridges; also a 2-span iron bridge, each span to be 100 ft. in length. Geo. A. Law, Chmn.

Indianapolis, Ind.—The Bd. of Pub. Wks. has adopted plans for a concrete steel arch bridge across Pogue's Run.

Indianapolis, Ind.—See "Railroads."

South Bend, Ind.—The Co. Comrs. have employed A. J. Hammond to prepare plans and specifications for the Colfax Ave. bridge.

La Grange, Ind.—Bids will be received June 2 by V. D. Weaver, Co. Aud., for constructing an iron bridge over Plegon River.

Rushville, Ind.—It is stated that bids are wanted by the Co. Comrs. until June 10 for constructing steel superstructure and stone abutments for bridge across Lick Creek, Ansonia Township, and for bridge across Blue River, near Knightstown. Marquis L. Sisson, Chmn.

Vernon, Ind.—It is stated that bids are wanted by the Co. Comrs, until June 1 for constructing 2 steel bridges in Spencer Township. Harvey R. Weeks, Chmn.

Sedan, Kan.—It is stated that bids are wanted by the Co. Comrs. until May 29 for erecting stone abutments and retaining walls for 2 steel bridges. J. J. Crouse, Chmn.

Wichita, Kan.—The Co. Comrs. have appropriated $12,000 to build 2 street county bridges.

Cumberland, Md.—Co. Engr. W. H. Lefevre, Engr. Somerville, of Pittsburg, and Engr. J. P. Gaffney, of Cumberland, the committee appointed by the Co. Comrs. to examine the condition of the bridge across Potomac River from Cumberland and the bridge between Westernport and Piedmont, have reported as follows: The Cumberland bridge weak and dangerously unsafe, and one span of the Westernport bridge too weak for safety.

Cambridge, Mass.—Local press reports state that as soon as plans are ready, bids will be asked by the Comrs. for supplying the steel for bridges to be built at Cambridge and So. Boston.

Blackstone, Mass.—At a recent town meeting an appropriation of $10,000 was made for the building of a bridge at Central St., Millvale.

Worcester, Mass.—The building of a suspension bridge at Lake Quinsigamond is reported under consideration.

Taunton, Mass.—The replacing of the present Weir drawbridge with a $23,000 structure is reported to be under consideration.

Grand Rapids, Mich.—The date of receiving bids for a concrete or concrete-steel arch bridge at Bridge St. has been extended from May 15 to June 5, as advertised in The Engineering Record.

The Bd. of Superv. has authorized the Bridge Com. to receive bids for constructing the North Park bridge, cost not to exceed $30,000.

Battle Creek, Mich.—The Common Council has adopted a resolution directing the City Engr. to prepare plans and specifications for constructing a steel, cement or stone bridge across Battle Creek at Main St. W.

Three Rivers, Mich.—Bridge bonds amounting to $39,000 are reported to have been sold.

Fullerton, Neb.—The proposition voted upon May 6 to issue $75,000 bonds to build steel bridges across Loup River at Genoa, Fullerton and Palmer, is reported to have carried.

Somerville, N. J.—Joshua Doughty, Jr., Co. Engr., writes that bids will be received June 2 for the construction of a bridge over Green Brook at Girard Ave., to cost about $7,000.

Glens Falls, N. Y.—A bill has been signed by Governor Odell appropriating $5,000 for the construction of a bridge across Glens Falls feeder.

Canajoharie, N. Y.—The Rochester Bridge & Construction Co., of Rochester, is reported to have secured the contract to construct a bridge across Erie Canal at Canajoharie, for $19,542.

Niagara Falls, N. Y.—Local press reports state that the City and Railroad Officials are considering the building of a bridge at Pine St.

Syracuse, N. Y.—Governor Odell has signed a bill appropriating $9,500 toward the building of a bridge at Willow St.

Durhamville, N. Y.—The Governor has vetoed the bill appropriating $57,000 for a steel viaduct at Durhamville.

Sodus, N. Y.—Governor Odell has signed a bill providing an appropriation of $5,000 for remodeling the Sodus Bay bridge.

Cleveland, O.—C. A. Gallagher, of Newburg, Gen. Supt. Newburg & South Shore Ity. Co., writes that it is proposed to construct 4 bridges at Cleveland, at a cost of about $200,000, and the company is now ready to receive bids for same. Engineer, H. L. Shuler. (General offices of company are at Cleveland.)

Cincinnati, O.—Bids will be received June 13 by the Bd. Co. Comrs. for constructing substructure and approaches, also wrought iron truss bridge over East Fork of Taylor Creek, Green Township. Eugene L. Lewis, Co. Aud.

McKeesport, Pa.—Bids will be received May 27 by C. E. Soles, City Compt., for constructing a steel viaduct across White's Hollow.

Greensburg, Pa.—John H. Brown, Controller, writes that the contract for a steel bridge across Sewickley Creek (bids opened May 14) has been awarded to Nelson & Buchanan Co., of Pittsburg, for $11,985.

Scottsdale, Pa.—O. G. Chick, Clk. Co. Comrs., writes that the York Bridge Co., of York, has secured the contract for constructing a bridge near Scottsdale (bids opened Apr. 16).

Scranton, Pa.—The Select Council has passed a resolution to instruct the City Engr. to prepare plans and specifications for a $6,400 bridge at Ash St.

Mauch Chunk, Pa.—Bids will be received by the Bd. of Co. Comrs. until June 1 for constructing the substructure and superstructure of an iron bridge across Quakake Creek, Packer Township. S. W. Hofford, Clk. of Bd.

Nashville, Tenn.—Press reports state that the Louisville & Nashville Ry. Co. will expend $500,000 this summer on a new bridge and approaches at Red River near Adams Station on the Henderson Division.

Houston, Tex.—The Council has adopted the report of the Bd. of Pub. Wks. recommending the building of a bridge at Rusk St., which with the approaches, is estimated to cost $15,000.

Milwaukee, Wis.—A bill has passed the Senate authorizing Milwaukee Co. to construct a bridge at Grand Ave. over Menomonee Valley.

PAVING AND ROADMAKING.

San Francisco, Cal.—The building of a driveway along the shore of the Golden Gate, connecting the Presidio with the Ocean Boule. at the cliff, is being agitated.

Bridgeport, Conn.—Bids will soon be wanted for laying about 4,100 yds. of brick, wood or bituminous macadam pavement. H. G. Scofield, City Surveyor.

Denver, Colo.—Local press reports state that the bid of the Colorado Paving Co. for paving on 14th St., at $1.49 per sq. yd. (bids opened May 6), has been rejected, and new bids will be received immediately. There are about 18,743 sq. yds. to be paved.

Bridgeport, Conn.—Bids are wanted May 29 for about 4,100 sq. yds. brick, wood or bituminous macadam pavement, as advertised in The Engineering Record.

Pana, Ill.—It is stated that Engr. L. S. Ham estimates the cost of paving a portion of 3d St. at $21,312. The paving of 2d St., at a probable cost of $14,000, is reported to be under consideration.

Chicago, Ill.—Bids will be received May 27 by the Bd. of Local Improv. for grading, curbing and paving with asphalt, vitrified brick, granite block, etc., portions of numerous streets. Andrew M. Lynch, Pres.

Paris, Ill.—Thompson & Case, of Peoria, are reported to have received the contract to pave on a portion of W. Court St., at $25,964.

Chicago, Ill.—See "Electric Railways."

Glencoe, Ill.—The following bids were opened May 9 by the Bd. of Local Improv. for macadamizing 4 streets: Todd & Karrow, Chicago, $13,393; John A. McGarry & Co., Chicago, $14,445; Jas. Cape & Sons, Racine, Wis., $14,804; Dolese Bros. Co., Chicago, $14,884, and Jas. H. Roche, Chicago, $16,972. The detail bid of Todd & Karrow is as follows: For 10,650 sq. yds. macadam, 90 cts. per sq. yd.; 500 ft. 20-in. concrete gutter, 50 cts. per ft.; 7,000 cu. yds. excav., 30 cts. per cu. yd., and 9,330 ft. 4 to 12-in. drain, 20 cts. to 55 cts. per ft. Frank A. Windes, Village Engr.

Indianapolis, Ind.—Local press reports state that plans are being prepared for the proposed boulevard, and bids will soon be asked.

Versailles, Ind.—Bids will be received June 2 by the Co. Comrs. for constructing about 9 miles of macadam road in Center Township. John A. Spencer, Co. Aud.

Washington, Ind.—It is stated that steps are being taken to construct 22 miles of gravel road in Daviess Co. Address Co. Comrs.

Elwood, Ind.—Press reports state that bids will be received June 1 by Chas. M. Parsons, City Clk., for paving with vitrified brick roadways and sidewalks on portions of several streets.

Bluffton, Ind.—Press reports state that bids will be received June 1 by the Common Council for constructing cement walks, curbs, gutters and paving with bitulithic pavement and brick on portions of several streets.

Paoli, Ind.—Press reports state that bids will be received June 4 by the Bd. of Co. Comrs. for constructing the W. Baden and Huron road; length about 18,700 ft.

Vincennes, Ind.—J. D. Williams, Co. Aud., writes that the contracts for gravel roads (bids opened May 18) have been awarded to Chas. Ridgway, of Vincennes, for $30,801, and to Hicks Theobold .Co., of North Vernon, for $42,082.

Warsaw, Ind.—Bids will be received May 26 by Geo. W. Dresser, City Clk., for 23,516 sq. yds. brick and 11,373 sq. yds. sheet asphalt paving; also 8,163 lin. ft. vitrified curb. J. V. Godman, City Engr.

Princeton, Ind.—The Co. Comrs. are reported to have awarded the contract for constructing the Union Township gravel roads to Jos. E. Hart, of Vevay, Ind., at $64,500.

Mt. Vernon, Ind.—Press reports state that 26 miles of rock road are to be built in Harmony Township, at an estimated cost of $65,000., Contracts soon to be let by the Co. Comr.

Sioux City, Ia.—Bids are wanted May 26 for furnishing material for paving portions of Jackson St. with sheet asphaltum on a 4-in. Portland concrete foundation; approximately 42,000 sq. yds. L. L. Cathcart, Chmn. Paving Com.

Marshalltown, Ia.—Bids are wanted May 25 for 15,500 sq. yds. asphalt paving and 8,800 ft. of combined curb and gutter. Wm. Bremner, City Engr.

Somerset, Ky.—The Fiscal Court has appropriated $20,000 for constructing pike roads in Pulaski Co.

Augusta, Me.—The City Council has passed an order to purchase a steam road roller at a cost not to exceed $2,500. C. E. Purinton, Chmn. of Com.

Baltimore, Md.—The First Branch of the City Council has passed over the Mayor's veto the following ordinances: Appropriating $19,000 for repaving streets aronnd Union Sq. with asphalt blocks; appropriating $37,500 for repaving McCulloh St. from Lafayette Ave. to North Ave. with asphalt blocks; appropriating $25,700 for repaving North Ave. from Broadway to Washington St. with asphalt blocks; appropriating $4,600 for repaving Ensor St. from Harford Ave. to Chase St. with vitrified bricks.

Worcester, Mass.—F. A. McClure, City Engr., writes that it is proposed to replace the old pavement at bottom of Mill Brook sewer, with concrete in part, to cost about $25,000. Work to be done by Sewer Dept.

Pittsfield, Mass.—The Warren Bros. Co., of Boston, has secured the contract for about 13,000 yds. of bitulithic pavement on North and West Sts. About 27,000 yds. of asphalt will be let later on. A. A. Forbes, Engr. Bd. Pub. Wks.

Long Meadow, Mass.—Press reports state that the question of issuing $20,000 bonds for road improvements is being agitated.

Haverhill, Mass.—Bids will be received by the Com. on Streets, Sidewalks and Bridges until June 1 for furnishing 2,500 ft. of granite edgestones and 40,000 granite paving blocks. A. L. Gillen, Clk. of Com.

Boston, Mass.—The lowest bid opened on May 18 by Supt. of Sts. Jas. Donovan, for the construction of a telford macadam road between East Boston and Revere, a distance of 3,291 ft. and 100 ft. wide, was submitted by Coleman Bros., 70 Green St., for $39,055.

Lowell, Mass.—An order has been adopted by the Bd. of Aldermen providing for a loan of $28,000 for the widening, grading and macadamizing Varnum Ave., the macadamizing of Hale, Bellevue, Andrew and Fulton Sts.

Traverse City, Mich.—Bids are wanted June 5 for a brick pavement on 6th St., as advertised in The Engineering Record.

Detroit, Mich.—Local press reports state that it has been decided to pave with brick on River Road, a distance of abont 2 miles, at a probable cost of $40,000.

Sherman, Mich.—J. D. Criss, City Clk., writes that the citizens have voted to issue $5,000 bonds for street improvements.

Charlotte, Mich.—This city contemplates laying about 7,000 sq. yds. brick pavement during the present season. E. Shepherd is Mayor.

Lansing, Mich.—The Village Surv. has been authorized to prepare plans, specifications, etc., for improving portions of Clinton and Walker Aves. by grading, curbing and paving with vitrified brick on a concrete base. The cost has been roughly estimated at $17,528 for Clinton Ave., and $2,453 on Walker Ave.

Bay City, Mich.—City Engr. Thompson estimates the cost of paving with brick on a concrete foundation a portion of Washington St., at $46,137.

St. Paul, Minn.—The Barber Asphalt Paving Co. is reported to have secured the contract to pave with asphalt on University Ave. from Rice to Dale Sts. For detail bids, see the issue of The Engineering Record of May 9.

City Engr. Rundlett estimates the cost of paving on Maria Ave. from 7th to Cherry Sts., as follows: With brick, $20,310; with sandstone, $26,774, and with asphalt, $21,304. The St. Rys. portion for the 3 materials is $12,764, $16,112 and $13,403.

City Engr. Rundlett has submitted to the Bd. of Pub. Wks. the following estimates for paving on 3d St. from Sibley to the 7 corners: Brick, $29,166; sandstone, $41,562; asphalt, $32,027.

Local press reports state that bids will be received by the Bd. of Pub. Wks. for paving with brick on a portion of Mississippi St. at an estimated cost of $14,231; also for paving similarly on a portion of E. 7th St. at an estimated cost of $45,788.

Bids will be received by the Bd. of Pub. Wks. until May 28 for paving with brick on a portion of Mississippi and E. 7th Sts., estimated to cost $14,231 and $45,788, respectively. It. L. Gorman, Clk.

Duluth, Minn.—J. W. Preston is reported to have submitted the lowest bid for paving with sandstone on a portion of Michigan Ave., as follows: With sand filling, at $10,145, and with tar and gravel filling, at $10,734.

The City Council has adopted a resolution to purchase a portable tar macadam plant, having a daily capacity of 1,000 yds.

The cost of paving on Superior St. will be, according to local press reports, $27,626. Bids are to be received on all kinds of paving material.

Towson, Mo.—Bids will be received by the Bd. of Co. Comrs. until May 26 for improving Eastern Ave., requiring 10,000 sq. yds. of 8-in. macadam surfacing; probable cost, $9,000. W. W. Crosby, Co. Roads Engr.

Ashland, N. H.—The Robin Concrete Co., of Manchester, has secured the contract for a concrete roadway at Ashland, at $1.80 per sq. yd. for concrete roadway, 85 cts. per sq. yd. for paving, 35 cts. per cu. yd. for earth excav., and 25 cts. per ft. for drains. Engineer, A. W. Dudley, of Manchester.

Woodbury, N. J.—Press reports state that this town contemplates making $25,000 street improvements this season.

Jersey City, N. J.—C. H. Van Keuren, Ch. Engr. Bd. St. & Water Comrs., writes that the contract for grading, etc., the additions to Columbia Park, requiring in all about 32,900 sq. ft. cement walks (bids opened May 19) has been awarded to P. Tunnelty, Jr., Monmouth St., for $6,757.

Union, N. J.—Bids will be received June 1 by the Town Council for improving by curbing and paving with asphalt on portions of Morgan St.; also flagging sidewalks. Emil Bautz, Jr., Town Clk.

Camden, N. J.—The Co. Bd. of Freeholders is reported to have awarded the contract for building a stone road, from Haddon Heights to Mt. Ephraim, to J. R. Shanley, at $12,500.

Mt. Holly, N. J.—Bids will be received by the Co. Bd. of Freeholders until June 8 for constructing about 12 miles of macadam roads in Burlington Co. J. E. Darnell, Dir.

Newton, N. J.—Press reports state that all bids received recently for building 1½ miles of macadam road in Sussex Co. have been rejected, the lowest received being $12,000.

Camden, N. J.—Street repaving bonds, amounting to $75,000, are reported to have been sold.

Cape May, N. J.—See "Sewerage and Sewage Disposal."

New Brunswick, N. J.—The Co. Bd. of Freeholders has decided to macadamize about 9½ miles of county roads this year.

Belvidere, N. J.—Solomon Bros., of Morristown, N. J., are reported to have secured the contract to build 10½ miles of road in Warren Co. at $50,000.

Perth Amboy, N. J.—The report of the Municipal Com. of the Chamber of Commerce recommending the paving with asphalt on a portion of High St. has been adopted by the Bd. of Aldermen.

New York, N. Y.—Bids will be received May 28 by the Bd. of Park Comrs. for repairing asphalt roadway pavements in Boro. Manhattan; also constructing rock asphalt mastic walks adjacent to the new wing of the Metropolitan Museum of Art, Central Park, and the Soldiers' and Sailors' Monument in Riverside Park; also for laying and relaying asphalt walk pavements in Hamilton Fish Park. Wm. R. Willcox, Chmn.

Ithaca, N. Y.—Bids are wanted May 26 for paving with macadam and brick on portions of numerous streets. John Miller, City Clk.

Utica, N. Y.—The Council on May 15 passed a resolution to pave portions of Seneca and Hoyt Sts. Kind of pavement to be designated June 5th.

Yonkers, N. Y.—Governor Odell has signed a bill authorizing the issue of $50,000 bonds for the improvement of country streets and roads which have been in use for more than 20 years.

Rochester, N. Y.—The Rock Asphalt Pavement Co. is reported to have secured the contract to pave with asphalt on Chatham St., at $6,835.

Wm. Fuller is reported to have received the contract to pave with brick on a portion of S. Union St., at $21,261.

Buffalo, N. Y.—Bids will be received May 27 by the Bd. of Pub. Wks. for paving and repaving portions of 3 streets; also May 29, for repaving portions of 5 streets. Francis G. Ward, Comr.

New York, N. Y.—Bids will be received May 28 by the Bd. of Park Comrs. for furnishing and delivering a steam road roller for the New York Zoological Park, in Bronx Park. Wm. R. Willcox, Chmn.

Reports state that the Co. Bd. of Freeholders has adopted a resolution to expend $45,000 the coming year for macadam roads.

Sandy Hill, N. Y.—The proposition to issue $83,000 bonds to be used to pay the cost of paving on portions of Main, John and River Sts. and Park Pl., is reported to have carried at the election held May 2.

Bids are wanted May 28 for laying 30,000 yds. of brick pavement, including curb and excavation. Orson C. Richards, Engr.

Brooklyn, N. Y.—The Bd. of Estimate has authorized the grading and paving of a portion of Bleecker St. with granite blocks; also the regulating and grading of Morgan Ave., between Metropolitan and Meeker Aves., and of Morgan Ave., between Stagg St. and Metropolitan Ave., both at a cost of about $15,000.

Charlotte, N. C.—Street paving bonds amounting to $70,000 are reported to have been sold.

Wilson, N. C.—See "Water."

Greensboro, N. C.—Press reports state that the proposition to issue $300,000 county road bonds, carried at the election held May 12.

Salem, O.—Geo. D. Smith & Bro., according to local press reports, have secured the contracts for paving on portions of Highland Ave., Howard and New Garden Sts. and E. Bway., at a total cost of $62,452.

Tiffin, O.—The City Council is stated to have decided to pave Hall St.

Wauseon, O.—It is stated that bids are wanted June 12 for grading, draining and graveling several miles of roads. J. E. Morrell, Co. Aud.

Jersey Shore, Pa.—See "Sewerage and Sewage Disposal."

New Castle, Pa.—Contracts are reported to have been awarded as follows: To J. H. & M. E. Miller, for paving Shenango St., at $8,138, and to J. C. Devine & A. Parady for paving Cedar St. with asphalt, at $12,658.

Tyrone, Pa.—Bids are wanted June 1 for paving and curbing, as advertised in The Engineering Record.

West Chester, Pa.—The Boro. Council has adopted a resolution to borrow $9,000 bonds, with which to make street repairs.

Philadelphia, Pa.—A transfer bill has passed both branches of the Council appropriating $50,000 for the extension of the Torresdale Boule.

Conshohocken, Pa.—The Council, according to press reports, has passed an ordinance to borrow $100,000 for street improvements.

Wilkinsburg, Pa.—Frease & Sperling, Boro. Engrs., write that the following bids were opened May 5 for paving Penn Ave. with Ligonier block: J. H. McQuade, $22,826; Ott Bros., $18,810; Booth & Flinn, $18,121; Thos. Sweeney & Co., $18,101 (awarded contract). The detail bid of the successful bidders is as follows: For 5,900 sq. yds. block, $2.19 per yd.; 2,800 ft. curbing, 58 cts. per ft., and 8,500 cu. yds. grading, 40 cts. per cu. yd. Bidders all of Pittsburg.

Anderson, S. C.—O. H. Sheffield & Co., 518 Anstell Bldg., Atlanta, Ga., have been employed as engineers for the proposed street paving. About $30,000 will be expended. Plans and specifications will be ready about June 1st, and contracts will be let about June 15th.

San Antonio, Tex.—The Bexar Co. Good Road Assoc. has decided to ask the Co. Comrs. to appoint an engineer to prepare estimates on the construction of 17 of the main county roads radiating from the center of the city, a distance of 10 miles, the roads to be built 16 ft. wide, 12 in. thick and of good material.

Ft. Worth, Tex.—The paving with asphalt on a portion of Houston St. is reported to be under consideration.

Houston, Tex.—Bids are wanted June 15 for paving with brick, gravel or asphalt on a portion of McKinney St. F. L. Dormant, City Engr.

Bay City, Tex.—At the election held May 4 the proposition to issue $15,000 street improvement bonds, carried.

Ft. Monroe, Va.—See "Government Work."

Seattle, Wash.—The Council Com. on Streets has granted the petitions of the property owners of Queen Ann Hill for the improvement of Warren Ave., cost $4,500; 6th Ave., cost $26,200 and Queen Ann Ave., cost $29,800, by paving with bituminous macadam.

The City Engr. has submitted to the Bd. of Pub. Wks. the following estimates for street improvements: Concrete walks on portions of several streets, total cost $49,140, and for grading portions of numerous streets, cost $46,400.

Marinette, Wis.—The lowest bid received by the Bd. Pub. Wks. May 15 for paving 5 streets with macadam was submitted by John Striffler, of Marinette, for $25,886. His bid in detail was 70 cts. to 74 cts. per yd. for macadam; stone curbing, 50 cts. per yd.; concrete curbing and gutter, 65 cts. per yd., and brick gutters, $1.75 per yd.

Oshkosh, Wis.—The paving with asphalt on Algoma St., at an estimated cost of $60,000, is being considered.

Waukesha, Wis.—A. Dieman & Son are stated to have received the contract to pave on Wisconsin Ave., Williams St. and part of Arcadian Ave., at about $30,000.

Ashland, Wis.—It is stated that bids are wanted by the Bd. of Pub. Wks. until June 9 for paving with asphalt on portions of several streets. A. D. McDonald, Comr.

Winnipeg, Man.—The City Council contemplates paving with asphalt on a portion of Smith St., at an estimated cost of $10,920.

Toronto, Ont.—Bids will be received May 26 by Thos. Urquhart (Mayor), Chmn. Bd. of Control for constructing concrete sidewalks, brick, asphalt and wood block pavements; also macadam roadways on portions of numerous streets.

Park Hill, Ont.—Bids will be received June 1 by T. Alex. Mayburry for constructing 20,000 sq. ft. granolithic sidewalks.

POWER PLANTS, GAS AND ELECTRICITY.

Montgomery, Ala.—Local press reports state that Alex. Rice and associates will construct an electric light plant, to supply commercial lights in business district.

Geneva, Ala.—The town is about to petition the Legislature for permission to construct water works and an electric light plant.

Clayton, Ala.—Bids will be received until June 13 for $20,000 municipal electric light and water works bonds. J. J. Winn, Jr., City Clk.

San Francisco, Cal.—A press report states that the Stanley Electric Co., of Pittsfield, Mass., has secured the contract for machinery for the California Gas & Electric Co., contract reported to amount to $500,000. Consulting Engr. is G. E. Theberath, of San Francisco.

South Norwalk, Conn.—A. E. Winchester, Gen. Supt. Electric Wks., writes that the contract for constructing an electric light plant (bids opened May 12) has been awarded to Bellman & Sanford, 149 Bway., N. Y. City, N. Y., for $13,070. He further states that they are now in the market for 110 series enclosed arc lamps for direct-current street lighting, 5 amp., 70 to 75-volt; also that they have for sale a complete arc dynamo-engine unit of 1,100-H.-P. 2 60-light arc dynamos, and 100 open arc series lamps.

Sparks, Ga.—It is stated that R. A. Knights, of Adel, Ga., contemplates installing an electric light plant at this place.

Douglas, Ga.—It is stated that the Douglas Ice & Power Co. will install an electric light plant.

Galva, Ill.—The Chmn. of Lighting Comrs. is stated to have been instructed to correspond with Electrical Engrs. in regard to preparing plans and specifications and superintending the construction of an electric light plant.

Peoria, Ill.—The Council has granted the Citizens' Gas Co. a franchise for steam heat, hot water and power service.

Joliet, Ill.—According to local press reports the Drainage Bd. have prepared plans for the water power improvement between Joliet and Lockport; the cost of work, including material and labor, is estimated at about $4,000,000.

Taylorville, Ill.—The Taylorville Gas & Electric Co., of Taylorville, is reported incorporated, with a capital of $85,000, to operate a light, heat and power plant. Incorporators: D. D. Shumway and Thos. R. Johns.

Anderson, Ind.—It is stated that bids will probably be received June 1 for erecting a steam-heating plant for the Home Heating Co., cost not to exceed $20,000. E. R. Vincent, Indianapolis, Ind., is the Des. Engr.

Bluffton, Ind.—Robt. S. Ashe, of Richmond, is stated to have secured the contract for the construction of an arc and incandescent lighting system, for $31,748.

Michigan City, Ind.—The Michigan City & Northern Indiana Gas Light Co. has been incorporated, with a capital of $220,000, to supply gas in Michigan City and neighboring cities and to own and acquire rights and privileges and for the manufacture and distribution of gas. Incorporators: I. C. Elston, Jr.; R. C. Dawes, and others.

Davenport, Ia.—The Davenport Water Power Co. has been organized, with a capital of $10,000, to furnish water power to mills, factories and other plants using motive power. Incorporators: Chas. F. Francis, E. Hugo Schmidt and Geo. Mengel. It is understood that the company proposes utilizing a wing dam opposite Grand Isle for furnishing motive power for the manufactures along the Rockingham manufacturing district.

Keokuk, Ia.—Government Engineers, interested parties in Keokuk and elsewhere, are reported to be in Keokuk discussing the question of constructing a dam across Mississippi River, to cost, with other improvements, about $3,000,000.

New Orleans, La.—Bids will be received by V. Tujague, City Compt., until June 8 for constructing an electric lighting and power system for the city. W. J. Hardee, City Engr.

Hancock, Mich.—W. W. Mercer and others are stated to have petitioned for a franchise for a gas plant.

Lapeer, Mich.—The Council has passed an ordinance granting Jas. D. Butterfield and associates a franchise for a gas plant.

Grand Rapids, Mich.—The Bd. of Superv. is stated to have granted the Edison Electric Co. permission to construct a dam across Flat River in Vergennes Township.

Caledonia, Minn.—Bids will be received by Jerry Kenny, Village Recorder, for furnishing the following for an electric light plant: A 125-H.-P. engine; 2 boilers, 80-H.-P. each, and 2 dynamos, 40-Kw. each.

Duluth, Minn.—It is reported that the Great Northern Power Co. will erect a main power station and sub-stations in connection with its development of St. Louis River water power. Plans have been prepared by A. H. Albertson.

Fertile, Minn.—Bids are wanted June 1 for an electric light plant. Oscar Claussen, Engr., St. Paul.

St. Charles, Minn.—The citizens are stated to have voted May 12 to issue $10,000 bonds for an electric light plant.

Pascagoula, Miss.—See "Electric Railways."

Memphis, Mo.—The Memphis Electric Light, Heat & Power Co. has been incorporated to sell electric current, hot water and steam heat; capital, $10,000. Incorporators: A. E. Platter, Elias Scofield, and others.

Bozeman, Mont.—It is stated that bids will probably be received June 1 for constructing an electric light plant for the People's Electric Light & Power Co., to be located at Gallatin Valley. The plant is to be operated by water power, and is to have a capacity of 75-arc and 3,000 16-c.-p. incandescents. Estimated cost, $75,000. Address G. L. Hogan.

Hebron, Neb.—The Hebron Light, Power & Htg. Co. is reported incorporated, with a capital of $12,000, by C. M. Wetherald, C. L. Richards, and others.

Yardville, N. J.—The Yardville Electric Light, Heat & Power Co. is reported to be making arrangements to extend its system through Groveville.

Albany, N. Y.—Bids will be received until June 1 by the Bd. of Contract and Supply for a 50-year franchise for the construction of a brick or concrete conduit for the purpose of conveying heat by steam pipes from St. Agnes' School to the Cathedral of All Saints. Isidore Wachsman, Clk.

Binghamton, N. Y.—The Sun Vapor Street Light Co. has secured the contract for lighting the streets for 1 yr. at $22.40 for ea. naphtha lamp and $22.90 for ea. gas lamp.

Rochester, N. Y.—T. E. McGarr, Secy. State Comm. in Lunacy, writes that the following contracts have been awarded for electric work in Rochester State Hospital (bids opened May 6): Engines, generators, etc., to the Fred. Fish Co., Rochester, for $5,466, to include Watertown engines and Thompson-Ryan dynamos; switchboard, electric light wiring and fixtures, to F. L. Frost, of Albany, $8,775, and telephone and watchman's clock systems, to McDonell & Dumond, Rochester, at $1,292.

Middletown, N. Y.—It is reported that the Consumers' Gas Co. contemplate constructing a new gas plant, at a cost of $60,000.

Niagara Falls, N. Y.—A. C. Douglass, of Niagara Falls, is stated to have secured the contract for constructing a tunnel for the Toronto & Niagara Power Co. It will be 2,100 ft. in length, and is to be completed in 2 yrs.

Wellsville, O.—The Manufacturers' Gas Co., of Wellsville, has been incorporated; capital, $150,000. Directors: J. H. McEwen and L. H. Thornton, of Wellsville.

Put-in-Bay, O.—Russell K. Ramsey, of Saudusky, is stated to have secured a franchise for the construction of an electric light plant for Put-in-Bay.

Cleveland, O.—The Council on May 11 passed an ordinance providing for the issue of $200,000 bonds for the establishment of a municipal electric light plant.

Cuyahoga Falls, O.—P. Parker, of Cuyahoga Falls, is stated to have petitioned Council for a franchise to furnish natural gas to town.

Sumpter, Ore.—According to press reports, Randall H. Kemp, Local Mgr. of the Great Eastern Power & Light Co., announces that all plans of the company have been completed, and that preliminary work will commence immediately. The first electrical plant to be installed will be on John Day River, at the head of John Day Valley, and will generate 6,000-H.-P., which will be utilized immediately. The company has water-power rights capable of generating 23,000-H.-P. To utilize this power will involve the erection of plants at three separate points. Main office of company will be located here, with W. A. McNaughten Pres., and R. H. Kemp, Local Mgr.

Harrisburg, Pa.—The Harrisburg Light, Heat & Power Co. is stated to have secured the contract for lighting the city for 5 yrs., at $47 per 2,000 c. p. arc light per yr. The Paxtang Electric Co. bid $49.50 a yr. for a 5-yr. contract, and the United Electric Co., $64 per yr. for 5 yrs.

Jermyn, Pa.—H. A. Willman, Chmn. Light Com., writes that it is proposed to construct an electric light plant to cost from $12,000 to $15,000. C. F. Baker and C. A. Battenberg are also interested.

Masontown, Pa.—The Masontown Light, Heat & Power Co., of Masontown, has been incorporated with a capital of $10,000.

Johnstown, Pa.—Geo. Kreuger is stated to have secured the contract for the power house of the Consumers' Light, Heat & Power Co., for $25,000.

Bethlehem, Pa.—The Bethlehem Heat & Power Co., of Bethlehem, is reported incorporated with a capital of $10,000.

Pawtucket, R. I.—The Council is stated to have authorized the Com. on Street Lights to make a 5-yr. contract with the Pawtucket Electric Co. for lighting the streets and public buildings.

Bishopville, S. C.—Bids will be received by the Lee County Mfg. Co. May 27 for an electric light plant, to cost, including power, $6,500.

Chattanooga, Tenn.—Saml. Jenkins, of Chattanooga, is reported organizing a company, with a capital of $500,000, to build an electric-power plant for operating street railway, lighting city and furnishing manufacturing enterprises with power, etc., and for development of about 800 acres of coal lands on Walden's Ridge.

Madisonville, Tex.—It is reported that A. S. & H. J. Allen will soon begin the construction of an electric light plant at this place.

Lynchburg, Va.—It is reported that the Lynchburg Gas Co. has sold its plant to Southern Ry. and will expend $100,000 in new gas plant.

Tacoma, Wash.—The Snoqualmie Falls Power Co. is stated to have petitioned the Co. Comrs. for a franchise to extend its pole line and furnish electric current for light and power throughout the county.

Davenport, Wash.—Bids will be received June 6 by D. Cameron, City Aud., for a steam engine, boiler and dynamo for the water and light plant.

Welch, W. Va.—The Welch Water, Light & Power Co., now operating the water works and electric light plant in Welch, proposes during the coming summer to lay about 4,000 ft. of 4-in. and 6-in. water pipes, erect 12 fire hydrants, and install about 20 gate valves; also to double the capacity of its electric light plant by the addition of new boilers, engines, and generators; also introduce a new pump for its water works. The company will issue about $25,000 bonds to cover the above improvements. D. J. Howell, Mgr. & Treas., 605 12th St., N. W., Washington, D. C.

Grantsburg, Wis.—It is stated that bids will probably be received June 1 for erecting a village electric light plant, cost not to exceed $8,000. Oscar Clausen, Engr., St. Paul, Minn.

Waukesha, Wis.—The Waukesha Gas & Electric Co., of Waukesha, has been incorporated; capital, $100,000. Incorporators: T. W. Haight, H. M. Buck and F. H. Putney.

Fredericksion, N. B.—It is stated that bids are wanted June 1 for lighting the streets for a term of 10 years with 62 1,200-c.-p. arc lights. Chas. W. Beckwith, City Clk.

ELECTRIC RAILWAYS.

Fresno, Cal.—The Pacific Light & Power Co., of Los Angeles, has absorbed all the street railway companies of this city. They will be run under one management, and many improvements are contemplated.

Denver, Colo.—One of the plans of the Denver Tramway for the coming summer is to extend the South Bway. line 3 miles, so as to reach Littleton.

Victor, Colo.—The Council has ordered printed the ordinance granting right of way to the Colorado Springs & Cripple Creek Electric Ry. through the business streets.

Freeport, Ill.—The City Council has passed an ordinance granting a railway and lighting franchise for 20 yrs. to the Freeport Electric Co.

Des Moines, Ia.—The Western Iowa Interurban Ry. Co. has been formed to build an electric railway between Des Moines and Council Bluffs; capital, $1,000,000. Directors: H. H. Polk, of Des Moines; E. W. Weeks, of Guthrie Center; J. A. Nash, of Audubon, and others.

Glasgow, Ky.—K. T. Morris and E. B. Taylor, in company with an engineering corps, have begun surveying for electric railway from Glasgow to Burksville. The right of way has already been secured by the Glasgow, Burksville & Cumberland Valley Traction Co.

Shelburne Falls, Mass.—A bill has been passed by Legislature incorporating the Shelburne Falls & Ashfield St. Ry. Co.

Huntington, L. I., N. Y.—The Highway Comrs. have granted a franchise to Wilkins K. Putnam, of Brooklyn, for the construction of an electric railway across this town to connect Huntington and Amityville.

Dunkirk, N. Y.—The Buffalo, Dunkirk & Western Ry. Co. has secured a 99-yr. franchise to operate in Hanover. Franchises are yet to be secured in Westfield and Silver Creek.

Ballston Spa, N. Y.—The Ballston Terminal R. R. Co. has filed a certificate of extension of its proposed route in the Fulton County Clerk's office at Johnstown, showing the territory over which the road will pass between Ballston and Johnstown. The route is about 20 miles long.

Newburgh, N. Y.—The Intervale Traction Co. has completed a survey of its proposed road, and will apply at once to the R. R. Comrs. for an order of construction. The company will build from Newburgh to Goshen, via New Windsor, Valls Gate, Salisbury Mills, Washingtonville, Greycourt and Chester. Edw. R. Emerson, Pres.; W. Johnston McKay, Secy.

Buffalo, N. Y.—The Buffalo & Batavia Construction Co. has been incorporated to build an electric railway; capital, $10,000. Incorporators: Spencer Kellogg, Geo. L. Lewis and Stuart R. Mann, all of Buffalo.

Devils Lake, N. D.—A. B. Kerlin, of Devils Lake; F. B. Wood, of Minneapolis, Minn., and others, are to organize the Devils Lake Rapid Transit Co., with a capital of $50,000, to build an electric railway from Devils Lake to Chautauqua.

Baker City, Ore.—Major Bonta, representing an Eastern firm, has a party of engineers at work on the survey for an electric railway from Baker City to the John Day Valley.

West Masontown, Pa.—The West Masontown Ry. Co. has been incorporated, with a capital of $20,000, to build an electric railway between West Masontown and Masontown. Directors: W. I. Crawford, of New Castle; J. V. Hoover and L. G. Sterling, of Masontown.

Mauch Chunk, Pa.—Permission has been granted to Receiver Crilley, of the Mauch Chunk, Lehighton & Slatington St. Ry. Co. by Judge Trexler to build a power house at Lehighton, at a cost of about $11,000.

Newtown, Pa.—The Newtown St. Ry. Co. is preparing to greatly improve its line between Doylestown and Bristol, 27 miles.

RAILROADS.

Gadsden, Ala.—The engineers who have been surveying a line from Lock Three, on Coosa River, to Gadsden, Ala., for the Seaboard Air Line, have completed their work; total length of extension is 20 miles. A steel bridge will be constructed over river at Lock Three. W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.

Pueblo, Colo.—The Colorado, Oklahoma & Texas R. R. Co. is stated to have filed amended articles of incorporation providing for the extension of the proposed route to a total distance of 600 miles from Pueblo to Denison, Tex.

Denver, Colo.—The Denver & Rio Grande R. R. Co. (E. J. Yard, Ch. Engr., Denver) is stated to have awarded contracts for the construction of the first 25 miles of the Rio Grande & Southwestern R. R. to Deal Bros. & Mendenhall, of Springfield, Utah; contract reported to be about $750,000. The contract for 17 additional miles will be let at an early date.

Washington, D. C.—Drake & Stratton, of Philadelphia, Pa., are stated to have secured the contract for constructing the twin single-track tunnel extending from 6th St. and Virginia Ave., S. E., a distance of 2,500 ft. This is the first contract in connection with proposed removal of grade crossings and the erection of a union station by the Pennsylvania and the Baltimore & Ohio Railroads; total cost of work will be about $10,000,000.

Stillmore, Ga.—The Millen & Southwestern R. R. Co. will, it is stated, soon begin to build an extension of 23 miles from its present terminus at Stillmore to Vidalia, where it will secure connections with the Macon, Dublin and Savannah Road, and the Seaboard Air Line. Frank R. Durden, of Monte, Ga., is Gen. Mgr.

Indianapolis, Ind.—It is reported that the Indianapolis Southern Ry. Co. are about to receive bids for the grading, bridge building and trestle work on its new line. A number of tunnels will also be cut through rock, one of which will be 1,800 ft. long. D. M. Perry, Pres. Union Trust Bldg.

Shreveport, La.—The Shreveport & Red River Valley R. R. Co. was incorporated here May 9th under the name of the Louisiana Ry. & Navigation Co., with a capital of $12,000,000. Wm. Edenborn is named as Pres., and Clarence Ellerbe, Secy. The charter provides for the building of a line from Shreveport to New Orleans via Baton Rouge, and permits the building of the line to a point in La. on the gulf of Mexico, and for the construction of a line from Shreveport north along the western border of the State.

Minneapolis, Minn.—The Minneapolis, Superior, St. Paul & Winnipeg R. R. Co., with headquarters in Minneapolis, has been financed, and is now ready to complete the survey on preliminary lines already laid out. The new road will run from Minneapolis to the head of the Lakes and to Beaudette, a station on the Canadian Northern. The main line will be about 320 miles to Beaudette, the Superior division from Anoka will be 120 miles and sundry branch lines 60 miles; capital, $12,500,000. S. M. Hanley, Pres. E. C. Hollige, Ch. Engr.

Aberdeen, Miss.—Enos R. Stewart, of Selma, Ala.; Robt. R. Zell, of Birmingham, Ala., and others, are reported interested in the construction of the Tombigbee River R. R. from Aberdeen, Miss., via Columbus, Ga., and through the Tombigbee River Valley to Linden, Ala., to connect with the Louisville & Nashville. From Linden it is projected to go to Pensacola, Fla., with a branch line from Demopolis to Bessemer.

Schenectady, N. Y.—The Governor is stated to have approved the bill providing for an appropriation of $75,000 as the State's share of preliminary work for the abolition of grade crossings in Schenectady.

Nichols, N. Y.—The Nichols & Northern Pennsylvania R. R. Co. has been incorporated, with a capital of $40,000, by Caleb L. B. Tylee and Clinton N. Tylee, of Newark, N. Y.; Chas. M. Hyde, of Corning, and others, to build a short cut railroad from Nichols to Nicholson, Pa., via LeRaysville.

Buffalo, N. Y.—Governor Odell on May 12 signed the bill granting the Buffalo Grade-Crossing Comn. authority to contract with railroads for abolition of grade crossings on following streets: Bway., Bailey Ave., Niagara St. and Amherst and Austin Sts., where the N. Y. Central, Erie, Delaware, Lackawanna & Western and Grand Trunk railroads cross.

Cleveland, O.—The American Steel & Wire Co. is stated to have petitioned the city for permission to lay tracks and operate a railroad about 5 miles in length, connecting its furnaces on flats with mills in South End and Newburg.

Indiana, Pa.—It is reported that during the summer the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) will extend its line from the Cherry-tree, this county, by way of Flemming Summit to Twolick Creek.

Bishop, Pa.—A corps of engineers is stated to have commenced the final survey for the Wabash R. R. from Bishop to Canonsburg and Washington, from which point the road will extend into Greene County. Jos. Ramsey, Jr., Pres., St. Louis, Mo.

Somerset, Pa.—The Kimberly Run Coal Co., of Somerset, Pa., has secured a charter to construct a railroad from the mines to the Baltimore & Ohio R. R.

Latrobe, Pa.—D. F. Keenan and the Smith Construction Co., of Philadelphia, are stated to have secured the contract from the Pennsylvania R. R. for the construction of 7-mile change of line between Latrobe and Millwood; probable cost of work is $4,000,000.

Elizabethton, Tenn.—A charter is stated to have been granted to the East Tennessee R. R. Co. to operate a railroad from Elizabethton to head waters of Roan Creek.

Jackson, Tenn.—It is stated that the survey of the line of the Illinois Central R. R. from Jackson, Tenn., to Birmingham, via Sheffield, has been completed. H. U. Wallace, Ch. Engr., Chicago, Ill.

Valdez, Alaska Ter.—A charter has been granted to the Valdez, Copper River & Tanana R. R. Co. to construct a railroad from Valdez to Eagle City on Yukon River, a distance of 413 miles; capital, $5,000,000.

Tacoma, Wash.—It is reported that the Canadian Pacific Ry. Co. is preparing to build a 200-mile extension from the international boundary to Tacoma, and possibly to Portland, Ore. E. H. McHenry, Ch. Engr., Montreal, Que.

Charleston, W. Va.—The Kelley's Creek & Southwestern R. R. Co., Charleston, W. Va., has been incorporated to construct a railroad from mouth of Kelley's Creek to Sutton; capital, $100,000. Incorporators: F. M. Staunton, J. W. Dawson, and others, of Charleston.

Raleigh, W. Va.—The Flat Top R. R. Co., of Charleston, W. Va., has been incorporated to construct a railroad from Raleigh to Bramwell; capital, $10,000. Incorporators: Chas. E. Hawkins, Fairmont, W. Va.; G. O. Chilton, of Charleston, W. Va., and others.

Wharncliffe, W. Va.—The Tug Fork & Gilbert Creek R. R. Co., of Huntington, W. Va., has been incorporated to build a railroad from Wharncliffe to the mouth of Gilbert Creek; capital, $10,000. Incorporators: H. C. Duncan, Jr.; C. W. Campbell, and others, all of Huntington, W. Va.

St. Agatha, Que.—The promoters of the Montreal Northern Ry. Co. are stated to have concluded arrangements for the construction of a line to extend 50 miles from St. Agathe to Lachute.

PUBLIC BUILDINGS.

Florence, Ala.—It is stated that plans are being prepared for a Methodist Church to be erected here, at a cost of $20,000. Rev. S. E. Wasson, Pastor.

Los Angeles, Cal.—It is stated that bids are wanted by the Bd. of Superv. June 16 for erecting the brick and stone county hospital buildings. Wm. Moser, Archt.

Norwich, Conn.—Bids will be received May 28 by the Treas. Dept., Capitol, Hartford, for erecting a hospital for the Insane. Henry H. Gallup, Treas.

Washington, Ga.—L. Smith, Clk. Co. Comrs., writes that the contract for erecting a court house (bids opened May 12) has been awarded to Savannah Contracting Co., of Savannah, for $39,900.

Lincoln, Ill.—J. M. Deal, Archt., Lincoln, writes that the contract for erecting a court house (bids opened May 11) has been awarded to V. Jobs & Sons, of Peoria, for $131,000.

East St. Louis, Ill.—The Congregation of the Summit Ave. M. E. Church is stated to have had plans prepared for an edifice to be erected at 13th St. and Summit Ave.; probable cost, $45,000.

Lincoln, Ill.—Valentine Jobst & Son, of Peoria, are stated to have received the contract for erecting the court house here, for $131,000.

Connersville, Ind.—The Connersville Sanitorium Co. will erect a building here, to cost $25,000. Dirs.: C. J. Chambers and W. J. Porter.

Des Moines, Ia.—W. W. Witmer is having plans prepared for a 3-story armory, to cost $20,000.

Denison, Ia.—Bids will be received June 9 by M. J. Collins, Co. Aud., for erecting a courthouse. Geo. A. Berlinghof, Archt., Beatrice, Neb.

Oelwein, Ia.—Bids will be received May 27 by H. D. Wood, Chmn. of Bldg. Com., for erecting a church. Netcotte & Donnan, Archts., Independence.

Lawrence, Kan.—Geo. A. Berlinghoff, of Beatrice, Neb., is stated to have been selected to prepare plans for the Carnegie Library to be erected here, at a cost of $25,000.

Lexington, Ky.—Bids will be received May 29 by D. F. Frazee, care Phoenix Hotel, for installing electric wiring in the Kentucky Agricultural Experiment Station Building. F. Paul Anderson and John T. Taig, Consulting Engrs.

Augusta, Me.—Bids are wanted June 12 for fireproofing and refinishing the 3d and 4th floors of south wing of State Capitol, Augusta. Col. E. C. Stevens, Supt. Pub. Bldgs.

Lansing, Mich.—S. A. Commons, Clk. Bd. State Auditors, writes in regard to bids opened May 13 for heating Capitol that only one bid was received and was from A. A. & E. B. Piatt, for $8,000 per yr. Their present contract for heating the building is $6,000 per yr. for 2 yrs. ending June 30, 1903. The bid was rejected, and new bids will be received May 27.

Marshall, Mich.—The plans of Haug & Schurman, of Saginaw, are stated to have been accepted for the court house to be erected here; probable cost, $25,000.

Flint, Mich.—The plans of Clark & Munger, of Bay City, are stated to have been accepted for the Genesee County Court House; estimated cost, $100,000.

St. Louis, Mo.—Andrew Carnegie's gift of $1,000,000 for the erection of a $500,000 central library and $500,000 for branch libraries is stated to have been accepted by the Council.

Manchester, N. H.—Plans are stated to have been accepted for the 2-story, 192x102-ft. armory to be erected here, at a cost of $48,000.

Atlantic City, N. J.—The plans of Albert R. Ross, 156 5th Ave., New York City, are stated to have been accepted for the library to be erected here; estimated cost, $60,000.

New York, N. Y.—The following bids were opened May 15 by the Bd. of Estimate and Apportionment for materials and labor for completion of interior marble work in Hall of Records (bid *b* is an alternative, omitting certain marble): John Pierce, *a*, $355,295; *b*, $249,292. Robt. H. Reid & Co., *a*, $373,000; *b*, $271,000. Thos. Dwyer, 1st Ave. and 107th St., *a*, $249,907; *b*, $206,082.

Bids will be received June 1 by Homer Folks, Comr. Dept. of Pub. Charities, for furnishing material for erecting a gymnasium at the New York City Children's Hospitals and Schools, Randall's Island.

Bids will be received May 28 by the Bd. of Pub. Comrs. for furnishing material for plumbing and interior finish of 2 shower-bath rooms in the pavilion to be erected in the Wm. H. Seward Park. Wm. R. Willcox, Chmn.

Long Island City, L. I., N. Y.—The following bids were opened May 19 by F. V. Greene, Police Comr., for 75th Precinct Station House, 4th St., near Vernon Ave.: Jas. McFerran, $112,500; Geo. Hildebrand, $97,700; Murphy Bros., $94,500; Danl. J. Ryan, $92,000; Thos. B. Leahy, $88,943; Thos. G. Carlin, 215 Montague St., Brooklyn, $88,800.

Buffalo, N. Y.—Bids are wanted May 29 for erecting a municipal hospital with outbuildings on East Ferry St.; bids to be submitted separately for ventilating, heating, plumbing, gas fitting, electrical work, masonry, etc. Francis G. Ward, Comr. Dept. of Pub. Wks.

Brooklyn, N. Y.—It is stated that the Congregation of the Sixth Ave. M. E. Church has decided to erect an edifice at 8th St. and 6th Ave., at a cost of $60,000. Rev. Wellesley W. Bowdish, Pastor.

Long Island City, L. I., N. Y.—Walter G. Frey, Pres. Queens Boro Library, writes that no contracts were awarded May 19 for erecting the Carnegie Libraries at College Point, Astoria and Far Rockaway, as all bids were too high, lowest being $7,000 above the amount set aside for building.

Gloversville, N. Y.—The Governor is stated to have signed a bill providing for an appropriation of $50,000 for a State armory.

Yonkers, N. Y.—The Governor is stated to have signed a bill authorizing the issue of $250,000 bonds for a city hall.

Clinton, N. Y.—A bill is stated to have been signed by the Governor providing an appropriation of $49,000 for an addition to the hospital at Clinton Prison.

Sonyea, N. Y.—A bill is stated to have been signed by the Governor, providing an appropriation of $59,600 for improvements at the Craig Colony for Epileptics.

Brooklyn, N. Y.—The following bids were opened May 20 by J. Edw. Swanstrom, Boro. Pres., for repairs and alterations to rooms in Borough Hall: Thos. Dwyer, $59,224; Fuller & O'Connor, $55,600; John J. Cashman, $55,371; D. J. Ryan, $52,365.

Bids will be received June 9 by the Dept. Bd. of Health for furnishing material for erecting a boiler house and disinfecting plant at the Kingston Ave. hospital. Ernest J. Lederle, Pres.

Columbus, O.—Local press reports state that bids will be received June 9 by Richards, McCarty & Bulford, Archts., for remodeling 2 dormitories for the Denison Univ.; probable cost, $20,000.

Sandusky, O.—Press reports state that bids will be received until June 18 by Frank L. Packard, Archt., Columbus, for furnishing material and making alterations and additions to the sanitary appliances and also additions to buildings at the Ohio Sailors' and Soldiers' Home at Sandusky.

Lisbon, O.—Bids are wanted May 28 for furnishing material and erecting a village hall. Lodge Riddle, Village Clk.

Alliance, O.—Bids will be received May 29 by the Bd. of Educ. for furnishing material for erecting a Carnegie library on Arch Ave.; separate bids will be received on plumbing and heating. W. S. Epperson, Archt., 109 "Katy" Bldg., Sedalia, Mo. Geo. H. Judd, Clk. of Bd.

Providence, R. I.—Bids will be received June 3 by the Joint Standing Com. on City Property for erecting a fire station; separate bids must be submitted for gas piping, plumbing, steam heating and electric wiring. Jeremiah H. Hall, Chmn.

Charleston, S. C.—It is stated that the Congregation of the R. C. Church will erect an edifice, to cost about $30,000.

Beresford, S. D.—Bids are wanted May 30 for erecting a brick Catholic Church. Address Rev. Jas. McNalley, Pastor.

Olympia, Wash.—D. B. Garrison, Secy. Capitol Comn., writes that the following bids were opened May 12 for installing in Capitol an automatic system of heat regulation and force ventilation: F. E. Hautman Plumbing & Htg. Co., Seattle, $13,950 (awarded contract); C. J. Adams & Co., Seattle, $14,280, and McPherson, Miller & Co., Portland, $14,835.

Sydney, P. E. I.—It is stated that bids are wanted May 30 for erecting a brick and stone church. A. Matheson, Secy. Bd. of Trus.

BUSINESS BUILDINGS AND DWELLINGS.

Mobile, Ala.—Watkins & Johnson, 82 St. Francis St., are reported to have prepared plans for a store building and will receive bids until May 30.

Los Angeles, Cal.—It is reported that the contract for plumbing Hellman Blk., 4th and Spring Sts. (H. W. Hellman, owner) has been awarded to Thos. Haverty, Los Angeles, $31,500; electric wiring for same, to F. E. Newberry Co., St. Louis, Mo., $12,400; polished and cut granite work, Carl Leonard, Los Angeles, $48,000.

John P. Krempel, 415 Henne Blk., is reported to be preparing plans for a brick business building to be erected on San Fernando and Alameda Sts. for A. G. Hubbard.

San Francisco, Cal.—Albert Sutton, Safe Deposit Bldg., is reported to have prepared plans for a 4-story apartment house to be erected at Olive Ave. and Franklin St. for Miss E. D. Buckingham, at a cost of $80,000.

New Haven, Conn.—It is stated that the contract will soon be let for the erection of a 4-story brick addition to the Toof House on Wintbrop Ave. for the Home for the Aged; probable cost, $60,000. Brown & Von Beren, Archts., Exchange Bldg.

Washington, D. C.—York & Sawyer, 156 5th Ave., New York, N. Y., are reported to have been selected to prepare plans for a bank building for the American Security and Trust Co. at 15th St. and New York Ave.; probable cost, $150,000.

Chicago, Ill.—It is stated that S. D. Kimbark will erect a 12-story building at 151 Wabash Ave., to cost about $300,000.

Wabash, Ind.—The Odd Fellows of this city will soon let the contract for an opera house and lodge hall; probable cost, $40,000.

Frenchlick, Ind.—Plans are being prepared for an addition to the Frenchlick Hotel; estimated cost, $110,000. Thos. Taggart, Pres.

Des Moines, Ia.—Benson & Marxer have secured the contract for the new Chamberlain Hotel; cost, $200,000.

The Essex Blk. will be remodeled, at a cost of $20,000.

Atlanta, Ga.—Bruce & Morgan, Prudential Bldg., are receiving bids for the entire construction of a 15-story, 50x110-ft. building for the 4th National Bank. J. W. English, Pres.

North Adams, Mass.—It is stated that the Hoosac Valley St. Ry. Co. (W. T. Nary, Supt.) will erect a car barn on the site of the building destroyed recently by fire.

Boston, Mass.—A permit has been issued to the New England Real Estate Trust Co., for the erection of a 5-story building for stores and light manufacturing at 123-9 Washington St., N.; estimated cost, $70,000. Builder, Stephen H. Whidden, 43 Milk St. Architect, Winslow & Bigelow, 3 Hamilton Pl.

Plans have been filed for remodeling Hotel Clifton by adding stores and a rearrangement of interior, new plumbing, etc. Estimated cost, $50,000; builder, Jas. Fagan, 96 Hammond St. Architect, F. A. Norcross, 110 Tremont St.

St. Paul, Minn.—Frye & Jenkins are stated to be preparing plans for a 4-story apartment house to be erected at 6th and Summit Sts., at a cost of $50,000.

Meridian, Miss.—Krause & Hutchinson, of Meridian, are preparing plans for remodeling the 4-story store for L. H. Arkey; cost about $15,000.

Fairbury, Neb.—It is stated that the Harbine Bank Co. will erect an office building here, to cost $25,000.

Brooklyn, N. Y.—Geo. L. Morse, Eagle Bldg., is stated to be preparing plans for a 7-story, 50x92-ft. building to be erected at Remsen and Clinton Sts. for the Brooklyn Heights R. R. Co.

Albany, N. Y.—John Dyer, Jr., Tweddle Bldg., is stated to have received the contract for erecting the 8-story brick addition to the Ten Eyck Hotel; estimated cost, $100,000.

Petersburg, Va.—The plans of Thos. E. Radcliffe, of Petersburg, have been adopted for Elks' Home Bldg., to cost $18,000.

Richmond Va.—Noland & Baskerville, Chamber of Commerce Bldg., have prepared plans for an office building and apartment house for the Va. State Insurance Co. to be erected on Main and 5th Sts., to cost $50,000. Geo. L. Christian, Pres.

M. J. Dimmock, 1111 E. Main St., is completing plans for a $20,000 office building for the Presbyterian Comn. of Publication, to be erected at 6th and Grace Sts. Address Rev. Dr. A. L. Phillips.

Lynchburg, Va.—The Lynchburg Traction Co. (R. D. Apperson, Gen. Mgr.) will erect a car house, including a machine, repair and paint shop, in this city.

La Crosse, Wis.—A correspondent writes that bids will be opened 1st week in June for a hotel to be erected here, to cost $170,000. Architects, Handy & Cady, 172 Washington St., Chicago, Ill.

SCHOOLS.

Chicago, Ill.—It is stated that bids are wanted by the Bud. Mgr. of the Bd. of Educ. until May 29 for erecting an addition to Langland School. W. B. Mundle, Archt. of Bd.

Indianapolis, Ind.—J. L. Johnson, of Los Angeles, Cal., is stated to have given $65,000 to the Indiana Physico-Medical Assoc. for the erection of a college in this city.

Grinnell, Ia.—Bids will be received June 6 by the School Bd. for erecting a school in Sub-Dist. No. 1. J. W. Harpster, Secy.

Ames, Ia.—H. W. Schluetter, Marquette Bldg., Chicago, Ill., is stated to have received the contract for erecting the central building of the Iowa State College, for $262,000.

Burlington, Ia.—Bids will be received June 6 by Wm. W. Turpin, Secy. School Bd., for erecting an 8-room school.

Topeka, Kan.—There will be 4 schools and one 4-room addition to a school built this year. They will be of brick, and are estimated to cost $131,000. The Bd. of Educ. is offering 1½ per cent. for complete plans.

Galena, Kan.—Bids will be received June 8 by the Bd. of Educ. for $20,000 high school bonds. W. R. Elliott, Clk.

Amherst, Mass.—Plans have been completed by McKim, Mead & White, of New York, N. Y., for a brick and stone observatory for Mass. Agricultural College; cost, $35,000.

Boston, Mass.—The Daly Industrial School of this city is to erect a 3-story brick school, 140x40 ft., to be connected with its main building on Train St., Ward 24. Architects, Maginnis, Walsh & Sullivan, Boylston St. Builders, Kelly Bros., Haverhill, Mass.; estimated cost, $65,000.

St. Paul, Minn.—Bids are wanted June 6 for furnishing material for erecting an addition to the Baker school. O. E. Holman, Pres. Bd. of School Inspectors.

Mountain Lake, Minn.—It is stated that bids are June 5 for erecting a high school. A. Jansen, Secy.

Meridian, Miss.—J. W. Beeson is asking for bids for steam heating plant and private sewerage and electric light plant for his college about to be erected. Architects, Krause & Hutchinson, of Meridian.

Agricultural College, Miss.—Bids will be received May 29 by R. C. King, Secy. Miss. A. and M. College, P. O. Agricultural College, for improving brick dormitory. R. H. Hunt, Archt., Chattanooga, Tenn.

Dover, N. H.—The city of Dover is to erect a $55,000 high school. Plans to be in competition. A. G. Whittemore is Mayor.

Concord, N. H.—Perly F. Gilbert, of Lowell, Mass., has completed plans for a $50,000 addition to high school.

Weehawken, N. J.—Bids will be received May 27 by the Bd. of Educ. for erecting an addition to school No. 2, including heating, electrical work, plumbing, etc. Percie A. Vivarttas, Archt., Union Township. Arthur V. Briesen, Dist. Clk.

New York, N. Y.—Contracts for school work (bids opened May 18 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City) have been awarded as follows: For electric wiring, etc., in School 34, Boro of Bronx, O. K. Electrical Constr. Co., 725 Bway., for $3,140; for sanitary work in Long Island City High School, Boro of Queens, to Jas. Hailey, 288 Flatbush Ave., Brooklyn, for $18,438, and for installing, ventilating and heating apparatus in School No. 17, Boro of Brooklyn, to Frank Dobson, 218 E. 42d St., for $9,900.

Bids will be received June 1 by C. B. J. Snyder, Supt. of School Bldgs., for installing, ventilating and heating apparatus in school No. 34, Boro. Bronx and in school No. 24. Boro. Manhattan; also for sanitary work in school No. 24.

Brooklyn, N. Y.—Bids will be received June 1 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing, ventilating and heating apparatus in school No. 123.

College Hill, O.—Bids will be received June 4 by the Bd. of Educ. for erecting a 4-room school. E. H. Dornette, Archt., Cincinnati. Frank H. Simpson, Pres.

Newark, O.—Bids will be received June 6 by the Bd. of Educ. of McKean Township for erecting a school at Highwater. F. A. Carpenter, Clk.

Akron, O.—Bids will be received June 9 by the Bd. of Educ. for erecting the Fraunfelter School; separate bids will be received for plumbing, sewerage and gas fitting, also ventilating and heating. F. O. Weary, Archt., Rm. 54, Akron Savings Bank Bldg. A. E. Kling, Pres.

Cleveland, O.—Local press reports state that the time for receiving bids for erecting the Mill St. school has been extended to June 15. Address Bd. of Educ.

McKeesport, Pa.—Wm. M. McCord, of this city, is stated to have received the contract for erecting a 3-story brick building for the McKeesport Natatorium and Medical Inst.; estimated cost, $60,000.

Philadelphia, Pa.—The Council is stated to have passed the transfer bill providing $55,000 for the erection of the West End School at 6th and South Sts.

Cranston, R. I.—The School Com. is stated to have decided to purchase a site at Park and Pontiac Aves. for the erection of a school, to cost about $50,000.

Newberry, S. C.—It is stated that bids are wanted by the Bldg. Com. of Newberry College until June 1 for erecting the main building. F. P. Milburn, Archt., Columbia.

Aberdeen, S. D.—It is stated that bids are wanted May 27 for erecting a brick Normal school, 41x134 ft.; cost, $30,000. W. L. Dow & Son, Archts., Sioux Falls.

Cando, S. D.—Bids are wanted June 1 for erecting a school. Address S. C. Byer.

Beaumont, Tex.—It is stated that bids are wanted June 15 for erecting a 3-story brick and terra cotta school, 110x200 ft., to cost $65,000. A mechanical system of ventilation and steam heating is to be installed. G. Allen, Archt., Waco.

Brownwood, Tex.—It is stated that an addition will be erected to the Howard Payne College, at a cost of about $40,000. J. H. Grove, Pres.

Beloit, Wis.—Patton & Miller, 153 La Salle St., Chicago, Ill., is stated to have prepared plans for a gymnasium for Beloit College; probable cost, $40,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Hartford, Conn.—Edw. Balf Co. is stated to have secured the contract for the removal of ashes, rubbish and garbage for a term of 5 yrs., for a total of $179,135. The only other bid received on May 13 was from Hillis & Stafford, whose total bid was $184,100.

Washington, D. C.—W. Stutler, Supt. St. Cleaning Dept., writes in regard to street cleaning (bids opened May 1) that R. V. Rusk, 472 Louisiana Ave., N. W., secured the contract at the following figures: For machine sweeping or flushing paved streets, 16 13/16 cts. per 1,000 sq. yds.; cleaning public alleys, 35 cts. per 1,000 sq. yds.; cleaning unimproved streets, $64 per day for 32 men, 10 horses and carts with drivers. All contracts for 3 yrs.

St. Louis, Mo.—According to local press reports, members of Municipal Assembly are discussing preparation of ordinances to place garbage disposal entirely under control of the Bd. of Pub. Improv. The method to be used has not been decided upon. The present contract will soon expire.

East Orange, N. J.—Two bids were opened by City Council May 11, to perform scavenger work for 2 and 3 yrs. from Aug. 1st. John Finan, the present scavenger, asked $18,000 for a 2-yr. contract, and $27,000 for 3 yrs. Chas. E. Anen offered to do the work for $16,500 for 2 yrs., and $25,000 for 3 yrs.

Brooklyn, N. Y.—Bids will be received June 3 by John McG. Woodbury, Comr. of Street Cleaning, for furnishing and delivering 200 combination can and bag carriers.

New York, N. Y.—Bids will be received June 3 by Thos. Sturgis, Fire Comr., for furnishing and delivering ash and stable cans.

Bids will be received June 4 by John McG. Woodbury, Comr. of Street Cleaning, for furnishing material and labor required for removing snow and ice.

Troy, N. Y.—Bids will be received by the Bd. of Contract & Supply until May 26 giving the contract price per yr. for a period of 5 yrs. to receive and dispose of, by means of cremation or other efficient process, all the ashes, garbage, dead animals and refuse collected by the city scavengers. Jas. M. Riley, Clk.

Buffalo, N. Y.—Bids are wanted May 29 for the collection and removal of dirt, ashes, garbage and general refuse from buildings and dwellings, markets, streets and alleys for a period of 5 yrs., ending July 1, 1908. Bids are to be submitted separately, as follows: The price per net ton of 2,000 lbs. for garbage, and per cu. yd. for ashes and general refuse; price per month for the collection, also disposal, and for the collection and disposal of all garbage, ashes and refuse. Bids are also to be submitted for the sanitary disposal of garbage giving total cost for a period of 5 yrs.; also cost per yr. for a period of 5 yrs.; also cost per ton. Francis G. Ward, Comr. Pub. Wks.

Dayton, O.—The Bd. of Pub. Service is reported to be considering the question of constructing a garbage crematory.

Pittsburg, Pa.—Bids will be received by the Dept. of Pub. Safety until May 27 for furnishing and erecting a garbage furnace on the Municipal Hospital grounds, for the Bureau of Health. Harry Moore, Dir.

Spokane, Wash.—The Decarie Mfg. Co., of Minneapolis, Minn., is stated to have secured the contract for a garbage crematory for Spokane, at $22,500.

GOVERNMENT WORK.

Ft. Huachuca, Ariz. Ter.—Bids are wanted June 6 for constructing a gymnasium and post exchange building at this post. Address Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, Colo.

Ft. Baker, Cal.—Bids are wanted June 2 for constructing gymnasium and post exchange building at this post. C. P. Miller, Ch. Q. M.

Leadville, Colo.—Bids will be received June 25 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing (not including heating apparatus, electric wiring and conduits) U. S. Post Office at Leadville.

New London, Conn.—The following bids for dredging in New London harbor were opened May 15 by Maj. Chas. F. Powell, Corps Engrs., U. S. A., price given per cu. yd.: R. G. Packard & Co., New York, N. Y., 15 cts.; Emory R. Seward, New York, N. Y., 12.75 cts.; The International Constr. Co., New York, N. Y., 13.75 cts.; Morris & Cumings Dredging Co., New York, N. Y., 9.4 cts.; Virginia Dredging Co., Richmond, Va., 10.5 cts.; John P. Randerson, Albany, N. Y., 10.9 cts.

Hartford, Conn.—The following bids were opened at Washington, D. C., May 14 for constructing an extension to U. S. Custom House and Post Office at Hartford (not including heating apparatus and passenger elevator): Morrill & Wheaton Constr. Co., Boston, Mass., $234,900; Forsburg & Sons, Boston, Mass., $226,000; A. B. Stannard, New York, N. Y., $192,330; Richardson & Burgess, Washington, D. C., $199,257; Connors Bros., Lowell, Mass., $233,000; Curtis & Maloney, Springfield, Mass., $205,000.

Norwich, Conn.—The Prescott & Buckley Constr. Co., of Plattsburg, N. Y., is stated to have secured the contract for erecting the new post office for $73,887.

Rock Island, Ill.—Bids are wanted June 11 for furnishing sheet iron and steel, material for heating and lighting, etc., for the Rock Island Arsenal. Maj. S. E. Blunt, Commanding.

Boone, Ia.—Bids will be received June 18 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing, including plumbing, heating apparatus, electric wiring and conduits, U. S. Post Office at Boone.

Des Moines, Ia.—According to local press reports the following bids were opened by Maj. R. B. Turner, Q. M., U. S. A., May 15 for constructing a sewage purification plant at Ft. Des Moines: Iowa Eng. Co., Clinton, $24,900; Municipal Eng. Co., New York, N. Y., $16,730; O. P. Herrick, Des Moines, $19,750; Cameron Septic Co., Chicago, Ill., $9,500; W. M. Whitman, New York, N. Y., $10,000.

Lawrence, Kan.—Bids will be received June 12 by the Comrs. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing a tile drainage system and extending the sewer at Haskell Ins. For further information, apply to H. B. Peairs, Supt. of Ins.

Ft. McKinley, Me.—Capt. A. W. Yates, Q. M., U. S. A., Portland, Me., writes that the contract for a steel or stone wharf at Ft. McKinley (bids opened Apr. 13) has been awarded to Philip H. Doyen, of Knightsville, Me., for $22,853.

Capt. A. W. Yates, Q. M., U. S. A., Portland, writes that the contract for sidewalk, path construction, etc., at Ft. McKinley (bids opened Apr. 20) has been awarded to R. D. Shanahan, of Portland.

Bids are wanted June 6 for constructing telford road. Address Capt. A. W. Yates, Q. M., U. S. A., Portland.

Indianhead, Md.—Bids will be received May 26 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing material for constructing 2 brick houses at naval proving ground. A. S. Kenny, Paymaster-Gen., U. S. Navy.

Saugatuck, Mich.—Bids are wanted June 17 for constructing a pier at this place, as advertised in The Engineering Record.

Ft. Snelling, Minn.—Bids are wanted June 3 for constructing a gymnasium and post exchange building at this post. Geo. E. Pond, Ch. Q. M., St. Paul.

Albuquerque, N. M.—Bids will be received June 11 by the Comrs. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing a brick laundry, including plumbing, at the Albuquerque Indian School. For further information apply to A. O. Wright, Superv. in Charge.

New York, N. Y.—The following bids for dredging in (*a*) Hudson River and (*b*) Saugerties Harbor, N. Y., were received by Col. Amos Stickney, Corps Engrs., U. S. A., May 15, price given per cu. yd. scow meas.: Morris & Cumings Dredging Co., 17 State St., *a*, 34.9 cts. Newburgh Dredging Co., Newburgh, *a*, 25 cts.; *b*, 22.5 cts.

Cherokee, N. C.—J. L. Welshans, of Waynesville, N. C., has secured the contract for a steam-heating plant at Cherokee Indian School, for $1,897.

Portland, Ore.—The Northwest Constr. Co., of Astoria, is stated to have secured the contract for 150,000 tons of rock to be used in the extension of jetty at mouth of Columbia, for 91 cts. per ton.

Ft. Greble, R. I.—Capt. Thos. H. Slavens, Q. M., U. S. A., of Newport, writes that the contract for a 12-bed hospital at this post (bids opened Apr. 15) has been awarded to Chas. J. Souderman, 166 Spring St., Newport.

Rapid City, S. D.—Bids will be received June 10 by the Comrs. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material for constructing a brick employes' quarters, including plumbing and acetylene gas-piping; also an addition to a brick dormitory, including plumbing and gasoline gas-piping, at the Indian School, Rapid City. For further information apply to Sam D. Davis, Supt. of School.

Memphis, Tenn.—Geo. Moore & Son, of Nashville, are stated to have secured the contract for erecting the extension to post office, etc., at Memphis, for $197,400.

Ft. Bliss, Tex.—S. P. Brosius, Engr. in Office of Q. M., Washington, D. C., is stated to have prepared plans for water works and a sewerage system at this post.

Norfolk, Va.—Bids are wanted June 6 for constructing a 2-story brick and steel building for equipment at the Navy Yard, Norfolk. Limit of cost, $68,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Monroe, Va.—Bids are wanted June 2 for constructing paved roads, walk, concrete seawalls, grading, etc. Address C. P. Townsley, Q. M.

Ft. D. A. Russell, Wyo.—Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, writes that the following contracts have been awarded for buildings at Ft. D. A. Russell (bids opened Apr. 23): To Bradley & McGarvey, of Cheyenne, for workshops, Comrs.' quarters and gunshed, pumphouse, stables and barracks, and Lieuts.' Quarters, for $92,683; to W. O. Morrison, of Denver, Colo., for bakery, $6,600. Heating in the two d. s. Lieuts.' Quarters, one barrack, and putting in new boiler, etc., in pumphouse was awarded to Harris & Algor, of Philadelphia, Pa., for $8,088. Electric wiring was awarded to E. B. Hendrie, of Denver, Colo., for $1,815. The bids for plumbing were rejected, and new bids will be received June 23.

NEW INDUSTRIAL PLANTS.

The Wilson Laundry Machinery Co., Columbia, Pa., will erect a 50x200-ft. building with a 35x43-ft. ell and install a 100-H.-P. boiler, a 75-H.-P. Corliss engine and machine tools.

The Bukolt Mfg. Co., Stevens Point, Wis., will erect a 3-story, 40x60-ft. factory building, a 20x30-ft. engine room and a 2-story, 20x50-ft. storage house. The present power plant will be used for some time.

The Consolidated Paper & Bag Co., Elkhart, Ind., will at once rebuild the part of its mill recently burned.

T. H. Bunch, Little Rock, Ark., proposes to rebuild its plant, recently burned, erecting an elevator with fast-handling capacity and storage room of about 75,000 bu. It is also expected to erect a 300x50-ft. warehouse.

Ashley Horne, Clayton, N. C., is interested in the erection of a 40-ton, 2-press oil mill. Bids are wanted for machinery, including a 120-H.-P. boiler and a 100-H.-P. engine. A. J. Barbour, Pres.

E. P. Dismukes, Columbus, Ga., is considering the erection of a yarn and hosiery mill.

The River & Railroad Terminal Co., Pittsburg, Pa., expects to erect a large cold-storage plant in Pittsburg and a smaller one in McKeesport. G. W. C. Johnson, secretary and treasurer.

The Oxford, Miss., Oil Mill Co. is in the market for gears, pulleys, belts, oil tanks, cleaning machinery, electric power machinery, etc. Engines and boilers have been bought.

The Pendleton, S. C., Cotton Mills are being organized to erect a 3,000-spindle yarn mill. J. J. Sitton will be president and treasurer.

The Yankee Girl Knitting Co., Dover, N. J., will erect a 3-story, 100x48-ft. building. The power will be electricity.

Toch Bros., 468 W. Broadway, New York, paint makers, will erect a 3-story, 30x100-ft. fireproof building in Long Island City and make other alterations. Engines and boilers will be installed.

The Logan & Maphet Lumber Co., Knoxville, Tenn., has bought 9,000 acres in Campbell County and will install a circular sawmill of 25,000 to 30,000-ft. capacity and several smaller portable mills.

MISCELLANEOUS.

Springfield, Ill.—The House is stated to have passed the bill appropriating $142,000 for improvement and maintenance for 2 years of the Illinois and Michigan Canal.

Beardstown, Ill.—It is stated that bids will be received about July 10 for constructing levee and ditch, southwest of city, for Menodosia levee and drainage dists.; estimated cost, $32,000. Address Fred. J. Freunch.

Chicago, Ill.—The Governor is stated to have signed the bill conferring authority for a $1,000,000 bond issue by the town of Lake View for the purpose of reclaiming from the lake 215 acres as an addition to Lincoln Park, extending from Fullerton Ave. north to Cornelia St.

Boston, Mass.—It is stated that plans are being perfected by the State authorities for the construction of a dock in Boston Harbor. The dock will be an extension of Grand Junction docks in East Boston, and will stretch out for nearly a mile down the harbor; cost of docks and wharves estimated at $5,000,000.

Albany, N. Y.—The Governor has signed the bill appropriating $275,000 for extraordinary canal improvements and repairs.

New York, N. Y.—Bids will be received May 28 by the Bd. of Park Comrs. for furnishing material and erecting steel work for fences of antelope and elephant enclosures in New York Zoological Park, Boro. Bronx. Wm. R. Willcox, Chmn.

Bids will be received May 28 by the Bd. of Park Comrs. for furnishing material and constructing a parapet wall and piers along 5th Ave. in front of the Metropolitan Museum of Art. Wm. R. Willcox, Chmn.

Albany, N. Y.—The Governor is stated to have signed a bill appropriating $25,000 for the State Supt. of Pub. Wks., to be used for cleaning out Albany basin and dredging the channel.

Buffalo, N. Y.—Bids will be received by F. W. M. Heerwagen, City Compt., until May 28 for $383,824 grade crossing bonds.

Memphis, Tenn.—Ch. Engr. H. N. Pharr, of St. Francis Levee Bd., in his annual report recommends the construction of 40 miles of drainage canal back of levees, which will contain 800,000 cu. yds., and the removal of which will cost at least $100,000; construction of 17 miles of levee opposite the ft. of Cut Island; construction of the Walnut Bend levee, for which a special appropriation from Congress allotted the sum of $90,000, and the closing of the crevasse at Random Shot, and some other slight repairs and enlargement work to be done in the vicinity of Pecan Point.

Richmond, Va.—Bids are wanted June 2 for 2,000 ft. of 12-in. asphalt spiral riveted pipe and 30 rubber connections for same. W. E. Cutshaw, City Engr.

Montreal, Que.—A press report states that the Comrs. appointed to inquire into and report upon the most suitable form of dry dock for the Montreal district and the site best adapted for the purpose, have reported in favor of a permanent structure, built of concrete and masonry, to cost, with approaches, about $925,000, and suggested a site below the current of St. Mary's River.

BUSINESS NOTES.

The office of the Union Terminal Co. has been removed to 27 Pine St., New York. Tyndale Palmer, Vice-Pres. & Gen. Mgr.; Roy Stone, Chief Engr.; Lloyd E. Latta, Secy.

The Valentine Engineering Co., Philadelphia, informs us that the Eastern Steel Foundry Co. proposes to erect a steel foundry at Eddystone, Pa. The buildings will average about 500x250-ft., and the machine shop, 250x113 ft. The power plant will include three 200-H.-P. boilers, two 150-H.-P. engines, two 160-Kw., direct-connected generators, an underwriters' fire pump, two feed pumps, a hot water feeder, a 1,000 cu. ft. air compressor and air receiver. All the machinery to be installed in the power house has been contracted for.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Emery Estate, Cincinnati, O., two 200-H.-P. tandem compound self-oiling engines for direct-connection to Westinghouse generators, to be used in the Mercantile Library building; Douglas, Wyo., Electric Co., two 80-H.-P. direct-connected engines.

Recent orders received by the United States Wood Preserving Co., 29 Broadway, New York, for paving with creo-resinate wood block, include 10,000 sq. yds. of paving on several important thoroughfares in [illegible] as well as 2,000 yds. additional for a private contract in the same city; also paving five [illegible] for the City of Baltimore as well as the Metropolitan Ave. Bridge over Newtown Creek, Brooklyn, [illegible] ew Mattapan Bridge in Boston, and the Elm St. [illegible] ge in Waltham, Mass. The company has also [illegible] red contracts for paving streets in Jamestown, N. Y., and Hartford, Conn., as well as bridges in Lowell, Mass.; Rome, N. Y., and Utica, N. Y. The new ferry boats which the Erie R. R. Co. is now building will have their driveways paved with creo-resinate wood block.

The Duke of Marlborough has ordered two electric elevators with push-button control from the Otis Elevator Co., to be installed in his London home.

In a plant recently installed in the South by the Pneumatic Engineering Co., 128 Broadway, New York, the air-lift system pumps 9,000,000 gallons of water per day from four 10-in. wells.

The Toledo, Bowling Green & Southern Traction Co. has recently purchased from the Westinghouse Electric & Mfg. Co. a 250-Kw. rotary converter which will be used for supplying current to its lines. Power will be received in the form of alternating current from the Maumee Valley Electric Co., which is installing a 250-Kw. inverted Westinghouse rotary-converter for the purpose, together with three 100-Kw. raising transformers.

The Lunkenheimer Co., Cincinnati, O., manufacturer of brass and iron steam specialties, has recently placed with the Nernst Lamp Co. of Pittsburg, a large additional order for Nernst lamps of various sizes. The plant is now illuminated throughout by this make of lamp. The Nernst Company has agencies in every important city of New York, Pennsylvania, the New England and Atlantic Coast States, while additions have been made in Salt Lake City, Denver, Lincoln, Neb.; San Francisco, Los Angeles, Seattle, and generally throughout the Mississippi and Western States.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
May 25.	Condo, N. Dak., Adv. May 2 to 16	May 2
May 26.	Harriman, Tenn.	May 16
May 26.	Alva, Okla Ter.	May 9
May 27.	Dassel, Minn.	May 23
May 27.	Elgin, Tex.	May 23
May 27.	Pipe, etc., Grand Rapids, Mich. Adv. May 23.	May 23
May 27.	Chicago, Ill.	May 23
May 28.	White Plains, N. Y.	May 23
May 28.	Philadelphia, Pa., Adv. May 23	May 23
Jnn. 1.	Odell, Ill.	May 23
Jnn. 1.	Barron, Wis.	May 23
Jun. 1.	Gouverneur, N. Y.	May 2
Jun. 2.	New York, N. Y.	May 23
Jun. 2.	Duluth, Minn.	May 23
Jun. 2.	Eveleth, Minn.	May 23
Jun. 3.	Ft. Dodge, Kan.	May 23
Jun. 4.	Yonkers, N. Y., Adv. May 23	May 23
Jun. 4.	So. Jamaica, L. I., N. Y.	May 23
Jun. 6.	Freeport, Minn.	May 23
Jun. 6.	Washington, D. C., Adv. May 16, 23	May 16
Jun. 8.	Lancaster, Pa., Adv. May 16, 23	May 16
Jun. 8.	Schenectady, N. Y., Adv. May 23	May 23
Jnn. 9.	Ilion, N. Y.	May 23
Jun. 10.	Dillon, Mont., Adv. May 23	May 23
Jnn. 15.	North Tonawanda, N.Y., Adv. May 23.	May 23
Jnn. —	Pump, Niagara Falls, Ont.	May 9
Jul. 1.	West Point, Va.	May 23
	SEWERAGE AND SEWAGE DISPOSAL.	
May 25.	Harrisburg, Pa.	May 23
May 25.	Indianapolis, Ind.	May 23
May 26.	Sioux City, Ia.	May 23
May 26.	New York, N. Y.	May 16
May 27.	Sunderland, Mass.	May 16
May 27.	Brooklyn, N. Y.	May 16
May 28.	St. Paul, Minn.	May 23
May 29.	Altoona, Pa., Adv. May 23	May 23
May 29.	Aberdeen, S. D.	May 9
Jnn. 1.	Woonsocket, R. I., Adv. May 23	May 23
Jun. 1.	Lestershire, N. Y., Adv. May 16, 23	May 16
Jnn. 1.	Ridgefield Park, N. J.	May 23
Jun. 1.	Belfast, Me.	May 16
Jnn. 1.	Anderson, Ind.	May 16
Jun. 1.	Cuba, N. Y.	May 16
Jun. 4.	Ansonia, O., Adv. May 23	May 23
Jun. 4.	Boston, Mass., Adv. May 23	May 23
Jun. 6.	Washington, D. C. Adv. Apr. 25, May 9, 16.	Apr. 25
Jun. 8.	Milburn, N. J., Adv. May 23	May 23
Jnn. 9.	Bound Brook, N. J.	May 23
Jun. 10.	Pine Bluff, Ark.	May 23
Jun. 15.	Webster City, Ia.	May 23
Jnn. 15.	Burlington, Ia.	May 16
Jun. 20.	Washington D. C., Adv. May 16, 23	May 16
Jun. —	Ballard, Wash.	May 9
	BRIDGES.	
May 27.	McKeesport, Pa.	May 23
May 28.	New York, N. Y.	May 16
May 29.	Sedan, Kan.	May 23
May 29.	Fletcher, Ont.	May 23
May 30.	Alexandria, La.	May 23
May 30.	Chicago, Ill.	May 16
Jun. 1.	Manch Chunk, Pa.	May 23
Jun. 1.	Vernon, Ind.	May 23
Jun. 1.	Vicksburg, Miss.	May 16
Jnn. 1.	Gettysburg, Pa.	Apr. 25
Jnn. 2.	Alma, Cal.	May 23
Jnn. 2.	La Grange, Ind.	May 23
Jun. 2.	Somerville, N. J.	May 23
Jun. 2.	Quincy, Fla.	May 23
Jun. 2.	Niles, O.	May 16
Jun. 3.	Oak Ridge, La.	May 2
Jun. 3.	Livingston, Mont.	May 2
Jun. 4.	Ft. Benton, Mont.	May 9
Jun. 5.	Covington, Ind.	May 23
Jun. 5.	Grand Rapids, Mich., Adv. May 23	May 23
Jun. 6.	Oroville, Cal.	May 23
Jun. 10.	Terre Haute, Ind., Adv. May 16	May 16
Jun. 10.	Rushville, Ind.	May 23
Jun. 11.	Mishawaka, Ind.	May 23
Jun. 15.	Burlington, Ia.	May 16
Jun. 22.	Olivet, S. D.	May 16
Jnl. 10.	Castlewood, S. D.	May 2
	PAVING AND ROADMAKING.	
May 25.	Marshalltown, Ia.	May 23
May 25.	Elmira, N. Y., Adv. May 16, 23	May 16
May 25.	White Plains, N. Y.	May 16
May 26.	Warsaw, Ind.	May 23
May 26.—	Sioux City, Ia.	May 23
May 26.	Ithaca, N. Y.	May 23
May 26.	Towson, Md.	May 23
May 26.	Toronto, Ont.	May 23
May 27.	Buffalo, N. Y.	May 23
May 27.	Chicago, Ill.	May 23
May 28.	Road roller, New York, N. Y.	May 23
May 28.	New York, N. Y.	May 23
May 28.	St. Paul, Minn.	May 23
May 28.	Sandy Hill, N. Y.	May 23
May 28.	New York, N. Y.	May 16
May 28.	Salem, Ind.	May 9
May 29.	Buffalo, N. Y.	May 23
May 29.	Lorain, O.	May 9
Jnn. 1.	Anderson, Ind.	May 16
Jun. 1.	Union, N. J.	May 23
Jun. 1.	Tyrone, Pa., Adv. May 23	May 23
Jun. 1.	Augusta, Ga., Adv. May 16, 23	May 16
Jun. 1.	Haverhill, Mass.	May 23
Jun. 1.	Park Hill, Ont.	May 23
Jun. 1.	Bluffton, Ind.	May 23
Jun. 1.	Elwood, Ind.	May 23
Jun. 1.	Huntingburg, Ind.	May 9
Jun. 2.	Versailles, Ind.	May 23
Jun. 2.	Princeton, Ind.	May 16
Jun. 2.	Bluffton, Ind.	May 16
Jun. 2.	Bowling Green, O.	May 9
Jun. 4.	Paoli, Ind.	May 23
Jun. 5.	Traverse City, Mich., Adv. May 23	May 23
Jun. 8.	Mt. Holly, N. J.	May 23
Jun. 8.	Albany, N. Y., Adv. May 16	May 16
Jun. 9.	Ashland, Wis.	May 23
Jun. 10.	Bowling Green, O.	May 16
Jun. 11.	Newark, N. J., Adv. May 23	May 23
Jun. 11.	Seymour, Ind.	May 16
Jnn. 12.	Bridgeport, Conn., Adv. May 23	May 23
Jun. 12.	Wauseon, O.	May 23
Jun. 12.	Bloomington, Ind.	May 16
Jun. 15.	Anderson, S. C.	May 23
Jun. 15.	Houston, Tex.	May 23
Jun. 15.	Burlington, Ia.	May 16
	POWER, GAS AND ELECTRICITY.	
May 27.	Bishopville, S. C.	May 23
May 27.	Rochester, N. Y., Adv. May 16	May 16
Jnd. 1.	Fertile, Minn.	May 23
Jun. 1.	Corry, Pa., Adv. May 9 to 23	May 9
Jun. 1.	Anderson, Ind.	May 23
Jun. 1.	Grautsburg, Wis.	May 23
Jun. 1.	Bozeman, Mont.	May 23
Jnn. 1.	Fredericton, N. B.	May 23
Jun. 1.	Albany, N. Y.	May 23
Jun. 1.	Lebanon, Pa.	May 16
Jnn. 1.	San Diego, Cal., Adv. May 23	Apr. 18
Jun. 5.	Franchise, Wytheville, Va.	May 16
Jun. 6.	Davenport, Wash.	May 23
Jun. 8.	New Orleans, La.	May 23
Jun. 18.	Portland, Ore., Adv. Apr. 18 to May 2.	Apr. 18
Jun. 15.	Vernal, Utah	May 16
Jnn. —	Napoleon, O.	May 16
Jun. —	North Yamkill, Ore.	Apr. 4
Sep. 1.	Corona, Cal.	May 16
———	Caledonia, Minn.	May 23
	GOVERNMENT WORK.	
May 25.	Ft. Slocum, N. Y.	May 16
May 25.	Plattsburg Barracks, N. Y. Adv. May 9 to 23.	May 9
May 25.	Ft. Monroe, Va., Adv. May 9, 23	May 9
May 25.	Norfolk, Va., Adv. May 2, 16	May 2
May 25.	New York, N. Y. Adv. Apr. 25 to May 16.	Apr. 25
May 25.	Lockport, N. Y., Adv. Apr. 18, 25	Apr. 18
May 26.	Indianapolis, Ind.	May 23
May 26.	Washington, D. C.	May 16
May 26.	Baltimore, Md.	May 16
May 26.	Philadelphia, Pa.	May 16
May 26.	Des Moines, Ia.	May 2
May 26.	Boston, Mass. Adv. Apr. 25 to May 9, 23.	Apr. 25
May 27.	Cherokee, N. C.	May 16
May 27.	Rock Island, Ill., Adv. May 2 to 23	May 2
May 27.	Norfolk, Va., Adv. May 2, 16	May 2
May 28.	Ft. Banks, Mass.	May 9
May 28.	Chattanooga, Tenn., Adv. May 2 to 23.	May 2
May 28.	Ft. Wadsworth, N. Y.	May 2
May 28.	Tompkinsville, N. Y., Adv. May 2, 9	May 2
May 29.	Ft. Shaw, Mont.	May 16
May 29.	Philadelphia, Pa.	May 16
May 29.	Boston, Mass.	May 16
May 29.	Brunswick, Ga.	May 16
May 29.	Duluth, Minn., Adv. May 9 to 23	May 9
May 29.	Ft. Myer, Va., Adv. May 2 to 23	May 2
May 30.	Mobile, Ala.	May 9
Jun. 1.	Ft. Rosecrans, Cal.	May 16
Jun. 1.	Vancouver Barracks, Wash.	May 16
Jun. 1.	San Francisco, Cal.	May 16
Jnn. 1.	Ft. Logan, Colo.	May 9
Jnn. 1.	Montgomery, Ala.	May 2
Jun. 1.	Sitka, Alaska	Mar. 21
Jun. 2.	Ft. Monroe, Va.	May 23
Jun. 2.	Ft. Baker, Cal.	May 23
Jun. 2.	Springfield, S. D.	May 9
Jun. 3.	Ft. Snelling, Minn.	May 23
Jun. 3.	Phoenix, Ariz.	May 16
Jnn. 3.	Ft. Greble, R. I., Adv. May 16	May 16
Jun. 3.	Milwaukee, Wis., Adv. May 9 to 23	May 9
Jun. 3.	Springfield, Ill., Adv. May 2, 9	May 2
Jnn. 4.	San Francisco, Cal.	May 16
June 4.	Metal Work, Baltimore, Md. Adv. May 9.	May 9
Jun. 4.	Light House, Baltimore, Md. Adv. May 9.	May 9
Jun. 4.	Scranton, Pa.	May 2
Jun. 5.	Grand Rapids, Mich., Adv. May 9 to 23.	May 9
Jnn. 6.	Ft. Huachuca, Ariz. Ter.	May 23
Jun. 6.	Norfolk, Va.	May 23
Jnn. 6.	Ft. McKinley, Me.	May 23
Jnn. 6.	Ft. Mott, N. J.	May 16
Jun. 6.	Ft. Leavenworth, Kan. Adv. May 9 to 23.	May 9
Jun. 8.	Ft. Terry, N. Y., Adv. May 23	May 23
Jun. 8.	Ft. Ethan Allen, Vt., Adv. May 23	May 23
Jun. 8.	Cleveland, O., Adv. May 2, 9	May 2
Jnn. 8.	Portland, Ore.	May 2
Jnn. 8.	Sitka, Alaska	Apr. 25
Jun. 9.	St. Augustine, Fla., Adv. May 16, 23.	May 16
Jun. 9.	Htg. P. O., Paducah, Ky. Adv. May 9, 16.	May 9
Jnn. 10.	New York, N. Y., Adv. May 16, 23	May 16
Jnn. 10.	Rapid City, S. D.	May 23
Jnn. 10.	St. Paul, Minn.	May 2
Jun. 11.	Albuquerque, N. M.	May 23
Jun. 11.	Rock Island, Ill.	May 23
Jnn. 11.	Bldg. P. O., Paducah, Ky. Adv. May 9, 16.	May 9
Jnn. 12.	Lawrence, Kan.	May 23
Jnn. 12.	Philadelphia, Pa.	May 16
Jun. 15.	Norfolk, Va., Adv. May 23	May 23
Jun. 15.	Manila, P. I., Adv. Mar. 14 to May 9.	Mar. 14
Jun. 16.	Ft. Caswell, N. C., Adv. May 23	May 23
Jnn. 16.	Alexandria, Va., Adv. May 16	May 16
Jnn. 17.	Sangatuck, Mich., Adv. May 3	May 23
Jun. 18.	Boone, Ia.	May 23
Jun. 19.	Ft. Leavenworth, Kan., Adv. May 23.	May 23
Jun. 22	Stillwater, Minn., Adv. May 23	May 23
Jun. 22.	Baltimore, Md., Adv. May 23	May 23
Jnn. 22.	New Haven, Conn., Adv. May 23	May 23
Jun. 23.	Ft. D. A. Russell, Wyo.	May 23
Jun. 24.	Tompkinsville, N. Y., Adv. May 23	May 23
Jun. 25.	Leadville, Colo.	May 23
Jun. 30.	Philadelphia, Pa., Adv. May 16, 23	May 16
Jun. 30.	New Orleans, La., Adv. May 9, 16	May 9
	BUILDINGS.	
May 25.	Schools, New York, N. Y.	May 16
May 25.	Bldg., New York, N. Y.	May 16
May 27.	Htg. Capitol, Lansing, Mich.	May 23
May 27.	School, Aberdeen, S. D.	May 23

May 27.	School, Weehawken, N. J.	May 23
May 27.	Church, Oelwein, Ia.	May 23
May 27.	School, Grand Forks, N. D.	May 16
May 27.	School, Williamsport, Pa.	May 16
May 27.	Church, New Britain, Conn.	May 16
May 27.	Library, Cleveland, O.	May 9
May 28.	Hospital, Norwich, Conn.	May 23
May 28.	Hall, Lisbon, O.	May 23
May 28.	Pub. Bldg., New York, N. Y.	May 23
May 28.	Jail, Edmonton, Alberta, N. W. T.	May 16
May 28.	School, Poplar, Mont.	May 16
May 28.	School, Akron, O.	May 16
May 29.	Pub. Bldg., Lexington, Ky.	May 23
May 29.	Dormitory, Agricultural College, Miss.	May 23
May 29.	Hospital, Buffalo, N. Y.	May 23
May 29.	Library, Alliance, O.	May 23
May 29.	School, Chicago, Ill.	May 23
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Jun. 1.	College, Newberry, S. C.	May 23
Jun. 1.	School, New York, N. Y.	May 23
Jun. 1.	School, Brooklyn, N. Y.	May 23
Jun. 1.	Gymnasium, New York, N. Y.	May 23
Jun. 1.	Library, Waxachie, Tex.	May 16
Jun. 1.	Library, Cleveland, O.	May 16
Jun. 1.	City Hall, Mitchell, S. D.	May 16
Jun. 1.	Hospital, Brooklyn, N. Y.	May 16
Jun. 1.	Pub. Bldg., Dayton, O.	May 16
Jun. 1.	Jail, Monticello, Miss.	May 2
Jun. 1.	Church, Liberty, Ind.	Apr. 25
Jun. 2.	Library, Danville, Ill.	May 16
Jun. 2.	Pub. Bldg., Pueblo, Colo.	May 16
Jun. 2.	Court house, Hamburg, Ark.	May 16
Jun. 3.	Fire Station, Providence, R. I.	May 23
Jun. 4.	School, College Hill, O.	May 16
Jun. 5.	School, Mountain Lake, Minn.	May 23
Jun. 5.	Plans, Moscow, Idaho	May 2
Jun. 6.	School, Newark, O.	May 23
Jun. 6.	School, Burlington, Ia.	May 23
Jun. 6.	School, Grinnell, Ia.	May 23
Jun. 6.	School, St. Paul, Minn.	May 23
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jun. 9.	Court house, Denison, Ia.	May 23
Jun. 9.	Hospital, Brooklyn, N. Y.	May 23
Jun. 9.	School, Akron, O.	May 23
Jun. 9.	Dormitories, Columbus, O.	May 23
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Jun. 12.	Capitol, Augusta, Me.	May 23
Jul. 13.	Court House, La Grange, Ga.	May 9
Jun. 15.	School, Beaumont, Tex.	May 23
Jun. 15.	School, Cleveland, O.	May 23
Jun. 15.	School, Scotch Ridge, O.	May 16
Jun. 16.	Hospital, Los Angeles, Cal.	May 23
Jun. 16.	School, Bedford, Ind.	May 2
Jun. 18.	Pub. Bldg., Sandusky, O.	May 23
Jun. 22.	Fire Station, Houston, Tex.	May 16
Jun. —	Hotel, La Crosse, Wis.	May 23

MISCELLANEOUS.

May 25.	Dredging, etc., New York, N. Y.	May 16
May 26.	Garb. Disp., Troy, N. Y.	May 23
May 26.	Pier, New York, N. Y.	May 16
May 27.	Garb. furnace, Pittsburg, Pa.	May 23
May 27.	Levee, Terre Haute, Ind.	May 16
May 27.	Dredging, etc., New York, N. Y.	May 16
May 27.	Garb. Disp., Hoboken, N. J.	May 9
May 28.	Park Work, New York, N. Y.	May 23
May 28.	Wall and Piers, New York, N. Y.	May 23
May 29.	Garb. Disp., Buffalo, N. Y.	May 23
Jun. 1.	R. R. work, Whatcom, Wash.	May 16
Jun. 1.	El. Ry. franchise, Whittier, Cal.	May 9
Jun. 1.	El. Ry. franchise, Redwood City, Cal.	Apr. 18
Jun. 1.	El. Ry. franchise, San Mateo, Cal.	Apr. 25
Jun. 2.	Pipe, Richmond, Va., Adv. May 23.	May 23
Jun. 2.	R. R. Work, Columbus, O.	May 16
Jun. 3.	Garb. Disp., Brooklyn, N. Y.	May 23
Jun. 3.	Garb. Disp., New York, N. Y.	May 23
Jun. 4.	Snow Removal, New York, N. Y.	May 23
Jun. 9.	Ditch, Nevada, Ia.	May 16
Jul. 10.	Ditch, etc., Beardstown, Ill.	May 23
Jun. 12.	Garbage, St. Joseph, Mo.	May 16
May 2.	'04 R. R., Oodnadatta, So. Australia.	Feb. 21

PROPOSALS.

Notice to Contractors.

HIGHWAY IMPROVEMENT.

STATE OF NEW YORK, OFFICE OF THE STATE ENGINEER AND SURVEYOR, ALBANY, N. Y.

Pursuant to Chapter 115 of the Laws of 1898, sealed proposals will be received by the undersigned at his office in the State Hall, at Albany, N. Y., on Monday, the 8th day of June, 1903, at twelve o'clock noon, for the improvement of public highways, as follows:

No. 72—Catskill Road, Tompkins County, length 1.869 miles.

No. 126—Town Line Extension Road, Broome County, length 1.970 miles.

No. 127—Park Bridge Road, Broome County, length 2.040 miles.

No. 128—Aurora-Buffalo Road, Erie County, length 5.573 miles.

No. 129—River Road, Secs. 2-3, Erie County, length 3.015 miles.

No. 130—Main Street Road, Sec. 4, Erie County, length 5.625 miles.

No. 131—Main Street Road, Sec. 5, Erie County, length 6.581 miles.

No. 132—Genesee Turnpike, Onondaga County, length 1.130 miles.

No. 133—Little Falls-Dolgeville Road, Herkimer County, 2.290 miles.

No. 134—Fenton Road, Broome County, length, 2.170 miles.

No. 135—Violet Avenue Road, Dutchess County, length 3.290 miles.

No. 136—Windsor Road, Sec. 2, Clinton County, length 1.750 miles.

No. 137—Plattsburg-Keesville, Sec. 2, Clinton County, length 4.520 miles.

No. 138—Plattsburg-Mooers, Sec. 1, Clinton County, length 7.570 miles.

No. 139—Hamilton Bridge Road, Oneida County, length 1.290 miles.

No. 140—Seneca Turnpike, Oneida County, length 2.280 miles.

Sealed proposals will also be received by the undersigned at his office, in the State Hall at Albany, N. Y., on Wednesday, the 10th day of June, 1903, at twelve o'clock noon, for the improvement of public highways, as follows:

No. 141—Kingston-Ellenville, Sec. 3, Ulster County, length 6.820 miles.

No. 142—Saugerties-Woodstock, Sec. 3, Ulster County, length 2.850 miles.

No. 143—Echo Lake-Pine Bridge, Westchester County, length 3.140 miles.

No. 144.—Bedford-Cross River, Westchester County, length 5.230 miles.

No. 145—Delaware River Road, Delaware County, length 1 mile.

No. 146—Geneva-Canandaigua Road, Ontario County, length 5.624 miles.

No. 147—Burr's Mills Road, Jefferson County, length 3.920 miles.

No. 148—Pine Bridge-Yorkton Heights, Westchester County, length 3.490 miles.

No. 149—Yorktown Heights-Putnam County Line, Westchester Co., length 6.620 miles.

No. 150—Cross River-Turk Hill, Westchester County, length 3.460 miles.

No. 151—Turk Hill-Putnam County Line, Westchester County, length 5.520 miles.

No. 152—Fonda, East, Montgomery County, length 2.500 miles.

No. 153—Newburg-Campbell Hall, Orange County, length 13.380 miles.

No. 154—Chester-Valla Gate, Orange County, length 11.490 miles.

No. 155—Fonda, West, Montgomery County, length 2.500 miles.

No. 156—Chester-Goshen Road, Orange County, length 3.530 miles.

Plans and specifications for all of the above work may be seen at the office of the undersigned. They may also be seen for all roads in the counties of Herkimer, Dutchess, Clinton, Ulster, Westchester, Delaware, Montgomery and Orange, at the office of H. A. Van Alstyne, Division Engineer, State Hall, Albany, N. Y.; for the counties of Tompkins, Broome, Onondaga, Oneida and Jefferson, at the office of W. H. H. Gere, Division Engineer, Weighlock, Syracuse, N. Y.; for the counties of Erie and Ontario, at the office of A. J. Rockwood, Division Engineer, Triangle Building, Rochester, N. Y. Plans and specifications for the roads within each of the following counties may be seen at the office of the County Clerk of the County within which each road is located, respectively: Tompkins, Herkimer, Dutchess, Delaware, Montgomery and Jefferson, and at the office of the Clerk of the Board of Supervisors of the County within which each road is located, respectively: Broome, Erie, Onondaga, Clinton, Oneida, Ulster, Westchester, Ontario and Orange.

The attention of bidders is called to the fact that the following roads are in such close proximity to each other that they can be economically managed by the same contractor: Nos. 126, 127 and 134; Nos. 130 and 131; Nos. 139 and 140; Nos. 152 and 155; Nos. 143, 148 and 149; Nos. 144, 150 and 151.

Proposals must be made for the completion of each road for a lump sum in accordance with plans and specifications. Each proposal must be accompanied by New York draft or certified check, payable at sight to the order of the State Engineer and Surveyor for five per cent. of the proposal. Such draft or check will be held until the execution of the contract. The successful bidder must give a bond executed by a surety company approved by the undersigned and in amount not to be less than fifty per cent. of the contract price. Attention is called to the fact that ninety per cent. monthly payments will be made instead of seventy-five per cent., as formerly.

Proposals for each road must be presented in a separate sealed envelope endorsed on the outside with the number and name of the road for which the proposal is made.

Specifications, bidding sheets and form of contract may be had on application to the undersigned or to the Division Engineers above mentioned.

The right is reserved to reject any and all bids.

EDWARD A. BOND,
State Engineer and Surveyor.

May, 1903.

Electric Light Plant.

NOTICE OF BIDS FOR PLANS AND SPECIFICATIONS FOR AN ELECTRIC LIGHT PLANT FOR THE CITY OF SAN DIEGO, CAL.

SAN DIEGO, CAL.

In pursuance of Ordinance No. 1313 of the Ordinances of the City of San Diego, passed and approved on the 17th day of March, 1903, notice is hereby given that the Common Council of the City of San Diego, on the 1st day of June, 1903, will receive sealed proposals or bids for furnishing to the City of San Diego plans and specifications for an Electric Light Plant. Said bids shall be for the furnishing of plans and specifications for an electric light plant of sufficient capacity to supply the said City of San Diego, and the inhabitants thereof, with electric lights, including lighting of the streets and public places in said City with electric lights; that said plant shall be of such power and capacity as will furnish from 200 to 500 arc lights of two (2,000) thousand candle-power each, and the furnishing of sufficient light to the inhabitants of said city.

[Seal.] GEO. D. GOLDMAN,
City Clerk of said City.

U. S. ENGINEER OFFICE, 25 PEMBERton Sq., Boston, Mass., Apr. 23, 1903.—Sealed proposals for rock excavation in Boston Harbor, Mass., will be received here until noon, May 26, 1903, and then publicly opened. Information furnished on application. W. S. STANTON, Lt. Col., Engrs.

PROPOSALS.

Water Works.

DILLON, MONT., MAY 14TH, 1903.

Sealed proposals will be received by the City Council of the City of Dillon, Montana, until 2 o'clock P. M., June 10, 1903, for furnishing material and constructing a waterworks system for the City of Dillon.

Plans and specifications may be seen at the office of the City Clerk of the City of Dillon, Montana, or at the office of Doremus & Kelsey, Civil Engineers, Salt Lake City, Utah.

The right is reserved to reject any and all bids.

B. F. WHITE, Mayor.

Pipe Sewers.

ANSONIA, OHIO.

Sealed proposals, addressed to C. A. Ackerman, Village Clerk, Ansonia, Ohio, will be received up to 10 o'clock, Thursday, June 4th, 1903, for the construction of approximately six thousand dollars' worth of Pipe Sewers and appurtenances. Bids must be accompanied by a certified check of Five Hundred ($500) Dollars, on some National Bank in Greenville, Ohio, made payable to William Werts, Mayor, without conditions. Same to be forfeited as liquidated damages in case of failure of successful bidder to enter into contract and bond as required by the Village Council within ten days after notification of acceptance of bid.

The Council reserves the right to reject any or all bids.

Plans, profiles and specifications may be seen at the Village Clerk's Office on and after May 25, 1903.

WILLIAM WERTS, Mayor.
JUSTIN M. DeFORD, Engineer.

Commonwealth of Massachusetts.

METROPOLITAN SEWERAGE WORKS—NOTICE TO CONTRACTORS.

Sealed proposals will be received at the office of the Metropolitan Water and Sewerage Board, 1 Ashburton Place, Boston, Mass., until 2.30 P. M. of Thursday, June 4, 1903, for constructing parts of Section 44, Section 46, and force-mains and sewer in connection with Ward Street Pumping Station, being Section 76 of the High-Level Sewer, located respectively on Nut Island and Nut Island Bar, in Quincy, Hough's Neck, in Quincy, and in Roxbury, in accordance with the forms of contract and specifications to be furnished by the Board. All bids must be upon the blank forms furnished by the Board. Some particulars are estimated to be as follows:

Parts of Section 44: Length, 918 feet; inside diameter of sewer, 135 inches by 150 inches; masonry sand-catcher and screen-chamber; laying 570 feet of 60-inch cast-iron pipe.

Section 46: Length, 792 feet; inside diameter of sewer, 135 inches by 150 inches.

Section 76: Laying 3,060 feet of 48-inch cast-iron force-main, 20 feet of 78-inch by 84-inch sewer, and masonry bell-mouth in connection therewith.

Plans can be seen and specifications and forms of contract can be obtained at the above office, or at the office of the Engineering Department, Pemberton Building, Boston, Mass. The Board reserves the right to reject any or all bids. HENRY H. SPRAGUE, HENRY P. WALCOTT and JAMES A. BAILEY, Jr., Metropolitan Water and Sewerage Board. WILLIAM M. BROWN Engineer Sewerage Works. WILLIAM N. DAVENPORT, Secretary.

PROPOSALS.

Spiral Riveted Pipe, Rubber Connections.

RICHMOND, VA., MAY 19, 1903.

Sealed proposals will be received at this office until 5 P. M., Tuesday, June 2d, 1903, for the following articles:

Two thousand (2,000) feet 12-in. Asphalt Spiral Riveted Pipe.

30 rubber connections for same.

Full information to bidders can be had upon application at this office.

The Committee on Improvement of James River reserves the right to reject any and all bids offered and to award the contract as a whole or in separate parts.

W. E. CUTSHAW, City Engineer.

Notice to Road Builders.

Sealed proposals will be received by the Committee on Roads and Assessments of the Board of Chosen Freeholders of Essex County, New Jersey, for grading and paving with Telford pavement the following avenues and roads:

Grove Street, in the City of East Orange, Borough of Vailsburg, and Town of Irvington, extending from Central Ave., East Orange, to Clinton Ave., Irvington, a distance of about two miles.

Swamp Road, in the Townships of Caldwell and Livingston, extending from Bloomfield Ave., Caldwell, to Mt. Pleasant Ave., Livingston, a distance of about five miles.

Dutch Lane, in the Township of Caldwell, extending from Bloomfield Ave. to Fairfield Road, a distance of about two and two-thirds miles.

Ridgewood Ave., in the Borough of Glen Ridge, extending from Bay Ave. to Watchung Ave., a distance of about one and one-eighth miles.

Hobart's Gap Road, in the Townships of Livingston and Milburn, extending from Northfield Road, Livingston, to the Morris Turnpike, a distance of about four miles.

The proposals to be submitted to the Committee on Thursday, June 11th, at 11 A. M., at the office of the Committee, 196 Market St., Newark, N. J., and at no other time or place; each road to be bid for separately.

Each proposal to be accompanied with a certified check for one thousand ($1,000) dollars, as surety for the execution of the necessary contract, and is to be indorsed on the outside with the name of the bidder and the work proposed to be done.

Plans and specifications may be seen at the above office.

The committee reserve the right to reject any or all bids.

THOMAS McGOWAN, Director.

U. S. ENGINEER OFFICE, NEW LONdon, Conn., May 21, 1903.—Sealed proposals, in triplicate, for extending breakwater at New Haven, Conn., will be received here until 12 noon, June 22, 1903, and then publicly opened. Information on application. CHAS. F. POWELL, Maj., Engrs.

U. S. ENGINEER OFFICE, 812 ST. PAUL St., Baltimore, Md., May 21, 1903.—Sealed proposals for dredging in Patapsco River, Maryland, will be received until noon, June 22, 1903, and then opened. Specifications, blank forms and information furnished on application. CHAS. J. ALLEN, Lt. Col., Engrs.

Additional Proposal Advertisements are printed on pages 21, 22, 25, 26.

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NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of THE ENGINEERING RECORD by 10 A. M. Tuesday of the week of issue. New advertisements can be received up to noon of Wednesday of the week of issue.

Remittances should be made by check, New York draft or money order in favor of THE ENGINEERING RECORD. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company, London, or our London office.

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A Typical Modern Steel Plant.

It is rarely the good fortune of a metallurgical engineer to be retained in connection with a steel plant every portion of which can be laid out in the light of the latest experience and most satisfactory theories. Most steel works must be constructed around some existing plant, to the peculiarities of which it is necessary to make the designs conform, oftentimes to the disadvantage of the new works from an economical point of view. No such hindrances were in the way of the builders of the Lackawanna Steel Works at Buffalo, portions of which are now in operation. Here all the advantages of an admirable site, ample capital and a staff of ripe experience in steel making were combined with a sort of progressive conservatism on the part of the management which has resulted in a plant that may truly be termed typical of the latest features of steel making in this country and abroad. Accordingly The Engineering Record takes pride, which it trusts its readers will consider pardonable, in beginning on page 568 of this issue the first of a series of articles on this great industrial enterprise, about which so much has been said and so little is definitely known.

One fact will impress the reader strongly as he becomes acquainted with the features of the works, and that is the wide range of specialists whose labors have contributed indirectly to making the plant what it is. The power house is provided with blast-furnace-gas engines originally designed in Germany, but made in this country under the direction of a specialist in such machinery. The blowing engines and the electric generators were designed by the engineering staffs of firms which have made such apparatus a specialty. The coal and ore handling devices are the work of other specialists, and the same is true of the great pumping plant, the air compressors, the electric motors employed for running all the machine tools; in fact, throughout the plant the idea is everywhere forced upon an observer acquainted with some of the old steel works that here, in a truly modern steel plant, the problem of the designers has been to bring together in the best way for economical operation the various appliances suited for the purpose which a host of specialists have spent the best part of their lives in perfecting. In steel works still in operation, although dating from an early period of the industry, it will often be found that a large part of the plant was detailed by one or two men working for the owners on a salary basis. That the works they built have been so successful is a great tribute to their mechanical ability and foresight, but no one can desire that the conditions under which their work was done shall ever return. Such an industrial enterprise as that of the Lackawanna Steel Company represents engineering of a far higher order, and while wondering at the achievements of former days it will not do to overlook the practical advantages of present conditions, which enable the manager of such an establishment to obtain the best of everything without any bother about the details. He has enough to do in determining the broad outlines of such an enormous enterprise and in seeing that all construction progresses smoothly and harmoniously toward the desired end.

A study of these articles will prove again, what The Engineering Record has long emphasized in its editorial columns, that the engineer of to-day must devote a part of his time to a systematic study of the new devices which are being brought out by companies making a specialty of certain lines of machinery. The time is past when the designing engineer can wait until he has been retained for a given work before he investigates the latest productions of these manufacturers. Some of the younger members of the profession are inclined at first to regard with suspicion the information obtained from business houses, but as they gain experience they learn to modify this view and to lean more and more on the people whose whole success depends on being able to provide appliances for them that are better than they can secure of their own initiative.

The Conditions at the New Croton Dam.

Much interest of a somewhat intense sort has lately been aroused in New York City regarding the disclosures of the foundation bed on which will rests the new masonry portion of the new Croton dam designed to displace the embankment with core wall originally contemplated for the southerly end of the structure. It will be remembered that this core wall and embankment portion had been partially constructed when the committee of experts, consisting of Messrs. Elnathan Sweet, J. J. R. Croes and Edwin F. Smith, were appointed to consider the advisability of substituting masonry for the combination structure, and that they reported in favor of that procedure. Early this spring, when the removal of the embankment and core wall had sufficiently progressed to disclose the foundation bed of the latter, large quantities of disintegrated limestone were found. The consistency of this disintegrated material was reported to be that of light brown sugar. In other words the limestone had practically changed to sand in many places over considerable areas and to unknown depths in the bed rock.

Inasmuch as the new Croton reservoir formed by the dam will be urgently required in the immediate future for the water supply of New York City, and as the dam is probably the most prominent modern masonry structure of its class, the unexpected revelation of badly disintegrated rock under the southerly portion has centered upon the work an extraordinary amount of interest both on the part of civil engineers and the general public of New York City. As an incident of this sort is always apt to be exaggerated or even grossly mis-stated in the public prints, The Engineering Record has taken pains to secure accurate information before making editorial comment upon a matter of so much public and technical importance. It is the purpose in these comments to treat the actual conditions existing at the site of the dam without regard to any other consideration than those conditions. The events which led to the change of plans have already been set forth impartially and accurately in the past issues of this journal, and they need to be neither restated nor discussed at this time.

About 300 feet in length at southerly end of the new Croton dam was originally intended to be of embankment and core wall, the maximum height of core wall at its junction with the main masonry dam being about 150 feet. This is the portion recommended by the board of experts to be reconstructed in masonry. The removal of this partially constructed embankment and core wall has not yet been completed, but the disintegrated limestone already alluded to has been uncovered. The deepest portion of the core wall is still in place, and, hence, what will be disclosed by its removal cannot be definitely stated. It appears, however, as if the worst portion of the disintegrated rock is found at a higher elevation in the face of the hill at the southerly end of the dam and under a comparatively shallow part of the latter. Obviously no part of a masonry dam could properly be founded upon such material, especially if the dam must perform a duty so imperative to the safety and welfare of a great city as the new Croton dam. It is a simple matter to remove such soft material in order to reach solid and durable bed rock. That is a regular procedure and, indeed, it was followed with scrupulous care in preparing the foundation for this great masonry structure, as was described in the "Transactions" of the American Society of Civil Engineers for 1900 by Mr. Chas. S. Gowen, M. Am. Soc. C. E., in his paper, "The Foundations of the New Croton Dam." The removal of this disintegrated material will necessarily increase the cost of the new masonry work by increasing its volume, and, what is even more unfortunate, will defer the completion of the dam and the date at which the much-needed reservoir can be used. These features of the situation, however, cannot be avoided, and they must be accepted as inevitable results of the situation. The Aqueduct Commissioners should realize the necessity of hastening the completion of the work to the utmost of their power. To expedite the work is their imperative duty, the responsibilities of which are most pressing.

One of the gravest questions arising in connection with these disclosures is whether the disintegration of the limestone is an old one or whether it is now going on at a sensible rate. The answer to this question can doubtless be

made by the two eminent geologists whom the Aqueduct Commissioners have wisely called to their assistance. On the other hand, much unnecessary apprehension has been stirred up in the daily press in a sensational way by suggesting that the disintegration is of great depth and may extend under the main masonry work of the dam already in place. There is no ground whatever for such sensational statements. A perusal of Mr. Gowen's paper will show that the foundation of the main masonry structure was prepared with extraordinary care and that all possible precautions were taken to remove disintegrated material as well as to fill solidly with concrete every crevice or fissure found. It will obviously be necessary at the present time to satisfy public apprehension by actual examination of the bed rock across the entire valley immediately adjacent to the dam so as to set at rest absolutely any possible question as to complete stability of any part of the structure. There are methods of accomplishing this end neither very costly nor very time consuming. There need be no uneasiness on the part of the public as to the excellence or stability of the work when completed. Neither the construction of the new part of the dam nor the re-examination of the bed rock of the old involves operations of special difficulty or which are not well known in the foundation operations of civil engineers. It is only necessary to follow carefully and with due consideration of all the local features involved such procedures as are commonly employed in the larger foundation works of dams and other structures.

There are certain general features of engineering experience which ought also to be realized by the public much more thoroughly than is commonly the case. A civil engineer responsible for such a great work as this dam is confronted by most serious conditions on both hands; on the one he must attain complete security for the structure, and on the other he is expected to accomplish that result with the greatest possible economy. In foundation operations of magnitude he is frequently compelled to deal with the most obscure and complicated conditions which can ever confront an engineer. The discharge of such difficult duties sometimes requires a partial change of plans impossible to be anticipated by any human prevision. No one can intelligently contemplate the perplexities of these conditions without wondering why the disclosures made in the progress of great foundation works do not more frequently frustrate original plans.

The Pennsylvania Good Roads Law.

It is a rather interesting fact that, although the active agitation for a law giving aid to highway improvements in Pennsylvania was begun many years ago, it bore no fruit until this year. Other States which took up the subject at a later date have been enjoying the advantages of such laws for some years, yet definite action was deferred for a long time in Pennsylvania. The strength of the agitation was noteworthy, which made the delay in obtaining the desired results all the more surprising. Over twelve years ago a committee of Philadelphia gentlemen decided to call attention to the subject by offering a series of prizes for the best essays on road improvement, the first of $400, the second of $200 and the third of $100. This committee included such well-known men as George B. Roberts, Jay Cooke, Joseph Wharton, George W. Childs, A. J. Cassatt, John H. Converse, John Sellers, Jr., and John Lowber Welsh. A number of good papers were received, the first prize going to Mr. Henry Irwin of the engineering staff of the Canadian Pacific Railway. The essays were printed in a book, sold at a nominal price, and for some time the local press printed reviews and extracts from them which called attention to the subject. At a little later date the Engineers' Society of Western Pennsylvania took up the subject, and, by means of papers and discussions, showed conclusively the lack of adequate highways worthy of the name in the Pittsburg district. This society kept up the agitation at irregular intervals and must be credited with doing good missionary work. But for a long time the seed sown by these organizations and other interested parties fell on apparently barren soil. On the whole, it may have been just as well that this was so, for the State has had the advantage of numerous precedents and of accumulated experience elsewhere, in preparing its new law on the subject.

This law places the administration of all State highway matters in the hands of a commissioner appointed by the governor. The commissioner must be a "competent civil engineer experienced in the construction and management of improved roads," and he must give all his time to the work, for which he draws a salary of $3,500 a year. His staff consists of an assistant, who must possess the same qualifications as the commissioner, a chief clerk and a stenographer. His offices are located in the capitol at Harrisburg, and must be open at all reasonable times.

The initiative toward securing State aid must be taken by the commissioners of the county where it is desired. They take this step by preparing a description of the road which needs improvement, and submitting it with all the needful drawings to the commissioner. He investigates the matter, and if the project meets his approval he prepares a detailed report on the cost and proper methods of carrying out the work. This report is sent to the county commissioners and the highway officials of the townships in which the road lies. If these local authorities consider it advisable to go ahead with the improvement after receiving the commissioner's statement of the character of the work for which State aid will be given, then the project is adopted for execution as soon as the funds are forthcoming, two-thirds from the State appropriation and one-third from the county and the townships. The appropriation must be spent among the several counties in proportion to the length of township and county roads they contain, but if any county does not call within two years for the amount to its credit, the sum may be used elsewhere. Not less than a quarter of a mile of road can be built under State aid at any one place, and the roadway must be at least 12 feet wide.

The engineering features of the work are left in the hands of the commissioner, while construction will all be done by contract, any township having the privilege of bidding for the work within its boundary. One peculiar clause in the back part of the act leaves the selection of the material to be employed in the improvement of the road in the hands of the county commissioners, which is a dangerous power to leave with inexperienced men. The maintenance of the improved roads is entrusted to the township authorities, and the commissioner is allowed to give some financial assistance for this work where it is needed.

The appropriation which has been made for carrying out this act is $6,500,000, of which $500,000 is available in the present year, the same sum next year, $1,250,000 during the third year and the same sum the fourth year, and $1,500,000 during each of the last two years.

It will be seen from this very brief outline of the act that its purpose has apparently been to combine the good features of the Massachusetts, New Jersey and New York acts, and to avoid some of the sources of complaint against them. The organization of the department is based on that of New Jersey, but is more elaborate, and it will be interesting to see whether such an organization is ample for the State road work in a commonwealth of the size and diversity of topography of Pennsylvania. Only experience can settle this question. The experiment will be watched with interest from all over the country, and in some respects the results will be of the greatest value in assisting other States where laws for the same purpose are under discussion. It has long been asserted that the Massachusetts organization was too cumbersome, and that the New Jersey system was tried under conditions which made it impossible to predict its value for a larger State, while the New York system was adapted to the office of the State Engineer and Surveyor, but useless in a State without such a department already extant.

Notes and Comments.

An International Competition has been announced by the Austrian Minister of Commerce for designs for a ship lock with a lift of 35.9 meters for the Danube-Oder canal. The boats to be handled are assumed to have maximum dimensions of 67 meters length, 8.2 meters beam and 1.8 meters draft. The designs must provide for thirty lockages in each direction in twenty-four hours. Prizes of 100,000, 75,000 and 50,000 crowns are offered. The competition closes on March 31, 1904.

Water Waste has reached such a serious stage in Chicago that the Chief of Police has issued orders for the arrest of all persons found violating the ordinance which restricts lawn sprinkling to a couple of hours early in the morning and four in the evening. The loss of pressure in apartment houses in some parts of the city is causing the tenants much inconvenience and the landlords considerable worry, for they cannot expect to rent quarters without a good water supply. The city engineer is blamed for much of the trouble, and he admits that the situation is serious. In his opinion the remedy to be applied first is to check the waste, in which view he deserves the approval of all. By the immediate introduction of meters on all properties where persistent waste is detected, by the investigation of the condition of the street mains, which will often reveal great losses of water through causes that would not be revealed without such a search, and by arousing a general appreciation of the dangers attending a shortage of water, the authorities can reduce the losses without having to recommend the introduction of a universal meter system, which will probably be impossible in Chicago at present, even if it should be desirable.

An Ancient Bridge, at Binghamton, N. Y., succumbed on May 20, to the combined effects of progressive corrosion and heavy overloading, and dropped an electric car and its crew and six passengers into the icy waters below. The structure had outlived its usefulness by many years, and had entered upon that dangerous period of a bridge's existence during which it carries without a tremor the heaviest class of loads and then falls under a comparatively light weight. A few days before the accident, a heavy engine and a Hayes truck had passed over it at a gallop on their way to a fire, imposing a much greater strain than that due to the electric car which finally brought it

down. City Engineer S. E. Monroe reported a year ago that the bridge was dangerous and should be replaced immediately.

The East Pittsburg works of the Westinghouse Electric and Manufacturing Company are now available and is expected to increase the furnish a floor space equal to two-thirds of that now available and is expected to increase the company's capacity 50 per cent. The construction of this large addition is a particularly interesting indication of the state of the electrical industry, because it was only two years ago that the same works had their space doubled. About that time the company's capital stock was increased from $15,000,000 to $25,000.000 and $3,000,000 of the additional shares were issued. It is now proposed to issue $4,500,000 more shares to provide additional working capital and meet the expenditures for the addition to the company's plant. In the circular of President Westinghouse announcing the stock issue, he states that the net earnings from manufacturing operations during the last year, including those of subsidiary companies, exceed 20 per cent. on the outstanding shares.

The Municipal Electric Lighting Plant which Mr. Robert G. Monroe, commissioner of water supply, gas and electricity of New York, has been trying in vain to receive authority to construct, is the subject of a recent report by Dr. Cary T. Hutchinson. He states that in the Boroughs of Manhattan and the Bronx there are now in public service 5,000 arc lights and the equivalent of 160,000 incandescent lamps of 16 candle power. The number of arc lights ought to be doubled, he states, and in estimating the cost of a new plant he provides for such an increased capacity. He concludes that the cost of such a service from a municipal station, such as he recommends, would be practically half of the present charges. In arriving at his figures he makes no allowance for "lost taxes," and his estimates "are based on the assumption of economical construction on a cash basis and of competent and economical management." As these assumptions are at the bottom of much of the controversy concerning a municipal plant, it is difficult to see how the report has advanced the project very materially.

The Refuse Fuel Schemes of Dr. Woodbury, head of the New York Street Cleaning Department, have dropped out of the newspapers lately. The last idea which was urged in connection with this subject was the desirability of compressing the refuse into little bundles and selling them to the large power plants of the city. There were some astonishing figures, printed as "official," concerning the fuel value of this stuff, but anyone who took the pains to see the apparatus employed in the experiment would not regard the results as of much reliability. City refuse of certain classes is a fair fuel; this is well known through repeated trials here and abroad, and all that Dr. Woodbury's tests showed was that such refuse existed in New York, which was also well known.

Engineering Education must certainly be attracting widespread attention if the amount of oral and written discussion it is receiving can be taken as a reliable indication. The Institution of Mechanical Engineers of Great Britain recently discussed an elaborate paper on the subject, and in the issue of the London "Engineer" received this week there is a long contribution on the subject from Prof. Robert H. Smith. It is interesting to notice the stress he lays on subjects mentioned lately in The Engineering Record. Concerning the study of English he writes, "much of the poor result from English engineering colleges is due to this ignorance of correct language," which he calls "brutal ignorance" in another place. With regard to business training, his idea is: "We very much need courses of systematic lectures on costs and cost accounts, general factory accounts, economy of production, works organization and management. To leave a knowledge of these important matters to be scrambled for by hook or by crook, by fair means or foul means, is effective neither in producing sound, safe estimates nor in creating good moral tone and character. Equally much needed are courses of lectures on commercial and industrial law and custom, and, for some students, parliamentary practice." In considering such comments the question naturally arises whether the average course in a technical school is not so full of well-assorted subjects already that the addition of more will produce an injurious rather than a beneficial effect. The observation of competent critics seems to indicate that the use of good language and the adoption of business habits are best taught by the example set by the entire body of teachers rather than by the precepts of a single instructor.

The Comprehensive Paving Project on which the city of Harrisburg, Pa., has entered was the subject of an important report by Mr. Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York. In the course of this important document, the author makes some statements concerning the laying of bituminous macadam by inexperienced parties which are so eminently sound that they are here reprinted: "I notice that your City Engineer has prepared specifications for bituminous macadam other than Warren's, although they both call for work which is identical, except that the names of the Warren Brothers' bituminous cements are omitted in the one. I do not think it would be wise to use such specifications. I have already expressed the opinion that Warren's pavement might properly be given a fair trial. No one is so deeply interested in its success as its inventors and promoters; other contractors would doubtless be glad to see it a failure. If, then, your city officers decide to lay a reasonable amount of it, the results obtained would be conclusive only if it were laid by its friends. Failure would be invited if it were laid by those whose interests are inimical to its success." Pavements of this type can only be laid successfully by skilled men, using the best materials and working under competent superintendents. If any reports of failures of bitulithic pavement are heard, an investigation will probably show that the trouble was due to the work being done in a manner contrary to the practice of the people who have developed the type of construction. Condemnation of such construction because of the failure of work which was built in imitation of it but was not the true type is manifestly unjust.

The Inspection of Paving Work is also a subject on which Mr. Lewis lays particular stress. His experience of many years in charge of the street improvements of a large city where paving problems were complicated makes his advice on inspection particularly valuable. "Successful results in carrying out the extensive improvements contemplated," he reports, "will depend largely upon the intelligent supervision and inspection given to the work during its progress. The mere presence of an inspector on every block will not insure good workmanship. It is important, however, that every detail of construction be constantly watched, the sub-grading, the mixing of concrete, the setting of curb, the temperature of every load of asphalt, the rolling of broken stone and wearing surface, their proper thickness, the careful cutting of brick—each one of these are constantly necessary to insure that the city is getting what it is paying for. Several thousand dollars saved on inspection will be likely to cost the city many thousands in subsequent repairs. Special expert advice on the asphalt mixtures is also of the utmost importance." In writing these comments, the author probably had no intention of reflecting on the desire of a contractor for such work to evade any of his obligations. His intention was probably to indicate that the best of inspection is necessary under all conditions. The successful laying of pavements depends on strict attention to so many little details of seeemingly trifling importance, that the natural tendency of some laborers to be careless must be watched and checked by contractor as well as engineer. The contractor, in fact, is in a considerable measure dependent for his reputation on the faithful work of laborers, and every good contractor will welcome plenty of intelligent inspection because it will make his own supervision of the construction less arduous.

One of the Youngest Consulting Engineers in New York, who has been practising for himself less than three years, but already is in charge of the designs and construction of new works costing about $12,000,000, besides serving as the chief engineer of a large "trust" operating over twenty industrial establishments, was recently asked what was the main secret of his remarkable success. After thinking some time, for the question came from a man at the head of great enterprises and a probable client in the future, this engineer answered that his success was probably due to the observance of two rules. The first of these was that it was easier and cheaper to correct a few lines on a drawing board than to tear down masonry or reconstruct steam piping. The second rule was never to do anything himself that he could hire an assistant to do satisfactorily. Everything in his office that is capable of standardization has been gone over repeatedly until most details of construction and specification requirements need receive no further attention. Their use in any new work is merely a matter of blue-printing and type-writing. In a recent large industrial proposition submitted to him, he found it unnecessary to draw a single line personally, and probably two-thirds of the designs were copied from sheets of standard details. His personal attention was needed only for the general layout of the different buildings, by which the desired output was obtained with a minimum of fixed and operating charges. Although this engineer has so little oversight of the details of his work, it must not be thought that he does not understand them. After graduating from a technical school eleven years ago, he served for several years in a lazy position, where he was sure of $1,800 a year for life, but not much else. So he threw this up and went to work, for nothing at all at first, in the designing room of an engineer for industrial undertakings. He worked his way through each branch of this specialty in turn, hydraulic and mechanical engineering, mill architecture and methods of construction, abandoning each when he was acquainted with it to begin at the bottom of the next branch. He never hesitated to abandon present advantages to gain greater things later.



General View of the Lackawanna Steel Works, from the Southwest.

THE WORKS OF THE LACKAWANNA STEEL COMPANY.

Part I: General Description of the Different Parts of the Plant and their Purposes.

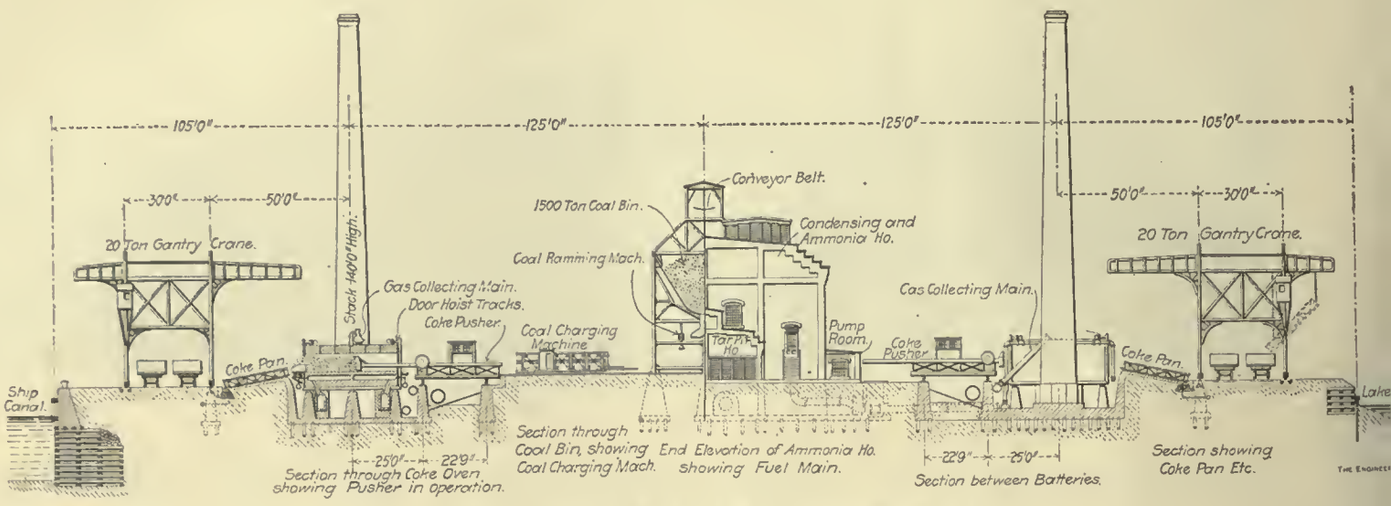
(With two-page inset.)

Many large steel plants have been formed by gradual extension, keeping pace with the growth of the industry, by unsystematic additions to a small original plant built many years ago and designed for a small output or for special processes. Others are remodeled plants at first intended for wrought and cast iron only. Consequently in many cases the final arrangement is not satisfactory. The buildings are not conveniently arranged, and are generally cramped; different elements of the plant are not in proper relation to one another, and difficult and expensive operations are involved in the transfer of materials. In very few cases are all of the processes of steel manufacture, from the treatment of the raw ore to the delivery of finished shapes, conducted in logical sequence in one plant. Therefore works designed especially to eliminate these faults and to comprehend in one system all the operations of modern steel making are of much interest and importance. One of the largest and most complete plants of this kind is being installed, near Buffalo, by the Lackawanna Steel Company, and will be described in this and succeeding articles from data secured by the staff of The Engineering Record from the officers of the company.

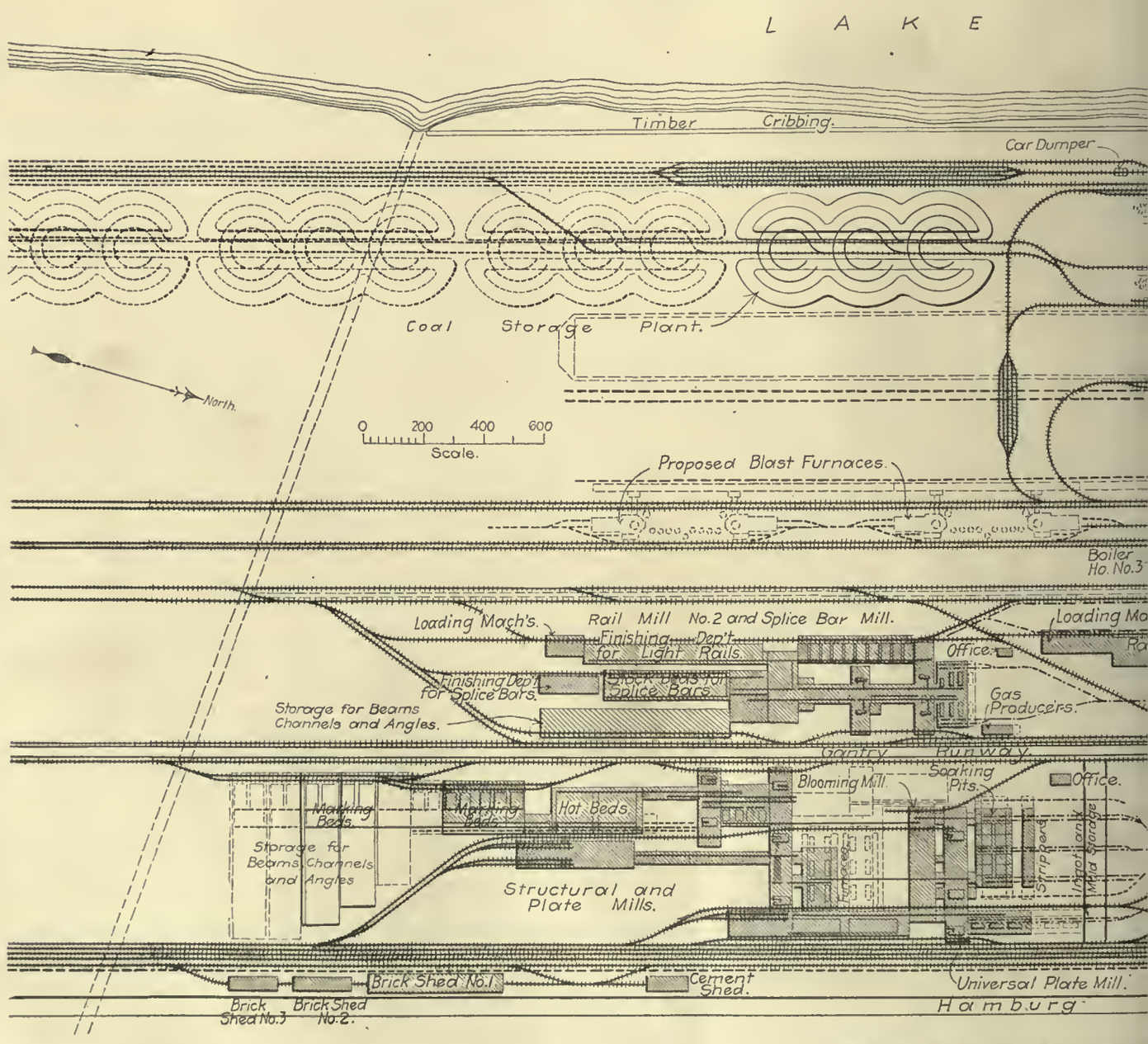
History.—On April 2, 1853, the Lackawanna Iron & Coal Company was organized to operate anthracite coal mines and iron works in Scranton, Pa., and manufacture merchant iron from puddled material. Later the manufacture of iron rails was taken up and followed by the manufacture of steel rails. In 1881 the Scranton Steel Company was formed to make steel rails. On January 9, 1891, the Lackawanna Iron & Coal Company and the Scranton Steel Company were consolidated under the name of the Lackawanna Iron & Steel Company. On February 1, 1899, the anthracite coal mines were sold, and the company devoted itself exclusively to the manufacture of steel rails, billets and merchant iron, with a total output of about 500,000 tons per annum. The company also operated three blast furnaces in Scranton and two at Lebanon, Pa. On Dec. 1, 1897, the company leased the two Bird Coleman furnaces, and on February 1, 1898, one blast furnace at North Cornwall, all using Cornwall ore and Connellsville coke. In 1899 it was decided to remove the Scranton works to Buffalo, N. Y., where a very suitable site was purchased; and at this time the capital stock of the company was increased from $3,750,000 to $25,000,000. In 1902 the Lackawanna Steel Company was incorporated under the laws of the State of New York, with a capital of $40,000,000, to absorb the Lackawanna Iron & Steel Company and the Lackawanna Coal & Coke Company, the latter owning bituminous coal properties. In order to be independent of the Connellsville coke, it was decided to build a by-product coke oven plant at Lebanon, Pa., to supply the five blast furnaces in that district with coke made from coal out of their own mines.

Location and Characteristics.—The Lackawanna Steel Company acquired a large tract of low land about 3½ miles in length and nearly ½ mile in average width on the shore of Lake Erie, about 4 miles south of the City Hall at Buffalo. This land adjoins the extremity of the United States breakwater, which affords a safe and commodious harbor at the north end of the property. Here a ship canal, 200 feet wide and 21 feet deep, below low water, and 4,000 feet long is being excavated parallel to the shore, to afford entrance for ore-bringing vessels. On the opposite side of the property a railroad has been constructed to connect with the twenty-six trunk and branch roads centering in Buffalo. Excellent traffic communication is thus established and competition assured which secures ample service and low freight rates. The soil is muck, sand and clay, so that most of the foundations are built on piles, and the material excavated from around the pile heads is used for filling the adjacent surface to the grade which has been established at a level about 8 feet above the average original level or, say, 10 feet above the datum, mean lake water level. The principal characteristics of the plant are its completeness, embracing all the operations of coking, smelting, Bessemer and open hearth steel making, and rolling heavy and light rails, billets, shapes and plates; the storage and mechanical handling of very large quantities of ore, pig iron and coal; special facilities for loading, unloading, transporting and handling great quantities of heavy materials and finished product; utilization of by-products and waste heat; economical systems of power production and distribution; systems of pneumatic, hydraulic and electric conduits; extensive and varied applications of individual electric motors to many kinds of tools and special operations; large and well-equipped auxiliary shops for the construction and maintenance of the buildings, equipment and tools of the main plant; extensive accommodations for office force and workmen; proximity to a great labor market, and exceptional shipping facilities. The superiority which is expected to give this plant an important commercial advantage in competition with other steel plants depends on these characteristics; on the arrangement of different sections of the plant so as to avoid rehandling of materials or obstructions in service; on the division of apparatus in duplicate units; and especially on skill and experience in the selection and adaptation of improved methods and details of operation and equipment found most advantageous in other plants. The coke ovens are of a new type; the method of storing and handling ore was especially worked out for this plant, and a new type of open hearth steel furnaces will be installed. The rolling mill scheme provides for the use of two-high reversing rolls, except where a few three-high mills, previously used in Scranton, will be installed.

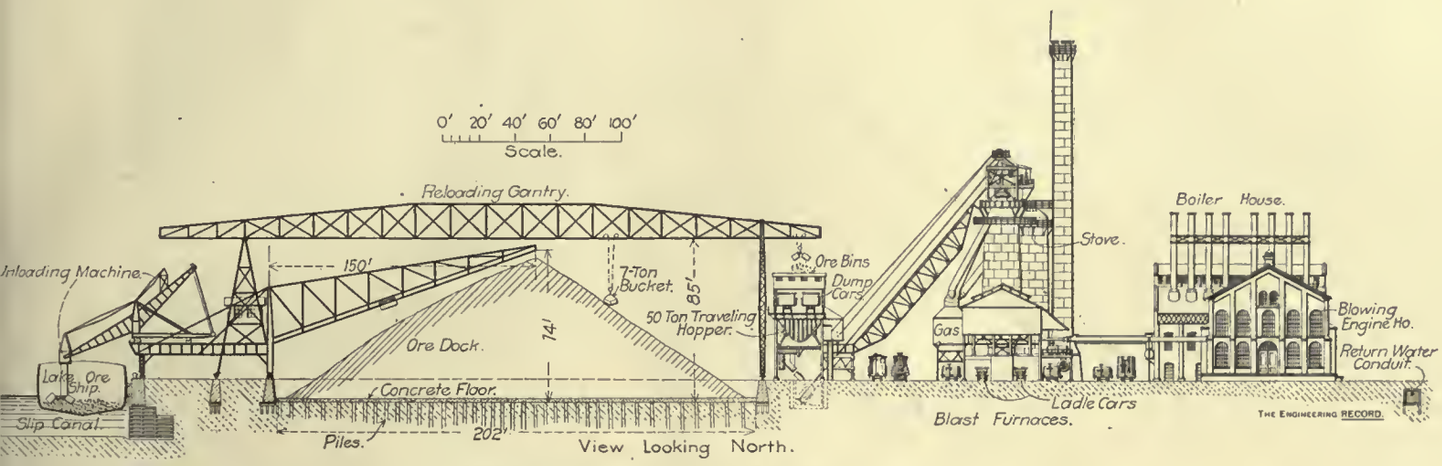
Arrangement.—The governing principle of the arrangement of the whole plant is the grouping of the different installations for the main processes in comparatively long and narrow areas, parallel to each other and to the ship canal, served by numerous connected lines of longitudinal and belt tracks. Materials move continuously in transverse or longitudinal directions, and are transferred from one division to another by the surface lines of railroad. Starting east from the lake shore the first divisions are consecutively the coke ovens, the ore dock, and the blast furnaces, in all of which the materials are moved transversely in process of manufacture. Adjacent to the blast furnaces are the boiler, blowing-engine and power houses for the development of all the power required for the entire plant, utilizing the waste gases from the furnaces. These buildings are approximately in the center of the plant, and on the opposite side are the steel furnaces and the rolling mills, in two longitudinal rows, one for the Bessemer and one for the open hearth. In these divisions the molten iron is received at the north end and, passing continuously south, without being interrupted or reversed, is carried in a long straight path through all the processes of manufacture. The finished steel is delivered



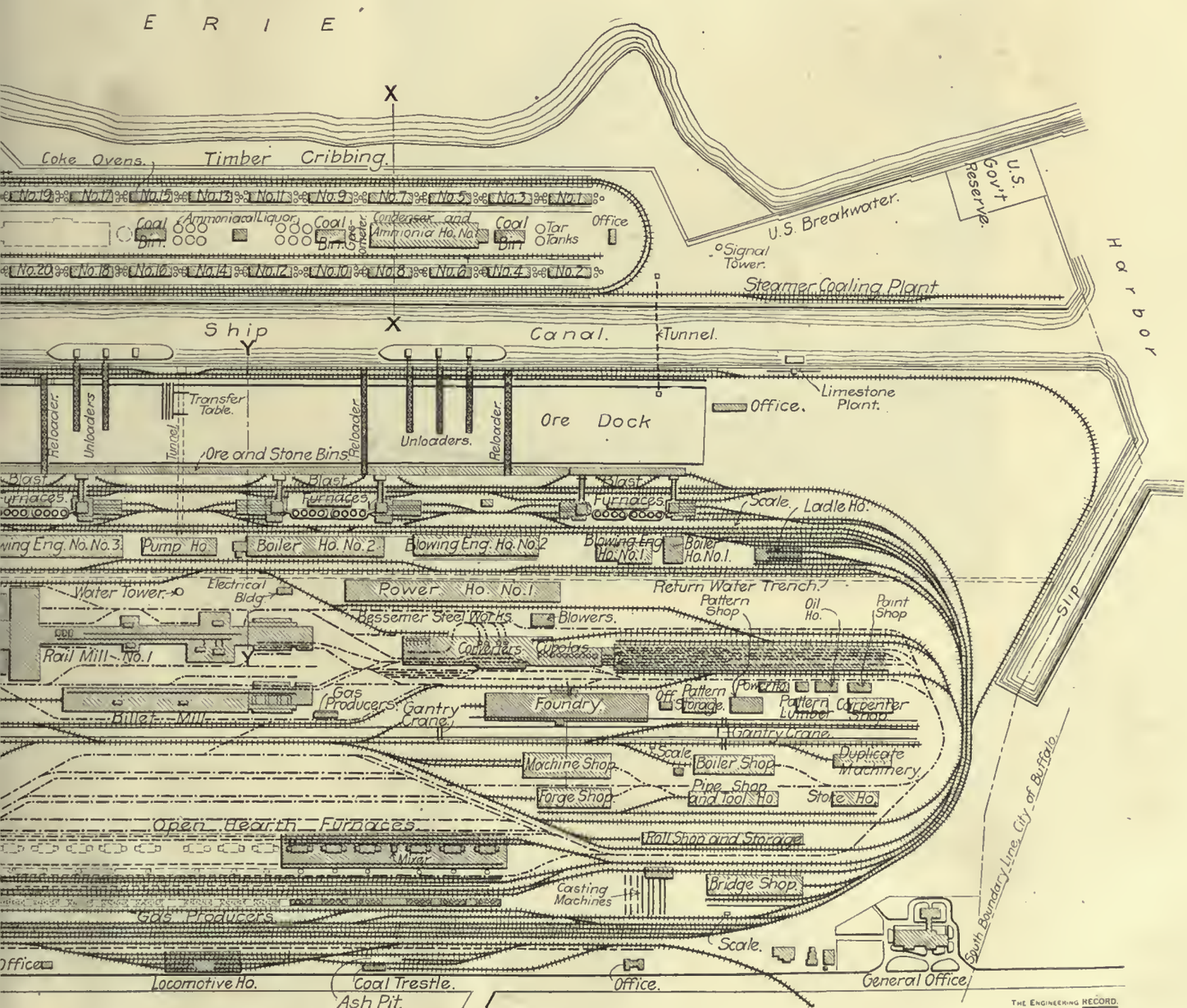
Section through Two Batteries of Coke Ovens, on X X.



GENERAL PLAN OF THE LACKAW



Section through Ore Dock and Blast Furnaces, on Y Y.



L COMPANY'S PLANT AT BUFFALO, N. Y.

for shipment or temporary storage at the southern extremity of the plant. In the northeast corner, adjacent to the steel furnaces, are located the foundry, machine shop and various auxiliary shops and buildings for the construction and maintenance of the plant. Near them is the main office, and at the opposite end of the plant, separated from it by the highway along its eastern boundary, are villages of model houses for the workmen and for the clerks and foremen. The arrangement conduces to the greatest simplicity and convenience of interchange between the different departments, and the most advantageous operation of the works as a whole. The ultimate construction of other portions, which will be operated advantageously as built, has been kept in mind, and allowance has been made for extension to the final limits provided on the plan.

The lake shore is protected by timber cribbing, and the space, about 400 feet wide and 2,500 feet long, between it and the ship canal, is occupied by the coke plant and served by a two-track standard-gauge belt line railroad and a parallel line of spur tracks. The southern continuation of this area is devoted to coal storage and yards for coal trains. Parallel to the coke plant on the opposite or eastern side of the ship canal is the ore dock 270 feet wide which will eventually have a length of 2,600 feet and a capacity of about 2,000,000 tons of iron ore. A row of six blast furnaces in three pairs, two of which are under construction, and one pair in operation, will extend from end to end of the ore dock, occupying a space about 100 feet wide with double lines of railroad tracks on each side. The power houses, boiler houses and engine houses are in a parallel group about 300 feet wide and 3,000 feet long, and separate the steel furnaces and rolling mills from the rest of the plant. The Bessemer works are in line with a mill for blooming and finishing heavy rail sections and one for making commercial billets, beyond which are two other rolling mills for light rails and for splice bars and shapes. The most easterly division contains the open hearth furnaces, which are in line with three sets of heavy roughing mills delivering to other mills making finished plates and structural shapes.

Electric Power.—Excepting the blowing engines, the rolling mill engines and a comparatively small amount of hydraulic and pneumatic machinery, all the mechanical part of the plant is operated by electricity, and the machines for its generation, distribution and application constitute one of the largest installations yet made. Electric power was chosen on account of the advantages usually recognized for large distribution and varied service. Its use obviates losses in the transmission of steam, the danger of freezing and leakage and the cost of piping for hydraulic and pneumatic systems, and saves the expense, great loss of energy and obstruction due to the use of shafts, belts and gears. The supply of a large number of small power units from a central station effects a great saving in the power required, by making the average load nearly uniform. The total amount is so great that any sudden increased demand for a single machine is not a large proportion of the aggregate. The variations in power for machines that are idle or are in operation practically balance each other.

Electricity is here generated by large units working under the best conditions and most careful supervision, and it is distributed safely and conveniently in lead covered cables carried in underground vitrified clay conduits so as to be easily accessible and entirely safe and out of the way. Nearly every tool and machine has one or more absolutely independent motors and can be run regardless of a breakdown in any other part of the works; or a single division or portion of division can be operated without requiring power for the portion which is idle. The motors are self-contained and are enclosed in compact dustproof cases which protect them from the severe conditions of mill service. They are also independent of any rigid connections so as to be especially adapted for all movable machines which would cause obstructions if operated by other forms of power.



Blast Furnaces and Gas Collecting Apparatus.

Excepting a small power installation, which will be retained for supplementary service, all the electricity is generated by three Sprague Electric Manufacturing Company's direct-current and five General Electric Company's alternating-current machines, each of them direct-connected to a 1,000 horse-power, two-cylinder, double-acting, two-cycle, gas engine of the Koerting type built by the De La Vergne Refrigerating Machine Company. The generators are designed to run for one hour with a 50 per cent. overload. The alternating-current machines have three steam-driven General Electric Company's exciters, and there is also a Sprague Electric Manufacturing Company's 500-kilowatt direct-current generator operated by a 1,000-horse-power Porter-Allen engine. Other electric equipment includes a 150-kilowatt alternator, a 37½-kilowatt motor-generator, and a 250-kilowatt direct-current dynamo made by the Westinghouse Electric & Manufacturing Company, which also furnished about 1,000 individual motors, aggregating about 30,000 horsepower, used to operate all kinds of machinery and shop tools. In addition to the above there are two 125-lamp arc light machines and some other electrical apparatus furnished by the General Electric Company. Direct-current at 220 volts is used exclusively for the overhead traveling cranes, for the ore and coal handling machinery and for all reversing rolling mill tables. Alternating current at 440 volts is used for nearly all shop tools and continuous running motors. Hydraulic pressure at 450 pounds is used for tilting converters and furnaces, for some of the hoists, and for transfers and pushing machines in the Bessemer and open hearth departments, but its application is limited. Compressed air at 100 pounds pressure is used throughout the plant wherever it is possible for short movements within the limits of one piston stroke, and for operating all pneumatic tools. Steam is used to supply some of the blast furnace blowing engines, for the pumps and chiefly for warming the buildings.

Present Condition.—Ground was broken in July, 1900. The foundry, machine shop and other auxiliary buildings at the north end of the plant were first constructed; foundation work, grading and track laying was vigorously pushed. The construction of the plant by units was commenced with the blast furnaces, ore docks, Bessemer steel works, coke ovens and rolling mills. Several thousand men have been continuously employed, and so much of the plant has now been completed that rail and water freight service is established; pig iron is being manufactured, and Bessemer steel could be produced at a few weeks' notice. The construction of four batteries of coke ovens is well under way. About half of the ship canal and half of the ore dock are nearly completed. The first divisions of the power plant are finished and in operation. The Bessemer converters are nearly ready for operation, and the building for rail mill No. 1 is ready to receive the machinery, a large part of which is on the ground.

The foundry, machine shop, forge shop and other auxiliary buildings at the northeast end of the plant are completed and have been for some time in use. The general office building has been occupied since the fall of 1901, and grading, gas and water supplies, sewerage and other improvements are well-advanced for the two villages, in which many of the houses are erected and occupied. The riveted steel work for the first buildings of the plant was made by contract, but that for the succeeding buildings is being fabricated in the bridge shop designed and equipped for that purpose, at the north end of the plant. A machine shop and foundry in Buffalo, with a capacity of about 700 tons a month have been leased to promote the construction operations. About 7,000 men are at work on the coke ovens, ore dock, blast furnaces, power houses, and other portions of the plant now in progress. The works are designed to have, within two years, an annual output of 1,250,000 tons of finished steel, includ-

ing rails, splice bars, billets, structural materials, sheared and universal mill plates, of which 800,000 tons will be Bessemer and 450,000 tons open hearth steel. The plans contemplate the extension of the open hearth furnaces to an ultimate capacity of about 1,000,000 tons a year.

Operation.—The plant is divisible into eleven separate departments as follows: I., 940 by-product coke ovens with a capacity of 4,000 tons a day; II., lake ore unloading department with five Hulett unloading machines and three Wellman-Seaver reloading machines to handle from vessels in the ship canal and store enough ore and limestone to produce about 1,200,000 tons of pig iron per annum; III., a present installation of two 300-ton and four 800-ton blast furnaces with provision for a future extension to a capacity of about 7,000 tons daily; IV., four 10-ton Bessemer converters, two rail mills, a billet mill and a splice bar and structural mill with a capacity of about 3,000 tons daily; V., six 200-ton Talbot open hearth steel furnaces, a structural mill, a sheared plate mill and a universal plate rolling mill with a capacity of 1,650 tons a day; VI., the power department with a central station for electric power, compressed air and hydraulic power, a pumping plant for all water supplies, blowing engine houses, boiler houses and gas producers; VII., repair and construction shops for the manufacture and maintenance of most of the machinery and equipment of the plant; VIII., general yard department controlling all tracks and operating all locomotives at the plant for general service; IX., the terminal and connecting railroad outside the works, which receives all materials except ore, and delivers finished product to other railroads for shipment; X., the house department, including two villages, one with 454 houses in rows for the workmen and another with 100 detached houses for the foremen and clerks; XI., the administration department, in the general offices at the northeast corner of the plant, from which the Buffalo, Lebanon and Wehrum plants are directed, and where all designing, construction and operation is controlled.

The sequence of operations from the receipt of coal and ore to the shipment of finished steel shapes, bars and plates, is substantially as follows: Cargoes of from 3,000 to 6,000 tons of ore are delivered by boats in the ship canal, and are unloaded by traveling Hulett unloaders with a capacity of 200 tons per hour for 90 per cent. of the cargo. The ore is lifted in automatic scooping buckets, hoisted and conveyed transversely to the shore end of a cantilever bridge, where it is delivered to a trolley running to the extremity of the cantilever truss 150 feet long and 74 feet high, from which it is dumped on the ore dock. The ore dock has a capacity of 750 tons per linear foot, and consists of a concrete platform about 5 feet below grade, supported on piles and enclosed by concrete retaining walls. It is traversed from end to end by steel gantries of 279 feet span and 85 feet clear height. The trolley hoist runs on the lower chord of the gantry truss and from it is suspended a 7-ton bucket of the clam-shell type, which lifts the ore and transfers it to the cantilever end of the gantry, where it can be dumped directly, at a rate of about 140 tons per hour, into continuous elevated steel storage bins, or into a 50-ton movable hopper which can discharge into the main bins or into small dump cars traveling below it over the tops of the main bins so as to distribute the ores from the different mines and keep the different classes separate. Some of the bins are reserved for limestone. Ore and stone are drawn from the bins into hoppers on scale cars, which take the charge to the skip cars, which are drawn up inclined bridges to the tops of the blast furnaces.

Crushed soft coal is received by rail, and about 150,000 tons will be stored for emergency, in circular piles commanded by radial cranes. Ordinarily the cars are dumped by car dumpers into a 50-ton steel hopper, which delivers to an elevated horizontal conveyor belt running between the batteries of coke ovens and filling 1,500-ton steel coal bins, each arranged to serve six batteries of ovens. The coke when withdrawn is loaded by a gantry into cars which are drawn by locomotives to the blast furnaces, and there dumped in hoppers which deliver to the skip cars running to the tops of the furnaces.

Bessemer Process.—The blast furnaces are tapped into 25-ton ladles which, on week days, are hauled by locomotives, and emptied by a traveling crane into a 300-ton mixer. The mixer is a large steel tank lined with brick and resembles a horizontal semi-cylinder on rockers. In it the products of different furnaces are poured and form a homogeneous mixture. The mixers are tilted by an electrically operated rack and discharge the melted iron through a spout at the corner diagonally opposite that where it is received. The metal is poured into 10-ton ladles on cars on the second floor of the building,



Hulett Machine Unloading a Lake Ore Vessel.

whence they are drawn by electric locomotives to the converters and tilted to empty into the latter. Air at a pressure of about 25 pounds is blown through the bottoms of the converters for about ten minutes, when the metalloids are eliminated, and the converters are tilted to empty their contents into 10-ton ladles.

These ladles are handled by revolving hydraulic jib-cranes which pour the steel into 2-ton ingot moulds seated in pairs on cars at grade. After the ingots are sufficiently solidified the cars are drawn by locomotives to the stripping machines in the rail or billet mills. Here each mould is hooked to the cylinder of a suspended overhead traveling hydraulic press, and the piston is extended against the ingot so as to draw the mould up and away from it. The mould is then returned to the converter house while the ingot remains on the car and is delivered to the 60-foot 7½-ton girder crane which handles it in and out of the soaking pits. The revolving cranes in the Bessemer house are supplemented by a girder crane which can pour the ingot moulds if the former is disabled.

From the soaking pits the ingots are carried on electric cars to rail mill No. 1 where they are passed continuously through six two-high roll trains driven by large reversing steam engines operated at at maximum speed of 150 revolutions a minute. These mills have a capacity of 2,000 tons in 24 hours of finished rails weighing 60 pounds or more per yard. All transferring and handling of materials for them is done by hydraulic or electric machinery. The rails are finished about 200 feet long and are sawed hot into 30 to 60-foot lengths, as desired. They are taken on automatic roller tables to the hot beds, across which they are moved by spur chains or ropes, transferred by roller tables to the finishing shop, straightened, drilled, inspected and loaded on cars for shipment, by electrical machines.

Part of the product from the Bessemer converters is delivered to the billet mill, which has a rolling capacity of 2,000 tons in 24 hours, and is provided with independent soaking pits and stripping plants. The billets are shipped to the storage yard or to the purchaser, or are delivered to mill No. 2 and there rolled into light rails, splice bars or structural shapes. This mill is commanded by one 85-foot 30-ton girder crane, and has two 3-high billet and two 2-high reversing blooming trains driven by two 4,000 horse-power and one 3,000-horse-power Porter-Allen engines. All the steam engines in rail mill No. 1 and in the billet mill are provided with a Weiss central condensing plant of 20,000 horse-power capacity. Rail mill No. 2 has four 3-high trains driven by 3,000-horse-power Porter-Allen engines provided with a 10,000-horse-power condensing plant. In this mill the blooms are delivered by electric charging machines to the upper ends of continuous furnaces. The slightly inclined bottom of the furnace is covered with blooms, and as fast as one is removed from the hottest place, another is pushed into its position by the downward sliding of the continuous line of blooms on inclined water-cooled skids on the furnace floor. The blooms are removed from the furnace by electric machines which deliver them to the roll train.

Open Hearth Process.—In the open hearth department the metal from the mixers is carried in 30-ton ladles suspended from overhead cranes and emptied into six 200-ton Talbot open hearth furnaces mounted on the plate girder platforms of steel towers. Carefully determined proportions of iron oxide ore, rolling mill scale and lime are also put into the furnaces by electric charging machines, and fuel gas is supplied and ignited. Iron oxide and silicon elliminate the metalloids, and the lime absorbs the phosphorus so that in about two hours the whole charge has become purified to

the required degree, and the furnace is tilted by a hydraulically operated rack to discharge about 30 tons of molten steel into a ladle suspended from a girder crane. A small quantity of ferro-manganese is put in the ladle to insure deoxidation. Thirty tons of molten pig iron and the proportionate quantity of ore, scale and lime are added to the charge in the furnace; the entire contents are again refined, and in two hours another 30 tons is drawn off, and so on. Saturday night the furnace is emptied and repaired if necessary, and Monday morning it is recharged with blast furnace iron, ore and lime and about 50 tons of steel scrap.

The open hearth furnaces deliver to 50-ton ladles suspended from 75-ton traveling cranes, which carry them over the pouring floor to a place where the ingots are cast. Afterwards the ingots are stripped and placed in the soaking pit in a manner similar to that described for the Bessemer ingots. The open hearth furnaces have a capacity of 2,200 tons in 24 hours, which is much larger than any other Talbot furnace plant yet installed, and may be more than doubled by proposed extensions. The open hearth furnaces and the soaking pits are supplied with fuel gas generated in mechanically-operated Fraser-Talbot gas producers located near the open hearth building.



Wellman-Seaver Reloading Machines over the Ore Docks.

The ingots may be delivered from the soaking pits to either of two mills. The 40-inch blooming mill for structural shapes is driven by a 10,000-horse-power 54x66-inch twin-cylinder reversing engine built by William Tod & Company, of Youngstown, O. From the mill the blooms are charged into continuous furnaces and then delivered successively to two 34-inch roughing trains and a finishing train driven by 48x54-inch reversing twin-cylinder engines. These mills roll shapes up to 24-inch I-beams, which are delivered by automatic roller tables to the hot beds, saws, shears and marking and shipping sheds, where they are loaded on cars by traveling cranes with electro-magnets.

The ingots can also be delivered to a 32-inch slabbing mill with a 46x60-inch reversing twin-cylinder engine for the horizontal rolls, and a 36x48-inch twin-cylinder reversing engine for the vertical rolls. From this mill the slabs are taken on automatic roller tables to Sieman's regenerative heating furnaces equipped with electric charging and drawing machines. From the furnace the slabs are delivered on roller tables to a 132-inch plate mill with a 40x60-inch twin-cylinder 5,000 horse-power reversing engine. The unfinished plates are pushed transversely by electric machines to a 132-inch finishing train driven by a 40x60-inch twin-cylinder 5,000-horse-power reversing engine, from which they are taken on roller tables to cooling bed, shears and scales and finally loaded on cars for shipment, by girder cranes and magnets.

A third class of ingots is delivered from the Siemens furnaces to the 48-inch universal plate mill, driven by a 55x60-inch twin-cylinder reversing engine. Here plates are rolled, finished, cut and shipped as described for the sheared plates. In this mill there are three Weiss condensers for the different groups of engines.

The Sunday product of the blast furnaces is put into ladle cars and drawn by locomotives to the casting machine, where it is poured into pressed steel moulds in an endless chain which runs under water, chills the pigs and dumps them into cars which carry them to storage near the Bessemer works. This stock yard is commanded by a large electric gantry which unloads the pigs and reloads them, by means of an electro-magnet lifting several at once and places them in 5-ton cars. The cars are elevated by hoists to the charging floor of the Bessemer house where electric charging machines tilt them so as to empty their contents into the mouths of the cupolas. Limestone and coke are delivered in the same manner from the bins in the pig yard to cupolas. The cupolas are tapped into runner troughs on the third floor of the cupola house which discharge through a hole in the floor into a ladle in the story below, which is carried by an electric car to the Bessemer converter. By this arrangement provision is made for throwing the Bessemer and open hearth department out of service on Sundays without interrupting the operation of the blast furnaces.

Organization.—At the head of the technical organization of the Lackawanna Steel Company is Mr. Henry Wehrum, general manager in charge of the Buffalo plant and of the other properties of the company. The general manager's staff consists of thirteen officers, each with his own organization and staff of assistants. The engineering force at the plant includes about 150 engineers, assistant engineeers and draftsmen. The assistant comptroller's office is in the main office at the plant, where the costs for all departments of construction, maintenance and operation are classified and corrected, and accounts made up for transmission to the New York office, where general results are formulated.

Proposed Extension of Lehigh Valley Railroad Shops at Sayre, Pa.

The Lehigh Valley Railroad has adopted a plan for an extension of its principal locomotive and car repair shops at Sayre, Pa., rearranging the use to be made of some of the present shop buildings and gradually, in the run of years, extending the system until the plant will consist of three groups of buildings, respectively for the repairs of locomotives, passenger cars and freight cars. The present intention is to construct during the next two years only additional facilities for locomotive repairs. The work during the first year will consist mainly of preparing the site and erecting the principal buildings at a cost of about $1,000,000; the installation of the heavy work, such as the power plant, machinery, yard work, etc., will commence about a year hence.

In common with most roads of the country having old shop layouts the Lehigh Valley is forced to recognize its inability to maintain the increasing heavy power efficiently and economically with inadequate facilities. The road now has nearly 800 engines to maintain with an inadequate number of shop pits available for heavy repairs; only fourteen of these pits are in the present main locomotive repair shops at Sayre, while the balance are scattered over the road at various smaller shops not adapted for heavy work. By concentrating all the heavy work at Sayre, where it can be done more efficiently and expeditiously, the pits and facilities at the smaller shops will be available for comparatively heavy running repairs, and the proposed changes will produce great economies and eliminate serious detention to shopped engines.

The work to be done during the next two years will consist of the construction of a new 366x749-foot main locomotive repair shop, a 103x363-foot blacksmith shop, a store-house of the same size, and a central power plant.

The main locomotive shop will have an erecting shop with 48 erecting pits, divided into an east and a west section, each section being 60x627 feet. Between the two sections will be the 156x627-foot machine shop. At one end of the building will be the 121x366-foot boiler shop.

The machine shop will be divided into two bays, each 60 feet wide and a central bay 36 feet wide. The last will have a gallery over it for the heating apparatus, toilets, lavatories, lockers, etc. The space under the gallery will be utilized for small machinery, benchwork, link and motion work, toolroom, etc.

Between each erecting shop and the machine shop there is a 42-foot space 627 feet long, called a covered yard. This space is to be used as an overflow storage ground for both the erecting and machine departments, making a conveniently located space inside the building in place of an open yard for storage of dismantled parts and miscellaneous materials. In this space will be located the storage pits, lye vats, tire-shrinking platforms, etc. This plan gives the result that all locomotive repair work, with exception of blacksmith and forge work, will be conducted in one large building with overhead cranes serving all important points.

The erecting shop is designed as a transverse shop with heavy overhead traveling cranes for transferring engines over others standing on the pits. This system corresponds to the practice of the most recently built large locomotive repair plants of the Philadelphia & Reading Railway at Reading, Pa., the Lake Shore Railway at Collinwood, Ohio, and the Pittsburgh & Lake Erie Railroad at McKees Rocks, Pa. A similar system has been in use at the Baldwin Locomotive Works and at the Brooks Locomo-

tive Works for about ten years, and has been recently installed at the Richmond Locomotive Works and the Rogers Locomotive Works. A modification of this system is in use by the Pennsylvania Railroad in the old machine shops at Altoona, where a heavy overhead traversing crane has been introduced in place of a transfer table.

The capacity of the overhead cranes in the erecting shop will be 120 tons on the upper level and 15 tons on the lower level. The overhead cranes in the machine shop and covered yard will have a capacity of 15 tons. All the cranes will extend into the boiler shop.

The details of the power plant and machinery have not been finally determined. All power and lighting will be electrical. The machinery in the machine shop will be driven by a combination of individual and group drives.

Ample provision has been made for future extensions and additions and the new buildings will be grouped in connection with the present buildings so as to give a practical, economically working shop plant.

The building will generally have concrete foundations, brick walls, steel frame and roof trusses, covered with slag roofing laid on armored concrete. The floors will be generally wood on concrete beds. In the higher grade buildings the top floor will be maple, in other buildings yellow pine. The blacksmith shop and part of the boiler shop will have a cinder floor. Side windows will have plain glass and in the main locomotive shop factory ribbed glass. Roof lights and monitor lights will be wired glass. The heating of the main shop will be by a hot air blower system, the fans being run by motors and the heater units supplied with exhaust steam from the power plant. All other buildings will be heated by direct steam radiation. All pipes and main wiring will be conducted from the central power plant through an underground tunnel and ducts to the various buildings. Proper provision will be made for water supply, fire service, drainage, sewerage, sanitary arrangements, etc.

The design, construction and equipment of the new shops will be in charge of Mr. Walter G. Berg, the chief engineer, and Mr. H. D. Taylor, the superintendent of motive power of the Lehigh Valley Railroad Company.

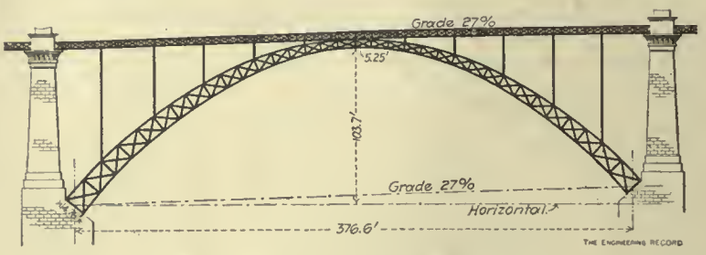
Street Cleaning by the Municipality instead of by contract with private companies has proven effective in Columbus, O., judging from the 1901 report of Director of Public Improvements F. J. Immel, in which it is stated that under this system notwithstanding many new streets were added to the schedule and the frequency of sweeping in many instances was increased, there was a saving of over $40,000 to the property holders over the lowest bid of the contractors. As evidence of the improvement in the cleaning made it is stated that from the same territory there were removed in 1901, 29,000 cubic yards more dirt than in 1900.

Types and Details of Bridge Construction.—VII.

By Frank W. Skinner, C. E.

Arch Trusses (Continued).

The Western Railway of France crosses the Seine, in Paris, between the Champ de Mars and Corcelles at a one per cent. grade on the Passy Viaduct which contains a main channel skew span with two two-hinge arch trusses 281¼ feet long and 31 feet 10 inches apart on centers. The center line of the truss is a parabolic curve with a rise of 39.36 feet, and the depths of the truss perpendicular to it, at the crown and skewbacks are about 6.6 and 4.9 feet respectively. The trough shaped chords are each made with four angles of varying sizes up to about 6x6 inches, two 18-inch webs and a 39-inch cover plate. The web members consist of verticals 6½ feet apart and diagonals of varying inclinations, all riveted to the chord web plates. Each web member is double, each duplicate part consisting of four angles riveted together back to back both sides of the web plates. In the end panels the chord webs join to make solid full depth plates and form a closed box section, tapered to the ends, where they are seated in steel castings with hinge bearings on the skewback pedestals.



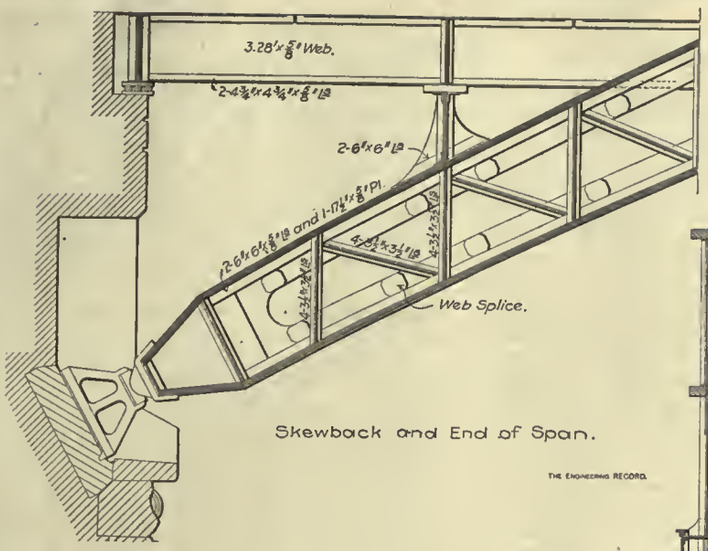
Main Span of the Cornhouse Bridge.

The clear width between trusses is 28 feet 7 inches and the width of the bridge over all is 35 feet 5 inches. In the center of the span the trusses are connected by eight transverse lattice-girder struts with curved lower chords. The struts are connected in the middle by longitudinal struts, and the panels thus formed are X-braced to form the top lateral system. The clear height of the roadway platform is 24 feet 1 inch above the water, and it is 16 feet in the clear below the lower chord in the center of the truss. The floorbeams are 13 feet apart, and in the middle of the span are suspended from each truss by twelve verticals at alternate points. These verticals are riveted to the gusset plates on the lower chords and are very flexible longitudinally so as not to transmit longitudinal stress from the floor to the trusses. At their intersection the floor and trusses are not connected, and beyond it the floor is free to move longitudinally on vertical supports from the top chords of the trusses. The trusses are connected by transverse struts and lateral diagonals, and have vertical sway bracing below floor level.

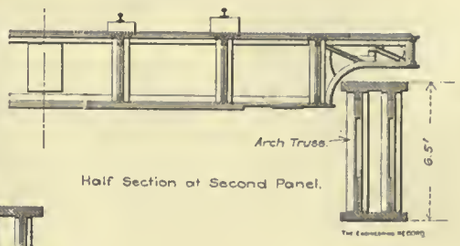
The stringers and floorbeams are covered with a continuous solid steel flat plate and have rigid transverse connections to the trusses. The trusses are skewed 13 feet in the width of the bridge and all the transverse members of the bridge are parallel and oblique. Arch stresses were calculated for full load, half load and for a load covering 65 feet each side of the center. The weight of the span is about 872 tons, and it was erected on pile falsework having an 82-foot center opening for navigation. This was closed by a span of lattice girders with curved top chords, which were erected on a pair of barges, floated to position and deposited on the seats by sinking the barges. The erection was accomplished by a traveling gantry which moved at floor level between the trusses. This gantry had a cantilever cap overhanging both trusses and assembled them with movable two-hand windlasses. It had clearance through it for a material track on the bridge axis. This bridge exemplifies the importance attached in Europe to the appearance of conspicuous structures. The design and erection were described in the "Génie Civil" June 2, 1900, and in "Engineering" January 17, 1902.



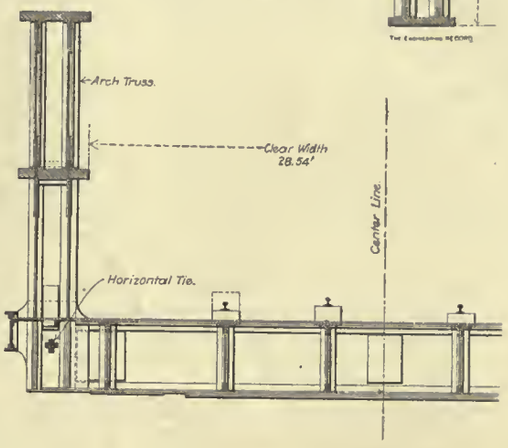
Part of Main Span and One Approach of the Cornhouse Bridge.



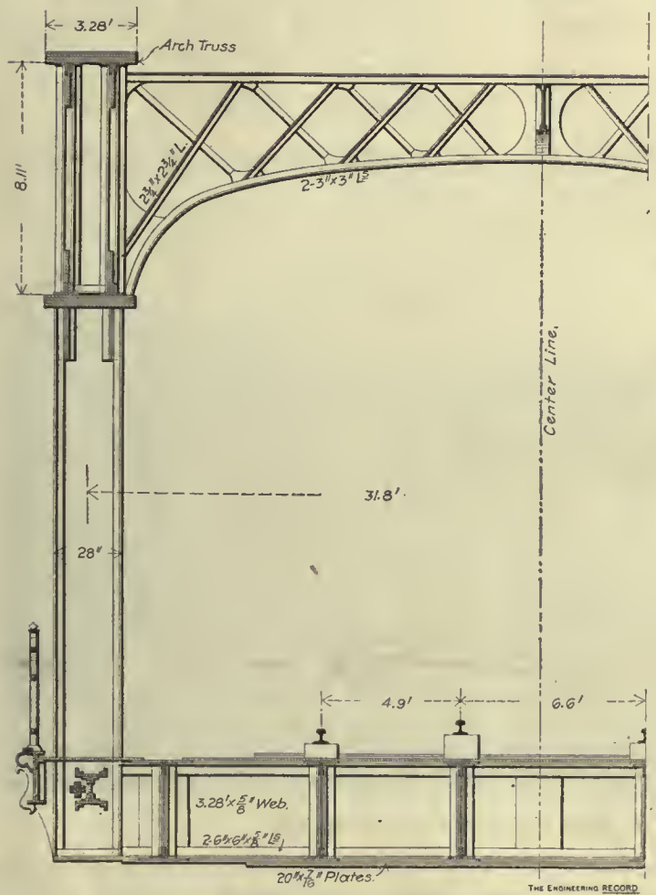
Skewback and End of Span.



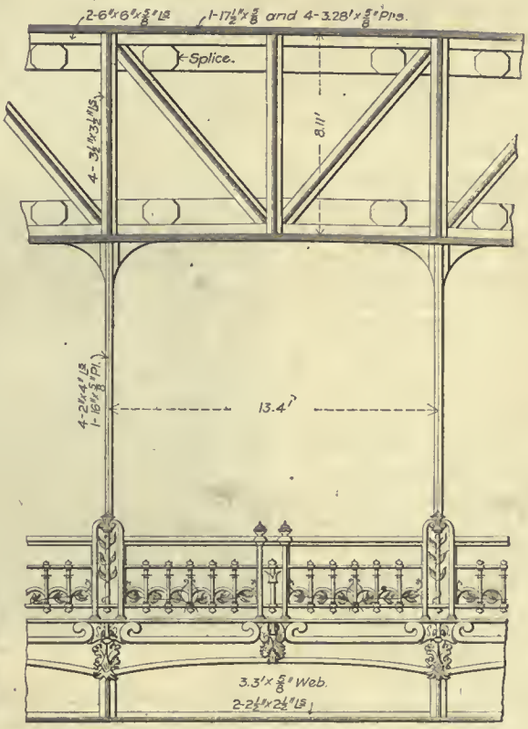
Half Section at Second Panel.



Half Section at Fifth Panel.



Half Cross-Section at Center.



Elevation of Center Panel of Truss and Floor.

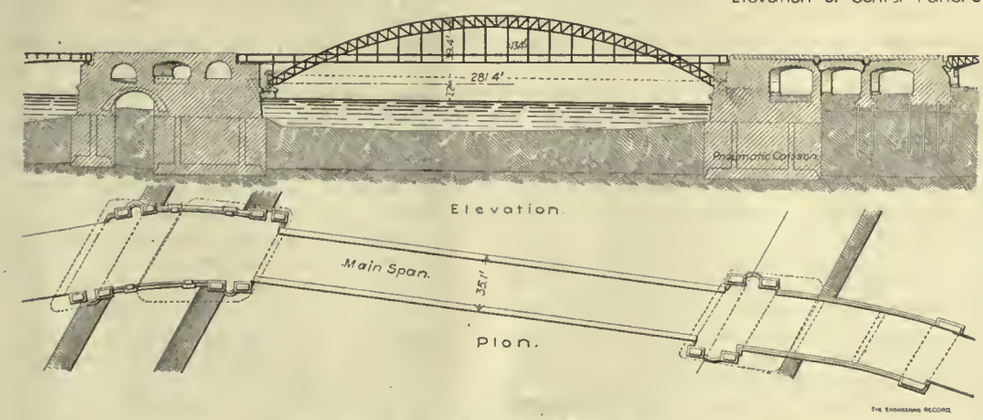


Diagram and Details of the Passy Viaduct.

The Cornhouse bridge over the River Aar, near Berne, Switzerland, was illustrated in the "Génie Civil" of December 3, 1898, and in The Engineering Record of June 17, 1899. It is a very lofty and handsome structure, picturesquely situated and interesting for its importance, its graceful design and the difficulties encountered in building its foundations. Its maximum dimensions are about 1,240 feet length, 41 feet width and 160 feet height, and it has five 113½-foot spans and one 376.6-foot span. The main span has two hingeless parabolic arch trusses, 43½ feet apart at the skewbacks and 26 feet apart at the crown, with corresponding radial depths of 14¾ feet and 5¾ feet. The rise of the lower chord is 103.7 feet, and the top chord carries ten vertical spandrel posts which support the lattice-girder roadway trusses. The trusses are battered 1:12 and are each divided into 34 panels by radial struts with a solid web plate transverse to the bridge axis and four Z-bars making up I-shaped cross sections. The diagonals in each panel are single channels with reinforced flanges and are cut to clear at intersections, where they are riveted to flange connection plates.

The top chord is of inverted trough section with pairs of angles making T-shaped top flanges for its webs. Reinforcement plates, the width of both angles, are riveted to each flange outside the covered plate which connects the webs. The horizontal flanges of the lower web angles are reinforced and short connection plates are riveted to them and project inwardly to receive the lattice angles and the stiffened transverse diaphragms. The bottom chord is made of two built channels with the flanges reinforced by plates of equal width with the angles, except the second one on the lower flange, which is twice as wide and projects inwardly, nearly to the center line to receive the lattice angles on its upper side. The cross-sections of the top chord are 72, 61.5 and 108 square inches at crown, haunches and skewback, respectively, and the corresponding cross-sections of the bottom chord are 61.5, 72 and 140 square inches. The vertical spandrel posts are made with pairs of built channels latticed together and tapering in both directions from bottom to top. They have longitudinally extended bases riveted to the cover plates of the top chords through inclined connection flange angles, and have gusset plate connections to sway-brace struts and diagonals, both made with pairs of channels latticed.

The 72-inch lattice-girder floorbeams are web-connected to longitudinal girders of the same depth, are 17 feet apart and have both ends extended by cantilever sidewalk brackets 7½

feet long. The top flange has an I-shaped cross-section made of a web plate and four flange angles and the bottom flange has a T-shaped cross-section made with a web plate and two flange angles. The cruciform verticals are made with four angles, back to back, and the X-braces in the four panels between them are made with single channels riveted to the flange webs and to each other at intersections. There are riveted lateral diagonals crossing three panels each in the planes of the top and bottom chords of the arch trusses.

The ends of the chords are riveted to solid steel bearing castings with plane surfaces seated on cast steel pedestals anchored by long bolts tangent to the arch curve and screwed up against reaction beams, accessible from inspection chambers in the masonry. The shoes are adjustable transversely and in their distance from the ends of the chords, by sets of double wedges which were locked after the adjustments were made. The bridge has a solid steel floor, which, for the sidewalks is composed of longitudinal rolled troughs, filled with concrete and surfaced with asphalt, and for the roadway is composed of galvanized ¼-inch buckle plates, convex side down, concreted and paved with wooden blocks. The bridge was calculated for a live load of 90 pounds per square foot of floor surface and for 30 pounds wind pressure, and the main span weighs about 1,982,000 pounds.

It waa erected on framed trestle bents braced in pairs to make alternate towers and openings, and having an extra wide opening with inclined bents on each side for navigation through the center. The falsework was peculiar in being covered with a solid plank platform convex to correspond with the intrados of the lower chords. Above it an upper story was carried up to the height of the top chord and provided outside tracks for two traveling erection gantries with hand windlasses moving transversely to the bridge axis to assemble the truss members.

Material tracks outside the trusses were also spanned by the gantries. The pier foundations were on bad ground, and were very difficult and costly. The tall and massive piers were lightened by seven stories of interior chambers, with arched floors and roofs, which were concealed by solid face walls. The piers were chiefly of concrete, faced with granite, and were built with overhead horizontal frameworks covering them and carried up with the masonry to afford trolleys for handling materials.

(To be continued.)

Special Shop Floors recently constructed for The American Locomotive Works at Schenectady were designed for solidity and durability. They were laid on a sand fill covered with from 4 to 6 inches of 2½-inch screened broken stone rammed dry and flushed with about one gallon of hot coal tar for every superficial yard. This course was covered with 2 inches of hot sand and tar, mixed to the consistency of dry mortar, shoveled into place and thoroughly rammed to a level surface, in which were bedded 3x4-inch nailing strips about 3 feet apart on centers. To these strips were spiked 2-inch rough hemlock planks, which were covered with transverse tongued and grooved ⅞-inch maple floor boards 4 inches wide. Although expensive in first cost, it is believed that this floor will be economical in the end on account of its durability and freedom from decay. It was designed, and its construction was superintended by Mr. L. Duncan, instructor in the Sibley College of Engineering, at Cornell University.

Construction Work for a Water Power Plant near Danville, Va.

An unusually interesting water-power-electric plant is now in process of construction for the Dan River Power & Manufacturing Company on the Dan River a short distance above Danville, Va. Preliminary plans comprehend the ultimate installation of three 1,000-horse-power and three 750-horse-power turbine units besides auxiliary machinery, to generate electric current for utilization in a large cotton mill, now also being erected, high up on the hillside, adjoining the tracks of the Southern Railway. The hydraulic development will make a notable addition to modern works of this character, including a structure entirely of concrete extending across the river a distance of about 1,219 feet. Of this distance, 910 feet will be the rollway of the dam, 25 feet high above the stream bed, and the remainder of the concrete work will comprise the flumes, turbine chambers and tail race, and an abutement section carrying waste gates between the dam proper and the flume headgates.

The dam is curved upstream, having a radius of 1719.12 feet and a chord of 900 feet. It is being built with a boulder concrete center, an ogee downstream face and a cut-off in the foundation at both heel and toe, these about 6 feet wide. It is about 38 feet thick at the bottom and 17 feet thick at a height of about 15 feet. There is a curved surface of approach, on a radius of 2 feet 5 inches; and the ogee surface is formed by a radius of 8 feet at the top, a radius of 20 feet at the bottom, and a plane surface tangential to them at an inclination of 5 in 3, that is, an angle of about 59 degrees with the horizontal. The plant in short is a low head one in which water will be conducted through short flumes to the wheels. These will be of the horizontal type, submerged, and provided with draft tubes. Each group will drive an electric generator by direct connection to the shaft, which will be extended through a plate in the power house wall. The racks will be enclosed, behind the head gates, and there is to be a waste gate for draining each flume to the tail race, when necessary. The power house thus bridges the tail race and will be 223 feet 4 inches long and 35 feet wide. To shut off the main channel from the tail race there will be a wing wall extending downstream a short distance.

The work was started last September and since then some trouble has been experienced with high water. From now on until December, it is not expected that much damage or delay will arise from this cause, and by that time the work will be well along. The waste-gate structure was first erected and the cofferdam for that work is shown in an accompanying reproduction of a photograph taken October 29 last year. The dam was constructed entirely of bags of coarse sand taken from the river bed and it proved very tight, owing partly to the washing into the crevices between bags, of clay and sand carried by the river. Reaching from the right bank of the river a bridge was built, as shown, on log cribs sunk in place by the rock-filling. A similar crib high above the water was also constructed between the shore and the sand bag cofferdam and on this was erected a boom derrick and hoisting engine.

Along this portion of the work a cofferdam of sheeting was built later, the planks being laid in an inclined position against a stone weighted log structure and packed with clay, and carried high enough to stand against flood waters. The



First Stage of Construction, Danville Dam.

structure of this crib work consists of log bents having two upright inclined members bolted to a long bottom horizontal log and an intermediate horizontal log and a cross timber near the water line extending across the upstream ends of the bents and connecting them together. The planking was laid against this cross timber, and the tops of the bents form the piers for a bridge.

At present the waste-gate abutment is completed, the head gates are being placed in position and the dam is being built outward from the shore end on the left bank. Communication betwen the two shores has been established by a suspension bridge of which the main members consist of two 1¼-inch guy ropes anchored on each side of the channel of the river and passing over log piers built on stone-filled log cribs of an acute angle triangular form, with the vertex of the acute angle upstream. Plans are now being made for constructing a temporary bridge of short stiffer spans on heavy cofferdams for carrying material in cars on a narrow-gauge railway. There is now an Arthur Koppel industrial narrow-gauge railway equipment, aggregating on both sides of the

river about one mile of tracking and some thirteen dumping cars and two flat cars. For handling the material in construction there are at present five boom derricks, with booms 50 to 58 feet long, and one stiff-leg derrick, each provided with a hoisting engine equipment. There are also several steam boilers for supplying some Rand rock drills and various pumps for drainage, these largely of the centrifugal type directly attached to small vertical steam engines.

The dam is carried to solid rock throughout its length, this underlying, at the left bank, a thin layer of soil and several feet of heavy clay. Stone for the boulders and the concrete generally is obtained from quarries which have been opened on both banks. This stone has not fulfilled the expectations based on some borings, and it is thought that the waste will average 50 per cent. of the working, as only strong stone is being allowed for the concrete work. The poor, though hardly, rotten stone lies in seams between strata of better rock, and this spoil is being spread out and compacted below the dam. In a similar way, the clay excavation is being laid above. It may be added that the dam at the left end is being built into the hard rock of the river bank, and the space between the concrete masonry and the original bank is to be filled with puddled clay. At this end of the work there is a stone crushing plant of 12 to 18 tons hourly capacity and on the right bank of the river one of 24 to 30 tons hourly capacity, both made by the Good Roads Machinery Company, of Kennett Square, Pa., the latter having the crushed stone bin supported so that the dump cars can be run directly underneath it. The crushers are provided with cylindrical revolving screens with holes ⅜, 1, 1½ and 2 inches in size.



Depositing Concrete in Danville Dam.

The dam is built within forms of 2-inch grooved planking planed on the concrete contact side, and fastened by means of wire nails to 4x6-inch studs spaced vertically on 4-foot centers, one nail per plank per stud, so as to allow for utilizing the forms over and over again with minimum mutilation, as the work progresses. The forms are, of course, braced to the ground by diagonal timber struts. Three different mixtures of concrete are used, one for the boulder work, a richer concrete for the rollway surface and an intermediate mixture for the masonry between that and the boulder concrete. The boulder concrete is a 1:3:6 mixture with rocks 8 to 24 inches in diameter, all laid in layers with about 4 inches of concrete between the stones. The sand used is a mixture, composed of about 50 per cent. screenings from the crusher, passed through the ⅜-inch holes, 25 per cent. of the river sand, which is of a moderately coarse nature, and 25 per cent. of fine sand found high up on the river banks, where it is deposited during high water. The downstream face concrete is a 1:2:5 mixture, with 1½-inch stone, and is 1 foot thick; and the third class of concrete is a 1:4:8 mixture with 2-inch stones and 2 feet thick, so that the boulder concrete may be said to lie 3 feet behind the rollway surface. The end of each section is formed with vertical V-forms into a number of saw teeth, so to speak, by which the next section can be dovetailed into it with more or less irregular surfaces for bonding. The Old Dominion brand of cement, made by the Virginia Portland Cement Company, is used, and there are two gravity concrete mixers on each side of the river, made by the Contractors Plant Company.

The plant was designed by Messrs. Lockwood, Greene & Company, of Boston, and the construction is being superintended by them, Mr. Edward B. Wood being the resident engineer. The J. W. Bishop Company, of Worcester, Mass., is the general contractor, with Mr. F. L. Allen, manager, and Mr. E. J. Steere, engineer, in the field. The mill, also designed by Messrs. Lockwood, Greene & Company, and to have 80,000 spindles ultimately, is being erected by Mr. George B. Hinman, of Atlanta, Ga., with bricks made at the site from the native clay. A reservoir of 1,000,000 gallons capacity forms part of this industrial enterprise, and this is being constructed by Mr. Charles Orchard, of Danville.

Ware's Shoals Power Plant.

A 65-foot water power plant is now under construction on the Saluda River, between Greenwood and Laurens Counties, S. C., for the Ware's Shoals Manufacturing Company, of Laurens, S. C., which is building a 25,000-spindle mill on the Greenwood side of the river. The development includes a masonry dam 26 feet high and 550 feet long, backing water for about 1½ miles upstream. In one end, there will be fine sand or sluice gates, and adjoining these, the head gates for the canal, five in number. The dam is being built on a granite foundation with a vertical upstream face, a curved top and a heavily battered downstream face, ending in a curved toe. Adjoining the gate house and forming a part of the canal is a heavy masonry spillway 85 feet long. The dam masonry is granite laid in Portland cement mortar, with Portland cement concrete for filling spaces between stone. The canal will be 2,900 feet long, on the sloping side of a hill with an embankment on the lower side. The canal is high above water, and the banks are being built of earth excavation from the canal, consisting principally of clay with a small mixture of gravel, watered and rolled in 9-inch layers. The forebay at the end of the canal is protected by steel racks, and is formed by a masonry wall in which are located the entrances to four flumes. These extend to the power house, a distance of 350 feet, to four pairs of horizontal turbines, of which two pairs of 27-inch wheels, made by the Holyoke Machine Company, will be installed at the start. Each pair will be direct-connected to a General Electric three-phase, 40-cycle, 2,300-volt alternator of 750 kilowatts capacity, and an exciter will be direct attached to the end of the generator shaft. Lombard governors for the water wheels are to be installed, controlled from the switchboard. The floor of the power house is 50 feet below the level of water in the canal and the water in the tail race is 15 feet below the power house floor. At low water it is expected that 3,000 horse-power will be available, and at ordinary stages, 4,000 horse-power. The cost of development for 3,000 horse-power, with all electric and hydraulic machinery included, will be about $40 per horse-power. The mill building, which will utilize a part of the power, is, as at present designed, to have an ultimate capacity of 50,000 spindles. Messrs. W. B. Smith, Whaley & Company are engineers for the plant, superintending it from the Columbia, S. C., office. Messrs. Snyder, Oates & Company, of King's Mountain, N. C., are the general contractors.

Comparison of Methods of Estimating Soil-stripping from Reservoirs.

Abridgement of a paper by Frank S. Hart, Member Boston Society of Civil Engineers, in the "Journal" of the Association of Engineering Societies.

The Sudbury Reservoir, covering at high water 1,290 acres, was commenced in 1895 by the Boston Water Works, and with all the other water-supply property of the Boston Water Works in the Sudbury River watershed, has since become a part of the Metropolitan Water Works. In accordance with the practice which has prevailed on the water works since 1883, nearly the whole of this area required the removal of the thin layer of earth in which there was a relatively large proportion of organic matter. Ordinarily this layer was about a foot thick, sometimes much thinner; but, here and there, pockets and swamps or meadows were found in which the deposits were of considerable depth. The removal of this material was classed as soil stripping. There were over 4,000,000 cubic yards, costing over $1,000,000, and divided among 9 contractors in 17 contracts, and ranging in price from 19 to 36 cents per cubic yard. Some of this excavation, it is said, was sublet as low as 16 cents.

Picks and shovels, mattocks and axes, knives and scoops drawn by horses, all had their turn and try on sod, roots, muck and loam, as the previous experience or inexperience of the individual contractors persuaded them to consider advisable; and one contractor finally resorted to a hydraulic dredging plant. This plant, after it was adjusted to the conditions and managed skilfully, did the work for less than one-third of the contract price per

cubic yard. The transporting was done by wheelbarrows, horse and mule teams, narrow-gauge dump cars hauled by horses, or light steam locomotives, or by inclined railways with stationary engines, according to the conditions regarding location, kind of material, length of haul and the ideas and financial abilities of the several contractors and the apparatus and plant on hand. The hydraulic plant used water carriage through a longer or shorter stretch of pipe as required.

Naturally, the question as to which was the proper way for the engineers to measure the amounts of soil stripping for the monthly and final estimates came out prominently, and when these estimates fell short of the expectations of some contractor dissatisfaction was heard more or less emphatically. As the complaints might become chronic and epidemic and be legally troublesome, and as there offered a good opportunity, an exhaustive and practical comparison of three of the most prominent and popular methods and also a method suggested by a complaining contractor were tested, and the writer was selected to make a careful investigation into the whole subject.

The regular method of measuring the soil stripping, called the 50-foot-strip method, was adopted as the first method. It had been in use for some years in calculating the work on other reservoirs and had hitherto been considered satisfactory. By this method the areas were divided carefully by instrument and tape into squares 500 feet on a side, and, before the sections were entered upon by the contractor, profiles of the original surfaces were taken on lines 50 feet apart and parallel to one of the sides of these squares. The leveling was done carefully, convenient benches being first accurately established, the "heights of instrument" taken to the nearest hundredth of a foot and the work checked back to the bench started from or to some other equally well-determined bench. The readings for the ground surfaces were taken to the nearest tenth of a foot. These notes were plotted on roll profile paper and carefully checked. The scales used were 3 feet to the inch vertical and 40 feet to the inch horizontal, Queen's continuous profile paper, plate B, being found well adapted for the purpose. The profiles were so arranged as to allow room for subsequent ones on these same sections when changed by the removal of the soil. These profiles were repeated monthly whenever the contractor had done any work on these lines, or as often as necessary to include all of his work of excavation up to the date for the estimate pending, and when the contractor had satisfactorily completed any sufficiently extensive area the profiles of that part were taken with particular care to use in making the final estimate, so as to closely include between them and the original profiles the amount of work to be reported.

The vertical areas included between the original surface profile and the profile showing the state of the work at the last survey were obtained by a planimeter measurement checked by a second person. This method is found to give a very satisfactory degree of accuracy. These "section areas" were used as "end areas" 50 feet apart in the ordinary way of computing earth work, care being taken to fulfil geometrical conditions at the outskirts of the excavation.

The second method was the same as the first, only the profiles and sections were taken 25 feet apart. In making the comparison with the regular method on the pieces of soil stripping selected, the regular 50-foot lines, profiles and sections, were used, and the others were taken exactly half-way between. This second method is referred to as the 25-foot strip method, and, because of its being the one requiring the greatest number of elevations to be determined, it was chosen as the standard method to compare the others with.

The third method, abandoning profiles, plotting and sections, took elevations only at the corners of 25-foot squares on the original surface and on the finished excavation, and the mean of these four differences of elevation, was considered as the mean depth of excavation for the 625 square feet. Irregular boundaries and broken squares were, of course, carefully considered and allowed for in the several estimates. Three areas were selected for comparison.

The first and largest area, located along Stony Brook, contained nearly 14½ acres, being about 1,800 feet long and of irregular width, averaging about 350 feet. It was a narrow piece of the meadow on both sides of the brook, with a border of gently sloping upland on the westerly side. The mud or muck in the meadow was at places 3 or 4 feet deep, usually covered with a heavy, tough sod, and the loam on the upland hillside was about a foot deep, more or less interspersed with boulders and stumps of trees.

In order to show what larger differences, by comparison, may be balanced in a general average when the volume of stripping from a large area is considered by the various methods, a subdivision into four parts has been made of the total area, and one of the best proportioned and defined of these parts has been further considered in ten strips 50 feet wide. As all but a very small portion of the material from this area was moved by cars, the opportunity was taken to compare carloads with other measurements. The portions of Tables I. and II. given above show amounts of excavation for the different parts by the several methods.

In Table I. the lowest ratio by the 50-foot strip method is 95.68 per cent., with a volume of 3,650 cubic yards, and the highest ratio is 103.16 per cent., with a volume of 3,675 cubic yards, while for the total of 34,100 cubic yards on this area of about 14½ acres the ratio is 99.98 per cent. By the 25-foot square method the lowest ratio is 98.93 per cent. (as against 97.98 per cent. by the 50-foot strip method) for a volume of 6,270 cubic yards, and the highest ratio is 100.78 per cent. (as against 101.06 per cent. by the 50-foot strip method) for a volume of 10,270 cubic yards, while for the total amount of 34,100 cubic yards, the ratio is 99.95 per cent., the 5 parts compared being in each case nearer the standard by the 25-foot square method, while the totals agree almost exactly with each other, as well as with the standard.

A corresponding analysis of Table II. shows that, in that part of the area which was still further subdivided (4.3 acres), the lowest ratio by the 50-foot strip method is 91.04 per cent. for a volume of 7,800 cubic feet, and the highest ratio is 113.51 per cent. for a volume of 12,300 cubic feet, while by the 25-foot square method the lowest ratio is 95.78 per cent. for a volume of over 18,700 cubic feet, and the highest ratio is 107.17 per cent. for a volume of over 10,550 cubic feet. The totals compare 101.06 and 100.78 per cent. for the 50-foot strips and the 25-foot squares, respectively, as is also shown for this portion in Table I. In the above instances the 25-foot squares show closer ratios to unity than do the 50-foot strips, but in the comparisons that can be made, six cases out of the ten show the estimates for the 50-foot strips to be closer to the standards than are the corresponding estimates by the 25-foot squares.

The opportunity of comparing car measurement with measurement in excavation was availed of under fairly good circumstances. It was particularly understood that the contractor was to be entirely uninfluenced, either by any direction of the work on the part of the engineers or through any information from them of the count to be made and inspection to be maintained. Directions were necessarily given from time to time relative to the kind of material to be or not to be removed, the same as if no count and accompanying inspection were to be made; otherwise the above understanding was faithfully carried out.

The contractor was aware, of course, from the constant presence of the observer and his use of the note-book and the careful measurement of the essential dimensions of his cars by the engineers, which was impossible to avoid or conceal, that something of the sort was going on; but, other than the apparent variation in the fulness of the loading of cars, it seemed to make no difference in his control or direction of the work or in his choice of methods.

Each car was carefully measured to obtain the "struck" capacities, which were quite uniform, averaging 76.27 cubic feet, the smallest being 74.91 and the largest 77.88. Four designa-

Table I.—Materials Moved by Cars from the First Area, July and August Estimates.

Area between stations.	By method of 25-foot strips. Standard. Cu. yds.	By method of 50-foot strips. Cu. yds.	Ratio to standard.	By method of 25-foot squares. Cu. yds.	Ratio to standard.
35 + 25 and 40 + 0....	3643	3485	0.9568	....	....
35 + 25 and 40 + 0....	2624	2655	1.0117	....	....
Area = 2.68 acres.....	6267	6140	0.9798	6200	0.9893
40 + 0 and 45 + 0.....	3672	3788	1.0316	....	....
40 + 0 and 45 + 0.....	6237	6193	0.9929	....	....
Area = 3.88 acres.....	9909	9981	1.0073	9938	1.0029
45 + 0 and 50 + 0.....	4347	4313	0.9921	....	....
45 + 0 and 50 + 0.....	5923	6067	1.0242	....	....
Area = 4.32 acres.....	10270	10380	1.0106	10350	1.0078
50 + 0 and 55 + 25....	2870	2871	1.0005	....	....
50 + 0 and 55 + 25....	4775	4711	0.9867	....	....
Area = 3.53 acres.....	7645	7582	0.9919	7585	0.9922
July estimate.....	14532	14458	0.9949	....	....
August estimate.....	19559	19625	1.0034	....	....
Area = 14.41 acres....	34091	34083	0.9998	34073.	0.9995

Table II.—Materials Moved by Cars from a Selected Section of the First Area.

Areas by stations.	July estimate, cubic feet.	August estimate, cubic feet.	Total cubic feet.	Amount by 25-foot squares. Cuble feet.	Ratio to standard.
45 + 0 to 45 + 25.....	6500	6085	12585	12907	1.0256
45 + 25 to 45 + 50.....	7134	6206	13340	13937	1.0447
Sum of strips (standards)..	13634	12291	25926	26844	1.0351
Same by 50-foot strip.....	13491	13951	27442	...	....
Ratio of 50-foot strip.....	0.9895	1.1351	1.0585	....	....
45 + 50 to 45 + 75.....	7265	7567	14832	14560	0.9817
45 + 75 to 46 + 0.....	7028	9078	16106	15600	0.9686
Sum of strips (standards)..	14293	6645	30938	30160	0.9749
Same by 50-foot strip.....	14372	10515	30888	...	....
Ratio of 50-foot strip.....	1.0056	0.9922	0.9984	....	....
46 + 0 to 46 + 25.....	6614	7947	14561	14822	1.0179
46 + 25 to 46 + 50.....	5987	7642	13629	14304	1.0495
Sum of strips (standards)..	12601	15589	28190	29126	1.0332
Same by 50-foot strip.....	12968	16185	29154	...	....
Ratio of 50-foot strip.....	1.0292	1.0382	1.0342	....	....
49 + 50 to 49 + 75.....	9578	9145	18724	17934	0.9578
49 + 75 to 50 + 0.....	11555	9098	20652	20117	0.9741
Sum of strips (standards)..	21133	18243	39376	38051	0.9664
Same by 50-foot strip.....	20861	17800	38661	....	....
Ratio of 50-foot strip.....	0.9871	0.9757	0.9818	....	....
25-foot strips, 45 to 50....	117380	159922	277302	279458	1.0078
50-foot strips, 45 to 50....	116450	163795	280245	....	....
Ratio.....	0.9921	1.0242	1.0106	....	....

tions for the comparative fulness of the cars were used, viz.: A, for heaping full; B, for well-rounded loads, but with partly empty corners; C, for what would be judged to be even full if leveled off, and D, for a rather slack load. There were also several cases where some of the cars were only about ½ or ¼ full when the train was started for the dump. A was estimated to represent 3.640 cubic yards gross measurement; B, 3.232 cubic yards; C, 2.825 cubic yards; and D, 2.640 cubic yards. Table No. III. will give some idea of how the loading varied.

TABLE III.—ITEMS OF THE CAR-COUNT MADE ON THE FIRST AREA OF INVESTIGATION.

1896.	Number of car loads and condition of loading. A. (Heaping full.)	B. (Well rounded.)	C. (Even full.)	D. (Slack.)	½ full.	¼ full.	Totals. No. of car loads carried.	Gross amount carried cu. yds.	Aver. No. of cu. yds. per car.
July est..	108	3558	1914	312	18	0	5910	18148.	3.071
Aug. est..	15	2721	3951	765	89	6	7547	22160.	2.936
Total.	123	6279	5865	1077	107	6	13457	40308.	2.995
Aug. estimate, incl. 405 cu. yds. moved by carts.								22565	
Total estimate, incl. 405 cu. yds. moved by carts.								40713	



A Railroad Viaduct on Cribbing.

Owing to the sticky condition of the material excavated, most of the cars returned from the dump with considerable dirt adhering to the sides and bottoms. It was estimated that the average amount per car was about 5 cubic feet. No allowance was made for this lessened capacity in reckoning the gross amounts by car measurement.

Of the July portion there was estimated to be about 50 cubic yards of stone and stumps left on the area and not removed by the cars, and of the August portion about 180 cubic yards were likewise stones and stumps not included in the car measurements. The standard estimates should, therefore, be decreased accordingly before comparison is made with the amounts by car measurements. We have, then, by standard measurements, 14,482 cubic yards in July, 19,379 cubic yards in August, or a total of 33,861, to compare with car-measurements of 18,148, 22,565 and 40,713 cubic yards, respectively, and find the ratios to be as follows:

For the July estimate	1 to 1.253
For the August estimate	1 to 1.164
And for the total estimate	1 to 1.202

The second piece selected for investigation was so bounded as to have full squares and to be entirely inside an area previously untouched by the contractor. It contained about 4¾ acres of not very smooth upland pasture, with a small bog hole or mud pocket as a special feature. As on the first area, profiles were taken of lines 25 feet apart and elevations were taken at the corners of 25-foot squares. The depression at the mud pocket was the only condition likely to occasion any great difference in the estimates by different methods.

Here we found, for special instances, the lowest ratio by the 50-foot strips to be 78.71 per cent. and the highest to be 107.23 per cent., while the same areas gave, by the 25-foot squares, 100.99 and 91.97 per cent. The lowest ratio by the 25-foot square is 91.97 per cent., which was for the same area as was the highest per cent. by the 50-foot strips, and the highest ratio by the 25-foot squares is 102.91 per cent., as against 98.40 per cent. for the same area by the 50-foot strips—a considerable diversity But, on taking the whole area, we found that almost exactly 1 per cent. was the difference from the standards, and both the 50-foot strips and the 25-foot squares are alike to within 1/20 of 1 per cent.

The third area selected was on a flat hillside. It contained about 2 acres of rough pasture land. The contractor had entered upon the work before we were able to take the elevations for the corners of the 25-foot squares, but the division engineer had taken the levels for the 50-foot and 25-foot profiles previously—about the time that this investigation was first being considered. The range of variation is from 96.61 per cent. to 104.81 per cent., and these extremes are for two contiguous strips. If these were taken together they would almost neutralize each other's divergences from the standard and give a ratio of 99 2/3 per cent., which simply emphasizes the principle that the larger the areas involved the nearer the ratios are likely to be to unity.

A summary of the results obtained by applying the three above methods of estimating to the quantities on the three areas appears to abundantly corroborate and fully justify the opinion and decision of the engineer in charge for this kind of work. It would seem from this investigation that the 25-foot strips were fine enough divisions for standards, and that profiles closer together could not reasonably be demanded and would not give much more reliable results when sufficiently large areas are taken and a generally uniform depth of cutting is to be considered.

From a contractor's point of view, one method is as likely to be as favorable to him as either of the others. But, from the engineer's standpoint, the questions of expedition and expense have considerable weight when choosing the method, and are very proper subjects for discussion. Unfortunately, this investigation was undertaken under such conditions that no definite conclusions respecting these points could be obtained.

Mr. Desmond FitzGerald was the engineer in charge of the work as engineer of the Sudbury Department, Metropolitan Water Works; and Mr. Frederic P. Stearns is chief engineer of the Metropolitan Water and Sewerage Board.

Raising a Steel Railroad Viaduct.

The double track-plate girder viaduct of the Pennsylvania Railroad, at Becks Run, near Pittsburg, is about 800 feet long and 50 feet high with alternate 30-foot towers and 50-foot spans. The towers are made with two trestle bents having four columns battered transversely and braced with riveted horizontal and diagonal struts in every face. The structure weighs about 700 tons and was raised about 7 feet above the original grade.

The viaduct was used for both freight and passenger service, and traffic on it was interrupted for only eight days. Each column was seated on a masonry pier around which the earth was excavated to a depth of about 3 feet. In the bottom of this pit crib-work was started and built up on both sides of the column and pier to nearly the level of the first transverse brace, the lower side of which took bearing on cross beams which were supported at the ends by jack screws set on top of the cribbing. The jack screws were operated simultaneously at all the columns to lift the structure clear of the old masonry, thus supporting its weight entirely by the riveted connections between the struts and columns.

When the jacks were extended to their limits, blocking was built under the column bases and they were lowered to rest on it. The jacks were removed, screwed up and re-inserted lifting the viaduct another 12 inches, and so on successively until the required elevation was attained. The old piers were then removed down to the bottoms of the pits, and new masonry was built on, extending the piers to the required height, where they were finished with 4x4-foot granite caps 2 feet thick. The cribs were built up to a maximum height of about 12 feet above the surface of the ground, and were made of 6x8-inch timbers about 4 feet long, laid up cob-house fashion.

For each transverse trestle-bent there were four cribs arranged symmetrically with the center line of the viaduct and of the bent, about 2 feet inside of the longitudinal faces of the feet of the columns and about 7 feet on centers, each side of the center line of the bent. The cribs were connected both transversely and longitudinally by 8x8-inch timbers built in near the middle courses and reaching through from the outside to outside of adjacent cribs. Across the tops of each transverse pair of cribs there are working platforms of solid planks, and a 12x12-inch cap which receives at each end a set of three 12x12-inch longitudinal timbers one on top of another, making a beam 36 inches high

supported at the ends over the centers of the two cribs in the longitudinal pair, and having the middle bearing under the lower transverse strut of the bent close to its column connection.

Four 5-ton jack screws were set under each end of this compound longitudinal beam and raised it to allow successive courses to be built on the cribbing below. By this arrangement, the column bases were always left suspended clear over the masonry piers, and plenty of room was left between the cribs for building the new masonry. The work was accompanied by a change of grade in the track which required one end of the viaduct to be raised 2 feet higher than the other end. The disturbance which this occasioned in the steel work was provided for in each tower by detaching the columns in one trestle-bent from their girder seats, inserting between them 1½-inch filler plates and riveting them up again, allowing the other members of the tower to spring to the slightly altered relative positions. This work was satisfactorily executed by the John Eichleay, Jr., Company, of Pittsburg, in eight days, employing a force of 40 men and using about 200 5-ton jack screws and 30,000 feet of timber for the cribbing.

Electric Power and Lighting in the New Government Building at San Francisco.

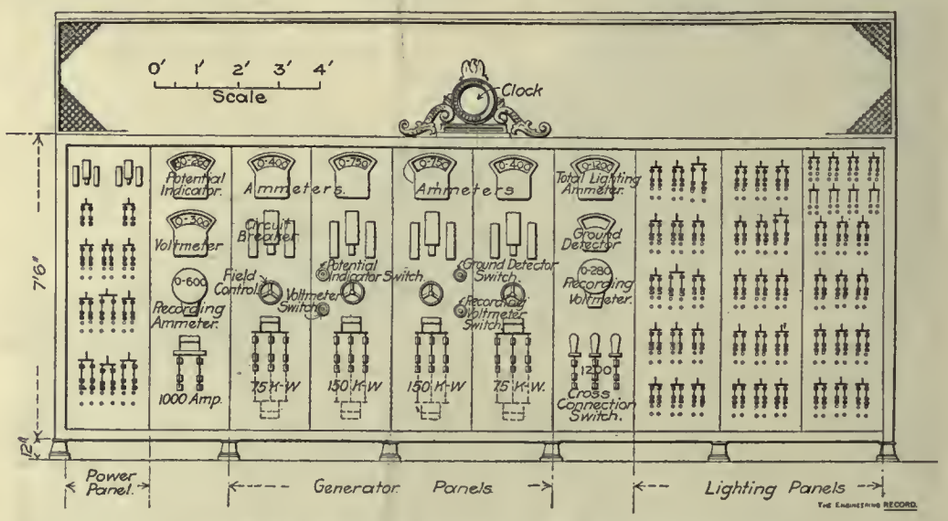
The power plant of the San Francisco Post Office and Court House, as described in the April 18 issue of this journal, was shown to be one of rather large proportions for a building not intended for manufacturing purposes or for supplying other than its own needs. The description of the ventilating and heating equipment in the May 2 issue showed that a considerable percentage of this power is consumed in driving ten fans and two water circulating pumps. The remainder of the current is employed in lighting nearly 4,000 incandescent lamps and providing power for five elevators. To recapitulate briefly, the generating plant comprises four direct-current Commercial Electric Company's dynamos, two of 150-kilowatts capacity and two of 75 kilowatts, each direct-connected to an Allfree tandem compound engine. The generator leads and field wires are run to the switchboard in a cable trench, the cables being lead covered and supported on cast-iron blocks with heavy porcelain insulators placed 4 feet apart. The cross-sectional area of the conductors is based on 1 square inch for each 800 amperes of current at the maximum generator output and is intended to keep the potential drop between the generators and switchboard within ½ of one per cent. when operating at full load.

The switchboard is located in the engine room, on the opposite side from the boiler room, as indicated in the basement cuts with the previous articles. It is of Tennessee marble 20½ feet long by 8½ feet high and contains ten panels, each 24 inches wide and 1½ inches thick, with the instruments disposed as shown on the accompanying elevation. An angle iron frame secured to the floor and ceiling supports the board 12 inches from the floor and 5 feet from the wall, the sides and top being enclosed by ornamental iron grilles with doors at the ends, as shown. The first panel at the left contains the fused knife switches which control all of the power circuits, and the three panels at the right similarly control all lighting circuits, while the intermediate panels contain the main station switches and instruments. The latter include one potential indicator, reading from 180 to 260 volts, mounted on a swinging arm and provided with a dial pattern indicator switch for making independent connections with the lighting and power bus bars, respectively; one voltmeter reading to 300 volts, mounted on a swinging arm and connected by a dial switch to any set of generator leads or the lighting or power bus bars; one differential type ground detector, similar to the potential indicator, with connections to the lighting or power bus bars; two ammeters for the 75-kilowatt generator panels, reading to 400 amperes; two ammeters for the 150-kilowatt generator panels, reading to 750 amperes; and one ammeter for the lighting circuit bus bars, reading to 1,200 amperes. All the foregoing instruments are of the station pattern with illuminated dials, and are of Weston make.

In addition to the above there is one Bristol recording ammeter with a scale range from 0 to 500 amperes and a 24-hour chart, connected to the power circuit bus bars and provided with a damping device for fluctuating currents; and one recording voltmeter, having a range from 0 to 250 volts and a 24-hour chart, connected through a dial switch with either the lighting or power bus bars. Mounted on brackets on the rear of the board are two Thomson integrating wattmeters, one for the lighting circuit with a capacity of 1,200 amperes and one for the power circuit with a capacity of 600 amperes. On each of the four generator panels there is a double-pole, double-break, magnetic I. T. E. circuit breaker, designed for closing each side of the circuit independently of the other. Two of 400-ampere capacity are mounted on the 75-kilowatt generator panels, and two of 750-ampere capacity on the 150-kilowatt generator panels. All have a working range from three-quarters normal rating to one-half overload and are capable of close adjustment throughout the range. Each generator panel also contains a three-pole, double-throw, double-break knife switch for connecting the corresponding generator to either of the two sets of bus bars, and a field rheostat with a sufficient number of steps to give a range of regulation between 200 and 250 volts by increments not exceeding one volt per step.

The upper set of bus bars on the back of the board is for the lighting circuits and the lower for the power, each set consisting of a positive, a negative and an equalizer bar. Each bar has a cross-sectional area of 2½ inches, and is built up of copper strips ⅛ inch thick. The connections from each set of bars to the ammeter and circuit breaker on each generator panel are made in such manner that they will remain in circuit when the main switch is thrown to feed either by the lighting or the power bus bars. A single-throw triple-pole switch of 1,200-ampere capacity on the face of the board is arranged to cross-connect the two sets of bars and in case of break down, the lighting bus bars may be connected to the city service by a single-throw, double-pole emergency switch of 1,000-ampere capacity. The feeder from this switch to the east corner of the building where the connection is made to the street service, has a cross-section of 1,200,000 circular mils and is carried overhead in the basement with the conductors of opposite polarity run in separate conduits.

The distributing systems from the switchboard are all of the two-wire form, with both conductors of a single circuit in the same conduit and in nearly every instance a separate feeder to each distributing cabinet or power outlet box. The feeder risers to the various floors are taken up through one or the other of the two ventilating shafts mentioned in connection with the ventilating and heating. Where the conduits pass through these shafts or through the basement they are exposed, but where they are run in finished parts of the building they are concealed under floors, in partitions, or in chases behind furring or lathing. The feeders and taps for the lighting circuits were selected of carrying capacities based on the number of lights to be supplied at .35 ampere for each 16-candle-power lamp, and allowing a loss of 2 per cent. in the feeders at the rated maximum load and 1 per cent. in the tap circuits. To give a 220-volt service at the tap outlets this requires a potential of 222.3 volts at the distributing tablets and 226.8 at the switchboard. The wires of the power circuits are of such sizes that the total loss of potential from switchboard to motor outlet boxes does not exceed 3 per cent. of 226.8 volts when delivering current under full load conditions.



Switchboard in the San Francisco Post Office and Court House.

Altogether there are forty-three distribution tablets for the control of the sub-systems of lighting circuits, each being roughly 2x3 feet in size and contained in a steel cabinet set in the wall with the back of the frame on the exposed side flush with the finished wall. The cabinets in corridors and all prominent locations have ornamental bronze frames with bevel glass doors and marble tablets within, while those in toilet rooms and the basement have plain frames with nickel plated finish and slate tablets. The tablets are mounted against the back of the cabinets, the latter being large enough to leave a margin of 4 inches or more around the board. This space is enclosed by marble or slate partitions towards the inside and the border of the door frame on the front, forming concealed connection compartments

from which the conduits containing the branches lead. The feeders connect at the bottom of each tablet to two bus bars which extend up along the center of the board and connect by lateral lugs to the horizontal tap circuit switches. The number of distribution cabinets and lamps as divided among the different floors are: Basement, 418 lamps, 10 cabinets; first floor, 1,722 lamps, 19 cabinets; second floor, 526 lamps, 6 cabinets; third floor, 647 lamps, 6 cabinets; and fourth floor, 518 lamps and 2 cabinets; making a total of 3,831 lights and 43 cabinets, or an average of 89 lights under the control of each distribution cabinet.

For the operation of the several motors, as previously mentioned, there are ten power feeder circuits as follows: Two each supply current for one of the two motors driving 90-inch cone fans for the fresh air supply; two each supply two motors each driving a 48-inch disk fan on the fourth floor for the removal of foul air; two each supply a motor driving a 60-inch disk fan in the basement for the removal of foul air; two each supply two passenger elevator motors; one supplies a pump motor for a hydraulic freight lift and a motor for the 60-inch blower for the boiler and engine room ventilation; and one supplies the motors for the hot water circulating pumps and the 36-inch disk fan for passing foul air from an isolated gathering chamber in the basement to one of the ventilating shafts. The motors for the seven disk fans are self-contained with the fan frames, while the connections of the other fans and the pumps are made to their motors with flexible couplings, allowing an independent alignment of motor and fan or pump shafts. The motors for the fans are capable of operating at the following speeds: For 90-inch cone fans, 125 to 250 revolutions per minute; for 60-inch blower and disk fans, 165 to 330 revolutions; for 48-inch disk fans, 200 to 400 revolutions; and for the 36-inch disk fan, 275 to 550 revolutions. In addition to the above, each motor is capable of being operated at two intermediate speeds, and the pumps may be operated from 25 per cent. below to 25 per cent. above normal speed.

The speed regulation in all cases is obtained by a speed controller, or rheostat, with a sufficient number of contact points to give easy acceleration between speed limits and permit continued running at the intermediate speeds. The motor tablets are of Tennessee marble, 1¼ inches thick with an ornamental brass or bronze casing secured to the wall by iron supports. Each board is equipped with a double-pole separately-closing circuit-breaker, a main double-pole, double-break spring-lever knife switch, a starting rheostat and a field rheostat, the two latter being mounted on the rear of the board. The motor tablets for the four motors on the fourth floor, in lieu of circuit breakers, have fuses inserted in the legs of the main switches.

The machines for the four passenger elevators are of the drum-hoist type with the motor mounted on the same base with the drum, and driving it through a tandem worm gear, and were manufactured by the Otis Elevator Company. Each is capable of lifting a live load of 2,500 pounds exclusive of the weight of the car and cables, at 200 feet per minute, and for a given position of the controller will not vary more than 10 per cent. in speed with different loads. Elevators 1 and 3 have a travel of 67 feet 8 inches, and elevators 2 and 4 of 55 feet 3 inches. All have the now common upper and lower limit automatic stops and centrifugal governors, which will cut off the motor current, release the guide grips and apply the brakes, when the maximum allowable speed is exceeded. If for any reason a car becomes blocked in the shaft while descending, a slack cable safety device will cut off the current and throw on the main brake. The controllers possess the following functions: To make and break the current and reverse the motor, to cut out starting resistance so as to accelerate the car to full speed within 5 seconds, and to circuit the motor through resistance when stopping and apply the brake. The controller is further arranged to automatically return to the stop position the instant the hand of the operator is removed, which makes it impossible for the car to start of itself.

The freight and ash elevator is a direct-acting plunger type of hydraulic lift manufactured by the Otis Elevator Company. It has a travel from the basement to the first floor only, a distance of 12½ feet, and is operated by water furnished at a pressure of 100 pounds through a compression tank of 60 cubic feet capacity, by a motor-driven triplex pump. The elevator will lift a live load of 2,000 pounds, exclusive of the weight of the platform and plunger, at a speed of 50 feet per minute, and is operated by a balanced valve arranged to move easily and to receive and discharge the water through graduated openings so as to avoid shocks when starting or stopping.

The building was designed in the office of Mr. James Knox Taylor, supervising architect of the Treasury Department, at Washington, D. C., and owes its mechanical and electrical features to Mr. J. E. Powell, chief mechanical and electrical engineer in the office of the supervising architect and his staff. Messrs. James McWilliams & Co., of Louisville, Ky., were the contractors for the electrical work herein described, including the installing of the elevators.

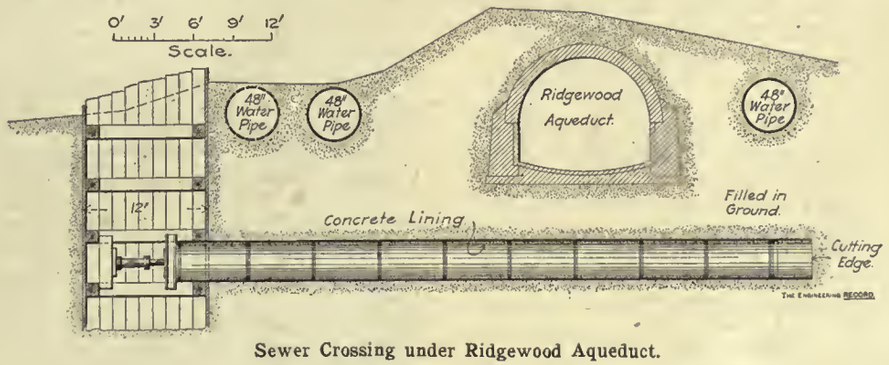
A Difficult Sewer Crossing under an Old Aqueduct in Brooklyn.

A very delicate piece of engineering was successfully carried through recently in forcing by means of hydraulic jacks a 36-inch pipe sewer under the big aqueduct which carries the greater part of the water supply of Brooklyn, N. Y., to the Ridgewood reservoir. The sewer is one which connects with the disposal plant described in The Engineering Record of June 28, 1902, and passes through the area in which the wells of the Oconee pumping-station—part of the Brooklyn water supply system—are located, at South Jamaica. In this part of its length the sewer is, of course, a cast iron main with leaded joints, in order to insure the safety of the water supply. The level of the sewer where it reaches the aqueduct is practically the same as that of the aqueduct, and an inverted syphon was therefore necessary in order to make the crossing.

In addition to the large brick aqueduct there were also two 48-inch iron pipes, one on each side to be crossed. A third main will soon be laid, as shown in the sketch. The aqueduct is of ordinary brickwork and very old, and it was feared that any ordinary methods that might be employed to make the sewer connection under it would result in serious damage to the aqueduct. The soil in the neighborhood of the crossing is almost entirely sand, and the ground-water level varies according to the operations at the pumping station. During the operation of building the crossing it stood at 1 or 5 feet below the surface, or 8 or 9 feet above the bottom of the inverted syphon. A large pump was employed to keep down the water and permit the work of jacking the sections of steel pipe under the aqueduct to be carried on.

The pipe which was used for this work was some that the contractor, Mr. John F. O'Rourke, had in stock, it being of a special internally flanged form which he uses for caissons in foundation work for buildings. It is 36 inches in outside diameter, 1 inch thick, and comes in 5-foot lengths. The flanges project 3 inches into the pipe, and their faces are machined so as to make tight joints. Nine of these special pipes were used, making with the 3-foot cutting section a total of 48 feet of pipe that was pushed through horizontally under the aqueduct. The cutting section consisted of a simple 3-foot cylinder of steel 36 inches in outside diameter, to which was riveted around the rear end on the inside a 3x3-inch angle.

A shaft 12 feet square was sunk to a depth of about 17 feet at one end of the proposed crossing. In the bottom of this was laid 3 feet of concrete as a foundation, with a sump in one corner from which the water was pumped as



Sewer Crossing under Ridgewood Aqueduct.

the work was carried on. A guide frame was arranged and the cutting edge started into the sand by 6-inch, 75-ton hydraulic jacks braced against the opposite side of the trench. When this was well started a 5-foot length of pipe was bolted to it and the jacking continued, and so on until the nine lengths had been forced through. The sand inside the pipe was removed as the work progressed, up to within 6 or 8 feet of the cutting edge. It had been supposed that nothing but sand would be encountered in the work, but at the further side of the aqueduct under the 48-inch pipe there was found some filled-in ground containing sticks and other rubbish, which fortunately, however, did not cause any serious trouble.

The exact pressure that was required to force the pipes under the aqueduct is not known, but it is probable that it was between 200 and 300 tons, as it was found necessary to use five of the 75-ton jacks. There was not the slightest indication that the aqueduct had settled during the operations, or that any damage whatever had been done. It had been suggested by the engineers of the water department that as a precautionary measure the crown of the aqueduct be removed for a distance of 50 feet each side of the crossing and a 5-foot main be lowered into it to carry the water supply while the sewer was being forced through. However, it was finally decided that this would be unnecessary, and the results seem to bear out this opinion.

After the pipe had all been forced in, it was

thoroughly cleaned, and a lining of concrete placed on the inside in order to make a smooth surface. The internal diameter of the finished syphon is, then, 28 inches. The concrete lining was put in with the help of light wooden centering, the invert being laid first and then the top of the pipe being filled by ramming the concrete horizontally through the 3-inch space between the centering and the pipe. It is thought that this work might have been simplified if the concrete lining had been put in before the pipe sections were forced in, leaving only space enough at the flanges to bolt the sections together, these spaces to be filled in afterward.

The work of constructing this sewer crossing has been done under the direction of the Bureau of Sewers of the Borough of Queens, Mr. J. H. Johnson, chief engineer. The plans were revised and approved by Mr. I. M. de Varona, chief engineer of the Bureau of Water Supply of Brooklyn. The contractor was Mr. John F. O'Rourke, of New York, who performed the work as far as shown in the cut. The short additional length and the manholes were built by Mr. De Witt C. Bouker.

Timber Preservation.

The subject of "Timber-Treating Plants," with especial reference to the treatment of railway ties, received able treatment at the hands of Mr. W. W. Curtis before the Western Society of Engineers, on May 20. An abstract of the paper follows. Attention was called to the fact that, although the subject of timber preservation had been before the public for a great number of years, it had received but little consideration until recently, due, no doubt, to the fact that the timber supply seemed inexhaustible. As time passed on new sources of supply were made available at former rates, because of new methods of merchandizing and cheaper rates of transportation. Then, too, the actual results to be obtained from such treatment were either unknown or disputed. As such treatment is necessarily somewhat expensive in first cost, it was not used by such managements as were desirous of making a good showing for the moment. To-day, however, conditions are different. The value of such treatment is recognized, as may be inferred from the fact that the number of ties to be treated in the present year will probably equal the product of the last twelve years.

As might be expected, several processes are in use. One of the oldest, and also one of the cheapest, is burnettizing, or the injection of zinc chloride. Good results are accomplished by this method, but it is open to the objection that the salts, being soluble, after a time are dissolved out of the timber, so that when the amount remaining becomes less than a certain mimimum, fungus life can begin its work anew. A condition for good results with this method especially, as well as with others, is the thorough drying of the ties after treatment, and the placing of these in a well-drained road bed.

Another method is the Wellhouse or zinc-tannin treatment. This to some extent overcomes the objections to the former process by sealing up the ducts in the timber by means of injections of glue and tannin following that of the chloride. Doubt has been expressed of late as to the additional life secured by the glue and tannin being equivalent in value to the additional cost of the treatment. As the additional cost of this method as compared with the former is but 3 cents per tie, it would seem that a small increase in the life of the tie would warrant the additional expense, each year's life of the same being estimated at a value of 5 cents.

Still another method which is in use at the present time is that of the zinc-creosote treatment. As creosote is the best timber preservative known, it would naturally be expected that any treatment in which this is employed would be an improvement. In regular creosoting, such a large amount is absorbed in obtaining a distribution sufficient to have any value, that the cost for the oil alone in the case of a 6x8-inch tie amounts to 30 cents, on the basis of 12 pounds per cubic foot and a cost of one cent per pound for the oil. This at present is generally considered prohibitive, although a life of twenty years can be expected as the result of such treatment, provided the ties do not cut out before this time. To overcome this difficulty several methods are used, in which a combination of creosote and zinc chloride is employed. The zinc-creosote treatment undoubtedly is of great value, and in Mr. Curtis' judgment, superior to most of the other methods employed.

A fourth method employed is the Hasselman process. This consists in the boiling of the timber in a solution of several substances, the principal one being sulphate of iron. A record of efficiency by this process has not as yet been definitely established, although it is no doubt the cheapest method that can be employed.

The cost of treatment per cubic foot by the various methods, not including any charges for profit, depreciation or interest, varies from 3¾ cents for burnettizing, 5 cents for zinc-tannin, and 7½ cents for zinc-creosote, to 15 cents for creosote on the basis of 12 pounds to the cubic foot. Although it may not be possible to determine which particular treatment is the most profitable, it is safe to say that whenever an inferior tie can be purchased and treated by any one of the processes, and then cost no more than a white oak or other first-class tie, the adoption of treatment is justified.

Mr. Curtis then described a plant recently erected. Such a plant, to be of the greatest value, should be so arranged that any process which may be developed in the future, may be used. The description included the proper method of handling the ties, both before and after treatment. The requisites of the plant proper, as regards the machinery required, was outlined, including the cylinders in which the timber is treated; the means of generating the steam used for steaming the timber; the condensers and air pumps for creating a vacuum in the cylinders, and such pumps as are required for transferring the fluid used in the treatment from cylinders to storage tanks and vice-versa, and also for supplying a pressure for forcing the fluid into the timber.

In the discussion which followed the paper, it was brought out that only such treatment as caused the fluid to penetrate all parts of the timber was of value, although several compounds for external application which are being advertised, might be of benefit in certain special places, where timbers were exposed to very humid air or similar conditions. Very little data has been obtained as to the effect of treatment on the strength of timbers, the holding power of spikes or similar details. Another fact brought out by the discussion was the destruction of the tie, not by decay, but rather by cutting out, in the case of treated timbers.

The McKeesport, Pa., Garbage Crematory, one of the first built in this country, has been sold to the United States Steel Corporation for $1, as part of the arrangement by which new tube mills will be located in that city. Another crematory will be built at once.

Some of the Work of the United States Geological Survey.

Topographic surveys and triangulation are in progress in a number of districts, as mentioned below, the state usually co-operating with the Geological Survey. The scales for the maps vary from one mile to two miles to an inch, and the contour interval is 20 feet. Railroads, highways, county lines, houses, streams and other features will be shown. The sheets as published will be obtainable from the Director of the Geological Survey, Washington, D. C., at five cents each. In Maine a network of triangulation has been established as a preliminary to topographic mapping. Topographic surveys are in progress in New York; in the Adirondacks, the St. Regis and Tupper Lake quadrangles will be completed, and the Loon Lake quadrangle partly surveyed this season. A series of atlas sheets for middle southern New York are in preparation; the Owego sheet, wholly within Tioga County, will soon be ready. Field parties are working also in other quadrangles in both western and eastern parts of the state. Since 1892, 31,106 square miles, or 64 per cent. of the state's area, have been surveyed; 176 of the 264 quadrangles have been mapped, and 140 maps have been published. The Saranac River, which falls some 1,400 feet in its course of 25 miles from the Saranac Lakes to Lake Champlain, is being gauged.

In Pennsylvania surveys have been begun in the vicinity of Johnstown and of Pittsburg, and during the present season mapping of the Houtzdale and Punxsutawney quadrangles, in Clearfield and Jefferson counties, will be completed. In West Virginia and Ohio topographical surveys are being extended. The coal formations of the former state have recently been briefly examined. Likewise in North Carolina, Tennessee, Georgia and Washington, along the Colorado River, in the Rocky Mountains and on the Pacific slope, surveys and triangulation are in progress and bench marks are being set. A new map of Alaska on a scale of 40 miles to an inch has recently been completed and will be printed in colors. This is the first contour map of this territory; the contour interval is 1,000 feet. Surveys and investigations in this region will be continued.

Chert Roads in Chattanooga.

Chert roads to the amount of 24,237 square yards were constructed in Chattanooga, Tenn., during 1902, and the city now contains about 9½ miles of gravel and chert roads, according to the report of City Engineer Robert Hooke for the year ending October 1. The average cost per square yard of the chert roadways laid on thirty-one streets during the past four and a half years is 43 cents, which includes the cost of grading, but not that of curbing and guttering. For the foundation furnace slag is used, as it is cheaper than crushed stone and quite as satisfactory for the purpose. When excavation is necessary to bring the street surface to subgrade, 6 inches is usually allowed for the thickness of the slag foundation and from 3 to 4 inches for the chert wearing surface. If the surface of the street improved is below what would otherwise be the sub-grade of the roadway, as has frequently occurred, the slag is applied of such thickness as will bring it to within 3 or 4 inches of the finished grade after proper consolidation by rolling, provided the thickness of the slag required does not exceed 12 or 15 inches, it being quite as economical to do the entire filling with slag as to fill with earth and to properly compact the same.

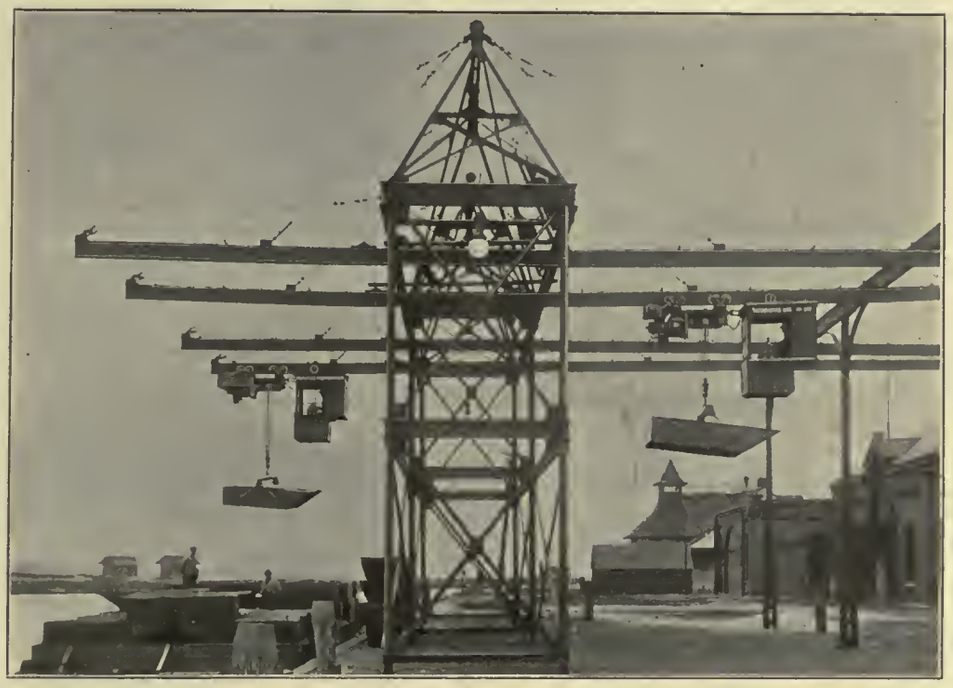
On the completion of the furnace slag founda-

tion to the required grade and after the road roller has been passed over it a sufficient number of times, a layer of chert sufficient in thickness to make 3 inches when compacted, is spread over the slag, and all fragments which measure more than 2 inches in their longest dimensions, are raked to the top and broken. This layer of chert is rolled with the road roller until it has been thoroughly compacted and a hard, even surface, true to the proper grade and cross-section, has been obtained. Extra chert is piled along the sidewalks for use in raising such low places in the roadway as may be developed during the process of rolling. If the chert has not sufficient moisture in it to enable the roller to compact it, it is watered by means of the sprinkler late in the afternoon and left till the following morning, when the rolling is resumed. The chert used in the construction of these roadways has, for the most part, been obtained from Summerville, Ga., a distance of 40 miles from Chattanooga. The price paid at present is 70 cents per cubic yard, delivered on board cars in Chattanooga.

Electric Traveling Hoists in the Milwaukee Garbage Crematory.

Readers of The Engineering Record who have followed the development of processes for the removal and ultimate disposal of city refuse are aware that the crucial feature of an unobjectionable service lies in the rapidity with which the offensive portions of this refuse are taken from the places where they are collected and on the cleanliness of all the plant employed for this purpose. If the carts are not well cleaned after each trip they will accumulate certain greasy matters which will give rise to more offensive odors than the fresh garbage, and if the garbage is allowed to stand in festering heaps at the disposal works it gives off a stench which has no equal for long range and flat trajectory. Accordingly every detail which will tend to minimize the sources of objection to refuse disposal is of prime importance.

In the disposal system employed at Milwaukee, Wis., the garbage is collected in specially designed iron skips or tanks which are fitted to carts of the usual type. These tanks, when filled, are taken to a wharf on the bank of the river and there placed on large scows. When a scow is loaded, it is towed to an island in the river where a large crematory of the Engle type has been constructed. Here a wharf has been built which is fitted with the terminal towers of an overhead tramway system of peculiar adaptability for this service. It is necessary to have the tanks carried into the second story over the tops of the furnaces of the crematory and to have the runway or track level, so there is a clear height of about 25 feet from the track to the ground. The building is about 90 feet from the face of the dock.



Electric Traveling Hoists at the Milwaukee Crematory.

The runways are four in number and their arrangement at the terminal towers at the wharf is shown in the accompanying illustration. The track is constructed of 12-inch I-beams which carry the trolley and operating cage on their lower flanges. The beams are guyed from the tops of the towers by heavy wires, and the ends projecting out over the scows are hinged so they can be raised to permit vessels to tie up at the dock. The runways are looped within the building to facilitate the hoists making the circuit of the furnaces and to prevent loss of time in switching when returning to the dock.

The tanks are lifted from the scows by means of an equalizing lever chained to the trunnions, this lever being hung from the bottom block of the hoist of the trolley. They are dumped by raising them after detaching one pair of chains. There are two of these hoists, each of 3 tons capacity and made by Pawling & Harnischfeger, Milwaukee. They have two motors and housed cages to protect the operators from the weather, for the work must be done promptly without regard to rain or snow. A direct current of 110 volts is employed and each beam carries on its top flange a pair of trolley wires which are fastened to but insulated from it. As rapid handling is necessary, the hoists have been constructed for a speed of 300 feet per minute under full load and 350 feet while running light. The total lift of 25 feet is effected in about a minute. The hoisting and carrying can be done separately or simultaneously, as the operator may decide.

The total length of this system of runways is about 880 feet, and its utility, both outdoors in any kind of weather and indoors where the transfer of the tanks must often be accomplished in narrow spaces, is evident, while its rapidity is particularly deserving of attention for reasons already mentioned.

Water Supply in the Mutual Life Insurance Building, New York.

The original building of the Mutual Life Insurance Company, New York, fronts on Nassau Street, and has wings on Liberty and Cedar streets. It has been enlarged by an extension about 178 feet long, 113 feet wide and 15 stories high, which is remarkable for the structural features and methods of building the deep foundations, as described in The Engineering Record of April 6 and April 13, 1901.

The original building contained a large number of offices and was supplied throughout by hot and cold water under pressure from several different roof tanks and separate pumps. After the completion of the new part of the building, additional services were connected to the street mains, new pumps and tanks were installed and the existing system was modified and connected to the new one, so that all portions of the building are now supplied from a single compound system which also serves the adjacent Stokes, Queen and Magdeburg buildings. This makes a very large and elaborate system of supply and distribution which practically covers an entire block and provides many thousand gallons of water daily for steam and power service, office uses, fire protection and miscellaneous purposes for many different establishments. All of the former pumps have been dismantled, except those in the Queen building, and the main pipes have been connected to the new system; but the old tanks have been retained for additional storage, and the arrangement of distribution pipes and the details of their control have been unchanged, except by the insertion of reducing valves to regulate the increased pressure from the new storage tanks on the roof of the tall building.

Service pipes from 2 to 4 inches in diameter are taken from the street mains on Nassau, Liberty and Cedar streets, and are connected to five meters, from which the discharge is normally taken to a No. 70 Continental filter installed in the basement of the old building. This filter consists of a pair of horizontal steel tanks 9 feet in diameter and 16½ feet long, and has a capacity of about 500,000 gallons in 24 hours, as described in The Engineering Record

Diphtheria Bacilli in Well Persons is the subject of a report of a committee of the Massachusetts Association of Boards of Health. As noted in the 1902 report of the Lowell board of health, the committee recognized two classes of persons carrying diphtheria bacilli, those not recently or directly exposed to the disease and those known to have been exposed recently. It adopts the following conclusions: (1) It is impracticable to isolate well persons infected with diphtheria bacilli if such persons have not, so far as known, been recently exposed to the disease. But if such cases should come to the knowledge of the health officers, they should be warned that they are dangerous, and instructed to take precautions. (2) It is not advisable, as a matter of routine, to isolate from the public all well persons in infected families, schools and institutions. It is advisable, however, to keep the children of infected families away from school and all public places. Wage earners may usually be allowed to continue their work, with the exception of teachers, nurses, and others who are brought into close contact with children. Milkmen should not be allowed to continue their business, on account of the risk incurred.

of December 12, 1896. The filters discharge under street pressure through ball cocks to a 20,000-gallon steel tank in the basement of the old building, which can also be filled by a by-pass direct from the meters. A 6-inch pipe from the bottom of this tank supplies a battery of three pumps which ordinarily deliver all the water used in the building to the roof tanks. The suction enters a manifold near the pumps which also receives branches direct from the filter and direct from the street main, so that water can be taken from either source at will. Outside the manifold, connections are also made by which filtered or unfiltered water can, if necessary, be supplied for the boiler service or for fixtures located below the second story where the street pressure would give sufficient head. Ordinarily, however, all are supplied by filtered water first pumped to the roof tanks.

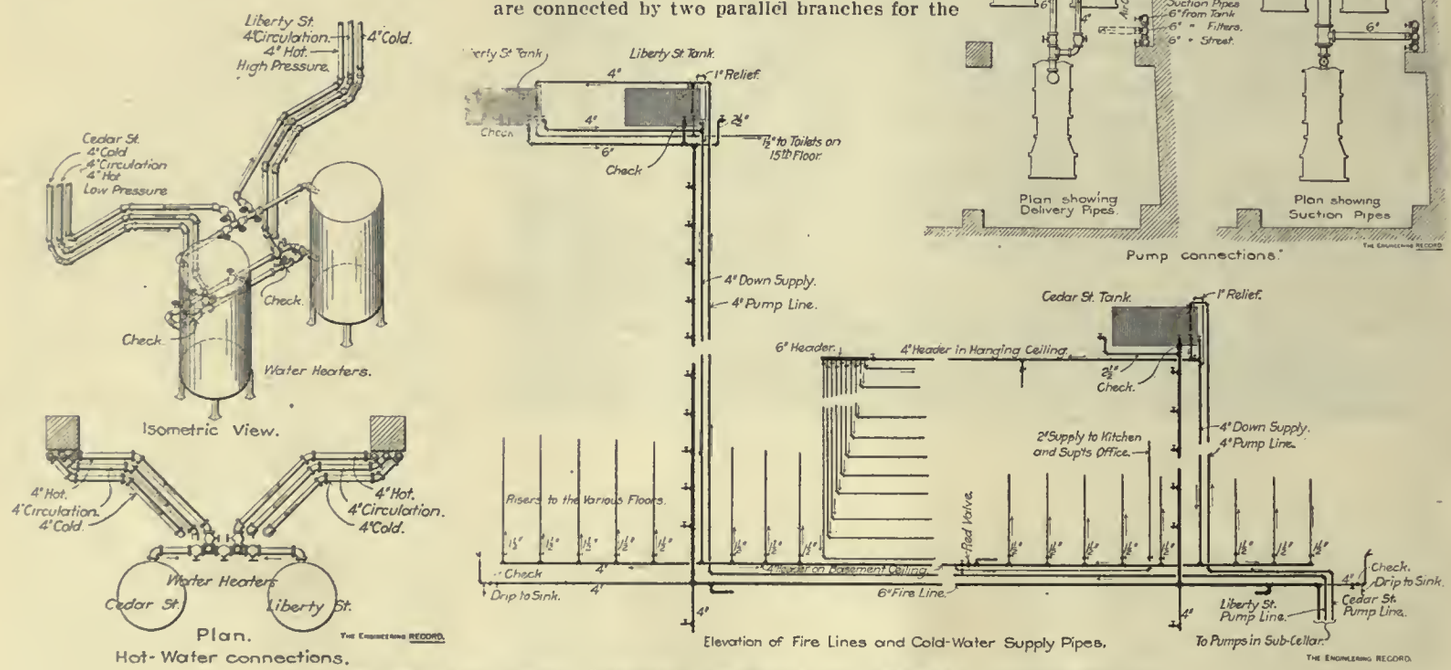
The two house pumps and the fire pump are cross-connected, as shown in the plan and isometric view, so that their discharges are all valved interchangeably to four riser lines, divided into two groups, one for the Cedar Street and one for the Liberty Street wing, and separated by a valve which is usually closed. Each wing has a 4-inch pipe to the roof tank, and a 6-inch fire line with valves on the former which are not here shown, but enable the pumps to be cross-connected with the boiler feed pipes. Each main discharge has a check-valve close to the pump to prevent back pressure, and beyond it there is a small air chamber.

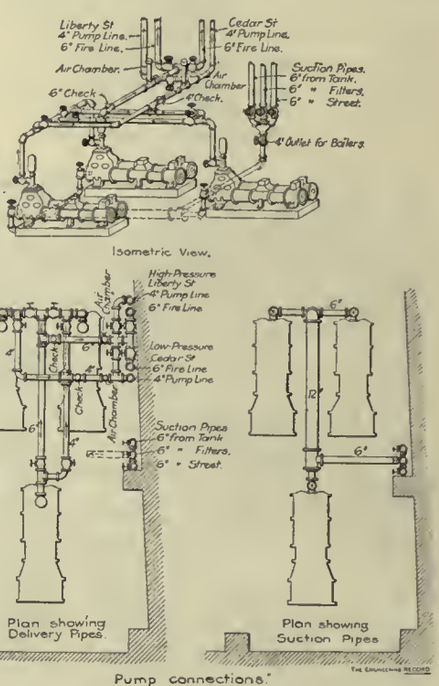
basement, where distribution is made by a belt line suspended from the ceiling and supplying risers to the different stories. The feet of all vertical lines are supplied with emptying valves and waste pipes, and they are arranged so that any one can be cut out for changes or repairs without interrupting the service elsewhere.

All tanks are filled through ball cocks and their supply is regulated by Ford valves placed on the pumps to control the special supply in accordance with the water level in the tanks. Branches from the tank mains supply the auxiliary tanks in the other buildings and in the other parts of the Mutual building. The house and fire pumps can all deliver to any one of the tanks, and either pump can perform the service of any other pump, and all of the tanks can be filled by gravity from the Liberty Street tanks, which are the highest.

Hot water is supplied for all toilet rooms and slop sinks. For some of the offices and for the kitchen, basement laundry and barber shop it is heated in two vertical Berryman hot water heaters each with a capacity of 50 gallons per minute. These are in the sub-basement, and are usually run separately under a high and low pressure from the Liberty Street and Cedar Street roof tanks. These heaters are fitted in the usual way with large interior brass coils operated by either live or exhaust steam. They each have a single inlet and a single outlet which are special in that they are taken from the sides of the heaters instead of from the ends, as is customary. The inlets are connected by two parallel branches for the

the Cedar Street wing is supplied with filtered water from the main suction tank and has a special pump which can deliver warm water from its condensers to the boiler feed water headers. The system is designed to be operated with the least possible trouble from a central point where most of the power and mechanical installation of the group of buildings is controlled; but the different tanks and distribution mains and headers in the separate buildings enable them to be readily supplied separately and controlled locally if necessary. The system was designed under the direction of Colonel J. H. Wells, civil engineer, and Mr. E. A. Klein, for Clinton & Russell, architects of the Mutual Life Insurance Company building. Acknowledgment is due Mr. Klein for





Details of Water Supply Systems in the Mutual Life Insurance Company's Building.

The suction header is connected to a 12-inch drum about 8 feet long which serves as an equalizer to feed the three pumps. The pumps are located four stories below the ground level in the sub-cellar of the new part of the building and deliver, as shown in the general elevation, to the roof tanks in the eighth and sixteenth stories of the two wings. The Liberty Street wing has a pair of rectangular, 5,000-gallon tanks connected by an equalizing pipe and valved to the same down supply and fire line. The Cedar Street tank has a capacity of about 12,000 gallons, and has a similar check valve connection to its fire line. The main supply from this tank is carried under the attic roof to a header, from which separate supplies are taken to the lower stories. The Liberty Street tank delivers directly to the cold water and return circulation pipes. The outlets are connected by a single horizontal pipe with one 4-inch riser to each wing. The horizontal connecting pipes have, between the high and low pressure risers, reducing and gate valves, which are ordinarily closed to separate the tanks, but which may be opened to put both of them under the same pressure. Each hot water supply riser has distribution branches in every story to supply the different groups of fixtures. The top of the riser terminates in a U bend in the upper story, with a small air pipe over the tank for vent, and returns full size to the heaters, thus providing a strong positive circulation that insures hot water at any fixture as soon as the contents of its short branch have been discharged.

The ice plant in the cellar and sub-cellar of

drawings. Mr. Thomas Swain was the contractor for the plumbing.

At the meeting of the Boston Society of Civil Engineers May 20 the committee on badges, appointed at the annual meeting, made its report and submitted three designs, any of which could be ordered in the form of a pin or a charm. The first represented the upper part of a Boston target rod, the second a compass enclosed in a circular band and the third a flattened plumb-bob. Dr. Louis Duncan, of the Massachusetts Institute of Technology, read an illustrated paper on the electrical transmission of power. An excursion is proposed for June 17, to see the filtration plant at Providence, the new draw-bridge at East Providence and the railroad crossing work at Fall River.

Letters to the Editor.

Tractive Resistance of Steel Wheelways.

Sir:—In your issue of April 25, 1903, page 438, are some data by General Roy Stone on the tractive resistance of the Murray Street, New York City, steel wheelway, which I desire to compare with that of the Transit Avenue steel wheelway in Chicago. General Stone states a result for the tractive resistance of the Murray Street wheelway which is equivalent to 14 pounds per ton on the level. As the New York trackway is laid in a stone-block pavement, the surface of the wheelway was probably clean, and therefore the two values are comparable. The results agree very well. The Chicago wheelway was made of a very light channel which was not well bedded, and therefore it should show the greater tractive resistance. Notice, however, that both of these results are much larger than is frequently claimed for a steel wheelway. It is claimed that some experiments conducted by an engineer of Pittsburg showed a tractive resistance of 3½ pounds per ton; but the axle resistance alone would be nearly, if not quite, that amount.

Incidentally General Stone gives the resistance of the "stone pavement" adjoining the wheelway as the equivalent of 45 pounds per ton. Photographs of the New York steel wheelway show the adjoining pavement to be rough stone blocks. Experiments by the writer on Chicago pavements (see page 29 of the author's Treatise on Roads and Pavements) gave a resistance for two pavements composed of "carefully dressed granite blocks" of 29 and 30 pounds per ton respectively, and for an "ordinary" granite block pavement 36 pounds per ton. These results seem entirely consistent with those for the New York pavement, since apparently the latter was much the rougher. There seems to be a considerably greater difference between the New York pavement and the "ordinary" Chicago granite block than between the latter and the special dressed block, and consequently the New York pavement should have considerably the greater tractive resistance.

Yours truly, Ira O. Baker.

Champaign, Ill., May 15, 1903.

Pressure Recording Gauges as a Protection to the Repair Department.

Sir:—In reference to article on pressure recording gauges contained in The Engineering Record of May 9, I would state that I fully endorse the views of the writer of the article. I believe that no water-works system is complete without at least one pressure recording gauge. In this department we have two, one at our main office and one at our repair department. We have found them especially valuable in recording the time required to shut off water in cases of breaks in mains. When large breaks occur in the down-town section, where there is large damage done, those who suffer loss are very apt to imagine that more time is required in shutting off the water than is actually the case. I inclose two dial records. The one marked "No. 1" shows a large break which occurred in a 12-inch main under asphalt pavement in the business section of the city. A large number of business places had their cellars flooded and there was some tendency to criticize the water department, it being claimed that it took the department men over an hour to reach the scene of the break and shut off the water. The record shows conclusively that the time required was less than half an hour. Without the recording gauge it would have been almost impossible to determine this. The record marked "No. 2" shows loss of pressure due to water used at a large fire which occurred within a few hundred feet of the main office, where the gauge is placed. During this fire the firemen used as many as 14 streams of water, and the record shows that the resulting loss of pressure was only 2 or 3 pounds. These two instances, out of many, show how valuable the recording gauge has been to this department. Its use cannot be too strongly advocated.

Yours very truly, John Venner,
Chief Inspector.

Syracuse, N. Y., May 23, 1903.

A Low-Pressure Alarm Gauge.

Sir:—The article in your issue of May 9 on "Recording Pressure Gauges" is interesting as showing the field of application of this device in a water-works plant and, it would seem, should impress upon the superintendent of any system, however small, the desirability of having at least one of these faithful and tireless monitors connected with his water mains. We have one such gauge on our low-service system and one is maintained on the high-service line at the same station and elevation, the normal pressures being 48 and 90 pounds, respectively. A valuable adjunct to the recording gauge, in use on our plant, is a low-pressure alarm gauge which can be set at any point desired, and when the pressure falls to that mark, an electric circuit is automatically closed, causing a bell to ring, thus giving immediate and audible information of "trouble" in the system. The device is home-made, and can be installed at little expense for night use in the residence of the superintendent, foreman, or wherever desired.

Very truly yours, Frank E. Merrill,
Water Commissioner.

Somerville, Mass., May 19, 1903.

Trade Publications.

A collection of points on packing has been prepared by Jenkins Brothers, New York. It describes the materials employed for packing, explains the forms in which the firm's product is prepared, and gives suggestions for the selection of the proper packing for any kind of service.

The Direct Separator Co., South Geddes St., Syracuse, N. Y., has published an excellent description of the principles, construction and uses of the separators designed by Prof. John E. Sweet; the pamphlet also contains an account of the Sweet exhaust head and the Powers steam trap, and is accompanied by a second pamphlet containing the results of some tests of the separators and a list of purchasers to date.

The new edition of the catalogue of the Climax Road Machine Co., Marathon, N. Y., is as useful to road builders and contractors as the previous issues. It describes the company's road machines, rock crushers, screens, elevators, portable stone bins and crusher outfits, stone distributing wagons, road rollers and scrapers.

The new wire rope list of the A. Leschen & Sons Rope Co., 920 North First St., St. Louis, is a book of 80 pages containing a description of the various classes of rope made by the company, including some with flattened strands, and pulleys, sheaves, fastenings and other fittings. The tables are unusually complete, and the book is also useful for the information concerning wire splicing, aerial tramways, and manilla rope which it contains.

The General Pneumatic Tool Co., Montour Falls, N. Y., has issued a bulletin concerning a combined stationary and portable riveter of the pneumatic type which will be found useful in shops where the amount of work to be done is not sufficient to warrant the purchase of several machines. Five minutes is long enough, it is stated, to convert the tool from one form to the other.

Concrete buildings are becoming so popular that special interest attaches to a folder prepared by Thos. C. Farrell, Washington, N. J., explaining the appliances he makes for the use of builders of such structures. They include molds, braces and forms for floors, walls, curbs, dams, and other classes of works.

The W. J. Clark Co., Salem, O., has issued a pamphlet describing a very large line of steel tote boxes for handling and storing all kinds of small hardware, steel barrels, kegs, lime measures, scoops, melting ladles, tool boxes, hoisting boxes and other sheet-metal utensils. The catalogue will be found of value by anyone who has occasion to use sheet metal, on account of the information it affords concerning the manifold forms into which the material can be worked.

The Haeseler-Ingersoll Pneumatic Tool Co., 26 Cortlandt St., New York, has published a well-printed pamphlet describing the Haeseler pneumatic tools, which are characterized by two special features, a valve mechanism having a radial movement and a new system of locking together the parts of the tool. Numerous excellent illustrations make these and other features of construction very clear.

There are few recent developments in gas making which have attracted more attention in Great Britain than the process of preparing fuel gas from slack discovered by Dr. Ludwig Mond, and commonly called by his name. The control of the process in the United States has been obtained by R. D. Wood & Co., Philadelphia, who have published a handsomely illustrated book of 100 pages concerning it. It describes the various stages of the process of manufacture, the cost and properties of the gas, and the various interesting plants which have been constructed for power and metallurgical purposes.

The striking folder concerning Keller hammers and other tools, which has just been sent out by the Philadelphia Pneumatic Tool Co., 21st St. and Allegheny Ave., Philadelphia, may not contain much technical information, but is well worth examination for its novel way of stating concisely the leading claims for such appliances.

The storage battery station at Alum Rock, on the San Jose & Santa Clara Ry., serves for the operation of a 10-mile electric road, as described in the last bulletin of the Electric Storage Battery Co., Philadelphia. There is an 85-horse-power gas engine, operated by California crude oil which is gasified by the exhaust from the cylinders, to care for the average heavy load of the summer season. The storage battery equalizes the engine load, and, during the season of light traffic, furnishes current for the road in connection with a station at San Jose, the gas engine being out of service.

Recent publications of the Fort Wayne Electric Works, Fort Wayne, Ind., include bulletins on arc circuit cut-outs, single-phase generators of the wal type, and belt-driven direct current generators, all useful to the managers of industrial establishments. There is also an instruction book on the installation and operation of direct-current series arc-lighting apparatus.

A valuable chart of the capacity of Anchor ventilators at different wind velocities, has been issued by Meurer Bros. Co., 569 Flushing Ave., Brooklyn, N. Y. The chart was prepared by

E. P. Goodrich, formerly with the Civil Engineer Corps, U. S. N., and is based on tests of the ventilators in actual service, made by him.

The Yearbook for 1903 of the Pierce, Butler & Pierce Mfg. Co., Syracuse, is one of the most elaborate trade publications received in some time. It is a large, handsomely printed book of 120 pages, which has by way of introduction a detailed explanation of the foundry and machine-shop practice of the company, which will interest all who care to know how the apparatus they employ is made. The many styles and sizes of steam and hot-water heaters made by the company are fully described, their particular fields of usefulness pointed out, and various types of radiators are illustrated.

The publication of trade catalogues on 3x5-inch cards for a card-index box, has been commenced by the Albany Steam Trap Co., Albany, N. Y. Four cards have been received, one on a combined pump and governor, two on non-return steam traps, and one on return traps. The cards explain the purpose of the apparatus and give lists of dimensions and capacities.

The Magee Furnace Co., Boston, has prepared a handsome book describing fully the construction of the many types of hot-water and steam heaters which it makes, and giving detailed instructions for setting them. Rules for estimating the size of heater and amount of radiation for a building and hints on chimney construction are also given.

A book of 189 pages is required to give a list of users of Reynolds-Corliss engines, made by the Allis-Chalmers Co., Milwaukee. The list includes pumps, compressors and blowers.

A useful, well-bound book concerning the types and uses of riveted steel pipe has been prepared by the American Spiral Pipe Works, 1173 S. Paulina St., Chicago. This pipe is now made in 3 to 40-inch sizes and of heavier gauges than heretofore. Hints concerning the detail designs of steam, exhaust, air or water mains of this construction, with tables of hydraulic data, make the book of much service.

Sibley & Pitman, 26 Warren St., New York, have prepared a general catalogue of desk and ceiling fan motors, which brings together in convenient shape information scattered through the publications of a number of companies.

A new edition of its general pumping machinery catalogue has been issued by the Stillwell-Bierce & Smith-Valle Co., Dayton, Ohio. It is a book of 114 pages, containing illustrations and brief descriptions of the many types of Smith-Valle pumping apparatus, from little tank-supply sizes to the largest triple-expansion machines for municipal water-works. Tables of dimensions are given for standard classes of pumps, but many of the illustrations relate to specially designed machines which are built to order only.

A new catalogue of exhaust fans has been prepared by the American Blower Co., Detroit. It explains the construction of the ABC steel-plate and cast-iron fans and the Dixie cast-iron fan, the latter being specially used for removing vapors and fumes, for which purpose it is sometimes lined with copper. Full tables of sizes, directions for setting up and memoranda useful in designing fan installations are given.

Two new bulletins have been added to the valuable series published by the Bullock Electric Mfg. Co., Cincinnati, O., one on type B motors, built in 1 to 10 horse-power sizes for slow speed, and 2 to 15 horse-power for moderate speeds, and the other on engine-type generators for direct current. Both are fully illustrated and accompanied by the usual tables of dimensions and weights.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal.

Mr. L. A. Dillon has been elected city civil engineer of Hamilton, O.

Mr. Harry A. McCallum has been elected city engineer of Peshtigo, Wis.

Mr. Moritz Wolf has been elected chief engineer of the water works of McKeesport, Pa.

Mr. Jefferson D. Eckles, of Greene township, Clinton Co., Pa., has been appointed county surveyor.

Messrs. W. B. Wood, E. W. Donn and W. J. Denning, architects, of Washington, have formed a partnership.

Captain David DuB. Gaillard, Corps of Engineers, U. S. A., has been ordered from Duluth, Minn., to Vancouver Barracks.

Messrs. James G. Hill and Frederick A. Kendall, architects, of Washington, D. C., have associated themselves under the firm name of Hill & Kendall.

Mr. Julian Griggs, city engineer of Columbus, O., has been reappointed, and Mr. William Wilcox has been made superintendent of the city electric light plant.

Mr. C. G. Wells has been elected city engineer of Galveston, Tex.; Mr. E. J. Owens, engineer of water works, and Mr. C. A. Reisel, assistant engineer of water works.

Mr. Robert E. Milligan has been appointed assistant general manager of the New York Continental Jewell Filtration Co. with office at 15 Broad St., New York City.

Professor C. P. Berkey, of the departments of geology and mineralogy in the Minnesota State University, has accepted a similar position at Columbia University, and will enter upon his new duties next fall.

Capt. John Stephen Sewell, Corps of Engineers, U. S. A., has been ordered to take charge of the construction of buildings for the Army War College and the Engineer School of Application at Washington, D. C.

Mr. Curtis Hill has been promoted to be first assistant engineer of the sewer department of St. Louis, Mo., and Mr. E. E. Wall has been appointed chief assistant engineer in charge of the water works extension.

Mr. J. H. Rice, for six years with the civil engineering corps of the Lake Shore & Michigan Southern Railway, has resigned to become superintendent of construction with the Dow Chemical Co., of Midland, Mich.

Professor Fortier, director of the experiment station of the Montana Agricultural College, at Bozeman, has been granted a year's leave of absence dating from July 1 to allow him to accept a position under the government to superintend the irrigation work in the state of California.

Mr. Richard W. Sherman, M. Am. Soc. C. E., ex-mayor of Utica, N. Y., and Messrs. Eugene Sherman, F. Seward Hurd and Charles E. Reynolds have formed a partnership to engage in general contracting. The firm name is Hurd, Sherman & Co., and the offices are in the Bastable Block, Utica.

Dr. Dugald C. Jackson, M. Am. Inst. E. E., M. Am. Soc. M. E., M. Am. Soc. C. E., professor of electrical engineering in the University of Wisconsin, and Mr. William B. Jackson, M. Am. Inst. E. E., M. Am. Soc. M. E., until recently travelling engineer with the Stanley Electric Manufacturing Co., have become associated as consulting engineers and experts with headquarters at Madison, Wis.

Mr. Dudley Farrand, of New York, for several years general manager of the United Electric Co., will accept the position of general manager of all the electric plants controlled by the Public Service Corporation of Jersey City, N. J., and Mr. Walton Clark, at present chief engineer of the United Gas Improvement Co., of Philadelphia, will be appointed general superintendent of the gas department.

Mr. Thomas Morrison has tendered his resignation as general superintendent of the Edgar Thomson steel works of the Carnegie Steel Co., at Braddock, Pa., and will retire from active business. He will be succeeded by Mr. Charles Dinkey, present assistant superintendent of the Homestead steel works, and Mr. John Lewis, master mechanic at the Edgar Thomson furnaces will become assistant superintendent.

Obituary Note.

Samuel H. McElroy, a well known civil engineer of Brooklyn, N. Y., died suddenly from apoplexy at his office in that borough, May 22. It is believed that his death was an indirect consequence of an electric shock he received about a month ago while alighting from an electric car. He was born in Albany fifty-five years ago, and while still a boy moved to Brooklyn, where he graduated from the Polytechnic Institute. As a civil engineer and surveyor he was associated with his father, the late Samuel McElroy, who planned the introduction of the water supply system in Brooklyn and was the engineer in charge of the survey of Prospect Park. Mr. Samuel H. McElroy served on a commission which laid out many of the streets of Brooklyn and was connected with many prominent public works, among them the Sea Beach Railroad, the Prospect Park and Coney Island Railroad, the South Brooklyn Terminal Railroad cut, the insane farm at St. Johnland, now known as King's Park, and the Flatbush sewer system.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 27, 28, 29, 30, 31 and 33.

WATER.

Tucson, Ariz.—Thos. Conlon, Supt. Water Dept., writes that the Tracy Eng. Co., of San Francisco, Cal., has secured the contract for a pumping engine (bids opened May 20) for $17,180.

San Jose, Cal.—It is stated that the San Jose Water Co. is to construct a new reservoir.

Bids will be received June 10 by the Bd. of Mgrs. for erecting a steel water tower at Agnews State Hospital. T. S. Montgomery, Secy.

Oroville, Cal.—The Butte County Canal Co., of Oroville, has been incorporated to take from the Feather River, near Oroville, sufficient water to irrigate about 20,000 acres of land in Butte and Sutter Counties; capital, $1,000,000. Incorporators: J. B. Clark, Fresno; A. K. Whitton, San Jose; D. C. McCallum, Oroville, and others.

Ft. Morgan, Colo.—The citizens are stated to have voted May 20 to construct water works, at a cost of $40,000.

Sterling, Colo.—C. L. Goodwin, Town Clk., writes that the contract for constructing water works (bids opened May 18) has been awarded to J. E. Hurd, 223 Plum St., Pueblo, for $5,850.

Greenwich, Conn.—See "Power Plants, Gas and Electricity."

Washington, D. C.—W. A. McFarland, Supt. Water Dept., writes that the following bids for furnishing 600 tons of 20-in. c. i. water pipe were opened on May 23; price given per ton: Reading Fdy. Co., Reading, Pa., $30.80; Dimmick Pipe Co., Birmingham, Ala., $33.98; Camden Iron Wks., Philadelphia, Pa., $35.90 and $35.10, and Drew Mach. Agency, Manchester, N. H., $37.11.

Columbus, Ga.—It is stated that bids are wanted Aug. 1 for $250,000 water bonds.

Clinton, Ind.—The following bids are reported to have been opened by City Council May 15 for constructing water works: Olds Constr. Co., $38,190; H. D. Halleck, $38,224; Phoenix Constr. Co., $43,460.

Atlantic, Ia.—See "Power Plants, Gas and Electricity."

Malvern, Ia.—The Chicago Bridge & Iron Co. is stated to have secured the contract for a steel water tank for the city; it will be 33½ ft. high, 19 ft. in diameter, hold 65,000 gals., and cost $4,000.

Maxwell, Ia.—The Iowa Eng. Co., of Clinton, is stated to have prepared plans for improving the water works and erecting a steel tower.

Storm Lake, Ia.—Prof. A. Marston, of Ames, Ia., is stated to be preparing a report on a new water supply.

Sioux City, Ia.—A press report states that bids are being received by City Aud. Ladyard for the purchase of $210,000 bonds for the construction of water works.

Cedar Rapids, Ia.—Geo. L. Mentzer, City Recorder, writes that the citizens voted May 19 to purchase the plant of the Cedar Rapids Water Co. He also states that no improvements or extensions are in contemplation to the water works at present.

Winfield, Kan.—Bids will be received June 8 by the State Bd. of Charities and Corrections at the Topeka State Hospital for furnishing material and erecting a standpipe at the Kansas State Asylum for Idiotic and Imbecile Youths at Winfield. John F. Stanton, State Archt., Topeka. Frank B. Denman, Secy.

Monroe, La.—See "Power Plants, Gas and Electricity."

Ruston, La.—See "Power Plants, Gas and Electricity."

Dexter, Me.—Geo. E. Foster, of Lisbon Falls, Me., is stated to have submitted the lowest bid for laying water pipe, for $9,366.

Salem, Mass.—The Water Bd. is reported to be considering the advisability of constructing dams around Wenham Lake to increase the water supply.

Williamsburg, Mass.—The citizens are stated to have voted May 22 to bond the town for $50,000 with which to construct water works.

Holyoke, Mass.—All bids recently received for the 20-in. c. i. pipe and special castings are stated to have been rejected and the Bd. of Water Comrs. has accepted the proposition of the Reading Foundry Co. for a special lot of about 600 tons of 20-in. c. i. pipe, at $28.50 a ton. The Holyoke Lead Pipe Co. has secured a contract for about 25 tons of lead, at $4.50 per cwt.

Coopersville, Mich.—The proposition to issue water works bonds is reported under consideration.

St. Cloud, Minn.—It is stated that bids are wanted June 15 for $100,000 water works bonds. Henry J. Limperich, City Clk.

Ellendale, Minn.—The National Constr. Co. is stated to have secured the contract for water works, at $6,950.

Woodlake, Minn.—Bids will be received June 8 by J. P. Hauck, Village Recorder, for constructing water works. Engineer, Oscar Clausen, St. Paul.

New Ulm, Minn.—Bids will be received June 2 by the City Council for opening 7 blocks of trenches, refilling and laying mains connecting same, placing gates and hydrants. Louis Schilling, City Clk.

Halsted, Minn.—The Village Recorder writes that bids are wanted July 15 for the construction of water works.

Millville, Minn.—It is stated that the Council contemplates constructing water works.

Bagley, Minn.—It is reported that the Village Recorder will secure estimates for water works.

Hattiesburg, Miss.—A. Fairley, City Clk., writes that bids are wanted June 2 for improvements to water works and sewerage system; probable cost of work is $20,000.

New Franklin, Mo.—The Council is reported to be considering the question of constructing water works.

St. Joseph, Mo.—The Council has passed ordinances providing for laying water mains on Jule, 7th and Pendleton Sts.

Great Falls, Mont.—Bids will be received June 15 by W. H. Smith, City Clk., for furnishing 42 fire hydrants, 17,000 lbs. pig lead, etc.

Ft. Missoula, Mont.—See "Government Work."

Wausa, Neb.—Calvin Keller, Village Clk., writes that it is proposed to construct water works, to cost $4,400.

Camden, N. J.—Bids are wanted by the Water Dept. June 10 for its yearly supply. L. E. Farnham is City Engr.

Perth Amboy, N. J.—The Bd. of Aldermen has passed a resolution to issue $80,000 bonds for the construction of an additional water main from the standpipe at Runyon to this city. This new pipe will be a 24-in. main; also a resolution providing for 2 new artesian wells to be driven at Runyon.

East Orange, N. J.—The City Council is reported to be seeking a new water supply, and a number of new plans suggested by C. C. Vermeule, Consulting Engr., are receiving consideration.

Batavia, N. Y.—The Horseshoe Lake Water Co., of Batavia, was incorporated May 22 with a capital of $125,000. Directors: C. O. Hodges, Batavia; J. B. Hamilton, Rush, and C. J. Brown, Brighton.

Lockport, N. Y.—A press report states that the Council will open bids on June 1 for the supply of pure water for Lockport. Wm. M. Foltz, Chmn. Com.

Waterloo, N. Y.—W. A. Gibson, Village Clk., writes that D. Gring, of Newport, Pa., representing the Seneca Lake Water Co. has secured a franchise for water works. This company, according to press reports, proposes to supply both Waterloo and Seneca Falls with water. Chauncey L. Becker and J. B. H. Mongin, of Waterloo, are reported to be among the stockholders.

Yonkers, N. Y.—A. W. Kingsbury, Clk. Bd. Water Comrs., writes that the following bids for constructing a water filtration plant were opened on May 21: Robt. L. Stewart, Yonkers, $52,760; Tucker & Vinton, N. Y. City, $45,895; Grady, Kearns & Hart, Yonkers, $59,556; Jewell Filtration Co., N. Y. City, $56,450; Molloy & Murray, Yonkers, $58,865.

Ilion, N. Y.—Water bonds, amounting to $69,000, have been sold.

New York, N. Y.—Bids will be received June 2 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing and delivering c. i. water pipes, branch pipes and special castings.

Greene, N. Y.—The following complete bids for constructing a gravity system of water works were received by Bd. of Village Trus. May 19: Troy Public Works Co., Utica, $16,949; J. J. Siegrist, Utica, $15,362; F. N. Lewis & Co., Herkimer, $27,608; Buck & Ireland, Binghamton, $15,447; Bauer & Hyatt, Owego, $16,367. In addition there were 5 bidders for the valves, hydrants, etc., alone, that of the Eddy Valve Co., Waterford, N. Y., being accepted, at $1,258; and the bid of Fritz & Partridge, Scranton, Pa., $13,813, was accepted for the construction of reservoir ($2,100), receiving chamber ($145), and furnishing and laying pipe.

Long Island City, N. Y.—Bids will be received June 9 by Robt. Grier Monroe, Comr. of Water Supply Gas and Electricity, N. Y. City, for furnishing material and installing boilers and appurtenances at pumping stations Nos. 1 and 2, Boro. Queens.

New Brighton, N. Y.—Bids will be received June 9 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing material and installing boilers and appurtenances at the pumping station of the Tottenville Water Wks., Boro. of Richmond.

Brooklyn, N. Y.—Bids will be received June 18 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, N. Y. City, for furnishing, delivering and laying a 48-in. c. i. force main, with appurtenances from the Ridgewood pumping station to Mt. Prospect high service tower; also until June 11 for furnishing, delivering and laying a 36-in. c. i. main, including all appurtenances, on Atlantic Ave.; also for retubing Morris boilers Nos. 0 to 9 inclusive at the Ridgewood Engine House.

Edenton, N. C.—See "Power Plants, Gas and Electricity."

West Manchester, O.—R. H. Siler, Corporation Clk., writes that it is proposed to construct water works, at a cost of $17,000. Contracts will probably be awarded in July.

St. Johns, Ore.—A press report states that at the Council meeting June 1 a water works franchise will be given for 25 yrs. to the company which will put in an ample plant, the city reserving the right to purchase it at the expiration of 20 yrs. C. A. Cook is Mayor.

Meadville, Pa.—Bids will be received by the Water Comrs. until June 10 for furnishing material and constructing a pump and boiler house, 50x100 ft., on Rogers Road, also for furnishing material and erecting foundation for Worthington pump to be erected in said building; for laying water pipe and special castings, valves, and other appurtenances. There will be about 7,000 ft. of 16, 18 and 20-in. pipe to be laid; for furnishing f. o. b. cars at Meadville, about 700 tons of c. i. pipe and specials, 700 ft. of 4-in. wrought iron pipe, 6 4-in. flange valves, 4 16-in. hub valves, 1 18-in. hub valve, 2 6-in. valves. Geo. S. Cullum, Supt. Water Wks.

Wilmore, Pa.—A press report states that the Pennsylvania R. R. Co. is about to expend about $200,000 in water works improvements. A private pipe line about 10 miles long will be built and long track tanks installed in each of the four tracks between Wilmore and Portage. The company also proposes to increase the size of the water main into Gallitzin and make numerous other betterments in the water facilities. W. H. Brown, Ch. Engr., Philadelphia.

Bradford, Pa.—E. C. Hopkins, of Rome, in a report to Council for a high water pressure, is stated to have recommended that reservoir No. 3 be connected direct to the outlet of reservoir No. 1 by means of a 16-in. pipe.

Gary, S. D.—Dr. W. S. Bentley, Town Clk., writes that it is proposed to construct water works, to cost about $6,000.

Gary, S. D.—W. S. Bently, Town Clk., writes that the citizens have voted to issue $6,000 bonds for constructing water works.

Salem, S. D.—The citizens are stated to have voted May 19 to issue additional water bonds. About 12 blocks of new mains will be installed.

Armour, S. D.—According to press reports, the Town Council has sold $10,000 water bonds, and bids are now asked for sinking 2 tubular wells to the soft water flow, and a standpipe will soon be erected.

Bristol, Tenn.—The City Council is stated to have appointed the following committee to negotiate for a new water supply: A. C. Harkleroad, Auson Klog, and Mayor Dickey.

Springfield, Tenn.—See "Power Plants, Gas and Electricity."

Mt. Pleasant, Utah.—A corps of engineers, under State Engineer Doremus, is reported to be making preliminary surveys for water works to be put in this summer, at a probable cost of $18,000.

Cle Elum, Wash.—The Pacific Coast Pipe Co., of Seattle, is stated to have secured the contract for 29,000 ft. of pipe, 12 hydrants and all connections for completing the water works, for $10,578. The contract for the trench work is stated to have been awarded to Carl Wright, of Cle Elum, for $2,320.

Seattle, Wash.—The Northwestern Irrigation, Power & Investment Co., of Seattle (W. C. Stayt, Mgr.), is stated to have secured 5,000 acres on east bank of Columbia River from Kettle Falls to 4 miles below Daisy, and will take water from the Colville River. The main ditch will be 16 ft. wide and 27 miles long, and will carry water to irrigate 16,000 acres. M. C. Conley will start construction of the ditch immediately, as the preliminary surveys are finished.

Tacoma, Wash.—N. L. Taylor, City Engr., writes that bids will be called for about June 15 for constructing a 4,000,000 gal. middle service distributing reservoir; there will be required 30,000 cu. yds. excav. and 6,000 sq. yds. concrete lining; also miscell. concrete work.

Port Angeles, Wash.—The City Council is stated to have passed a resolution directing the city attorney to prepare and submit an ordinance granting a franchise for water works to the party who would submit at once the most favorable proposition, the city to reserve the right to purchase plant after a given term of years.

Ballard, Wash.—The estimated cost of water mains on Chestnut, Wilbert, Bway., Ballard, Baker, Crawford, Post, Barnes and Mohr Sts. is reported to be $10,757.

Fennimore, Wis.—Bids will be received June 4 by Wm. Weaver, Village Clk., for a deep or artesian well. Geo. Cadogan Morgan, Engr., Chicago, Ill.

Milwaukee, Wis.—The U. S. Cast Iron Pipe & Foundry Co., of Chicago, Ill., has secured the contract for 1,000 tons of c. i. water pipe at $30.45 per ton, and the Camden Iron Wks., Philadelphia, Pa., secured the contract for 75 hydrants, each $36.80 (bids opened May 19).

Cheyenne, Wyo.—It is proposed to lay 4 blocks of new 6-in. water main in the near future. W. D. Pease, City Engr.

Port Arthur, Ont.—The citizens are reported to have voted to issue $91,000 bonds for water works. Engineer, Willis Chipman, Toronto, Ont.; Jas. McTeigue, City Clk.

Montreal, Que.—The Water Com. is stated to have procured from the Finance Com. $63,000 for mains, new service pipes and hydrants.

SEWERAGE AND SEWAGE DISPOSAL.

Little Rock, Ark.—Jas. F. Kieser, Supt. Pub. Wks., writes that the city will build several extensions to the sewerage system during the present season, the first of which will consist of 5 miles of pipe sewers, contract to be let latter part of June.

San Francisco, Cal.—City Attorney Lane has advised the Bd. of Pub. Wks. that the matter of reconstruction of 6th St. sewer be referred back to the Supervs. for such further action as they may choose to take, and that the contract already awarded for the work on a bid of $53,236, be considered void.

Danbury, Conn.—Bids are wanted June 1 for furnishing material and constructing 3,146 lin. ft. 6, 10 and 12-in. salt glazed, vitrified sewer pipe, including 6-in. branches 30 ft. apart each of sewer. A. L. Davis, City Engr.

Wilmington, Del.—The following bids for constructing Price's Run Sewer were opened by the St. and Sewer Dept. May 22d: Harry A. Miller, $95,927, and $6 per yd. additional for rock excav.; J. D. Murray, $103,328; Baltimore Constr. Co., $111,152; Christiana Constr. Co., $112,410. Owing to irregularity in some of the bids, all were rejected, and new bids will be received June 6th. T. Chalkley Hatton, Consulting Engr.

Washington, D. C.—Bids are wanted June 10 for granite curbing, asphalt blocks, sewer brick, cement, etc., as advertised in The Engineering Record.

Indianapolis, Ind.—The following bids were opened by the Bd. of Pub. Wks. May 25 for the construction of the Irvington sanitary sewerage system (Jas. B. Nelson, City Engr.), price given per lin. ft.: J. H. Green & Sons, Marietta, Wis., $2.14; Marion Co. Constr. Co., Indianapolis, $2.13; Indiana Sewer Co., Indianapolis, $2.12; Municipal Eng. & Contr. Co., Chicago, Ill., $2.11; Wm. Bossert, Indianapolis, $1.97 (awarded contract); total cost about $107,500. This work includes 53,000 ft. of brick and pipe sewers from 1 ft. 8 in. x 2 ft. 6 in. to 10 in. in diameter, 188 manholes, 4 catch basins, and 6 flush tanks, and 1,048 house connections. The trench is expected to average 28 ft. in depth, and will be excavated in yellow clay, gravel and blue clay.

New Albany, Ind.—Later reports state that the plans of Jenp & Moore, of Indianapolis, have been accepted for the proposed sewerage system.

South Bend, Ind.—Bids are wanted June 3 (readvertisement) for pipe sewers. A. J. Hammond, City Engr.

Ardmore, Ind. Ter.—The City Council is stated to have decided to construct a 3-mile system of sewers. Engineer, Chas. S. Wadsworth, of Oklahoma City, Okla. Ter.

Ottumwa, Ia.—John W. Scott is stated to have secured the contract for the construction of the South Ottumwa trunk sewer at $7.14 per lin. ft.; total cost about $30,000.

Sioux City, Ia.—City Engr. J. M. Lewis is stated to have prepared a preliminary survey for a 10-mile ditch from near Luton to Whisky Creek; probable cost, $37,000.

Burlington, Ia.—Bids will be received on June 15 for the construction of Stoney Lonesome sewer and the main Hawkeye sewer, paving Arch St. with asphalt and construction of 6th St. viaduct superstructure, all advertised in The Engineering Record of May 30th.

Kansas City, Kan.—The City Council is stated to have approved the plans of the City Engr. for a sewerage system in Armourdale, to cost about $50,000.

Annapolis, Md.—The Council is reported to be considering the question of constructing new sewers.

Grand Rapids, Mich.—Local press reports state that Alderman Renihan is having new estimates prepared by the City Engr. on the cost of building the West Side trunk sewer to take the place of the West Side ditch.

Coldwater, Mich.—Bids will be received by the Bd. of Pub. Wks. until June 10 for constructing approximately 1,440 ft. of 36-in. concrete sewer, 358 ft. of 24-in., 809 ft. of 20-in., 426 ft. of 18-in., and 928 ft. of 15-in. pipe sewer, together with the necessary manholes, catch basins, inlets, etc. Riggs & Sherman, Engrs., Toledo, O.

Charlevoix, Mich.—See "Paving and Roadmaking."

Madelia, Minn.—Bids will be received June 6 by the Village Council for constructing about 7 blocks of sewers. C. O. Cooley, Pres.

Hattiesburg, Miss.—See "Water."

St. Louis, Mo.—According to local press reports the Bd. of Pub. Improv. on May 19 rejected bids received Apr. 28 for sewers in Blackstone joint sewer district; probable cost of work is $57,000.

It is stated that bids are wanted by the Bd. of Pub. Wks. until June 9 for repairing sewers.

Kansas City, Mo.—An ordinance is before City Council providing for the construction of sewers in Sewer Dist. No. 220: 37,000 ft. of pipe sewers, 2,500 ft. of brick sewers, 141 manholes, 85 catch basins, and 6 flush tanks; cost about $100,000. D. W. Pike is City Engr.

Great Falls, Mont.—The proposition to drain south portion of city is being considered by City Council. Acting City Engr. Ellis has recommended 3 48-in. iron pipes to conduct water through R. R. Right of Way. Length of each conduit would be about 600 ft.

Summit, N. J.—Bids will be received June 2 by the Common Council for $125,000 sewer bonds. Robt. J. Muldowney, City Clk.

Hoboken, N. J.—Bids will be received June 10 by the Mayor and Council for constructing sewers in portions of Newark St. and Willow Ave.; also box sewers in portions of Grand and 15th Sts. Jas. H. Londrigan, City Clk.

Press reports state that bids are wanted June 10 for $35,000 bonds for cleaning and repairing sewers. Jas. H. Londrigan, City Clk.

Camden, N. J.—The St. Com. of City Councils is stated to have reported favorably on the measure providing for the construction of a link sewer to replace the line ditch now employed for draining purposes by the city; the sewer will be 6 ft. wide and will cost $75,000.

Mt. Morris, N. Y.—The question of constructing a sewerage system is reported under consideration.

Brooklyn, N. Y.—Bids will be received June 10 by J. Edw. Swanstrom, Boro. Pres., for furnishing and constructing small quantity of pipe sewer in portions of numerous streets; also 760 lin. ft. 30-in. brick sewer in portions of Columbia St.

Amsterdam, N. Y.—F. E. Crane, Supt. of Sewers, writes that contracts for sewers, bids opened May 20, have been awarded as follows: On E. Main St. to Eveline Contr. Co. of Waterford, for $3,541, and on Guy Park and Milton Aves. to Frank Pantelone, of Amsterdam, for $3,834.

Johnstown, N. Y.—Bids will be received by the City Council June 15 for trunk sewer work, to cost about $10,000. J. W. Taylor, City Engr.

Greensboro, N. C.—J. M. Bandy, City Engr., writes that 3 lines of main sewers are to be constructed, in all about 7.7 miles, with 3 septic tanks at a probable cost of from $65,000 to $75,000. Bids for construction are now being received.

Jamestown, N. D.—It is stated that bids are about to be received for the construction of a sewerage system, to cost $12,000. Engineer, Saml. Crabbe, of Fargo.

Cleveland, O.—Bids are wanted June 15 for $500,000 sewer bonds; also $200,000 electric light and power bonds. J. P. Madigan, City Aud.

Youngstown, O.—Bids will be received by the Bd. of Pub. Service until June 6 for constructing a sewer in a portion of E. Myrtle Ave. G. T. Prosser, Clk.

Wapakoneta, O.—Bids will be received by Chas. E. Fisher, Village Clk., until June 6 for furnishing material and constructing a main sewer in Sewer Dist. No. 3, requiring 1,058 ft. of 40-in., 707 ft. of 36-in., 364 ft. of 33-in., 2-ring brick sewer, and 1,427 ft. of 30-in., 2-ring brick or 30-in. D. S. pipe sewer, 246 ft. of 10 to 24-in. pipe sewer, tees, manholes, etc.; also for constructing local sewers in Sewer Dist. No. 7, requiring in all 2,228 ft. of 6 to 18-in. pipe sewer, tees, manholes, etc.

Geneva, O.—C. I. Crowther, City Clk., writes that bids will be received about July 1 for constructing a system of pipe sewers and disposal plant; probable cost, $50,000.

Sumpter, Ore.—S. S. Start, City Clk., writes that it is proposed to construct a sewerage system, at a cost of $15,000. The citizens will probably vote on the question next month.

Pendleton, Ore.—The Denny Clay Co., of Seattle, Wash., is stated to have secured the contract for sewer pipe, at $17,664.

Oregon City, Ore.—Wm. Sheahan, Chmn. Sts. and Pub. Property, writes that the following bids for sewer work in Sewer Dist. No. 3 were opened on May 14 (Engr. in Charge, Ernest Rands): Lyons & Gadke, Oregon City, $20,449; Baker & Mihlstine, Oregon City, $19,079; Howard & Smyth, Portland, $19,004; E. W. Riner, Portland, $15,302 (awarded contract); Jacobson-Bade Co., Portland, $15,404; Howell & Bitner, Oregon City, $18,119. This work includes about 11,500 ft. of pipe sewers from 24 to 8 in. dinmeter, 31 manholes, and 9 manholes and catch basins combined. The trench is expected to average 6 ft. in depth, and will be excavated in earth and solid rock.

Eugene, Ore.—An election will soon be held to vote on issuing bonds for the Jefferson St. sewer.

Philadelphia, Pa.—Contracts for constructing 3 main sewers are stated to have been awarded on May 23 by the Bd. of Pub. Wks. as follows: Luzerne St. extension and Pratt St. extension, to John McMenamy, each at $30,000, and for York St. relief sewer to Geo. A. Vare, for $20,000.

Glenolden, Pa.—The Boro. Council is stated to have decided to construct a sewerage system; also to improve streets.

East Providence, R. I.—The citizens are reported to have voted May 20 to appropriate $10,000 for sewers in Burgess and Mauran Aves.

Charleston, S. C.—See "Government Work."

Fair Haven, Vt.—The following bids for constructing a sewerage system were received by the Sewer Comrs. May 22 (Engr. in Charge, H. M. Greer, Ballston Spa, N. Y.): Golden & Hall, Troy, N. Y., $33,389 (awarded contract); Evelyn Constr. Co., Waterford, N. Y., $34,019; J. Marsden, Utica, N. Y., $35,703; A. M. Banker, Gloversville, N. Y., $37,176; Thos. O'Dea, Cohoes, N. Y., $40,817; C. N. Taylor, Wellseley, Mass., $41,231; Eglee-Bunting Co., Boston, Mass., $42,869; Fitzpatric k& Pennington, Plattsburg, N. Y., $44,155; Frank L. Allen, Worcester, Mass., $47,778.

Port Townsend, Wash.—See "Government Work."

Milwaukee, Wis.—F. H. Nakielski, 15 Walworth St., has secured the contract for constructing brick and pipe sewers on Western and Northwestern Aves., for $14,400.

BRIDGES.

San Jose, Cal.—J. G. McMillen, Co. Surv., writes that all bids received May 18 for constructing a steel bridge over Coyote River have been rejected; probable cost, $8,000.

Oakland, Cal.—Local press reports state that the Co. Bd. of Superv. has had plans and specifications prepared for a concrete bridge to be built across San Leandro Creek in Brooklyn Township, estimated to cost $6,480, and for one to be built across Tassajara Creek, from Dublin to Pleasanton, estimated to cost $3,400.

Washington, D. C.—Revised specifications for the proposed steel bridge which is to be built across Potomac River have been approved by Gen. Geo. L. Gillespie, Ch. of Army Engrs. It is stated that bids will be asked immediately. The new plans provide for a steel structure of 11 fixed spans, supported by 12 piers and 2 granite masonry abutments. The total length of the structure will be 2,666 ft. The roadway will provide accommodations for a double-track electric railway, a roadway 40 ft. wide with a sheet asphalt pavement and two 8-ft. sidewalks. Congress has appropriated $996,000 for the bridge.

Jacksonville, Fla.—Shaller & McCormick, of Boston, Mass., are reported to have received the contract to construct the Bridge St. viaduct in this city for $165,000.

Weiser, Idaho.—Jas. C. Graham, of Spokane, Wash., is reported to have received the contract to construct a steel bridge, 225 ft. long, across Snake River, near Weiser, for $112,000.

Quincy, Ill.—Henry Reese is stated to have submitted the lowest bid for paving the Park Pl. streets at $1.06 for Quincy brick, and $1.14 for Springfield or Galesburg brick, 38 cts. for new curbing and 8 cts. for resetting old curb. Total, $6,506 if Springfield brick is used, or $6,098 if Quincy brick is used.

Joliet, Ill.—Henry H. Stassen, Chmn. Bridge Com., writes that the contracts for constructing a bridge over Kankakee River (bids opened May 12) have been awarded as follows: For superstructure to Joliet Bridge & Iron Co., for $26,650, and for substructure to Keltie Stone Co., for $14,350.

Rock Island, Ill.—David H. Lyons, Co. Treas., writes that the contract for constructing a bridge near Hillsdale, between Rock Island and Whiteside Counties (bids opened May 19) has been awarded to the St. Louis Bridge & Iron Co., of St. Louis, for $20,899.

Bloomington, Ill.—Bids are wanted June 11 for asphalt pavement on Fill Ave. and on E. Jefferson St., 3,400 yds.; also for resurfacing E. Grove St., brick pavement with asphalt, 13,235 yds. Elmer Folsom, City Engr.

Pekin, Ill.—It is stated that all bids for constructing the bridge between Mackinaw and Little Mackinaw have been rejected, the lowest submitted being $6,300, and considered too high.

Momence, Ill.—Kershaw & Darst, of Kankakee, are reported to have received the contract to construct the E. Court St. bridge for $10,300.

Kankakee, Ill.—The Massillon Bridge Co., Massillon, O., is reported to have secured the contract to construct the Aroma bridge at Court St. for $10,750.

Marion, Ind.—It is stated that bids are wanted by the Co. Comrs. until June 20 for constructing a 175-ft. bridge across Mississinewa River in Mill Township. A. R. Smith, Co. Bridge Engr.

Washington, Ind.—The Southern Indiana Ry. Co. will, it is stated, ask for bids to build a bridge over White River at this point. The survey is now being made. John R. Walsh, Pres., Chicago, Ill.

Indianapolis, Ind.—Wm. Fife & Co. are reported to have secured the contract to construct a stone bridge at College Ave., for $79,600. They bid, according to reports, as follows: Stratfield stone, $8.65 per cu. yd.; concrete, $5 per cu. yd.; parapets, including coping, $11 per lin. ft.; wet excavation, $1.50 per cu. yd.

Burlington, Ia.—See "Sewerage and Sewage Disposal."

Wichita, Kan.—Bids will be received June 6 by the Bd. of Co. Comrs. for constructing the following bridges: A 4-iron-span bridge, each span 77 ft. long, over Arkansas River at Derby; a 32-iron-span bridge in Sherman Township; a 53-ft. iron bridge in Attica Township; a 2 80-ft. iron-span bridge over Little Arkansas River, between Kechi and Park Townships, and a 70-ft. iron bridge and a 75-ft. bridge, both in Salem Township. J. M. Chain, Co. Clk.

Topeka, Kan.—Bids will be received June 4 by the Township Bd. for constructing a stone arch bridge over a branch of Deer Creek in Topeka Township. J. B. Rowles, Trus.

Shreveport, La.—Bids are wanted June 18 for building 3 bridges, either wood or steel, in Caddo Parish, to be 150 ft., 160 ft. and 200 ft. long. A. L. Duringer, Clk. of Jury.

No. Adams, Mass.—It is stated that plans for a street railway bridge at Braytonville have been submitted to the Railroad Comrs. for approval. F. B. Locke, of No. Adams, is reported to be the Des. Engr.

Grand Rapids, Mich.—City Engr. Anderson has been employed to prepare plans for the North Park bridge, which it is proposed to construct of steel, 20 ft. wide and 600 ft. long, cost not to exceed $30,000.

Pillager, Minn.—The citizens of this village are reported to have voted $15,000 bonds for constructing a bridge across Crow Wing River.

Lithium, Mo.—It is stated that bids will be received by Thos. J. Killian, Co. Bridge Comr., Perryville, until June 3 for constructing the stone abutments, etc., for a steel bridge across Brule Creek at Lithium.

Omaha, Neb.—Bids received May 21 for constructing a highway bridge over Central Boule. at Leavenworth St. have, it is stated, been rejected. The bridge was estimated to cost $7,000; the lowest bid received was $11,500.

New York, N. Y.—The following bids were opened May 28 by G. Lindenthal, Comr. Bridges, for materials and construction of steel underflooring for roadways of Williamsburgh Bridge: John Kenney, Jr., $212,000; Pennsylvania Steel Co., $271,560; R. H. Hood Co., $168,746.

Canastota, N. Y.—According to press reports, $10,000 has been appropriated for the building of an arch across Canastota Creek.

Mechanicville, N. Y.—Gov. Odell has signed the bill appropriating $9,000 for a bridge to be built across Champlain Canal, connecting Burt Ave. and Frances St.

Binghamton, N. Y.—The Common Council has adopted a resolution authorizing the City Engr. to prepare plans, specifications and estimates for a new bridge to replace the present Rockbottom structure, 1 span of which collapsed May 20.

Bryan, O.—It is stated that bids are wanted June 6 for constructing the substructure of either stone or concrete for 6 bridges. Howard Friend, Co. Aud.

Portland, Ore.—The Council is considering the building of a bridge at First St., at a probable cost of $40,000.

Erie, Pa.—The following bids for constructing abutments and piers for the Buffalo Road overhead bridge (10,000 cu. yds. masonry) were received by Joint Session of Councils May 25th, price given per cu. yd.: John O'Hagan, Erie, $6.33; David Jones, Erie, $5.65, and Robt. Baumnn, Harbor Creek, Pa., $5.60 (awarded contract).

Philadelphia, Pa.—It is stated that Munck & Son, New York City, have secured the contract to construct stone piers for the bridge which the Philadelphia Rapid Transit Co. will build across Schuylkill River at Market St.

Selinsgrove, Pa.—See "Railroads."

Altoona, Pa.—According to local press reports, plans have been prepared by the engineering dept. of the Pennsylvania R. R. for a bridge at 17th St., the construction of which the city officials and the R. R. Co. are contemplating.

El Paso, Tex.—See "Railroads."

Colorado, Tex.—The Business Men of this city are reported to be interested in the building of a steel bridge across Colorado River, west of this city.

Ottine, Tex.—Aisbury & Son, of Houston, are reported to have secured the contract to construct a steel bridge, 320 ft. long, near Ottine, for $6,293.

Holston, Va.—Bids, plans and specifications will be received June 15 by John C. Staufield, Co. Superv., Holston, for constructing a 220-ft. steel bridge over Holston River.

Tacoma, Wash.—City Engr. Taylor is reported to be preparing plans for the Puyallup bridge, and as soon as plans have been completed, bids will be asked.

Aberdeen, Wash.—Local press reports state that the Puget Sound Bridge & Dredging Co., of Seattle, has received the contract to construct a bridge across Humptulups River for $6,700.

Puyallup, Wash.—It is stated that plans are being prepared for a $5,000 steel bridge to be built between Puyallup and Sumner.

Oshkosh, Wis.—Local press reports state that the Wisconsin Central and the Chicago, Milwaukee & St. Paul Railroads have awarded to the Wisconsin Bridge & Iron Wks., Milwaukee, the contract to construct a double track drawbridge, 480 ft. long, across Fox River, in this city. Contract price said to be $40,000.

Milwaukee, Wis.—Local press reports state that the following bids were received May 19 for building a bridge at W. Water St.: Modern Steel Structural Co., Waukesha, $80,000; Scherzer Lift Bridge Co., Chicago, Ill., $89,190; Milwaukee Bridge Co., Milwaukee, $127,400; American Bridge Co., New York City, $131,000.

Carleton, N. B.—The building of a bridge in this city is reported to be under consideration.

Belleville, Ont.—It is stated that bids are wanted June 12 for constructing steel overhead truss highway bridge, 100 ft. long, and 16-ft. roadway, at Bridgewater; also a 1-span, 43-ft. low truss steel bridge in Madoc. W. R. Aylsworth, Co. Clk.

Ottawa, Ont.—Press reports state that a bill has been passed by the Railway Com. incorporating the Pere Marquette International Bridge Co., for the purpose of constructing a bridge across Detroit River near Amherstburg. The capital stock of the company is placed at $500,000.

PAVING AND ROADMAKING.

Valdosta, Ga.—It is stated that the City Council is considering paving the business section of the city with vitrified brick, at a probable cost of $25,000.

Boise, Idaho.—The Barber Asphalt Paving Co. is reported to have secured the contract to pave on Main St., estimated to cost $44,738, at the following prices: $2.65 per sq. yd. for asphalt, on a concrete foundation; 50 cts. per cu. yd. for grading; 50 cts. per lin. ft. for both straight and curved curbing; and $4.25 ea. for covered gutters with iron covers.

Rockford, Ill.—It is stated that plans are being prepared for paving with brick or asphalt on a portion of Elm St.

Chicago, Ill.—Bids are wanted June 5 for furnishing material and appurtenances for constructing the superstructure of N. Western Ave. bridge over north branch of Chicago River, including machinery, locks, electrical equipment, etc. F. W. Blockl, Comr. of Pub. Wks.

Chicago, Ill.—Paving contracts aggregating an expenditure of almost $700,000 have been let by the Bd. of Local Improv. to John P. Agnew. The contracts include the W. 85th St. system, comprising 12 streets, at a cost of $156,739; N. Troy St. system, 6 streets, $91,929; Sawyer Ave. system, 12 streets, $86,964; Ceylon Ave. system, Norwood Park, $84,540; Armour Ave., 32d St. to 39th, $30,872. Macadam and novaculite pavement to be laid.

Indianapolis, Ind.—Bids will be received June 5 by the Bd. of Pub. Wks. for constructing a concrete steel bridge over Pogue's Run in Nowland Ave. Harold C. Megrew, Chmn.

Jasper, Ind.—Bids will be received June 22 by the Bd. of Co. Comrs. for constructing about 17 miles pike road in Brainbridge Township and certain streets and the public square in the town of Jasper, by grading, draining and macadamizing. A. H. Koerner, Co. Aud.

Scottsburg, Ind.—Bids will be received June 13 by the Bd. of Co. Comrs. for constructing 7 miles of free gravel roads in Vienna Township. J. Willis Craig, Chmn.

Mt. Vernon, Ind.—Bids will be received June 15 by the Bd. of Co. Comrs. for constructing 8 separate gravel roads, comprising 22,640 miles. Green B. Causey, Chmn.

Jasper, Ind.—It is stated that the citizens of Bainbridge Township have voted to build 19 miles of road.

Terre Haute, Ind.—The Bd. of Pub. Wks. has authorized paving with brick on portions of Wabash Ave. and Poplar St.

Indianapolis, Ind.—The Bd. of Pub. Wks. has decided to resurface Virginia Ave., at an estimated cost of $25,450.

Burlington, Ia.—See "Sewerage and Sewage Disposal."

Maysville, Ky.—The Street Improv. Com. has recommended to the City Council paving the streets with brick.

Alexandria, La.—Ira W. Sylvester, City Engr., writes that the following contracts have been awarded for paving, bids opened May 12: To Tolbert Bros., Shreveport, La., for 19,000 sq. yds. vitrified brick at $2.25 per sq. yd., and to the Barber Asphalt Co., of New York, N. Y., for 19,000 sq. yds. asphalt on 6-in. concrete naphtha binder and 2-in. wearing surface, at $2.31 per sq. yd.

Ft. Howard, Md.—See "Government Work."

Boston, Mass.—McGawley & Coughlan are reported to have submitted the lowest bid for paving and regulating a portion of Nashua St. at $5,307.

W. Springfield, Mass.—Local press reports state that Fred. T. Ley & Co. have secured the contract to pave with macadam on portions of Main St., 7,000 sq. yds., and Bridge St., 4,000 sq. yds., at 70 cts. and 63 cts. per sq. yd. respectively.

Pontiac, Mich.—The Warren Bros. Co. is reported to have secured the contract to pave with bituminous macadam on W. Huron St., requiring 10,471 sq. yds.

Charlevoix, Mich.—W. H. McCartney, Village Clk., writes that it is proposed to pave Bridge St. with brick and construct a sewer in said street, at a total cost of about $15,000. Contract will probably be let in June.

Ann Arbor, Mich.—The following bids for laying 12,000 sq. yds. asphalt block pavement were received by Bd. Pub. Wks. May 18: Geo. H. Kneal, Lansing, $25,463; E. L. Schneider, Ann Arbor, $25,128; Lamsm Bros., Detroit (awarded contract), $24,821; Wm. Clancy, Ann Arbor, $25,781. Details of lowest bid are: Asph. bl., 9,500 sq. yds., $2.19½; M. curb, 1,200 ft., 75 cts.; B. curb, 3,550 ft., 46 cts.; header, 500 ft., 47 cts.; excav., 3,000 cu. yds., 40 cts.

Detroit, Mich.—Local press reports state that the following are the lowest bids received May 18 for repaving on portions of several streets—*a*, Brainard St.; *b*, Pitcher St.; *c*, Peterboro St.; *d*, Cass Ave.: Cleveland Trinidad Asphalt Paving Co., sheet asphalt, *a*, $8,909; *b*, $9,108; *c*, $6,248; *d*, $7,259. C. H. Burchinal, block asphalt, *a*, $13,028 and *b*, $13,284. A 10-year guarantee is given with the sheet asphalt and a 5-year guarantee with the block asphalt.

Cedar Rapids, Mich.—The Council is reported to have authorized the paving of Grand Ave. with macadam.

Camden, N. J.—Bids are wanted June 16 for paving 2 streets with granite block on concrete, and 5 streets with asphalt or vitrified brick on concrete; total amount of contract about $100,000. L. E. Farnham, City Engr.

Asbury Park, N. J.—The city has appropriated $6,000 toward improving Ocean Ave.; the total cost will be $8,118.

Woodbury, N. J.—The Common Council has passed an ordinance to widen and pave with brick on Cooper St. at a probable cost of $25,000.

Paterson, N. J.—Local press reports state that Cyril R. Forbes submitted the lowest bid for repairing the asphalt streets damaged by the recent fire, at $2.60 for asphalt complete, $2.35 for top dressing of asphalt, $1 for concrete.

Kearny, N. J.—It is stated that Wright & Lindsley have secured the contract to macadamize portions of several streets in the upper Arlington section, at $20,194.

Edgewater, N. J.—Press reports state that John Winterburn received the contract to improve Undercliff Ave., at $7,600.

Newark, N. J.—Local press reports state that contracts for paving have been awarded as follows: To Jas. Seme, for paving with granite block on a portion of Livingston St., at $9,506, and to Thos. O'Connor, for paving similarly on a portion of Downing St., at $7,376; to Wm. Van Kuren, for paving with brick on a portion of Oraton St., at $6,116.

Merchantville, N. J.—The Boro. Council has decided to submit to a vote of the people the question of issuing $20,000 bonds to improve the streets of the Boro.

Union Hill, N. J.—Wm. Nolan is reported to have submitted the lowest bid for improving a portion of Liberty St., at $4,501.

Neptune, N. J.—Bids will be received by the Co. Bd. of Freeholders, at Freehold, until June 15 for constructing a stone and gravel road, a distance of about 4½ miles, in the Township of Neptune. John Guire, Dir. Bd.; W. H. DeNyse, Engr., 164 Bway., Long Branch, N. J.

Schenectody, N. Y.—Ordinances have been passed by the Common Council to grade, curb and pave with brick on portions of McClellan St. and Stanley Pl.

Little Falls, N. Y.—The contract for W. Main St. brick pavement, 1,231 ft. long and 34 ft. wide, was awarded on May 18 to John R. Baxter, Jr., of Utica, for $9,765. E. T. E. Lansing, City Engr.

Long Island City, N. Y.—Bids will be received June 4 by Jos. Cassidy, Pres. Boro. Queens, for furnishing material and regulating, grading, curbing and laying sidewalk on portions of 6 streets. Engineer's estimate, 9,570 lin. ft. new bluestone curb, furnished and set; 16,000 cu. yds. earth excavation, 47,530 sq. ft. new bluestone flag, furnished and set, etc.

New Brighton, N. Y.—Bids will be received June 5 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing material and regulating, grading and repairing with asphalt and granite block, and vitrified brick on a concrete foundation portions of 4 roadways. Engineer's estimate, 10,200 sq. yds. asphalt block, 23,900 sq. yds. vitrified brick, and 6,800 sq. yds. new granite block, including sandbed, laid with paving cement joints, 1,680 cu. yds. concrete, including mortar bed, 4,150 cu. yds. concrete, 15,750 lin. ft. new bluestone curb, furnished and set, etc.

New York, N. Y.—The following bids were opened May 28 by G. Lindenthal, Comr. Bridges, for creosesinate wood block pavt. for roadways of Williamsburgh Bridge: Eppinger & Russell, $34,210; R. H. Hood Co., $48,350; U. S. Wood Preserving Co., 29 Bway., $31,989.

Babylon, L. I., N. Y.—Press reports state that the macadamizing of the South Road, between the villages of Babylon and Amityville, a distance of about 4 miles, is being considered. Estimated cost, $12,000 per mile.

Rochester, N. Y.—The Rochester Vulcanite Paving Co. is reported to have submitted the lowest bid for paving with asphalt on a portion of West St., at $20,210, and the Whitmore, Rauber & Vicinus, the lowest for paving with asphalt on a portion of Catharine St., at $7,042.

Binghomton, N. Y.—Local press reports state that the Barber Asphalt Paving Co. has secured the contract to repair the asphalt pavements in this city at a probable total cost of $5,000.

Bids are wanted June 9 for paving with vitrified brick on portions of 6 streets. I. C. Hull, City Clk.

Johnstown, N. Y.—Jas. W. Miller, City Engr., writes that the following bids for bituilthic pavement on Williams St. were received May 18 by the City Clk., Item A being 9,528 sq. yds. of city paving; B, 1,166 sq. yds. between Ity. tracks; C, 685 sq. yds. medina stone along tracks; D, 4,500 ft. curb reset; E, 100 ft. new curb; F, 280 ft. headers—*a*, Bitulithic Pavg. Co., Detroit; *b*, Warren Bros. Co., Boston (awarded):

	A	B	C	D	E	F
a	$2.25	$2.45	$5.65	$0.15	$0.70	$0.50
b	2.15	2.40	5.10	.15	.75	.75

Syracuse, N. Y.—The paving of 5 streets, 3 with asphalt and 2 with brick, is reported to have been authorized.

Fonda, N. Y.—The Village Trus. have employed an engineer to make a survey of Main St. and Bway., and to estimate the cost of paving said streets with brick.

Buffalo, N. Y.—Bids will be received by the Dept. of Pub. Wks. until June 2 for repaving portions of 3 streets. Francis G. Ward, Comr.

Geneva, N. Y.—Paving bonds amounting to $35,500 are reported to have been sold.

Geneva, N. Y.—The following bids for 20,000 sq. yds. pavement, 8,000 cu. yds. excavation, 12,500 lin. ft. curbstone, etc., on 4 streets were received by Bd. Pub. Wks. May 14:

	Asphalt.	Vit. block.	4" curb.	Ex. cav.	Protection curb.	3" drain tile.	12" sewer tile.	Catch basins.	Inlets.	Tar mac.
F. A. Malette, Geneva	$1.975	$2.21	$0.70	$0.35	$0.60	$0.12	$0.60	$35.	$20.	$1.69
Barber Asph. Co., Utica	1.77	....	.62	.50	.48	.05	.55	62.	10.	....
R. W. Henson, Geneva	....	2.04	.65	.30	.60	.07	.60	30.	20.	....
Eastern Constr. Co., Buffalo	1.90	2.20	.70	.50	.60	.15	1.00	40.	35.	....
Thos. Fitzgerald, Jr., Fredonia	....	2.23	.65½	.38	.60	.12	.68	30.	20.	....
Warner-Quinlan Co., Syracuse	2.21	....	.75	.45	.50	.10	.80	50.	25.	....

F. A. Malette was awarded contract for laying tar macadam on Pulteney and Lake Sts., at $28,149. R. W. Henson was awarded contract for laying Metropolitan Block on Wadsworth St., at $4,352. Action on Bradford St. and the Lake Road deferred. W. S. Wood, Secy. Bd. of Pub. Wks., Geneva, N. Y.

Rome, N. Y.—The following bids for asphalt, brick or bituminous macadam pavement on W. Thomas St. were received by Common Council May 14—*a*, Barber Asphalt Pav. Co., New York; *b*, Interstate Paving Co., Utica; *c*, Warner-Quinlan Pav. Co., Syracuse; *d*, Warren Bros. Co., Boston; *e*, Warren Bros. Co. (bituminous macadam).

	Asph., inc. 5" Port. conc. base.	Cobble paving.	Relay flag.	Straight 4" curb.	Curved curb.	10" pipe.	Trench and backfill.	Extra excav.	Extra Port. concr.	Manholes.	Catch basins.	Total.
a	$1.76	$0.04	$0.03½	$0.65	$0.77	$0.30	$0.23	$0.15	$2.00	$26.	$35.	$26,327.83
b	1.85	.05	.04	.65	.80	.30	.30	.10	5.50	35.	40.	27,508.00
c	1.91	.05	.05	.60	.65	.30	.40	.50	5.00	45.	45.	27,957.47
d	1.83	.08	.04	.75	.97	.28	.46	.45	5.75	45.	40.	28,130.12
e	1.98	.08	.04	.75	.97	.28	.46	.45	5.75	45.	40.	29,931.92

The same companies bid the same prices for work on N. Madison St., the totals for which were: Barber, $38,396; Interstate, $40,119; Warner-Quinlan, $40,981; Warren Bros. Co., $41,206; Warren Bros. (Bitum. mac.), $43,832. Both these contracts were awarded to the Barber Co.

Albany, N. Y.—The following are the main items of the bids for improvement of Manning Boul., from Central Ave. to Van Woert St., received by Comr. Pub. Wks., May 18, and the contract awarded to Albany Material & Constr. Co.—*a*, Mulderry Bros.; *b*, M. F. Dollard; *c*, Robt. Shafer; *d*, Callanan & Malcolm; *e*, Frank Pidgeon, Saugerties, N. Y.; *f*, Albany Material & Constr. Co. (bidders all of Albany except *e*):

Items.	*a*	*b*	*c*	*d*	*e*	*f*
Excav. and trenching, 40,000 cu. yds.	$0.35	$0.40	$0.21	$0.31	$0.35	$0.285
Screenings on walks, 270 cu. yds.	2.20	2.00	2.50	2.15	1.90	2.00
Gravel walks, 1,400 cu. yds.	1.50	1.00	1.63	1.10	1.70	1.50
Concrete, 300 cu. yds.	6.00	8.00	6.00	6.00	7.50	8.00
6-in. macadam, 30,000 sq. yds.	.78	.58	.94	.63	1.05	.64
Cobble gutters on sand, 10,000 sq. yds.	.59	.50	.44	.75	.80	.44
Sod on 4 in. of loam, 10,000 sq. yds.	.19	.15	.18	.18	.30	.18
Grading and laying flags, 6,000 sq. ft.	.20	.16	.18	.20	.22	.19
Granite curb on concrete, 550 lin. ft.	.98	.70	.84	.85	.90	.80
Same, circular, 430 lin. ft.	1.05	.80	1.00	1.25	1.25	1.00
4-in. vitrified underdrains, 17,000 lin. ft.	.15	.10	.10	.13	.25	.12
12-in. vitried pipe, 1,750 lin. ft.	.52	.40	.45	.54	1.25	.55
20-in. vitrified pipe, 370 lin. ft.	1.20	1.25	1.33	1.30	2.00	1.50
30-in vit. pipe, 160 lin. ft.	2.90	3.87	4.34	3.87	6.50	4.25
36-in. vit. pipe, 70 lin. ft.	3.80	5.26	5.95	5.26	14.00	5.50
Cast iron inlet heads, etc., 13,000 lbs.	.045	.03	.04	.35	.05	.05
Receiving basins, 10	95.00	90.00	70.00	.95	90.00	60.00
Manholes, 4	50.00	40.00	40.00	.95	75.00	40.00
Inspector, $5 per day	750.00	500.00	950.00	750.00	500.00	675.00
Totals	$59,856	$52,314	$56,578	$57,699	$76,831	$51,263

Auburn, N. Y.—The City Engr. has been directed to prepare plans for paving the entire length of Owasco St.

Waynesville, N. C.—Bids will be received June 3 by the Bd. of Co. Comrs. for $50,000 road improvement bonds. W. T. Sharp, Chmn.

Celina, O.—Bids are wanted June 13 for improving T. W. Baker road, length, 5,691 ft.; W. H. Roettger road, 10,631 ft.; A. T. Kerns road, 10,666 ft.; improvements to consist of ditching, grading, graveling or macadamizing. M. Lutz, City Engr.

Delaware, O.—Bids will be received June 6 by the Co. Comrs. for improving Smart road, length, 7,512 ft., and Russell road, length, 4,780 ft., both in Sciota Township; also June 10, Conklin and Crumb road, length, 25,561 ft., in Liberty, Berlin, and Orange Townships, and Yates road, in Delaware and Berlin Townships, length, 20,916 ft. J. B. Taggart, Co. Surv.

Cincinnati, O.—Bids will be received June 24 by the Bd. of Pub. Service for furnishing material and improving by grading, granite curbing, and paving with asphalt portions of Bremen St. Geo. F. Holmes, Clk.

Bowling Green, O.—Bids are wanted June 22 for constructing about 7 miles of macadam road. B. C. Harding, Co. Aud.

Fremont, O.—The Council is reported to be preparing to pave with brick on West St.

Bryan, O.—The Council has passed the ordinance to pave with brick and some asphalt on portions of several streets, to all about 2 miles. The amount to be expended is estimated at $100,849.

Cleveland, O.—W. P. Rice Eng. Co. writes that the contract for paving with brick and grading and draining Woodlawn Ave. (bids opened May 16) has been awarded to Baldwin Bros. & Graham, of East Cleveland, for $4,099.

Napoleon, O.—Bids will be received June 12 by the Co. Comrs. for constructing road improvements in Washington, Damascus, Richfield and Napoleon Townships. D. F. Coe, Co. Aud.

Weston, O.—Saml. Wood, Village Clk., writes that the following bids for 6,540 sq. yds. brick pavement and necessary drainage were opened May 11: J. E. Conley, Dayton, O., $15,831; Thos. McKinney & Son, Toledo, O., $16,845; Blodgett & Businger, Weston, $19,891; H. G. Jennison, Toledo, O., $18,875. These bids are for Perkins block, on concrete foundation, with stone curbing, sewer tiling, catch basins, etc.

Stroudsburg, Pa.—The citizens of Barrett are reported to have voted to purchase a stone crushing plant.

Philadelphia, Pa.—An ordinance has been concurred in by the Council authorizing the surfacing of a portion of Grant St., at a cost of $25,000.

York, Pa.—The Common Council has passed the highway loan ordinance, which provides $37,000 for repairing certain streets.

Glenolden, Pa.—See "Sewerage and Sewage Disposal."

Pittsburg, Pa.—Bids are wanted June 2 for grading, curbing and paving with asphalt and block stone on portions of numerous streets. E. M. Bigelow, Dir. Pub. Wks.

Harrisburg, Pa.—Bids are wanted June 2 for curbing with either granite, marble, bluestone, medina stone or steel, and paving with either sheet asphalt, asphalt blocks, vitrified bricks, on a concrete base, or Warren's bituminous macadam waterproof pavement, on portions of 4 streets. Chas. B. McConkey, Highway Comr.

Butler, Pa.—Bids will be received June 2 by H. E. Coulter, Secy. Town Council, for grading, curbing and paving portions of Ziegler Ave. and Bluff St.

Knoxville, Tenn.—W. F. Park, Secy. and Superv., writes that the contract for macadamizing about 4½ miles of pike and grading (bids opened May 19) has been awarded to Fred. Netherland, of Dandridge, Tenn., for about $9,000.

Providence, R. I.—Bids will be received June 17 by the State Bd. of Pub. Roads for constructing about 3 miles of State highway in the towns of Exeter, North Kingstown, Tiverton and Cranston. John H. Edwards, Chmn.

Woonsocket, R. I.—It is stated that the Council has authorized the appropriation of $1,600 for the purchase of a stone crushing plant.

Spartanburg, S. C.—It is reported that street improvement bonds, amounting to $50,000, have been sold.

Sevierville, Tenn.—Road improvement bonds, amounting to $16,000, are stated to have been sold.

Charlottesville, Va.—The following bids for laying 30,000 sq. yds. bituminous macadam, granite spall or vitrified brick pavement and 55,000 sq. yds. macadam were received by Street Improv. Com. May 19—*a*, Warren Bros. Co., Boston; *b*, Chas. Gasser, Richmond, Va.; c, Pfaff, Ringwald & Smith, Chillicothe, O.:

	Vit. brick.	Gran. spall.	Bituminous macadam.	Stone mac., 40,000 sq. yds.	New mac., 15,000 sq. yds.	Curbing, 22,000 ft.	Curbing reset, 7,000 ft.	Curb corners, 250 ft.	Concrete bases.	Conc. under R.R. ties, etc., 7,000 lin. ft.	4" drain tile, 5,000 ft.	Excav., 30,000 cu. yds.
a	$2.08	....	$1.93	....	....	$0.44	$0.20	$0.60	....	$1.68	$0.05	$0.30
b	1.73½	$1.35½	....	.63	.97¾	....	.22	....	.75	.82	.16	.38
c	1.57	....	....	.13	.32	.38	.10	2.50	.20	.65	.10	.30

Totals are: Warren Bros., $90,823 (omitting macadam); Chas. Gasser, $122,638 for brick and $111,228 for granite spall; Pfaff, Ringwald & Smith, $82,935 for Peebles brick (awarded), $85,335 Porter brick and $89,835 Mack brick.

Charlottesville, Va.—Street improvement bonds, amounting to $70,000, are reported to have been sold.

Seattle, Wash.—The building of a boulevard on the west side is reported to be under consideration; estimated cost, $24,600.

Port Townsend, Wash.—See "Government Work."

New Richmond, Wis.—Bids will be received June 5 by the Bd. of Pub. Wks. for grading, curbing, guttering, and macadamizing Main St.

Jackson, Tenn.—Press reports state that bids will be received June 16 by the Bd. of Co. Comrs. for $150,000 good roads bonds.

La Crosse, Wis.—Bids are wanted June 23 for improving certain streets by macadamizing, cement curbing, etc. Lafe Holmes, Compt.

Milwaukee, Wis.—The contract for grading, macadamizing and cement curbing portions of numerous streets (14,000 ft.), for which bids were received by Bd. of Pub. Wks. May 20, has been awarded to the City Construction Co., of Milwaukee, at 44 cts. per lin. ft.

Montreal, Que.—Bids will be received by L. O. David, City Clk., until June 4 for repairing by resurfacing the asphalt pavements of the city during the season.

POWER PLANTS, GAS AND ELECTRICITY.

Pasadena, Cal.—The Consolidated Gas Co. is stated to have decided to issue $250,000 bonds to enlarge its plant.

Greenwich, Conn.—The Glenville Power & Water Co. is reported organized here, with a capital of $10,000,000, to supply water to Greenwich, Conn., and Rye, Harrison and Mamaroneck, N. Y., and to generate and distribute electricity throughout these and other sections for public and private use. The charter confers large powers of eminent domain in securing land for watershed and reservoir purposes near Riversville, on the middle branches of Byram River. Wm. J. Tingue, Nathaniel Wetherell and Henry H. Adams are the corporators.

West Palmbeach, Fla.—Jos. Jefferson, Pres. of West Palm Beach Electric Light & Power Co., is stated to have signed a contract with the Florida Electrical Co. at Jacksonville, for installation of an electric light plant. An ice plant will also be added.

Athens, Ga.—Capt. Jas. White is reported interested in the development of the power at Barnett Shoals, for electrical and manufacturing purposes.

Winder, Ga.—The citizens are stated to have voted May 20 to issue $15,000 bonds for an electric light plant.

Pekin, Ill.—The Council has granted the Citizens Gas & Electric Co. permission to construct and operate a system of pipes and conduits for conveying steam, hot water and power to Pekin.

Indianapolis, Ind.—According to local press reports the Bd. of Pub. Wks. is preparing specifications for competition for public-lighting contract. The bids are to be received the latter part of June, and call for a contract extending from Jan. 1, 1905, to Dec. 31, 1915.

Noblesville, Ind.—R. C. Beardsley, of Elkhart, Pres. Beardsley Gravity Dam Co., writes that an electric plant is to be constructed here for Thos. Griffin, to cost $70,000. About 1,000-H.-P. will be developed, and the dam will be 300 ft. long and 16 ft. high.

South Bend, Ind.—It is stated that plans have been decided upon by Chas. A. Chapin, owner of the majority of stock in the South Bend Mfg. Co., which controls the water power of west race, for equipping the race so as to supply power for the electric light plant in this city and making it supplementary to the electric plant in Buchanan, Mich. The plans contemplate steel bulkheads at the head of the race and permanent stone and cement retaining walls.

Atlantic, Ia.—The City Council is stated to have ordered the joining of the water works and city lighting plants; the work proposed will cost about $12,000.

Union, Ia.—The question of constructing an electric light plant is reported under consideration.

Wellsburg, Ia.—W. E. Reed is reported interested in the installation of an electric light plant.

Harper, Kan.—Mayor Baumstark is stated to have appointed a committee, with Councilman Cathcart as Chmn., to investigate the question of constructing an electric light plant.

Monroe, La.—Mayor A. A. Forsythe is stated to have been authorized by City Council to employ an expert to advise as to improvements of water works and electric light plant.

Ruston, La.—Press reports state that contracts will be let about June 10 for improving electric light and water works systems. B. F. Thompson, Mayor.

Centerville, Md.—The Council is stated to have granted John D. Thompson, of Trenton, N. J., a franchise for a gas plant.

Nashville, Mich.—The Village Council is stated to have granted a franchise to the Marshall Electric & Power Co. to install plant at Scipio, 3 miles northeast.

Lake Linden, Mich.—The Houghton County Gas Co. is reported formed, with a capital of $250,000, to construct a plant at Lake Linden to furnish gas.

Stillwater, Minn.—The Western Gas & Improv. Co. has taken over the plants of the Gas & Electric Light Co., and the Apple River Power Co., and will make extensive improvements.

Elmore, Minn.—The Council is stated to have voted to install either a gas or an electric light plant. C. D. Williams, Mayor.

Buhl, Minn.—Bids will be received June 15 by M. A. Nichols, for constructing an electric light plant. Engineer, Oscar Claussen, St. Paul.

Caledonia, Minn.—The contract for constructing an electric light plant (bids opened May 20) has been awarded to S. G. Reque, now at Caledonia, Minn. The plant to be erected by the city under the supervision of S. G. Reque.

Pelican Rapids, Minn.—It is stated that bids are wanted June 1 for $10,000 electric light bonds. Bids for constructing said plant, according to press reports, will soon be asked.

Laurel Springs, N. J.—The Clementon Township Com. is stated to have granted a franchise to the Clementon Township Electric Improv. Co. to construct and maintain an electric light plant at Laurel Springs, and to furnish light and power in the towns of Magnolia, Stratford, Kirkwood, Lindenwold, Laurel Springs, Overbrook, Clementon and other points in the new township.

Greene, N. Y.—Bids will be received until June 8 by the Village Bd. of Trus. for furnishing and setting 2 72 in. x 18 ft. horizontal fire tubular boilers, with 74 4-in. flues and all boiler trimmings; bids may also be submitted for water tube or other patented types of boilers of equal capacity; constructing a power house, including a 75-ft. high chimney; furnishing 2 100-H.-P. engines, 2 60-Kw. single-phase alternating dynamos and all station apparatus. Bids will also be received for lamps, converters and pole-line equipment. M. L. Cowles, Clk. of Bd.; Edgar B. Kay, Engr., Ithaca, N. Y.

Binghamton, N. Y.—City Engr. Monroe in his report to Council estimates the cost of subway construction in the business streets, of a size sufficient for all wires, at $42,600 per mile.

Hillsboro, N. D.—Bids will be received June 6 by D. Cameron, City Aud., for furnishing a steam engine, plain or compound; boiler and dynamo for the electric light plant. Loweth & Wolff, Engrs., St. Paul, Minn.

Edenton, N. C.—The citizens are reported to have voted to issue $30,000 bonds for an electric light plant and water works.

Cleveland, O.—See "Sewerage and Sewage Disposal."

Defiance, O.—The Defiance Water Co. is about to be incorporated, with a capital of $200,000. The plant will be constructed on Auglaize River.

Gallipolis, O.—The stockholders of the Gallipolis Gas & Coke Co. are stated to have amended and enlarged its articles of incorporation so as to permit the construction and operation of artificial gas works; to lay gas pipes through the streets, etc.; to lease and own natural gas wells, and to purchase, own, maintain and operate an electric light plant.

Mt. Joy, Pa.—The Solar Gas Light Co., of Mt. Joy, is reported incorporated, with a capital of $10,000.

New Florence, Pa.—The New Florence Light & Power Co. is reported organized, and have secured the contract for lighting the borough.

Huron, S. D.—The Consolidated Gas & Electric Co., of Huron, has been incorporated, with a capital of $25,000.

Springfield, Tenn.—The citizens are stated to have voted May 22 to issue $35,000 bonds for water works and an electric light plant.

Perry, Okla. Ter.—The city is reported to be considering the construction of an electric light plant. F. F. Busch, City Clk.

Beaumont, Tex.—Hal W. Greer and associates are stated to have secured a franchise for an electric light plant.

Bay City, Tex.—The Bay City Ice, Light & Power Co. has been incorporated; capital, $50,000. Incorporators: T. H. Stone, W. T. Goode and G. M. McGill.

Richfield, Utah.—W. H. Seegmiller, representing the Sevier Valley Electric Light & Power Co., is stated to have petitioned City Council for a franchise.

Olympia, Wash.—Bids are wanted June 2 for constructing a water power electrical plant for the Olympia Light & Power Co. E. W. Cummings, Constructing Engr., 70 Dexter-Horton Bldg., Seattle.

Seattle, Wash.—It is stated that the Seattle Electric Co. contemplates improvements this season, to cost $500,000.

Chelan, Wash.—E. B. Curtis and others are stated to have secured a franchise for an electric light plant.

Marinette, Wis.—It is stated that the St. Ry. Co. will rebuild the electric light plant, install new gas plant, and make other changes.

Superior, Wis.—Local press reports state that the North Western Fuel Co. has prepared plans for the erection of a plant to furnish electric power in Superior. The power is to be derived from the surplus heat of its coking plant.

Menominee, Wis.—The Wisconsin Power Co. has been formed here, with a capital of $250,000. The company has acquired the water power and other property of Knapp, Stout & Co. on Red Cedar River and will improve same at once by the construction of a new dam. John H. Coulter, Pres.; L. E. Gary, Secy., both of Chicago, Ill.

Montreal, Que.—The Montreal Light, Heat & Power Co. is stated to have decided to supplant the temporary improvements at the dam at Chambly by permanent work. Plans for the work have been completed by Hugh L. Cooper.

ELECTRIC RAILWAYS.

San Jose, Cal.—The City Council has passed an ordinance granting a franchise on Market St. to the San Jose & Santa Clara Railroad Co. and F. S. Granger.

It is reported that the San Jose St. R. R. is to be extended to Campbell.

Los Angeles, Col.—The Los Angeles & Redondo Electric Ry. has increased its capital stock from $500,000 to $1,000,000. The new stock is to be issued for the purpose of making betterments and extensions.

Los Angeles, Cal.—It is stated that L. C. Brand has applied for a franchise to construct an electric railway, and bids for said franchise, according to press reports, will be received until June 15. H. J. Lelande, City Clk.

Denver, Colo.—The Denver Tramway & Power Co. has filed for record a mortgage for $1,500,000. The bonds provide for improvements and the refunding of outstanding obligations. S. W. Cantril, Supt., Denver.

Stamford, Conn.—The Stamford St. Ry. Co. will, it is said, immediately begin the construction of a westward extension to Greenwich.

Rockville, Conn.—The Rockville, Broad Brook & East Windsor St. Ry. Co. has organized, with Frank Grant, of Rockville, Pres., and C. E. Harwood, of Rockville, Secy. This company is capitalized at $100,000, and application will be made for permission to build the road.

Wilmington, Del.—The Delaware Suburban Ry. Co. has secured a franchise to lay tracks in this city. The company is chartered to connect Wilmington with points down the State and in Md., including Elkton, Chestertown and Chesapeake City.

Washington, D. C.—The Old Dominion & Great Falls Electric Ry. is said to have obtained all rights of way to the Great Falls and that plans are practically completed for building the line, and that contracts for construction will be let in the near future. Senator Stephen B. Elkins and John R. McLean are interested.

Bishop, Ga.—It is stated that the Central of Georgia Ry. Co. will build an electric railway from Bishop to High Shoals, a distance of about 4 miles. H. M. Steele, Ch. Engr., Savannah.

Belleville, Ill.—The Belleville & Smithton Electric Ry. Co. has been incorporated, with a capital of $300,000. Incorporators: G. G. Bock, E. Thomas and others.

The Illinois Transit Co. has been incorporated, with a capital of $1,000,000, by Chas. E. Thomas, B. H. Portuondo and others to build electric railways between Belleville and O'Fallon Sts.; between the National Stock Yards and Eads Bridge, and also from the Stock Yards on Bowman Ave. to city limits and to East St. Louis.

Chicago, Ill.—The branch of the South Side Elevated, the branch to the stockyards, a third track for express trains between 12th and 43d Sts., and the lifting of the rails of the Chicago Junction along 40th St. are assured. Cost of the entire work estimated at $4,050,000. Construction will be begun in Aug. As compensation to the city for the third track the South Side Elevated will pave the alleys from 12th to 43d St. with asphalt.

Shelbyville, Ill.—The Shelby County Electric Ry. Assoc. has been organized to further the construction of the proposed electric railway in Shelby County. John W. Yantis, of Shelbyville, Pres.

Belleville, Ill.—The Illinois Transit Co. has been incorporated, with a capital of $1,000,000, by Dr. B. H. Portuondo, of Belleville, and others, to build an electric road from Belleville, connecting with the Belleville and O'Fallon road, and from the National Stock Yards to the Eads Bridge, East St. Louis.

Morrison, Ill.—The Morrison & Denrock Electric R. R. Co. has been incorporated, with a capital of $2,500, to build an electric railway from Morrison to Denrock. Directors: Geo. Milne, A. D. Hill, C. G. Macklin, and Paul A. Bent, of Morrison.

Crawfordsville, Ind.—The Consolidated Traction Co. has received a franchise for the use of the streets of Crawfordsville. Edw. Hawkins, Gen. Mgr., Indianapolis.

Richmond, Ind.—A franchise has been granted the Eastern Indiana Traction Co., which will build to Portland.

Evansville, Ind.—A franchise has been granted to the Evansville, Boonville & Rockport Traction Co. The company plans to build a 50-mile line.

Evansville, Ind.—The Bd. of Wks. has granted the Evansville & Henderson Ry. and the Evansville & Booneville Interurban Ry. franchises to enter the city over a joint or union track, with a double trolley, each company operating its own cars by its own power.

Plainfield, Ind.—The Indianapolis & Plainfield Ry. is securing right of way for the extension of its line from Plainfield to Green Castle by way of Cartersburg Spring. A branch will be run from the springs to Danville. Later lines will be built to Brazil and Rockville from Green Castle. M. Bonner, Supt., Indianapolis.

Burlington, Ia.—The Burlington & Keosauqua Ry. & Power Co. is to be organized to build an interurban electric line from Burlington to Keosauqua. Royal H. Holbrook is reported interested.

Keokuk, Ia.—The Keokuk & Western Illinois Ry. Co. has been incorporated, with a capital of $1,000, to build an electric railway from Hamilton, Ill., to Keokuk, and from Hamilton to Warsaw, Ill. Incorporators: Fred. P. Vose, of Evanston, Ill.; Geo. E. C. Johnson, Chicago, Ill., and others.

Owensboro, Ky.—Surveys are being made for the Owensboro & Hartford Electric R. R. Three routes will be surveyed. The road will be 53 miles in length.

Glasgow, Ky.—The Glasgow, Burkesville & Cumberland Valley Traction Co. has been incorporated, with a capital of $500,000, to build an electric railway from Glasgow, Ky., via Edmonton to Burkesville and probably southward to some point in Tennessee.

Caribou, Me.—Articles of incorporation have been filed by a company to build an electric railway from Caribou through Woodland, Washburn and Wade Plantation to Perham, a distance of 15 miles. Directors: S. L. White, J. D. Emery, and others.

Brunswick, Me.—The Harpswell & Brunswick Electric R. R. Co. has been organized, with Chas. E. Townsend, of Brunswick, Pres. The company plans to build an electric railway from Brunswick to Harpswell, a distance of 16 miles.

Detroit, Mich.—Dr. J. B. Kennedy, of Detroit, and others are reported to have decided to build an electric railway from Old Club to Grande Pointe Hotel and loop around the head of the island, following shore line of the Flats.

Grand Rapids, Mich.—The Grand Rapids Electric Ry. Co. has been incorported, with a capital of $2,000,000, to build an electric railway from Grand Rapids through Kent, Montcalm, Mecosta, Isabella and other counties to a point on Lake Huron. The company also plans to build a branch line from Grand Rapids through Kent, Barry, Eaton and Ingham Counties to the city of Lansing, the length of the entire line, including branches, being about 250 miles. Directors: J. W. Boynton and J. H. Dority, of Grand Rapids; J. C. Yarger, of Freeport, and others.

Vicksburg, Miss.—The Vicksburg R. R. Power & Mfg. Co. has secured permission to extend its line along Natl. Cemetery Road to Natl. Cemetery, a distance of about 2 miles. J. H. Pallister, Ch. Engr., Vicksburg.

Kansas City, Mo.—The St. Joseph, Parkville & Kansas City Ry. Co. has been incorporated, with a capital of $5,000,000, to succeed to the rights of the Kansas City, Parkville & St. Joseph Electric Ry. John J. Tootle, of St. Joseph, Mo.; E. W. Snyder, of Leavenworth, Kan., and H. B. McAfee, of Parkville, Mo., are directors. It is reported that the company proposes to complete plans for building its proposed line at once.

Amityville, N. Y.—The Amityville & Huntington R. R. Co., with principal office in Brooklyn, has been incorporated to build an electric railway about 14 miles in length from Amityville to the Long Island R. R. Station in Huntington; capital, $250,000. Directors: W. K. Putnam, A. S. Sanborn, and others.

Dunkirk, N. Y.—Plans are being prepared for the erection of the power house of the Buffalo, Dunkirk & Western Ry. It has been decided to utilize gas for fuel, there being an extensive gas belt on the route of the road. C. M. Bushnell, Secy., Buffalo.

Wadesboro, N. C.—The Merchants Ry. Co. has been incorporated to build an electric railway here. Incorporators: R. L. Hardidson, W. J. McLendon, Jr., and others.

Loveland, O.—The Loveland & Cincinnati Traction Co. has been incorporated, with a capital of $50,000, by Henry Burkhold, Wm. S. Munsell, and others to build an electric railway from Loveland to Madeira, where connections will be made with the Cincinnati & Columbus Traction line, now being built.

Tiffin, O.—Dr. J. D. Johnson, N. S. Muchmore, and R. R. Dumm are promoting an electric railway to connect Upper Sandusky with Tiffin, running by way of Sycamore.

Marietta, O.—The Parkersburg, Marietta & Interurban Ry. Co. contemplates building a line from Marietta up the east bank of the Muskingum Valley as far as Stowes Ferry and Lowell. J. R. Davis, Ch. Engr., Parkersburg, W. Va.

Youngstown, O.—The Youngstown & Southern Ry. Co. has increased its capital stock to $1,500,000. Gen. Asa W. Jones, Pres. Geo. Todd, Jr., Ch. Engr., is reported to be locating a site for a power house and is preparing to close contracts for material required for equipping and building the road. The power plant will probably be located in the North Lima coal fields. The line will extend from Youngstown to Lisbon, North Lima and East Liverpool. The same interests have organized the Youngstown & Salem Ry. Co.—capital stock, $300,000—to build a spur line to Salem.

Cincinnati, O.—The stockholders of the Cincinnati, Milford & Eastern Traction Co. have voted to increase the capital stock from $300,000 to $1,000,000. S. B. Day, of Elyria, Pres. The power house will be at Milford. The road will be broad gauge, and will enter the city over the tracks of the Cincinnati Traction Co.

Harrisburg, Pa.—Charters have been granted to the Rossiyn St. Ry. Co., capital $30,000, to build a 5-mile line in Crafton and Carnegie, and the Citizens' St. Ry. Co., capital $12,000, to build a 2-mile line in Butler, Pa.

Lewistown, Pa.—The Burnham branch of the Lewistown & Reedsville Electric Ry. Co. will be extended to New Burnham.

Houston, Tex.—The Houston Electric Co. will extend its Montgomery Ave. line about a mile. E. D. Martinez, Ch. Engr., Houston.

Staples, Tex.—B. J. Butler, of Staples, is said to be interested in a plan to build an electric railway from Staples to San Marcos, a distance of 8 miles.

Laredo, Tex.—The Laredo Electric Light & St. Ry. Co. is planning to make a number of improvements to its system.

Roanoke, Va.—It is stated that the U. S. Arsenic Mine Co., which owns property in the mountains of Floyd County, 30 miles southwest of Roanoke, will build an electric railway from Shawsville, on the Norfolk & Western, to its mines, about 13 miles distant.

Newport News, Va.—The stockholders of the Hampton Roads Electric Ry. Co. have authorized an issue of $300,000 bonds to be expended in general improvements. W. J. Nelms, Pres., Newport News.

Fairmont, W. Va.—The Fairmont & Clarksburg Traction Co., of Fairmont, is to construct an electric railway from Burnsville to Clarksburg; capital, $2,000,000. Incorporators: S. L. Watson, L. L. Malone, and others, all of Fairmont.

La Crosse, Wis.—The ordinance granting the La Crosse & Black River Falls Electric Ry. Co. a franchise to enter and operate its lines in Black River Falls has been passed.

RAILROADS.

Birmingham, Ala.—Declaration of agreement of consolidation of the East & West R. R. Co. and the Chattahoochee Terminal Ry. has been filed with the Secy. of State. The new corporation is to be known as the Atlanta & Birmingham Air Line Ry.; capital, $1,525,000. The purpose of the corporation is to construct and operate a line from Birmingham to a point near Atlanta.

Batesville, Ark.—The Batesville & Jacksonport R. R. Co. is reported incorporated to construct a 22-mile railroad to parallel the Iron Mountain and connect with the Rock Island at Jacksonport.

Phoenix, Ariz.—The San Pedro, Tucson & Gulf R. R. Co. has been incorporated to build a railroad from a point in the old Fort Grant reservation to Port Lobos on Gulf of California; capital, $150,000. Incorporators: N. O. Murphy, B. C. Mossman, and others. Principal office to be at Phoenix.

San Francisco, Cal.—The Dirs. of the Western Pacific Ry. Co., at a meeting here May 21, are stated to have decided to issue $50,000,000 bonds for the construction of the road. It is also announced that the property of the San Francisco terminal, Stockton, Beckwith Pass, Sacramento and Oakland roads will be immediately transferred to the Western Pacific.

Denver, Col.—The construction company which is building the Denver, Northwestern & Pacific R. R. is stated to have appropriated $5,300,000 for additional construction, including a 2¼-mile tunnel through the main range and a temporary line over the range. Contracts will probably be awarded by June 30.

Rock Island, Ill.—The Rock Island, Keithburg & Southern R. R. Co., of Rock Island, has been incorporated, with a capital of $25,000, to construct a line from Rock Island to Keithburg, and to enst bank of Mississippi River to Carthage Junction. Incorporators: Hal B. Allen and Van S. Allen, of Erie, Ill.; Howard M. Ogden, of Chicago, and others.

Sullivan, Ill.—The Springfield, Moweaqua, Sullivan & Mattoon R. R. Co., of Sullivan, Ill., has been incorporated, with a capital of $25,000, to construct a line from Springfield by way of Moweaqua and Sullivan to Mattoon. Incorporators: Jos. B. Titus and Saml. W. Wright, Jr., of Sullivan, Ill.; Isaac B. Craig, of Mattoon, Ill., and Valentine Snyder, Jr., of Moweaqua, Ill.

Sioux City, Ia.—It is stated that the Chicago & Northwestern Ry. Co. will build a line to Sioux City either from Centerville, S. D., or from Hawarden, Ia. E. C. Carter, Ch. Engr., Chicago, Ill.

Providence, Ky.—It is reported that the Louisville & Nashville R. R. will extend the Providence Branch through the western portion of the State to Sturgis, Ky., a distance of about 40 miles. R. Montfort, Ch. Engr., Louisville.

Bangor, Me.—It is stated that the Bangor & Aroostook R. R. Co. is to build an extension of the Katahdin Iron Works line in a northerly direction of Chesemcook Lake and perhaps to Chamberlain Lake, a distance of 50 miles. M. Burpee, Ch. Engr., Houlton, Me.

Columbia, Mo.—It is stated that bids are wanted by the Missouri Central R. R. Co., 68 Wall St., N. Y. City, for constructing 200 miles of railway, including masonry, grading, bridge work, etc. Wm. B. Cauthorn, Ch. Engr., Columbia.

St. Louis, Mo.—The St. Louis & St. Paul R. R. Co. has been incorporated, with a capital of $1,000,000, by Saml. F. Scott and A. C. Kinnead, of Kansas City, to construct a railroad to extend from the north line of Scotland County, through the counties of Scotland, Knox, Shelby, Monroe and Audrian, a distance of 150 miles. It will be a north and south line from St. Louis to St. Paul.

Selinsgrove, Pa.—The Northern Central Connecting R. R. Co. is reported incorporated to build a cut-off connecting the Northern Central with the Pennsylvania for the transportation of freight to the new Enola yards. The road will be 35 miles long extending from Selinsgrove Junction, across Susquehanna River to Selinsgrove, thence along the river and upon the Lower Branch division of the Pennsylvania canal to the main line of the Pennsylvania at Aqueduct Station, where Juniata River will be bridged. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Washington, Pa.—The Wabash R. R. Co. is stated to have secured a right of way for its line from Waynesburg to Washington, a distance of about 25 miles. W. S. Newhall, Ch. Engr., St. Louis, Mo.

Austin, Tex.—The State R. R. Comn. is stated to have granted the application of the St. Louis Southwestern Ry. Co., to issue $500,000 bonds for the purpose of constructing, equipping, completing and improving its branch line beginning at Noel, in Dallas County, and extending in a northensterly direction 14 miles to the northern terminus of the Dallas Terminal Ry. and union depot. M. L. Lynch, Ch. Engr., Tyler, Tex.

El Paso, Tex.—A press report states that in his annual report E. B. Cushing, of Houston, Engr. M. & W. of the Galveston, Harrisburg & San Antonio Ry. Co., will recommend the replacing of wooden bridges and trestles with substantial steel structures, and the reduction of grade and straightening of line at three points between El Paso and Del Rio.

Belington, W. Va.—The Baltimore & Ohio R. R. Co. is stated to have decided to construct a connection between its Belington branch and the line extending from Weston to Pickens, W. Va. The new road will be 12 miles in length. J. M. Graham, Ch. Engr., Baltimore, Md.

PUBLIC BUILDINGS.

Berkeley, Cal.—Andrew Carnegie is stated to have given this city $40,000 for the erection of a library.

Carnesville, Ga.—It is stated that bids are wanted July 1 for erecting a 2-story brick court house, 65x 95 ft. T. J. Crow, Ordinary, Franklin Co.

Elberton, Ga.—It is stated that bids are wanted June 6 for erecting Bethesda Methodist Church. W. B. Norman, Chmn. Bldg. Com.

Atlanta, Ga.—The Congregation of the Methodist Church are reported to have decided to erect the Wesleyan Memorial Tabernacle here; probable cost, $100,000.

Danville, Ill.—It is stated that bids are wanted June 15 for erecting officers' quarters, ventilating, heating, etc., at Danville Branch of the N. H. D. V. S. Maj. M. J. Barger, Treas.

Chicago, Ill.—It is stated that the county architect will prepare plans for a contagious disease ward and children's ward at the county hospital; estimated cost, $125,000.

Rossville, Ill.—Bids are wanted June 15 for erecting a church for the First M. E. Society. F. L. Stewart, Chmn.

New Castle, Ind.—Bids are wanted June 3 for the erection of a brick church for the M. E. Congregation, to cost $30,000. O. C. Kruch, Archt. Rev. C. King, Pastor.

Kokomo, Ind.—The contract will soon be let for the erection of a coliseum for the Alhambra Assoc.; estimated cost, $36,000. J. W. Barnes, Pres.

Franklin, Ind.—Bids will be received until June 9 at Franklin College for erecting a 1-story brick and stone library. Harris & Shepbell, Archts., Evansville, Ind.

Boonville, Ind.—Bids are wanted July 1 for erecting a court house. Harris & Shepbell, Archts., Evansville.

Richmond, Ind.—It is stated that $50,000 has been given to St. Stephens Hospital for the erection of a building.

Mt. Ayr, Ia.—It is stated that the Trus. of the Methodist Society are preparing to erect a church, to cost $20,000.

Topeka, Kan.—The contract for erecting the Kansas State Bldg. at La. Purchase Exposition, St. Louis, Mo., for which bids were received by Kans. Comrs. of the La. Purchase Exposition May 6, has been awarded to S. F. Beeler, of Ottawa, Kan., for $29,745. Richard H. Phillips, Ch. Engr., World's Fair Sta., St. Louis, Mo.

Bids will be received by S. H. Knapp, Secy. of Com., until June 22 for the erection of a Baptist Church, to cost about $25,000. Architect, H. M. Hadley, Columbia Bldg.

Iola, Kan.—Bids are wanted June 9 for erecting a court house. J. C. Holland & Squires, Archts., Topeka; J. W. Keller, Co. Clk.

Boston, Mass.—Plans have been filed by Archts. Kendal, Taylor & Stevens, 93 Federal St., for a 3-story, 84x66-ft., steel fireproof construction, brick and terra cotta building, at Bellevue and Park Sts., to be used as a Deaconess Hospital. Builders, Geo. W. Harvey, 17 Milk St. Estimated cost, $105,000.

Manistee, Mich.—Geo. Harvey, of Port Huron, is reported to have been selected to prepare plans for the Carnegie Library to be erected here, at a cost of $35,000.

Two Harbors, Minn.—Bids will be received June 16 by the Bd. of Co. Comrs. for furnishing material and erecting a jail and sheriff's residence. John P. Paulson, Co. Aud.

Kansas City, Mo.—The Congregation of the Westminster Congregational Church is reported to have purchased a site for the erection of an edifice at 36th and Walnut Sts., to cost $60,000.

Springfield, Mo.—F. M. Garthwait, of Chicago, Ill., is stated to have received the contract for erecting the public library, for $365,534. Bids will be received by the Library Bd. for heating, plumbing, lighting and furniture. Reed & Heckenlively, Archts., 302 College St.

Concord, N. H.—M. F. Oliver, of Concord, has prepared plans for a $10,000 granite chapel for Blossom Hill Cemetery.

Canandaigua, N. Y.—Bids are wanted June 5 for erecting a 2-story brick stable and dormitory for the Merrill House House. Will E. Martin, Village Clk.

New York, N. Y.—The following bids were opened May 25 by Thos. Sturgis, Fire Comr., for building for Hook & Ladder Co. 26 on 114th St.: Tolmie & Kerr, 245 W. 12th St., $53,289; Alfred Nugent & Sons, $54,799; Murphy Bros., $56,660; L. J. Rice, $58,635; James McFerran, $57,987; Geo. Hildebrand, $59,390; J. E. Butterworth, $59,946; M. J. Leahy, $57,000.

Bids will be received June 8 by Homer Folks, Comr. Dept. Pub. Charities, for furnishing material for erecting a dining pavilion for the Tuberculosis Infirmary of the Metropolitan Hospital, Blackwell's Island.

Bids will be received June 12 by the Dept. of the Bd. of Health for furnishing material and erecting a disinfecting station on Pier E. 132d St. Ernest J. Lederle, Pres.

John Peirce, 277 Bway., is stated to have received the contract for the marble work on the Hall of Records, for $225,293.

Chillicothe, O.—Local press reports state that bids will be received June 2 (extension of date) by Frank L. Packard, Archt., Columbus, for erecting a M. E. stone church.

Mahanoy City, Pa.—It is stated that the Congregation of the Salem United Evangelical Church will erect an edifice, to cost $25,000.

Reading, Pa.—A $50,000 edifice is to be erected at North Reading for the Reformed Congregation. Rev. Mr. Schaeffer, Pastor. Architect, A. A. Richter, of Lebanon.

Philadelphia, Pa.—An ordinance is stated to have been passed providing an appropriation of $200,000 for the erection of a hospital for the indigent.

Providence, R. I.—Bids will be received June 3 by Jeremiah H. Hall, Chmn. of Com. on City Property, for erecting a fire station on Mt. Pleasant Ave. and Dover St., including steam heating, electric wiring, plumbing, gas piping, etc.

Toronto Junction, Ont.—The contract for the erection of the post-office at Keele and Dundas Sts. is stated to have been awarded to Joy & Needham, for approximately $24,000.

BUSINESS BUILDINGS AND DWELLINGS.

Decatur, Ala.—Chas. W. Brown is reported to be having plans prepared for a hotel, to be erected here, to cost about $25,000. H. Cowell, of Huntsville, Archt.

San Francisco, Cal.—Saifield & Kohlberg, 339 Kearney St., is reported to have prepared plans for a 6-story brick apartment house for John M. Lee to be erected at Sutter and Jones Sts.

Alton, Ill.—Bowman & Kleinschmettger have secured the contract for erecting the 3-story building for Alton Banking & Trust Co.; cost, $20,000.

Chicago, Ill.—W. L. Bush is reported interested in the erection of a 12-story apartment house to be erected here, to cost about $600,000.

Chicago, Ill.—Press reports state that bids will be received by the Bd. of Educ. until June 5 for ventilating, heating, plumbing and gas fitting in Foster and Brownell Schools.

Dunkerton, Ia.—It is stated that bids are wanted June 15 for erecting a brick building for the First National Bank. Murphy & Ralston, Archts., Waterloo.

Detroit, Mich.—It is stated that McC. Le Beau will erect a 4-story dwelling at Boulevard and 2d Ave.; estimated cost, $25,000.

W. D. Butterfield, Home Bank Bldg., is reported to have prepared plans for a building for the Diamond Lodge, I. O. O. F., to be erected at Lawton Ave. and Grand River; probable cost, $25,000.

St. Paul, Minn.—It is stated that Paul Gotzian will erect a residence at Summit Court and Lawton St., to cost $25,000.

Kansas City, Mo.—The following brick dwellings are about to be erected, price given being cost of each: At 415 Gladstone Ave., for R. B. Janes, cost $10,000; at 400 Bway., for H. Stoop, $25,000; at 2914 Park Ave., for H. Stoop, $18,000, and at 2117-19 E. 10th St., D. H. Dehorney, $15,000.

Jersey City, N. J.—It is stated that the Jersey City Trust Co. will erect a bank building at Newark and Hoboken Aves.; probable cost, $130,000.

Buffalo, N. Y.—It is stated that plans are being prepared for a brick building to be erected here, for Wm. Hengerer Co.; probable cost, $250,000.

Cleveland, O.—Work has begun on foundations for new Prospect St. Theater. Contracts for the building, which will be 80x198 ft., have not yet been let. M. M. Gleichman, 89 Euclid Ave., Archt.

Dayton, O.—It is stated that the Union Traction Co. has had plans prepared for a 7-story station at St. Clair and 4th Sts.; approximated cost, $500,000.

Erie, Pa.—Work has begun on foundations for new Majestic Theater, of Erie Amusement Co. Contracts for the building, 80x165 ft., have not yet been let. M. M. Gleichman, Archt., Cleveland, O.

Chester, Pa.—Jacob Meyers & Sons, of Philadelphia, is reported to have received the contract for erecting the station for the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia); estimated cost, $65,000.

Philadelphia, Pa.—The warehouse at 925 N. Front St. is reported destroyed by fire May 25. Owner, Front St. Warehousing Co.

Chattanooga, Tenn.—It is stated that the Mountain City Club will erect a building here, to cost about $35,000.

Houston, Tex.—It is stated that bids are wanted June 15 for erecting a 6-story fireproof bank building for the Commercial National Bank. Green & Svarz, Archts., 211-16 Mason Blk.

Norfolk, Va.—E. Tatterson, of this city, is reported to have received the contract for erecting the 3-story building for the Business Men's Assoc.; probable cost, $45,000.

Winnipeg, Man.—Bright & Johnson is reported to have decided to erect a 3-story, 66x120-ft. warehouse on Bannatype St. J. H. Russell, Archt., 343 Main St.

NEW YORK, N. Y.

261 Bleecker St, 6-story br tenemt and store; c, $50,000; o, Levy Bros; a, A E Badt.

Lewis and Grand Sts, 6-story br flat; c, $70,000; o, Rosenberg & Feinberg; a, A E Badt.

Houston and Eldridge Sts, 6-story br tenemt and stores; c, $65,000; o, Nathan Silverson; a, G F Pelham.

Mott and Hester Sts, 2 6-story br tenemts and stores; c, $80,000; o, Saul Wallenstein; a, Bernstein & Bernstein.

41 E 7th St, 6-story tenemt; c, $50,000; o, Braverman, Silverson & Louden; a, A E Badt.

528 E 11th St, 6-story br tenemt and stores; c, $50,000; o, Kleinfield & Hamburger; a, Horenburger & Straub.

1st Ave and 13th St, 2 6-story br tenemts and stores; c, total, $130,000; o, Baum & Lapin; a, Bernstein & Bernstein.

14 W 24th St, 6-story br stores and lofts; c, $150,000; o, Rich Arnold estate; a, Schickel & Ditmars.

157 E 31st St, 6-story br tenemt; c, $50,000; o, John Roth; a, G F Pelham.

6th Ave and 43d St, 8-story br warehouse; c, $75,000; o, M McIlaic & P F Stiles; a, Buchanan & Fox.

70 W 55th St, 2-story br hotel; c, $305,000; o, Oxford Realty Co; a, Israels & Harder.

431 E 80th St, 2 6-story br tenemts and stores; c total, $100,000; o, Rebecca Meryash; a, Horenburger & Straub.

206 E 103d St, 6-story br flat and stores; c, $55,000; o, Hoft & Hirsch; a, G F Pelham.

683 5th Ave, 5-story stone clubhouse; c, $80,000; o, Criterion; a, Lowenson & Eisendrath.

113th St and Lexington Ave, 6-story br flat; c, $60,000; o, Weil & Mayer; a, Geo A O'Rourke.

Beaver and Pearl Sts, 15-story br office bldg; c, $600,000; o, Century Realty Co; a, Clinton & Russel.

410 Canal St, 1-story warehouse; c, $48,000; o, Benj B Varick; a, E P Robert.

Cliff and Ferry Sts, 9-story br warehouse; c, $70,000; o, Fred Vogel; a, W K Benedict.

140 Elm St, 6-story br factory; c, $75,000; o, Bryan C Hughes; a, Thos Graham.

5th Ave and 92d St, 5-story br dwell; c, $300,000; o, I Townsend Burden; a, Horace Trumbauer.

141st St and 7th Ave, 8 5-story br flats; c, $240,000; o, Fleischman Bros; a, G F Pelham.

155th St and 8th Ave, 16 5-story br flats; c total, $1,040,000; o, Harriet C Coogan; a, D'Oench & Yost.

SCHOOLS.

Pomona, Cal.—Bids are wanted June 20 for $30,000 school bonds. A. N. Harris, City Clk.

Ft. Collins, Colo.—Bids are wanted June 3 for erecting the irrigation engineering building at the State Agricultural College; appropriation, $40,000. A. M. Hawley, Secy. State Bd. of Agriculture.

Chicago, Ill.—Chas. Matthews is reported to be considering the erection of an apartment house at Michigan Ave. and 48th St., at a cost of $60,000.

Alton, Ill.—The Mgrs. of the Ursuline Academy are planning to build a $15,000 addition on E. 4th St.

Indianapolis, Ind.—Bids will be received June 9 by the Bd. of School Comrs. for erecting a school at Rader and 31st Sts. Clarence Martindale, Archt., 32 Blackford Blk.

South Bend, Ind.—Bids will be received June 2 by the Bd. of School Trus. for installing ventilating and heating apparatus in the grammar school now being erected. Geo. W. Selby, Archt., Dean Bldg.

Lafayette, Ind.—The contract for installing the heating plant at the Purdue University is reported to have been awarded to Adam Herzog & Son, 1201 Robert St., for $25,000.

Waterloo, Ia.—Bids will be received June 6 by H. B. White, Secy., for erecting 2 schools at East Waterloo. Separate contracts are to be received for heating and plumbing.

Council Bluffs, Ia.—Bids will be received June 5 by J. A. Price, Secy., for erecting a school in Dist. No. 1, Hardin Township.

Bloomfield, Ia.—The plans of G. M. Kerns, of Ottumwa, have been adopted for a 2-story and basement school, 64x120, of brick and stone; cost, $30,000.

Orono, Me.—Architects Thomas & Crowell, of Bangor, write that the contract for mason work on foundation for an engineering building at Univ. of Maine (bids opened May 6) has been awarded to M. C. Foster, of Waterville, Me.

Chelsea, Mass.—It is stated that an ordinance has passed the second reading providing for an issue of $75,000 bonds for the erection of a high and grammar school.

Bridgewater, Mass.—It is stated that plans are being prepared for a gymnasium for the Normal School, to cost $50,000.

Tewksbury, Mass.—Bids will be received June 1 by the Bldg. Com. for erecting a school. Harry Prescott Graves, Archt., 40 Middlesex St., Lowell.

Big Lake, Minn.—It is stated that bids are wanted June 4 for erecting a school. J. M. Haven, Clk. of School Bd.

Brycelyn, Minn.—It is stated that bids are wanted June 10 for erecting a school. A. E. Wilcox, Clk.

St. Paul, Minn.—Bids will be received June 10 by the Bd. of School Inspectors for installing ventilating and heating plant for Humboldt and Hendricks schools. O. E. Holman, Pres.

Ft. Missoula, Mont.—See "Government Work."

Bayonne, N. J.—Bids will be received by the Bd. of Educ. until June 16 for erecting School No. 8. R. T. Hewitt, Secy.

Plainfield, N. J.—Press reports state that bids are wanted June 15 for $60,000 high school bonds.

Ridgefield Park, N. J.—The citizens are stated to have voted to issue $28,000 bonds for a school.

Brooklyn, N. Y.—Bids will be received June 8 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for erecting addition and alteration; also installing ventilating and heating apparatus in school No. 7.

New Brighton, N. Y.—Bids will be received June 8 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures, electric bell system, etc., in high school No. 1, Boro. Richmond.

New York, N. Y.—The following bids were opened by C. B. J. Snyder, Supt. School Bldgs., Bd. Educ., May 25 for ventilating and heating apparatus in School 183, Boro. of Manhattan: Jas. Curran Mfg. Co., $20,500; Rossman & Bracken Co., $26,400; E. Rutzler, $22,535; John Neal's Sons, $20,244; Wm. N. Tobin, 109 W. 42d St., $20,217 (awarded contract); Walker & Chambers, $22,255; The Baldwin Eng. Co., $22,520; United Htg. Co., $20,821; Williams & Gerstle, $20,598; Fr. Dobson, $21,385.

Jere. J. Deady, 146 E. 16th St., has secured contracts for sanitary work in Schools Nos. 190 and 183, Boro. of Manhattan (bids opened May 25), at $8,997 and $8,793 respectively.

Bids will be received June 8 by C. B. J. Snyder, Supt. of School Bldgs., for installing electric light fixtures and electric bell system in school No. 24.

Martins Ferry, O.—Bids are wanted June 13 for erecting a high school. Address S. F. Dean.

Toledo, O.—It is stated that bids are wanted by the Bd. of Educ. until June 4 for erecting a school. M. M. Fowler, Clk.

Dayton, O.—Bids will be received June 18 by the Bd. of Educ. for furnishing material and repairing various schools, work to include cement, galvanized iron and corrugated iron work, repairs to boilers and furnaces, castings for furnaces, wrought iron work, etc. Wm. G. Haeussler, Clk.

Findlay, O.—Bids will be received June 15 by the Co. Bd. of Educ. of Cass Township for erecting 2 schools. Eli W. Pepple, Clk.

Cleveland, O.—Contracts for erecting the Brandon School and the Harvard St. School have been awarded as follows: General construction, to Michael Heintz, 1628 Lexington Ave., for $53,500; ventilating and heating, Bartlett Bros. Co., $4,615, and plumbing, to Strever Plumbing & Htg. Co., 405 Prospect St., $6,536. Archt., Frank S. Barnum, Supt. of Bldgs.

Bids are wanted June 5 for furnishing and delivering 20,000 lin. ft. 15-in. sewer pipe for the Water Wks. Division of Dept. of Pub. Service. A. R. Callow, Secy.

Oklahoma City, Okla. Ter.—It is stated that the Sisters of Mercy will erect a school here, at a cost of $100,000.

Norman, Okla. Ter.—Bids will be received June 3 by the Bd. of Regents of the Univ. of Oklahoma for furnishing material and erecting science building for said Univ. Arthur J. Williams, Archt., Oklahoma City. D. L. Larsh, Secy.

Salem, Ore.—The time for receiving bids for work at State Reform School at Salem, is June 2, not June 21, as previously stated. W. N. Gatens, Secy. Bd. of Trus. of Oregon State Reform School.

Lancaster, Pa.—Geo. Gesell is stated to have received the contract for erecting the Girls' High School, for $164,497.

Brackenridge, Pa.—Bids will be received June 5 by the Boro. School Dist. for $20,000 school bonds. John W. Girt, Secy.

STREET CLEANING AND GARBAGE DISPOSAL.

San Francisco, Cal.—Local press reports state that the lowest bid opened on May 20 by the Bd. of Pub. Wks. for street cleaning for the next fiscal year is stated to have been submitted by J. G. Harney, whose rates for the 4 districts will amount to about $199,735.

Shreveport, La.—Bids are wanted June 15 (readvertisement) for erecting a crematory for the incineration of garbage. Cost not to exceed $10,000. C. G. Rives, Compt.

St. Joseph, Mich.—The City Council is reported to have authorized the City Clk. to ascertain cost of constructing a garbage crematory.

New Brighton, N. Y.—Bids will be received June 5 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing material and transporting ashes, garbage and light refuse in Boro. Richmond.

Findlay, O.—The City Council is reported to be considering the question of establishing a garbage plant.

Pittsburg, Pa.—Bids are wanted June 2 for furnishing wagons, carts, sprinklers, sweepers and supplies. E. M. Bigelow, Dir. Pub. Wks.

Allentown, Pa.—It is stated that bids are wanted June 2 for street sweeping machine. H. F. Bascom, City Engr.

GOVERNMENT WORK.

Mobile, Ala.—Bids are wanted June 26 for furnishing material and constructing the Sabine Bank Light Station, Tex. Capt. Wm. E. Craighill, Engr. 8th Light House Dist., Mobile.

Hartford, Conn.—A. B. Stannard, of New York, N. Y., is stated to have secured the contract for constructing an extension to U. S. Custom House and Post Office (bids opened May 14), at $192,330.

Ft. Delaware, Del.—Bids are wanted June 4 for furnishing material and repairing South Dock. Address Lieut. Carl E. Wiggin, Q. M.

Washington, D. C.—Bids will be received June 16 at the Bureau of Supplies and Accounts, Navy Dept., for furnishing at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of electrical supplies, pipe, pipe fittings, valves, cranes and elevators, etc. A. S. Kenny, Paymaster-Gen., U. S. Navy.

Bids will be received June 9 at the Bureau of Supplies and Accounts, Navy Dept., for furnishing at the navy yards, Norfolk, Va.; Boston, Mass.; New York; League Island, Pa.; Portsmouth, N. H., and Charleston, S. C., the following supplies: Motors, boilers, locomotive, and water supply system, etc. A. S. Kenny, Paymaster-Gen., U. S. Navy.

Washington Barracks, D. C.—The following contracts have been awarded (bids opened Apr. 30): To the National Mortar Co., of Washington, D. C., 10,000 bbls. of Portland Cement, at $1.89 per bbl.; the Atlas Portland Cement Co., of New Jersey, 10,000 bbls. of Portland Cement, at $1.97 per bbl.; the Columbia National Sand Dredging Co., of Washington, D. C., 13,500 cu. yds. of building sand, concrete sand and gravel, at $1.25 per cu. yd.

New Orleans, La.—Bids will be received June 27 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing at the Naval Station, New Orleans, the following: Two-story brick office building, appropriation $30,000; also a 2-story brick and steel building for equipment—limit of cost, $80,000.

Ft. Howard, Md.—Bids are wanted June 11 for constructing and repairing roads. Address Capt. Morris K. Barroll, Q. M.

Annapolis, Md.—Bids will be received June 13 by H. C. Taylor, Ch. of Bureau of Navigation, Navy Dept., Washington, D. C., for conatructing officers' quarters at the U. S. Naval Academy, Annapolis.

Boston, Mass.—The following bids for rock excavation in Boston Harbor—*a*, upper main ship channel; *b*, lower main ship channel—were received by Lieut.-Col. W. S. Stanton, Corps Engrs., U. S. A., May 26, price given per cu. yd.: Daly & Hanan Dredging Co., Ogdensburg, N. Y., *a*, $19.23; *b*, $30. Eastern Dredging Co., Boston, Mass., *a*, $18.80; *b*, $23.80.

Petoskey, Mich.—Bids will be received on June 24 at the U. S. Engr. Office, Grand Rapids, for extension of West Breakwater at Petoskey, as advertised in The Engineering Record.

Ft. Wayne, Mich.—Bids are wanted June 10 for constructing gymnasium and post exchange buildings. W. H. Miller, Q. M., U. S. A., Chicago, Ill.

Ft. Missoula, Mont.—Bids are wanted June 6 (readvertisement) for constructing water works and sewerage system at this post. Geo. E. Pond, Ch. Q. M., St. Paul.

Plattsburg Barracks, N. Y.—Capt. T. B. Lamoreaux, Q. M., U. S. A., of Burlington, Vt., writes that the lowest bid opened May 25 for remodeling Drill Hall at Plattsburg Barracks, N. Y., into a gymnasium, was received from Arthur McQuillan, of Plattsburg, N. Y., for $27,140, with an alternate bid of $24,943.

New York, N. Y.—The following bids for dredging and rock removal in East River, N. Y., were received by Col. Amos Stickney, Corps Engrs., U. S. A., May 25—(*a*), shell reef; (1) excav. of ledge rock per ton; (2) excav. of other material per cu. yd.; (*b*) pot rock, excav. to a depth of 26 ft. below m. l. w. for lump sum: The International Contr. Co., Whitehall Bldg. (*a* 1), 045; (*a* 2), $2. R. G. Packard Co., 130 Pearl St. (*a* 1), $17.50; (*a* 2), $1.55; (*b*), $15,000.

Portland, Ore.—According to local press reports of May 19th no contracts have as yet been awarded for supplying the stone for the extension of Columbia bar jetty. There are 2 contracts to be awarded, one for 150,000 tons of stone, and the other for 450,000 tons of stone. The War Dept. at Washington is reported to have the bids under consideration.

Philadelphia, Pa.—Capt. J. C. Sanford, Corps Engrs., U. S. A., writes that the Submarine Contracting Co., 71 Wall St., New York, N. Y., submitted the following bid May 22 for removing rock and overlaying and adjacent material in Delaware River at Schooner ledge: $24.85 per cu. yd. for removing and depositing ledge rock or boulders exceeding 10 cu. ft. in volume, 9,500 cu. yds., and 55 cts. per cu. yd. for removing and depositing overlying and adjacent material, 163,000 cu. yds.; total bid, $325,725. This was the only bid received for the work.

Providence, R. I.—Local press reports state that certain architects have been invited to submit plans to be received until Sept. 14 for a post office building for Providence.

Charleston, S. C.—Bids will be received June 20 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a brick intercepting drain at the Navy Yard, Charleston. Amount available, $12,000.

Charleston, S. C.—The following bids were opened at Washington, D. C., May 23, for the general construction of a 3-story brick and steel building for equipment at Navy Yard, Charleston: Grant Wilkins, Atlanta, $147,500; Penn Bridge Co., Beaver Falls, $148,800; Clark Constr. Co., $130,000.

Dallas, Tex.—A press report states that Engr. Watt, connected with the Government Engr. Dept. at Galveston, with Mr. Wilson, formerly City Engr. of Galveston, and Mr. Parker, also an engineer from Galveston, are at McCommas Bluff, on Trinity River, 12 miles south of Dallas. They will make soundings and examinations for a lock and dam to be constructed at that point. They will also make soundings and examinations along the Trinity within the first 50 miles from Dallas and estimate the cost of constructing 4 or 5 locks and dams.

Ft. Douglas, Utah.—Bids are wanted June 15 for constructing a post exchange and gymnasium building, including plumbing, gas piping, heating and electric wiring, at Ft. Douglas. Capt. Sam V. Ham, Q. M., Salt Lake City, Utah.

Ft. Monroe, Va.—Bids are wanted June 11 for extending the water works. Address C. P. Townsley, Q. M.

Norfolk, Va.—The following bids were opened on May 23 at Washington, D. C., for constructing a 1-story steel storage building at Navy Yard, Norfolk: Grant Wilkins, Atlanta, Ga., $26,700 and $21,990; Penn Bridge Co., Beaver Falls, Pa., $32,890 and $22,090, and Frick & Hazen, Baltimore, Md., $27,400 and $22,848.

Norfolk, Va.—The following bids for dredging Nansemond River, Va., were received at U. S. Engineer's Office May 25: Smith & Robinson, 8-10 Bridge St., New York, N. Y., 24½ cts. per cu. yd. scow measurement, and Norfolk Dredging Co., Norfolk, Va., 49½ cts.

Port Townsend, Wash.—Bids are wanted June 2 (readvertisement) for constructing roads, boardwalks and sewer system at Ft. Casey; also sewer system at Ft. Worden. Address Geo. H. Penrose, Q. M., U. S. A.

NEW INDUSTRIAL PLANTS.

The General Electric Co., Lynn, Mass., is planning to erect a 350x650-ft. machine shop. One end of the building will serve as a power plant, and have a capacity of 2,000 to 3,000-H.P.

The International Cork Seal Co., 45 Bank of Baltimore Bldg., Baltimore, Md., will erect a 3 or 4-story, 50x150-ft. factory, to have a daily capacity of 100,000 to 200,000 gross seals and caps.

The Loomis-Pettibone Gas Machinery Co., 52 William St., New York, has bought 120 acres between So. Elizabeth and Linden, N. J., and has requested bids on buildings and machine tools.

The Sun Mfg. Co., Greenfield, O., will erect a new plant at Columbus, O. The site includes 5 acres and 3-story brick buildings having about 60,000 sq. ft. floor space will be erected. The company is in the market for power plant, including an automatic engine that will develop 150-H.P. at 80 lbs. pressure, a horizontal tubular boiler, pump, heater and dynamo.

The Rhinelander, Wis., Paper Co. will erect a 2-machine fiber plant and a sulphite and ground-wood mill. C. B. Pride, Appleton, Wis., who designed the plant and took the contract for the mill complete, has placed orders for most of the machinery.

The Wheel Within Wheel Co., Park Row Bldg., New York, will shortly erect a factory to cost at least $60,000. The equipment will cost from $50,000 to $75,000.

The Marion, Ind., Insulated Wire & Rubber Co. is excavating for a 3-story, 224x90-ft. factory building, with a 150x60-ft. basement. The company wants estimates for electric motors for the entire plant and also for motors for second and third floors only, using a 300-V.-P. Corliss engine to drive mills and other heavy machinery on first floor.

The Ohio Portland Cement Co., Columbus, O., will proceed at once with the erection of its cement plant. The Osborn Engineering Co., Cleveland, O., is the engineer for this plant.

Young & Russell, Youngs, Ga., are considering the erection of a flour mill.

The Wilkinsville, S. C., Cotton Oil Co. will erect a 10-ton oil mill and a three 70-saw ginnery power plant of about 60-H.-P. will be required. C. W. Whisonant is interested.

MISCELLANEOUS.

Pomona, Cal.—Bids are wanted June 20 for $30,000 park bonds. A. N. Harris, City Clk.

Chicago, Ill.—The Drainage Bd. is reported to have on May 21 formally adopted a plan for widening and improving south branch of Chicago River between Lake and Van Buren Sts. The plan contemplates the excavation of a part of the bank and involves an expenditure of about $2,000,000.

Covington, Ind.—It is stated that bids are wanted June 6 for constructing a levee on east bank of Wabash River, in Fulton and Wabash. S. L. Wilkins, Dir. Levee Dist.

Council Bluffs, Ia.—R. V. Innes, Co. Aud., writes that the contract for constructing the Fensler ditch (bids opened May 3) has been awarded to C. F. Pratt, of Movalley, Ia., at 11 cts. per yd.

Boston, Mass.—Bids will be received until June 4 by the Harbor and Land Comrs., Boston, for dredging at Bass River, approximately 15,000 cu. yds. Woodward Emery, Chmn.

Camden, N. J.—This city will let a contract in July for removal of 30,000 cu. yds. of earth; probable cost of work, $10,000. L. E. Farnham, City Engr.

Brooklyn, N. Y.—The following bids were opened May 22 by McDougall Hawkes, Comr. Docks, for building a pier at the foot of Bay Ridge Ave.: G. B. Spearin, $63,932; Bernard Rolf, $67,333; Augustin Walsh, $68,400; Wm. H. Jenks, $68,422.

The following bids were also opened for building a pier between 51st and 52d Sts.: Wm. H. Jenks, $34,394; A. Walsh, $35,000; B. Rolf, $35,633; Chas. B. Roderman, $38,640.

Bids will be received June 11 by Thos. W. Hynes, Comr. of Correction, N. Y. City, for furnishing and delivering engineer's supplies, etc.

Bids will be received June 10 by J. Edw. Swanstrom, Boro. Pres., for dredging Gowanus Canal, Wallabout Canal, Newtown Creek, and East River. Engineer's estimate of cu. yds. to be dredged: 30,000, 10,000, 2,000 and 2,000, acow measurement.

New York, N. Y.—Bids will be received June 2 by McDougall Hawkes, Comr. of Docks, for furnishing and delivering about 1,000 piles.

The following bids for furnishing all labor and materials required for building a pier, near foot of Peck Slip, East River, were received by Dept. Docks & Ferries May 26: W. H. Jenks, 130 Pearl St., $46,623; Bernard Rolf, 39 Cortlandt St., $45,433; Augustin Walsh, 96 Water St., $44,740 (awarded contract).

Long Island City, L. I., N. Y.—The Bd. of Estimate and Apportionment has given Pres. Cassidy $10,000, to be used in erecting street signs in the Boro. of Queens.

Portland, Ore.—The Port of Portland Comn. is stated to have opened the following bids May 18 for supplying piling and material for the drydock berth at St. Johns. The specifications called for 1,870 piles of 65 ft., 975,000 ft. of lumber, 5,000 cords of brush and 1,000 tons of rock, the piling to be driven at the dock site: J. E. Bennett, $46,070; Jos. Paquet, $43,965; Robt. Wakefield, $42,303; B. F. Smith & Co., $44,990. All the bids were rejected, being above Engr. J. B. C. Lockwood's estimate, which was $38,165, and the Clerk was instructed to secure new bids to be in May 28th.

Manitowoc, Wis.—It is stated that the Manitowoc Dry Dock Co. is to construct a new dock, at a cost of about $100,000.

St. John, N. B.—Local press reports state that the Imperial Dock Co. will construct a dry dock here. It will be 650 ft. long, the main part to be wood and the entrance granite and concrete. Engineer, Louis Coste, of Montreal, Que.; Geo. Robertson, Pres.

Ottawa, Ont.—The House is stated to have passed a bill appropriating $500,000 for the River St. Lawrence ship channel; $100,000 for Quebec harbor improvements; $50,000 for improvement of Port Arthur, and $30,000 for dredging mouth of Kaministiquia River.

BUSINESS NOTES.

The name of the Laufketter-Bendit M. E. Co., 714 Wainwright Bldg., St. Louis, is to be changed to the Bendit Mercantile Engineering Co. E. O. Edson has been elected secretary and treasurer to succeed F. C. Laufketter, who retires to become president of the Victor Mfg. Co., St. Louis. The company will continue to act as sales agent for the Consolidated Engineering Co., Direct Separator Co., Goulds Mfg. Co., Mansfield Engineering Co., Straight Line Engine Co. and Warren Steam Pump Co.

The Pittsburg Cement Co. has been incorporated, with a capital of $1,000,000, by W. P. J. Lawrence and Carroll Foster, Pittsburg; J. H. Baldwin, Newark, N. J.; Lemert S. Cook, Boston, and Joseph H. Reall, 514 Fitzsimmons Bldg., Pittsburg.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Belvidere Hotel, Baltimore, Md., three self-oiling engines of 600 H.-P., direct-connected to Crocker-Wheeler generators; Kentucky Wagon Co., Louisville, a 150-H.-P., self-oiling engine for direct-connection to a James Clark, Jr., & Co generator.

The United Engineering & Foundry Co., Pittsburg, installed last year a complete heating and ventilating equipment in the roll shop of the Lincoln Foundry Department. The apparatus, which was furnished by the B. F. Sturtevant Co., consists of a steel-plate exhauster direct-connected to a horizontal, side-crank engine. The exhauster draws air from out-of-doors through a large steam heater built up in sections of 1-in. pipe, one of the sections receiving the exhaust from the fan engine.

The Chicago Engineering & Construction Co., capital $250,000, has acquired the business of Weston Bros., consulting engineers. It is proposed to carry on a general engineering and contracting business. The officers of the company will be Charles V. Weston, Pres.; Geo. Weston, Vice-Pres.; Geo. A. Yuille, Secy. and Gen. Mgr.; Henry B. Hicks, Counsel. Addison E. Wells, Fred A. Wells and Edward B. Burling, all of Chicago, together with the above named officers, will make up the board of directors.

The Chuiasky Iron and Cement Co., Connell Bldg., Scranton, Pa., has recently been incorporated with the following officers: Robert E. Carter, Pres.; David S. Price, Vice-Pres.; L. A. Smith, Secy., and A. L. Derry, Treas. and Gen. Mgr. The company has erected a plant at Chuiasky, Pa., for the preparation of crushed slag for railroad ballast, road making, concrete fireproofing and roofing, and would like to hear from parties who are about to establish artificial stone plants in Eastern Pennsylvania, believing it can offer substantial inducements to plants locating in its vicinity.

The Barr Pumping Engine Co., Philadelphia, has within the last month closed contracts as follows: City of Brockton, Mass., one 6,000,000-gal. vertical triple-expansion fly-wheel pumping engine; City of Kansas City, Mo., one 25,000,000-gal. vertical triple-expansion fly-wheel pumping engine; Town of Plymouth, Mass., one 2,000,000-gal. horizontal compound-condensing direct-acting pumping engine, and the Town of Newton, Mass., a 6,000,000-gal. vertical cross-compound pumping engine.

The Expanded Metal Engineering Co., 256 Broadway, New York, has been formed to take over the business of the New York Expanded Metal Co., and to act as a developing company to investigate and extend the utility of steel-reinforced concrete and plastic cement work. Messrs. John F. Golding, the inventor of expanded metal, and Merrill Watson, manager of the New York Company, are connected with the new corporation. An experimental station will be built for testing all types of concrete construction.

The New York office of the Plunger Elevator Co., 156 Fifth Ave., has closed a contract for two of the latest types of plunger elevators to be installed in the New York Maritime Exchange.

The American Blower Co., Detroit, Mich., reports among larger orders recently received the following: Heating and induced draft apparatus for the Ironton, O., Engine Co.; drying outfits for the Illinois Sugar Refining Co., Pekin, Ill., and the Michigan Starch Co., Traverse City, Mich.; dry kiln for the Mengel Box Co., Louisville, Ky.; Brooklyn Cooperage Co., New York; Buckstege Furniture Co., Evansville, Ind.; Evanaville, Ind., Desk Co.; Cadillac Cabinet Co., Detroit, and many others.

Pawling & Harnischfeger, Milwaukee, Wis., crane and hoist builders, report the following among recent orders: American Stone Co., Brooklyn, N. Y., 2 cranes; Milwaukee Bridge Co.; The Louisville, Ky., Ry. Co.; Louisiana Purchase Exposition, St. Louis; The Ingersoll-Sergeant Drill Co., Easton, Pa., 2 cranes; The Milton, Pa., Mfg. Co.; The Vilter Mfg. Co., Milwaukee; American Road Machine Co., Kennett Square, Pa.; The Stilwell-Bierce & Smith-Valle Co., Dayton, O., 2 cranes; The Mahoning Foundry & Machine Co., Youngstown, O.; New York Shipbuilding Co., Camden, N. J.; The McConway & Torley Co., Pittsburg; Sterlit-Thomas Foundry Co., Pittsburg; Standard Oil Co., of New York, Atlas Works, Buffalo; Pennsylvania Engineering Works, New Castle, Pa.; Metropolitan St. Ry. Co., Kansas City, 2 cranes; Jefferson & Clearfield Coal & Iron Co., Ernest, Pa.; International Harvester Co., Hamilton, Ont.; Gould Coupler Co., Depew, N. Y., 3 cranes; Helena, Mont., Light & Traction Co.; American Sheet Steel Co., Pittsburg, 2 cranes (1 special); Allis-Chalmers Co., Milwaukee, 2 cranes; Howard Iron Works, Buffalo; American Bridge Co., Ambridge Works, Economy, Pa.; La Belle Iron Works, Steubenville, O.; Bradley Mfg. Co., Pittsburg; The New York Edison Co., New York.

PROPOSALS OPEN.

Bids Close. — See Eng. Record.

WATER WORKS.

Jun. 1. Lockport, N. Y. — May 30
Jun. 1. Gouverneur, N. Y. — May 2
Jun. 2. Hattiesburg, Miss. — May 30
Jun. 2. New York, N. Y. — May 30
Jun. 2. New Ulm, Minn. — May 30
Jun. 2. New York, N. Y. — May 23
Jun. 2. Duluth, Minn. — May 23
Jun. 2. Eveleth, Minn. — May 23
Jun. 3. Ft. Dodge, Kan. — May 23
Jun. 4. Fennimore, Wis. — May 30
Jun. 4. Yonkers, N. Y., Adv. May 23. — May 23
Jun. 4. So. Jamaica, L. I., N. Y. — May 23
Jun. 6. Freeport, Minn. — May 23
Jun. 6. Washington, D. C., Adv. May 16 to 30. — May 16
Jun. 8. Winnipeg, Man., Adv., May 30. — May 30
Jun. 8. Standpipe, Winfield, Kan. — May 30
Jun. 8. Woodlake, Minn. — May30
Jun. 8. Lancaster, Pa., Adv. May 16, 23. — May 16
Jun. 8. Schenectady, N. Y., Adv. May 23, 30. — May 23
Jun. 9. Long Island City, N. Y. — May 30
Jun. 9. New Brighton, S. I. — May 30
Jun. 9. Ilion, N. Y. — May 23
Jun. 10. Camden, N. J. — May 30
Jun. 10. San Jose, Cal. — May 30
Jun. 10. Meadville, Pa. — May 30
Jun. 10. Ruston, La. — May 30
Jun. 10. Dillon, Mont., Adv. May 23, 30. — May 23
Jun. 11. Brooklyn, N. Y. — May 30
Jun. 15. Halsted, Minn. — May 30
Jun. 15. Great Falls, Mont. — May 30
Jun. 15. Tacoma, Wash. — May 30
Jun. 15. North Tonawanda, N. Y. Adv. May 23, 30. — May 23
Jun. 18. Brooklyn, N. Y. — May 30
Jun. — Pump, Niagara Falls, Ont. — May 9
Jul. 1. West Point, Va. — May 23
Jul. — West Manchester, O. — May 30

SEWERAGE AND SEWAGE DISPOSAL.

Jun. 1. Woonsocket, R. I., Adv. May 23, 30. — May 23
Jun. 1. Danbury, Conn. — May 30
Jun. 1. Lestershire, N. Y., Adv. May 16, 23. — May 16
Jun. 1. Ridgefield Park, N. J. — May 23
Jun. 1. Cuba, N. Y. — May 16
Jun. 2. Hattiesburg, Miss. — May 30
Jun. 3. South Bend, Ind. — May 30
Jun. 4. Ansonia, O., Adv. May 23, 30. — May 23
Jun. 4. Boston, Mass., Adv. May 23. — May 23
Jun. 5. Cleveland, O. — May 30
Jun. 6. Wilmington, Del. — May 30
Jun. 6. Youngstown, O. — May 30
Jun. 6. Wapakoneta, O. — May 30
Jun. 6. Madella, Minn. — May 30
Jun. 6. Washington, D. C. Adv. Apr. 25, May 9, 16. — Apr. 25
Jun. 8. Milburn, N. J., Adv. May 23, 30. — May 23
Jun. 9. St. Louis, Mo. — May 30
Jun. 9. Bound Brook, N. J. — May 23
Jun. 10. Hoboken, N. J. — May 30
Jun. 10. Coldwater, Mich. — May 30
Jun. 10. Brooklyn, N. Y. — May 30
Jun. 10. Grand Rapids, Mich., Adv. May 30. — May 30
Jun. 10. Pine Bluff, Ark. — May 23
Jun. 15. Johnstown, N. Y. — May 30
Jun. 15. Webster City, Ia. — May 23
Jun. 15. Burlington, Ia., Adv. May 30. — May 16
Jun. 20. Washington, D. C., Adv. May 16 to 30. — May 16
Jun. 26. Shreveport, La., Adv. May 30. — May 30
Jun. — Little Rock, Ark. — May 30
Jun. — Ballard, Wash. — May 9
Jul. 1. Geneva, O. — May 30
——— Greensboro, N. C. — May 30

BRIDGES.

Jun. 2. La Grange, Ind. — May 23
Jun. 2. Somerville, N. J. — May 23
Jun. 2. Quincy, Fla. — May 23
Jun. 2. Niles, O. — May 16
Jun. 3. Lithium, Mo. — May 30
Jun. 3. Oak Ridge, La. — May 2
Jun. 3. Livingston, Mont. — May 2
Jun. 4. Topeka, Kan. — May 30
Jun. 4. Ft. Benton, Mont. — May 9
Jun. 5. Indianapolis, Ind. — May 30
Jun. 5. Chicago, Ill. — May 30
Jun. 5. Covington, Ind. — May 23
Jun. 5. Grand Rapids, Mich., Adv. May 23. — May 23
Jun. 6. Wichita, Kan. — May 30
Jun. 6. Oroville, Cal. — May 23
Jun. 10. Terre Haute, Ind., Adv. May 16. — May 16
Jun. 10. Rushville, Ind. — May 23
Jun. 11. Mishawaka, Ind. — May 23
Jun. 12. Belleville, Ont. — May 30
Jun. 15. Holston, Va. — May 30
Jun. 15. Burlington, Ia., Adv. May 30. — May 16
Jun. 18. Shreveport, La. — May 30
Jun. 20. Marion, Ind. — May 30
Jun. 22. Olivet, S. D. — May 16
Jul. 10. Castlewood, S. D. — May 2

PAVING AND ROADMAKING.

Jun. 1. Union, N. J. — May 23
Jun. 1. Tyrone, Pa., Adv. May 23. — May 23
Jun. 1. Augusta, Ga., Adv. May 16 to 30. — May 16
Jun. 1. Haverhill, Mass. — May 23
Jun. 2. Butler, Pa. — May 30
Jun. 2. Harrisburg, Pa. — May 30
Jun. 2. Buffalo, N. Y. — May 30
Jun. 2. Pittsburg, Pa. — May 30
Jun. 2. Versailles, Ind. — May 23
Jun. 2. Princeton, Ind. — May 16
Jun. 2. Bluffton, Ind. — May 16
Jun. 2. Bowling Green, O. — May 9
Jun. 4. Paoli, Ind. — May 23
Jun. 4. Long Island City, N. Y. — May 30
Jun. 4. Montreal, Que. — May 30
Jun. 5. Traverse City, Mich., Adv. May 23, 30. — May 23
Jun. 5. New Brighton, N. Y. — May 30
Jun. 5. New Richmond, Wis. — May 30
Jun. 6. Delaware, O. — May 30
Jun. 8. Mt. Holly, N. J. — May 23
Jun. 8. Albany, N. Y., Adv. May 16 to 30. — May 16
Jun. 9. Binghamton, N. Y. — May 30
Jun. 9. Ashland, Wis. — May 23
Jun. 10. West Boylston, Mass., Adv. May 30. — May 30
Jun. 10. Washington, D. C., Adv., May 30. — May 30
Jun. 11. Bloomington, Ill. — May 30
Jun. 10. Bowling Green, O. — May 16
Jun. 11. Newark, N. J., Adv. May 23. — May 23
Jun. 11. Seymour, Ind. — May 16
Jun. 12. Napoleon, O. — May 30
Jun. 12. Bridgeport, Conn., Adv. May 23. — May 23
Jun. 12. Wauseon, O. — May 23
Jun. 12. Bloomington, Ind. — May 16
Jun. 13. Scottsburg, Ind. — May 30
Jun. 13. Celina, O. — May 30
Jun. 13. Mt. Vernon, Ind. — May 30
Jun. 13. Washington, D. C., Adv. May 30. — May 30
Jun. 15. Neptune, N. J. — May 30
Jun. 15. Anderson, S. C. — May 23
Jun. 15. Houston, Tex. — May 23
Jun. 15. Burlington, Ia., Adv. May 30. — May 16
Jun. 16. Camden, N. J. — May 30
Jun. 16. Rensselaer, N. Y., Adv. May 30. — May 30
Jun. 17. Providence, R. I. — May 30
Jun. 22. Jasper, Ind. — May 30
Jun. 22. Bowling Green, O. — May 30
Jun. 23. La Crosse, Wis. — May 30
Jun. 24. Cincinnati, O. — May 30
Jun. 26. Shreveport, La., Adv. May 30. — May 30
Jun. — Charlevoix, Mich. — May 30

POWER, GAS AND ELECTRICITY.

Jun. 1. Corry, Pa., Adv. May 9 to 23. — May 9
Jun. 1. Albany, N. Y. — May 23
Jun. 1. Lebanon, Pa. — May 16
Jun. 1. San Diego, Cal., Adv. May 23. — Apr. 18
Jun. 2. Olympia, Wash. — May 30
Jun. 5. Franchise, Wytheville, Va. — May 16
Jun. 6. Hillsboro, N. D. — May 30
Jun. 6. Davenport, Wash. — May 23
Jun. 8. Greene, N. Y. — May 30
Jun. 8. New Orleans, La. — May 23
Jun. 10. Ruston, La. — May 30
Jun. 15. Vernal, Utah — May 16
Jun. 16. Buhl, Minn. — May 30
Jun. 18. Portland, Ore., Adv. Apr. 18 to May 2. — Apr. 18
Jun. — Napoleon, O. — May 16
Jun. — North Yamkill, Ore. — Apr. 4
Sep. 1. Corona, Cal. — May 16
——— Caledonia, Minn. — May 23

GOVERNMENT WORK.

Jun. 2. Port Townsend, Wash. — May 30
Jun. 2. Ft. Monroe, Va. — May 23
Jun. 2. Ft. Baker, Cal. — May 23
Jun. 2. Springfield, S. D. — May 9
Jun. 3. Ft. Snelling, Minn. — May 23
Jun. 3. Phoenix, Ariz. — May 16
Jun. 3. Ft. Greble, R. I., Adv. May 16, 30. — May 16
Jun. 3. Milwaukee, Wis., Adv. May 9 to 30. — May 9
Jun. 3. Springfield, Ill., Adv. May 2, 9. — May 2
Jun. 4. Ft. Delaware, Del. — May 30
Jun. 4. San Francisco, Cal. — May 16
June 4. Metal Work, Baltimore, Md. Adv. May 9. — May 9
Jun. 4. Light House, Baltimore, Md. Adv. May 9. — May 9
Jun. 4. Scranton, Pa. — May 2
Jun. 5. Grand Rapids, Mich., Adv. May 9 to 30. — May 9
Jun. 6. Ft. Missoula, Mont. — May 30
Jun. 6. Ft. Huachuca, Ariz. Ter. — May 23
Jun. 6. Norfolk, Va. — May 23
Jun. 6. Ft. McKinley, Me. — May 23
Jun. 6. Ft. Mott, N. J. — May 16
Jun. 6. Ft. Leavenworth, Kan. Adv. May 9 to 30. — May 9
Jun. 8. Prescott, Ariz., Adv. May 30. — May 30
Jun. 8. Ft. Terry, N. Y., Adv. May 23, 30. — May 23
Jun. 8. Ft. Ethan Allen, Vt., Adv. May 23, 30. — May 23
Jun. 8. Cleveland, O., Adv. May 2, 9. — May 2
Jun. 8. Portland, Ore. — May 2
Jun. 8. Sitka, Alaska — Apr. 25
Jun. 9. Washington, D. C. — May 30
Jun. 9. St. Augustine, Fla., Adv. May 16 to 30. — May 16
Jun. 9. Htg. P. O., Paducah, Ky. Adv. May 9, 16. — May 9
Jun. 10. New York, N. Y., Adv. May 16 to 30. — May 16
Jun. 10. Ft. Wayne, Mich. — May 30
Jun. 10. Rapid City, S. D. — May 23
Jun. 10. St. Paul, Minn. — May 2
Jun. 11. Ft. Howard, Md. — May 30
Jun. 11. Ft. Monroe, Va. — May 30
Jun. 11. Albuquerque, N. M. — May 23
Jun. 11. Rock Island, Ill. — May 23
Jun. 11. Bldg. P. O., Paducah, Ky. Adv. May 9, 16. — May 9
Jun. 12. Lawrence, Kan. — May 23
Jun. 12. Philadelphia, Pa. — May 16
Jun. 13. Annapolis, Md. — May 30
Jun. 15. Washington, D. C., Adv. May 30. — May 30
Jun. 15. Ft. Ethan Allen, Vt., Adv. May 30. — May 30
Jun. 15. Ft. Douglas, Utah. — May 30
Jun. 15. Norfolk, Va., Adv. May 23. — May 23
Jun. 15. Manila, P. I., Adv. Mar. 14 to May 9. — Mar. 14
Jun. 16. Washington, D. C. — May 30
Jun. 16. Ft. Caswell, N. C., Adv. May 23, 30. — May 23
Jun. 16. Alexandria, Va., Adv. May 16, 30. — May 16
Jun. 17. Saugatuck, Mich., Adv. May 23, 30. — May 23
Jun. 18. Boone, Ia. — May 23
Jun. 19. Ft. Leavenworth, Kan. Adv. May 23, 30. — May 23
Jun. 20. Charleston, S. C. — May 30
Jun. 22. Stillwater, Minn., Adv. May 23, 30. — May 23
Jun. 22. Baltimore, Md., Adv. May 23, 30. — May 23
Jun. 22. New Haven, Conn., Adv. May 23, 30. — May 23
Jun. 23. Ft. D. A. Russell, Wyo. — May 23
Jun. 24. Petoskey, Mich., Adv. May 30. — May 30
Jun. 24. Tompkinsville, N. Y., Adv. May 23, 30. — May 23
Jun. 25. Leadville, Colo. — May 23
Jun. 26. Mobile, Ala. — May 30
Jun. 27. New Orleans, La. — May 30
Jun. 30. Philadelphia, Pa., Adv. May 16, 23. — May 16
Jun. 30. New Orleans, La., Adv. May 9, 16. — May 9
Sep. 14. Providence, R. I. — May 30

BUILDINGS.

Jun. 1. School, Tewksbury, Mass. — May 30
Jun. 1. School, New York, N. Y. — May 23
Jun. 1. School, Brooklyn, N. Y. — May 23
Jun. 1. Gymnasium, New York, N. Y. — May 23
Jun. 1. Hospital, Brooklyn, N. Y. — May 16
Jun. 2. Church, Chillicothe, O. — May 30
Jun. 2. School, Salem, Ore. — May 30
Jun. 2. School, South Bend, Ind. — May 30
Jun. 2. Library, Danville, Ill. — May 16
Jun. 2. Pub. Bldg., Pueblo, Colo. — May 16
Jun. 2. Court house, Hamburg, Ark. — May 16
Jun. 3. School, Norman, Okla. Ter. — May 30
Jun. 3. Fire Station, Providence, R. I. — May 30
Jun. 3. Church, New Castle, Ind. — May 30
Jun. 3. School, Ft. Collins, Colo. — May 30
Jun. 3. Fire Station, Providence, R. I. — May 23
Jun. 4. School, Big Lake, Minn. — May 30
Jun. 4. School, Toledo, O. — May 30
Jun. 4. School, College Hill, O. — May 16
Jun. 5. School, Chicago, Ill. — May 30
Jun. 5. Dormitory, etc., Canandalgua, N. Y. — May 30
Jun. 5. School, Council Bluffs, Ia. — May 30
Jun. 5. School, Mountain Lake, Minn. — May 23
Jun. 5. Plans, Moscow, Idaho — May 2
Jun. 6. School, Waterloo, Ia. — May 30
Jun. 6. Church, Elberton, Ga. — May 30
Jun. 6. School, Newark, O. — May 23
Jun. 6. School, Burlington, Ia. — May 23
Jun. 6. School, Grinnell, Ia. — May 23
Jun. 6. School, St. Paul, Minn. — May 23
Jun. 8. Hospital, New York, N. Y. — May 30
Jun. 8. School, New Brighton, N. Y. — May 30
Jun. 8. School, Brooklyn, N. Y. — May 30
Jun. 8. School, New York, N. Y. — May 30
Jul. 8. Jail, Napoleon, N. D. — May 2
Jun. 9. School, Indianapolis, Ind. — May 30
Jun. 9. Court house, Iola, Kan. — May 30
Jun. 9. Library, Franklin, Ind. — May 30
Jun. 9. Court house, Denison, Ia. — May 23
Jun. 9. Hospital, Brooklyn, N. Y. — May 23
Jun. 9. School, Akron, O. — May 23
Jun. 9. Dormitories, Columbus, O. — May 23
Jun. 10. School, St. Paul, Minn. — May 30
Jun. 10. School, Brycelyn, Minn. — May 30
Jun. 10. School, Hankinson, N. D. — May 16
Jun. 12. Capitol, Augusta, Me. — May 30
Jun. 12. Pub. Bldg., New York, N. Y. — May 30
Jun. 12. Capitol, Augusta, Me. — May 23
Jun. 13. School, Martins Ferry, O. — May 30
Jul. 13. Court House, La Grange, Ga. — May 9
Jun. 15. Schools, Findlay, O. — May 30
Jun. 15. Church, Rossville, Ill. — May 30
Jun. 15. Pub. Bldg., Danville, Ill. — May 30
Jun. 15. Bank, Dunkerton, Ia. — May 30
Jun. 15. Bank, Houston, Tex. — May 30
Jun. 15. School, Beaumont, Tex. — May 23
Jun. 15. School, Cleveland, O. — May 23
Jun. 15. School, Scotch Ridge, O. — May 16
Jun. 16. School, Hempstead, N. Y., Adv. May 30. — May 30
Jun. 16. Jail, etc., Two Harbors, Minn. — May 30
Jun. 16. School, Bayonne, N. J. — May 30
Jun. 16. Hospital, Los Angeles, Cal. — May 23
Jun. 16. School, Bedford, Ind. — May 2
Jun. 18. School, Dayton, O. — May 30
Jun. 18. Pub. Bldg., Sandusky, O. — May 23
Jun. 22. Church, Topeka, Kan. — May 30
Jun. 22. Fire Station, Houston, Tex. — May 16
Jun. — Hotel, La Crosse, Wis. — May 23
Jul. 1. Court house, Boonville, Ind. — May 30
Jul. 1. Court house, Carnesville, Ga. — May 30

MISCELLANEOUS.

Jun. 2. Piles, New York, N. Y. — May 30
Jun. 2. Garb. Disp., Pittsburg, Pa. — May 30
Jun. 2. St. Cleaning, Allentown, Pa. — May 30
Jun. 2. Pipe, Richmond, Va., Adv. May 23. — May 23
Jun. 2. R. R. Work, Columbus, O. — May 16
Jun. 3. Garb. Disp., Brooklyn, N. Y. — May 23
Jun. 3. Garb. Disp., New York, N. Y. — May 23
Jun. 4. Dredging, Boston, Mass. — May 30
Jun. 4. Snow Removal, New York, N. Y. — May 23
Jun. 5. Garb. Disp., New Brighton, N. Y. — May 30
Jun. 6. Levee, Covington, Ind. — May 30
Jun. 9. Ditch, Nevada, Ia. — May 16
Jun. 10. Dredging, Brooklyn, N. Y. — May 30
Jul. 10. Ditch, etc., Beardstown, Ill. — May 23
Jun. 11. Supplies, Brooklyn, N. Y. — May 30
Jun. 12. Garbage, St. Joseph, Mo. — May 16
Jun. 15. St. Ry. franchise, Los Angeles, Cal. — May 30
Jun. 15. Garb. Disp., Shreveport, La. — May 30
Jul. — Removal of earth, Camden, N. J. — May 30
——— El. Ry. work, Columbia, Mo. — May 30
May 2, '04. R. R., Oodnadatta, So. Australia. — Feb. 21

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Railway Civil Engineering.

The general belief of the public seems to be that the day is past when railway work offers an attractive field to the civil engineer. It is true that the early locator, with his guard of soldiers or frontiersmen to stand off the Indians, was a picturesque character no longer to be seen, and without counterpart among the members of the profession to-day. But in importance and variety of his work the railway civil engineer of to-day is on a par with his predecessor, while in the actual cost of the construction carried on from his plans his responsibilities were never before equalled.

The early locating engineer enjoyed advantages which do not lighten the lot of his successor of to-day. Owing to the novelty of his duties and their hazardous nature when performed on or beyond the frontier of civilization, he became a character of some importance. To-day the locator is likely to be lost to the sight and knowledge of all save a few men associated with him. He is out in the open, away frem everybody, and everything he turns into the headquarters of the road to show that he has earned his salary is a set of note books and a few maps and profiles. There is no ponderous bridge, towering building or complicated machine to cause the public to admire his ability. The fine red lines on his drawings may indicate the completion of explorations and studies which will save his company hundreds of thousands of dollars in construction and operation, but it is against human nature for his really great achievements to receive from anyone equal credit with the professional man who puts up conspicuous structures of steel and masonry. It is the spender and not the saver who gets attention in engineering as in other fields of work.

The old idea of many men in the West was apparently merely to connect as rapidly as possible the two given terminal points by means of a line which did not exceed at any place a maximum grade. The first line answering the requirements was too often selected for construction, without any search for better routes. The results of this policy are shown in the enormous sums now being spent on cut-offs, the elimination of curves and the easing of grades. Some roads have apparently learned nothing from such experience, and expect to secure an engineer of the experience and knowledge needed for the best work for a salary of $150 a month. They pay willingly four or five times as much for the man who works out a bridge structure but grudge a transitman's salary to the man whose greatest achievement is in the line of economy and not expense. His work cannot be accomplished in an office supplied with every convenience, but must be done in the field, sometimes in arid regions, again in the roughest mountains, and occasionally in the heavy snows of a semi-arctic winter. The dangers accompanying rough life in the brush or en the prairie are merely incidents of his career. That his work under such conditions has been done well speaks much for his faithfulness, but less for his business sense.

The old conditions are now changing rapidly for the better, however, how rapidly few engineers not engaged in such work recognize. The locators are now mostly graduates of technical schools who are in this specialty because of its charm to them and not because of their inability to secure lucrative engagements in other lines. They insist upon good salaries and as good facilities for their work as the conditions permit. If they cannot receive the salaries and the facilities that the grade of their work merits they simply refuse to undertake it. As a slight indication of the present status of the locating engineer in the railway world, the attention paid to Mr. A. A. Schenck's paper on railway location before the Western Society of Engineers may be cited. This paper is practically the only one which has been prepared for some years on the fundamental principles and details of the subject, as viewed by a specialist of many years' varied experience. In some respects it is the most important railway paper of the year, and it is a pleasure to notice that its importance was recognized by the managers of some of the leading Western railways, who sent members of their engineering staffs to take part in its discussion. For some reason this discussion was confined to a single session, and the paper consequently did not receive the thorough sifting it merited, and which, indeed, the members and guests present were prepared to give it. This is the more to be regretted because so little is published on the subject. When railway companies are sufficiently interested in a paper to be semi-officially represented at the session when it is presented, there can be no question as to its importance and the advisability of a thorough discussion of its views.

Location is but one feature of the work of the railway civil engineer, and in the allied fields of construction and maintenance it is gratifying to perceive similar marked improvement in the conditions. This has been brought about in no small measure by the earnest work of the American Railway Engineering and Maintenance of Way Association, a youthful organization but one full of energy and inspired with a high purpose. It has recently decided upon a system of publishing and discussing its reports which is marked by sound sense. The work of the Association is done largely by committees, which are expected to collect data concerning designated subjects from all sources, condense them into suitable shape for comparative examination, and finally present a set of rules or drawings on the subjects for the members to adopt as general standards. It is needless to say that the discussion of such important reports, at meetings attended by representatives of most of the leading lines in the country, is generally prolonged and precludes the consideration of more than a few of them. The Association has accordingly decided to allow no report to come up for discussion until after its publication in the Bulletin at a date sufficiently ahead of the convention to allow ample time for its careful examination. Written discussions will be printed in the Bulletin and the oral discussions will be submitted to the speakers "for correction of diction and errors of reporting, but not for the elimination of remarks," so that before anything is published in the "Proceedings" of the Association it will have been scrutinized for mistakes of all kinds by many eyes. This new step in the management of the Association's technical work is based on such sound reasons that it will unquestionably make the convention of next year more important than those of the past. The aim of the managers seems to be the improvement of the quality of the organization's work without much regard to its quantity. Because of the present high standard of the best practice in railway civil engineering, this policy is manifestly a wise one, for a hasty discussion of the many details of any one general railway topic is productive of little permanent good.

The Value of Preliminary Studies in Water Purification Undertakings.

The Sewerage and Water Board of New Orleans has just issued its first report of technical interest, but the document is of such exceptional value that the delay in its appearance is more than offset by the value of its contents. When the subject of municipal water-works was brought up early in 1900, the proposal to build an experimental station for investigating the suitability of the Mississippi River as a source of supply met with little favor among the members of the Board. They were familiar with the disastrous results of the attempt at filtration made by the local water company, and believed that it was poor policy to waste any money on little laboratory tests when experiments with full-size filters had brought nothing but trouble to the people who made them. The Board knew that the Mississippi was as likely to be coffee-colored as to be what is called clear in New Orleans, clearness being a term for a sickly yellowish shade like that of circus lemonade. Having this knowledge, they did not consider the Mississippi as a possible source of supply. The water carries so much sediment in suspension that meters cannot be used for more than a few months before they are cut. Clear water can only be obtained at present by storing the rainfall and by purchasing mineral water. But after discussing the subject for half a year, authority was reluctantly given for the construction and operation of such a station. The technical details of that work are given on page 606, but there is a very instructive lesson to be drawn from these experiments which does not

need an accompaniment of chemical tables or of engineering plans to render it forcible.

The city has about $10,400,000 to spend on sewerage and water-works. The sewers will require about $4,560,000, the water mains and pumps will cost about $3,400,000, and the service pipes and house drains will cost $1,400,000, leaving only $1,000,000 for the construction of works to furnish the necessary water supply. The least expensive project for bringing the necessary quantity of unfiltered water from catchment areas lying north of Lake Pontchartrain would cost about $4,000,000. Hence the Board was practically left without any choice but the Mississippi as a source, for a pumping and purifying plant can be built for less than $1,000,000, which will furnish an excellent supply for all purposes.

When the subject was first investigated by the Board's general superintendent, Mr. George G. Earl, the Louisville and Cincinnati investigations of Mr. George W. Fuller had been completed, and they furnished information which showed what was the best general method of purifying turbid water like that of the Mississippi. Mr. Earl's provisional project provided for plain subsidence for 48 hours in reservoirs operated intermittently, then coagulation and a second but shorter period of auxiliary subsidence, and finally rapid filtration. While the experiments have proved the general correctness of this system, they have shown that its details can be modified in very important particulars. The period of preliminary sedimentation can be abridged to 12 hours, and that of auxiliary sedimentation extended to 12 hours. This means a decrease in the first cost of the plant amounting to many times the expense of the investigation, and increase in the efficiency and decrease in the cost of operation compared with the results which construction on the provisional plans would have produced. Moreover, the experiments have proved conclusively that the raw water of the Mississippi at New Orleans is quite safe hygienically and any process which will clarify it will also purify it satisfactorily.

This result is particularly interesting because there has been a belief among some engineers that the Louisville and Cincinnati investigations have furnished all the data necessary for designing works for the purification of such turbid streams. On the contrary the New Orleans experiments prove that a stream laden with such large quantities of extremely fine sediment as the Mississippi carries must be studied very carefully before the final plans are adopted. Present knowledge may enable the experienced engineer to determine a general system of purification works, but the adoption of details had best wait the results of investigations by a competent analyst.

Possible Improvements in Mechanical Plant in Buildings.

Several years ago there was a discussion in this journal, in which a number of prominent engineers took part, on the design of steam piping employed in the mechanical plant of office buildings. At that time but little attention was paid to this piping except in the work done from plans by comparatively few engineers, and accidents occurred with unnecessary and disquieting frequency. Mr. A. C. Walworth, among others, drew attention to the fact that a slug of water in a steam pipe was a projectile as little to be deflected from a straight path as the bullet from a gun, and when it struck it must inevitably produce unpleasant results. Since the publication of this discussion, there has been marked progress in the character of piping work, yet it seems desirable to call attention once more to the importance of the subject.

An engine plant in an office building performs such an important service that its safety should be assured by all reasonable precautions. One of these precautions is the prevention of the access of water to the cylinders. Theoretically this is a simple matter, but, with high-pressure mains in particular, the practical working out of the problem is not so easy. The water comes from two sources, the boiler and the mains themselves. The water that comes over from the boilers is of trifling amount unless the feed is very poor; this source of water has probably been exaggerated in the past. The water due to condensation in the piping is the important feature to consider. Its prevention is largely a matter of spending money for good pipe coverings. The condensation in a naked pipe can be reduced to about 20 per cent. by applying a three-quarter inch covering of several types, but a good two-inch covering of the best materials will be more durable and prevent 10 per cent. more of the condensation. In other words it will save half of the condensation ordinarily taking place in jacketed pipes and will thus pay a high rate of interest on its additional cost.

Some condensation is sure to occur in the steam lines, however, and it is important to provide means for its removal. In the discussion referred to, it was interesting to notice how many modifications of the same general principles were adopted by specialists in this work. One engineer did not use long-radius bends in office-building installations while another employed them wherever practicable. One of the best-known contributors to the symposium believed in running up his connection vertically for 2 feet from the boiler nozzle and then putting in an angle valve and a horizontal pipe to the steam main; another engineer asserted that the valve should be placed near the steam main; as in such a case the condensation in a considerable length of dead pipe is saved when the boiler is shut off. But while there was this difference in detail the general opinion was emphasized that more attention should be paid to the draining of the piping and the location of valves in places where they will not serve as stop gates for the collection of water which will cause trouble when steam is again turned on. Multiplicity of pipe lines and complexity of cross-connections, which were once the fad, are incompatible with the best of service and are fast disappearing.

Another feature of boiler room equipment which is open to improvement can hardly be classed as mechanical, yet at times the wish has been expressed that it was a mere machine on which it was possible to place reliance. This feature is the fireman. There are many sterling men who are firemen, but, speaking generally, it too often happens that the stoker in a small plant believes that his work is done when a certain amount of coal is put into the furnaces daily and a certain amount of ashes removed. The fact that by the exercise of intelligence and skill he can save his employer large sums does not appeal very strongly to him, for he probably feels that such a saving will have no reward in the shape of higher wages. The actual saving a fireman can effect is well shown by some tests made by Mr. George H. Barrus. With a twelve-inch fire using semi-bituminous coal, an analysis of flue gases showed 6.8 per cent. of carbonic oxide, 1.7 per cent. of free oxygen and 11 per cent. of carbonic acid. When the fire was reduced to six inches, the same boiler showed a falling off of the carbonic oxide to 0.5 per cent., and an increase in free oxygen to 3 per cent. and in carbonic acid to 16 per cent. The loss of heat with the heavy fire, due to the imperfect combustion of the carbon to carbonic acid, represented 25 per cent. of the total heat of combustion of the coal, while with the thin bed the loss is less than 2 per cent. Of course nobody expects a fireman to make analyses of flue gases, yet a really intelligent man can save his employer large sums by learning how to handle his fires with a minimum amount of coal. The fireman ought to know that his business is to save coal and not to burn it.

Notes and Comments.

To Suppress the Smoke Nuisance in Chicago, efforts along educational lines are being made. A visit was recently made to the University of Illinois by members of the Commercial Club to investigate smoke-prevention experiments which are being carried on. Proper methods of hand firing, automatic stokers, fire brick arches, boilers, chimneys and coal received attention, and the best combination of these for obtaining a minimum of smoke were discussed. Attention was called to the fact that although some light smoke was produced when fires were forced or new ones made, this did not resemble the heavy sooty smoke which characterizes many of the large steam plants in Chicago.

Standing Still is sometimes an expensive luxury, as the city of Pittsburg is beginning to understand when the project for filtering its water supply is considered. Several years ago, the citizens voted to spend two and a half million dollars for this purpose, plans for the work were prepared by eminent specialists, and bids were solicited. Since then nothing has been done. The city is paying 3¼ per cent. interest on the bonds it issued, which were in the amount mentioned, and it has to its credit from the proceeds of the bonds the sum of $2,218,347.51, on which it receives 2 per cent. interest. It is thus losing a considerable sum in the difference between these two interest charges, and it is also losing large sums indirectly through the 6.31 per cent. typhoid fever death rate, not to mention the loss due to the sickness of people who recover from this disease. Not only is the general death rate of the city high, 19.77 per 1,000, but the percentage of the deaths due to typhoid is altogether too great, for in Philadelphia it is only 1.84, in Baltimore 1.36, in Boston 1.26 and in New York 1.03. The situation strongly indicates the desirability of putting a stop to the interesting political game in the city long enough to construct the filtration works so badly needed.

The Town Refuse of Lytham, England, has been utilized for some months as fuel at the pumping plant where all the sewage from a community of about 10,000 persons is raised a few feet for discharge into a neighboring tidal stream. Centrifugal pumps are employed for the purpose and are run but a few hours daily, so as to discharge the sewage during the ebb tide only from storage tanks where it accumulates during the remainder of the day. Steam for the purpose is supplied by a Cornish boiler 20 feet long and 6½ feet in diameter, with a 3¼-foot flue. The refuse is burned in a two-cell destructor of the Meldrum type, rated at 17 tons per day; the amount actually burned has been about 10 tons. The stack is a low one, as forced draft is employed. This is an unusual feature of destructor plants and might be open to criticism where precautions are not taken to catch all particles of unconsumed refuse. In this installation the flues from the

destructor to the boiler and from the latter to the stack are long and provided with several sharp turns, and in the passage between the boiler and the stack there is a device for heating the air used in the blast, so that it is not surprising to learn that no objections of this nature have been raised against the satisfactory working of the plant. The installation is particularly interesting just now, on account of the newspaper notoriety given to one of the New York officials who has been conducting some crude experiments to demonstrate that refuse has a fuel value. The Lytham plant is merely the latest of a considerable number in Great Britain where the town refuse is employed for raising steam.

A Course in Fire Protection Engineering, leading to the degree of bachelor of science, has been established by the Armour Institute of Technology in Chicago. It will be under the direction of Prof. Fitzhugh Taylor, formerly engineer of the Underwriters' Laboratories in the same city, and will be a full four-year course. The special instruction seems to be three hours a week during the second year in the chemistry of fire protection, eight hours during the third and fourth years in fire protection engineering, and eight hours during the fall and winter terms of the fourth year in schedule rating, special hazards, underwriters' requirements and insurance practice.

The Prevention of Contaminated Water being furnished for domestic consumption is the subject of a recently approved law in New Hampshire. It provides that: "Whenever the state board of health, upon investigation, become satisfied that a well, spring, or other supply of water, used for domestic purposes, has become polluted so as to endanger the public health they are authorized to prohibit the person or corporation, owning or controlling said supply, from furnishing such water for domestic purposes, until they become satisfied that said water supply has been purified and made fit for domestic use. Any person or corporation official or agent violating the order of the board shall be punished by a fine of not less than $100 and not exceeding $1,000 for each and every day they continue to furnish water for domestic purposes after the order of the board has been served upon them."

Dragging Clay Roads is a method of maintenance which is now in great favor in Missouri and attracting so much attention that the State Board of Agriculture has published a 42-page bulletin concerning it. The drag was introduced by Mr. D. Ward King, of Maitland, and is merely a split log 10 or 12 inches in diameter and about 10 feet long, pinned together by cross bars so that the two pieces are about 30 inches apart and both have their flat surfaces to the front. The team is hitched to the drag so that it moves the dirt toward the center of the road. The directions given by Mr. King for using this rude scraper to improve a clay road are very simple. The work is done after every heavy rain, and when the road is in a bad condition to begin with, the first scraping should start when part of the surface is pretty wet. The first scraping is done by running the drag down the road over one rut and back over the other one. The next trip, which must wait for another good rain before it can take place, will cover a somewhat wider strip of the surface, and after a year's dragging the clay will be worked into a fairly uniform and hard surface with a good crown in the center to shed the water. The results from such scraping in many parts of the State indicate that the process is very successful when its low cost is considered.

The Proper Care of Elevators is a subject which seems about ripe for a careful and painstaking investigation. A modern high-speed passenger elevator is a piece of mechanism that represents years of careful thought by engineering experts and the expenditure of considerable sums in experiment. It is not a simple device and its adjustment is not to be entrusted to a jobbing repair man. The passenger traffic in the elevators in some large office buildings will mount up to a surprising figure, comparing with the railway traffic of numerous companies whose reputation as common carriers is national. The railways have careful tests by which the fitness of the men who run their trains is definitely determined before the lives of passengers are entrusted to their care. Both the state and the federal governments throw similar safeguards about the passengers who travel by water. But the man or woman who steps into an elevator is without any such protection. The elevators are inspected at stated intervals, but this occasional examination is not to be compared with the inspection of the locomotives or the marine engines which furnish other classes of transportation service. The companies building elevators recognize this fact by making their installations as nearly automatic as possible, but it may be questioned whether the public welfare does not demand some kind of oversight or test of the men who are in charge of this part of the mechanical equipment of these crowded office buildings. The number of accidents up to the present time has been small, but this is no proof that with increasing age the plants will not develop fatal weaknesses which will not be revealed by the occasional inspection of insurance companies and the perfunctory examination of elevator runners only superficially acquainted with the appliances.

The Importance of Good Inspection, concerning which a few statements by Mr. Nelson P. Lewis were printed last week, was emphasized by a recent occurrence which The Engineering Record is not yet at liberty to explain in detail. A careful engineer, having an excellent office-system of checking all designs to reduce to a minimum the chances of mistakes, planned a concrete-steel structure containing no details of intrinsic novelty, although of unusual general character. The construction was let to a contractor experienced in such work, for which he had acquired an enviable reputation. During its progress, the engineer's inspector was called away from the concrete-steel work for most of the time, as the party for whom the enterprise was being constructed objected to paying for an adequate resident engineering force and thereby rendered the supervision somewhat perfunctory. The contractor's foreman was a man of good reputation, and was directed by his employer to follow out the engineer's specifications and directions absolutely, without any protest. During the progress of the work a number of poor places were discovered which the contractor was as anxious to make good as the engineer was to have him do so. A test was made of the completed structure a few days ago and it was a pretty bad failure. Investigation indicated that the concrete was of the quality put down for pavement foundations where competition is severe and supervision slight on the part of the city. Samples showed a lack of homogeneity which would be fatal to any concrete-steel structure; they were full of honeycomb spaces and occasional voids a quarter of an inch in diameter. The material was wholly unsuited for its purpose and the failure of the work was inevitable. This is a case illustrating precisely the comment made last week on Mr. Lewis's statements. The reliable contractor desires the most thorough inspection as much as the engineer, and it is probable that on this piece of work the absence of inspection was the immediate cause of the failure. The contractor acknowledges his responsibility for the failure and is taking every step in his power to remedy the trouble which the delay in the completion of the work will entail. He probably relied upon the inspector to see that the foreman did the work in accordance with the specifications, and as the foreman was without the advice of a resident engineer he put in the concrete to the best of his knowledge, which proved to be of the paving foundation type.

Merchantable Water, if that term may be borrowed from the lumberman, is the subject of a decision by the Court of Appeals of Kentucky which would be amusing were it not serious. There has been litigation for some time between the city of Harrodsburg and the local water company, and the decision in question, 73 S. E. Rep. 1,032, settles the question whether the company is to receive back pay for a supply for domestic and fire protection purposes. The character of the supply is best indicated by extracts from the court's decision: "From three to six months in the year the water was foul, stagnant, impure, unfit for drinking and bathing purposes, and when streets or yards were sprinkled with it they gave forth foul and offensive odors; none of the citizens drank it during these times or used it for cooking purposes; few bathed in it." While its quality was thus not wholly above reproach, there were objections raised as to the quantity, as the court states "the standpipe was not sufficiently elevated or it was not kept full of water, so as to create the pressure required by the contract to extinguish fire." As to the reason for the defects in the quality of the supply, it is merely necessary to furnish another quotation from the same source: "The water did not run in the Salt River during the dry season of the year, and stood in pools, and the water company erected a dam across the river to accumulate water sufficient for its purpose, which caused the pools to extend several miles upstream, in which stock of all kinds entered and stood and the carcasses of dead animals accumulated, and the filth from the farms and buildings above was washed into it, and the mud and slime accumulated in it." The company had contracted to furnish pure and wholesome water in ample quantity for fire protection as well as other purposes, and these extracts from the court's decision indicate that full compliance with the contract could hardly be claimed. But the company had spent a large sum on its works, and so the Kentucky cadi has rendered the following curious decision: "The company has not complied, in substance and effect, with its contract, and it would be inequitable and unjust to compel the city to pay the full contract price for the water furnished by the company. On the other hand, the water furnished by the company has been of considerable benefit to the city, and the company has not intentionally failed to comply with its contract, but it has been slow in using its means to obtain the character of water it contracted to furnish, and, until it does substantially comply with its contract in these respects, it should only be allowed to recover a reasonable price for such water as it has furnished." The case has, therefore, been remanded to the lower courts for a decision as to merchantable grade of the supply and the amount the city should pay for it.

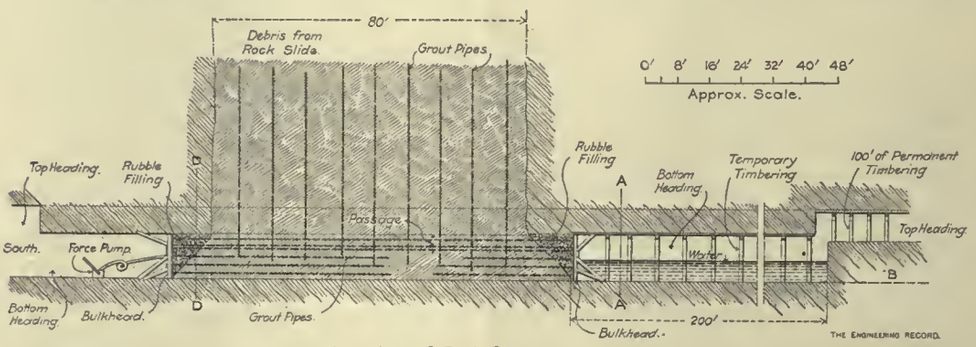
Section 4, New York Rapid Transit R. R.

Part I.—Excavating and Timbering.

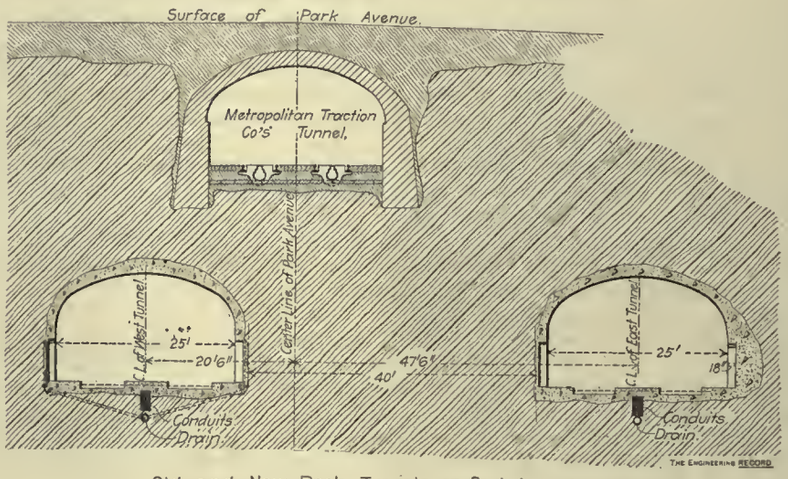
Section 4, Division 1, of the New York Rapid Transit Railroad extends north about 2,000 feet on Park Avenue from Thirty-fourth Street to Forty-first Street. It has, for the full length, two separate double-track, concrete lined, rock tunnels driven below the existing double-track street car tunnel. The tunnels are of the same grade and have a maximum depth of about 60 feet below the street surface; their alignments are not parallel horizontally nor symmetrical with that of the street car tunnel, but converge at the north end and are nearer to the east than the west curb line of the street. The separate excavations are about 20 feet high, 28 feet wide, and 6 feet apart in the clear at the south end and 20 feet apart at the north end. The minimum distance between the roof of the Rapid Transit tunnel and the floor of the street car tunnel is about 5 feet, and the maximum distance is about 15 feet. At some points the relative positions of the tunnels are nearly symmetrical with their center lines, as shown in the general cross sections, and at others, one of the Rapid Transit tunnels is half way underneath the street car tunnel and the other one almost entirely beyond it. The total amounts of rock excavation and concrete lining involved in the original estimates are respectively about 60,000 and 15,000 cubic yards.

Shafts were sunk at Thirty-fourth Street and at Forty-first Street at each end of each tunnel, and excavation was commenced from all of them, towards Thirty-seventh Street, late in 1900 and early in 1901. The work was carried on at first with top headings in the north ends of both tunnels and in the south end of the west tunnel, and with a bottom heading at the south end of the east tunnel. Afterwards the system in the south end of the west tunnel was also changed to a bottom heading which was maintained until the excavation there was completed. The methods of work, the plant installed, and the organization were described and illustrated in The Engineering Record of June 29, 1901.

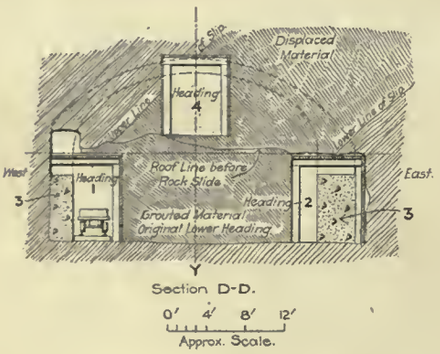
The rock was found very irregular and treacherous, much of it being soft and shaky and rapidly weathering so as to be very dangerous. The strata were inclined about 45 degrees downwards to the west, and in some places had open seams between them, which were filled with earth and water or micaceous substances, making very slippery surfaces. Great care was taken in all the operations, blasting was done with caution and usually with light charges, and the excavation was promptly timbered wherever there were indications of bad rock. In this way the work was carried on successfully until the bottom headings from the south end of the east tunnel met the top headings from the north end of the same tunnel, between Thirty-eighth and Thirty-ninth Streets, and the final blast shattered the rock between the two, opening up communication from one end of the tunnel to the other. Work of widening the tunnels to the full section and removing the benches was then carried on, and special precautions were observed in taking down the upper bench of the east tunnel by the use of very light charges to prevent shattering the rock beyond the limits of the excavation. While the work was in this stage, a section of rock about 80 feet long became loosened on its inclined bed and slid into the east tunnel between Thirty-seventh and Thirty-eighth Streets nearly filling it with debris for a length of about 100 feet and opening up an irregular pit to the surface of the street, which produced a slight depression and seriously injured adjacent buildings, as described in The Engineering Record of March 20, 1902. The tunnel was obstructed by a heterogeneous mass of large and small rock, sand, earth, broken pipes, timbers, etc., through which an irregular opening about 4 feet square existed from end to end in the upper part of the west side and gave access to a length of about 200 feet of the north part of the south heading up to a point where it communicated with the south end of the north upper heading, thus making a chamber which was inaccessible, except through the narrow openings at each end. Steps were immediately taken to insure the safety of the adjacent buildings and to prevent further disturbance in the tunnel. Vertical transverse bulkheads were built as close as possible to the debris at both ends, thus enclosing the damaged section with solid timber walls, which had 12x12-inch vertical posts 3 feet apart, securely wedged at top and bottom and braced with two or three outside rakers wherever they could be set, as indicated in the diagram marked Location of Rock Slide. The inside faces of these posts were sheathed with horizontal tongued and grooved planks 2 and 3



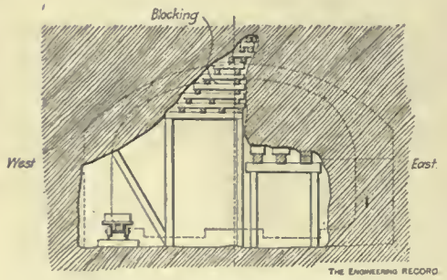
Location of Rock Slide.
Center Section through East Heading between 37th and 39th Streets.



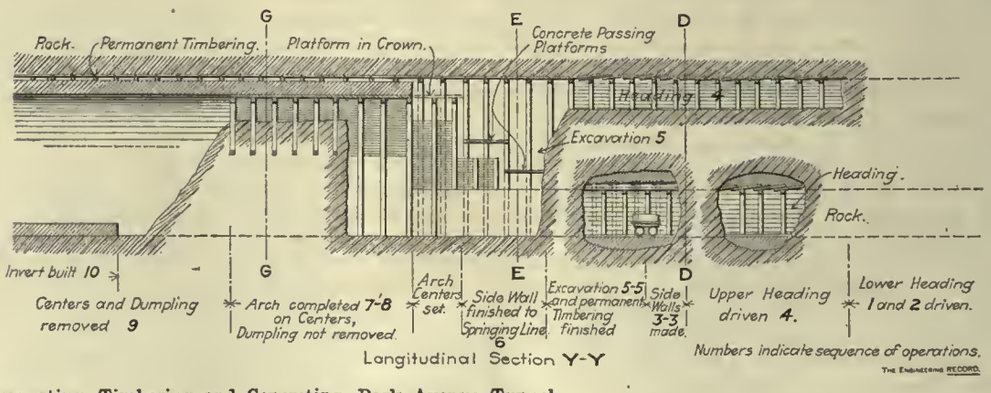
Old and New Rock Tunnels on Park Avenue.



Section D-D.
0' 4' 8' 12'
Approx. Scale.



Section A-A showing Temporary Timbering and Material Track ready to complete Lower Heading Side Cut 1.



Longitudinal Section Y-Y

Excavating, Timbering and Concreting, Park Avenue Tunnel.

inches thick, which were successively added from the bottom upwards as fast as the open spaces between the bulkheads could be packed with dry rubble which was filled in solid to the roof, excepting where the passageway was left through the debris on the west side.

Then 2-inch vertical pipes were driven down from the surface of the ground in the street to different levels below the tunnel roof and through them very thin cement grout was forced by four men operating a Douglas hand pump to its maximum pressure, probably more than 100 pounds per square inch. Twenty-four similar horizontal pipes were inserted through the bulkheads, some of them being driven 10 feet beyond, and through them grout was forced in the same way until the pumps were worked to a standstill. Men also entered the narrow passageway between the bulkheads and screwing flexible hose to the pipes injected the grout wherever a crack or cavity could be discovered. Some grout escaped into a broken sewer and had to be cleaned out; but the most of it was filled between the interstices of the stones and made a solid mass which soon set hard, but did not bond with the broken stone or with the sides of the tunnel on account of the dirt and rubbish contained there. In all about 2,000 barrels of Portland and Rosendale cement were used, and a force of four or five men was occupied for four weeks on the grouting, at the end of which time the passage between bulkheads had been reduced to such small dimensions that it was only possible to crawl through it with difficulty. The grout and rubble work filled the tunnel so solidly, and the pit above it was so well closed by earth dumped in from the top, that no other settlement in the street or adjacent buildings was appreciable, and after the grout was well hardened, operations were commenced in re-excavating the tunnel and completing the required section at this point by soft ground methods. Two bottom headings, 1-2, as shown in section DD were first driven and timbered with 12x12-inch vertical posts and caps about 4 feet apart. These were lagged with horizontal 2-inch planks on the roof and on the sides, as indicated in the diagram, and permanent concrete side walls 3-3 were built in them, that on the east side of the tunnel being made of double thickness to resist the possible thrust from the inclined rock strata.

After the side walls were built a central top heading 4 was driven full length and heavily timbered and lagged. At the north bulkhead transverse drifts 5-5, shown in sectional plan KK and section EE, were then run from drift 4 in both directions to the full width of the finished excavation, and from them the excavation was carried south, widening the upper part of the tunnel above the grouted mass to its full required dimensions. This was very slowly and carefully accomplished by series of approximately horizontal 2-inch holes 5 feet deep which were drilled from the center outwards with burdens of from 5 to 20 inches. The excavation was made in sections A, B, C of successive transverse strips numbered 1, 2, 3, etc. As fast as the excavation was made the roof was thoroughly braced with single posts and cap pieces set on the concreted mass, and the remainder of the side walls and the roof arch was concreted in sections from 5 to 9 feet long. All the concrete was brought from the south shaft through the No. 1 heading on the west side where the passageway was 4 feet wide. On the other side the passage was reduced to 2 feet on account of the extra thickness of the side wall and did not leave space for a concrete car. All the concrete was shoveled from the cars on to the lowest passing platform (shown also in longitudinal section YY), and thence filled in behind the center for the top of the side wall. When this was completed, concrete was passed from this platform to the next higher platform from which another portion of the roof arch could be reached. Finally the concrete for the crown of the arch had to be shoveled a third time from the second platform to the third platform in the top heading, whence it was pushed back longitudinally to fill the crown of the arch, or was thrown over for use on the east side wall and east half of the arch, which could not be supplied from the east heading. After the completion of the roof, the grouted material between the side walls was easily removed and the concrete invert built with ordinary methods. This difficult and tedious work was commenced in May and it required until December to complete the 80 linear feet.



Temporary Timbering near Rock Slide.

Immediately after the rock slide, the 200 feet of bottom heading, which had been driven north of the damaged section of the east tunnel, was timbered with temporary 12x 12-inch vertical posts and caps 8 feet apart, as indicated in the diagram of Location of Rock Slide. Adjacent to this section 100 feet of the south end of the top heading was permanently timbered in the usual way, and about 125 feet north of it was temporarily timbered with bents consisting of a cap and two posts. The timber for this bottom heading, adjacent to the rock slide, was carried through the top heading at the north end of the tunnel and lowered down through the opening between it and the bottom heading, which was an awkward and difficult operation. At one time an incline was built at the north end of the lower bench in the tunnel and the timber cars were pulled up by a hoisting engine.

The timber bents were very irregular, but generally consisted, as shown in section AA, of one low bent on the east side which supported the main part of the roof and a much higher narrow bent adjacent to it with its cap wedged up in the irregular opening in the roof, besides which there were inclined posts to support the roof on the west side and allow clear-



Air Connections for Drills in Heading.



Drilling First Round in Heading.

ance for the narrow gauge service track, which had a very crooked alignment, to clear the irregular spacing of the posts and bents. After the timbering was completed, the remainder of the lower bench north of Thirty-eighth Street was removed in the usual way, giving access to the 200 feet of lower heading north of the rock slide. Here the excavation was first widened to its full dimensions on the east side for a height of about 10 feet, and the side wall was built there and afterwards the side wall on the west side was built, all materials and concrete being handled by cars on the west side.

This work was very slow on account of the obstruction made by the unusually heavy timbering, which occupied a large portion of the original lower heading and left insufficient working room. This heading had been filled with water most of the time for six months since the rock slide, when it had been inaccessible, and the roof and walls were disintegrated and in danger of falling, so that it was considered dangerous to remove the timbering when the upper bench was excavated.

When the side walls were built the concrete floor was carried down to the solid rock at an average depth of 2 feet above sub-grade, and was extended 5 feet beyond the inner face of the wall so as to provide berms on which to lay service tracks each side of the tunnel. On the inner edges of these berms and on the bottom of the excavation between them, timber sills were laid on which were built transverse timber cribs about 3 feet apart in the clear with 4 feet clearance between them and the side walls, as shown in sections BB and ZZ. These cribs were built from the north and south ends towards Thirty-eighth Street under the temporary bents.

Transverse timbers reaching from the center of the tunnel to both sides were supported on the cribs and on the tops of the side wall, with longitudinal pieces wedged up tight against the roof, carrying in some places, lagging which closed the bottom of the central roof cavity and supported filling packed in tightly.

(To be continued.)

Neals Shoals Power Plant.

A low-head water-power development, having a dam with a 900-foot rollway, is now being developed at Neals Shoals on the Broad River, about 11 miles from Union, S. C., for the Union Manufacturing & Power Company. Messrs. W. B. Smith Whaley & Company, of Columbia, S. C., are engineers, and Mr. George O. Terney, of Spartanburg, S. C., is contractor for the work.

The plant is of the type having the power house at one end of the dam, and the dam is to be of rubble masonry construction, 24 feet high and 23½ feet thick at the bottom. Its top, which will be of concrete, is designed with a plane of approach of about 37 degrees to the horizontal, a rollway at crest with an 8-foot radius, a downward sloping plane 8.61 inches to 1 foot vertical drop and a curve at the toe on a 7½-foot radius. There are to be sand or flood gates at each end of the dam.

A pond 10 miles long and protection of the power house during times of high water will require the construction of two earth dams about 200 yards upstream from the power-house. The main generating machinery will comprise four 1,300-kilowatt three-phase 12,000-volt General Electric alternators, each direct connected to run at 133 revolutions per minute to two pairs of horizontal turbines. The minimum flow of the river is said to be 1,500 cubic feet per second.

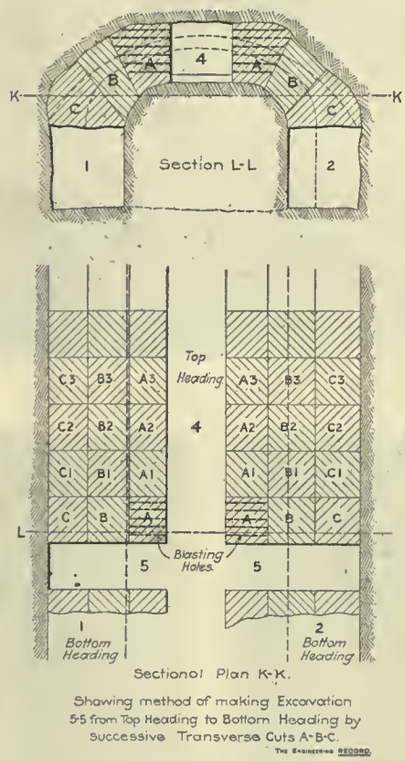
The Power Plant of the Neversink Light and Power Company.

For the supply of electric current for lighting, power and railway purposes in the towns of Monticello, Middletown and Port Jervis, N. Y., a water power plant has been built in Sullivan County at a spot locally known as Rose's Point and situated at the crossing of the old Delaware and Hudson Canal over the Neversink River. The builders of the plant were fortunate in securing the use of a part of the canal, which has been condemned for transportation purposes, and by a moderate expenditure for repairing and deepening, were able to convert it into a storage reservoir to assist in supplying the plant during its peak loads and the dry seasons. The regular supply of water is diverted from the Neversink River at a point about one mile above the power house and is conveyed through a feeder canal about 20 feet wide at the rate of about 400 cubic feet per second in ordinary seasons. The course of the river and feeder, the location of the power house and the provision for storing water are shown on the accompanying map. The reservoir canal, which embraces two storage ponds, as indicated, extends back from the power house in a crooked path nearly two miles long and is stopped at the upper end by an earth cut-off dam. The feeder canal runs along the side of a hill in cut and fill.

In order to get a sufficient head it was necessary to dam the river near the feeder inlet, since the tail race wastes back into the river. The dam is of concrete, 188 feet long and 10 feet high. The flow of water to the plant is controlled at the upper end of the feeder by three headgates set in a concrete structure and operated by the usual form of crabs. Ordinarily about 1,000 horse-power can be developed continuously from the river, but with the assistance of the reservoir, which is refilled during the periods of light loads, an overload amounting to 1,500 horse-power may be carried for 6 hours.

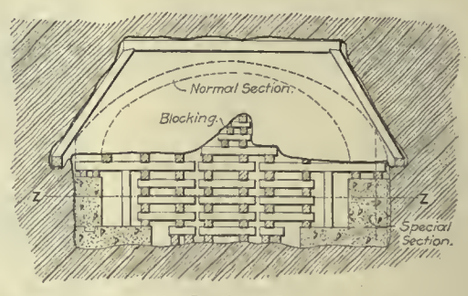
The power house is shown in plan and sectional elevation by accompanying drawings. The building throughout, including girders and roof, is of the Ransome patent concrete-steel construction, and was erected under the supervision of the Ransome-Smith Company, of New York. It is approximately 40x60 feet in area and 45 feet high. The water in the forebay stands within 2 feet of the top of the wheel chambers, which it enters after passing through a set of inclined racks consisting of 3x¼-inch iron bars placed edgewise 2 inches apart on centers. In the front wall of the wheel chambers are several passages each controlled by wooden gates operated by crabs on top of the masonry. Two of the wheel chambers each contain a pair of 27-inch horizontal S. Morgan Smith Company's McCormick turbines direct-connected to a 300-kilowatt alternator, and a single 15-inch wheel of the same make and pattern connected to a 30-kilowatt exciter. The third chamber will later contain another pair of 27-inch wheels to drive an additional 300-kilowatt alternator, and since any two are capable of carrying the full load there will always be a reserve unit for emergency. The exciting equipment is already in duplicate as either of the 30-kilowatt direct-current dynamos is capable of exciting all three of the large alternators. One of the large double turbine units is regulated by a Sturgess governor and the other by a Lombard, and since the wheels are set in open chambers, nearly perfect regulation is possible. The head of water in the chambers is about 23 feet, which with the 17-foot draft tube below each turbine, gives a total fall of 40 feet. The steel flume-heads are built in the concrete-steel wall which separates the wheel chambers from the dynamo room. The shafts of the wheels project through the flume-heads and by means of flexible couplings are direct-connected to the alternators and exciters. The alternators are three-phase, 600-volt, 60-cycle machines driven at 300 revolutions per minute, and the exciters are 125-volt direct-current machines running at 800 revolutions. The electrical apparatus in the power house is all of the General Electric Company's manufacture.

There are seven transformers of 100-kilowatt capacity each, for increasing the voltage to 10,000 preparatory to transmission to the distributing centers, where it is stepped down to various

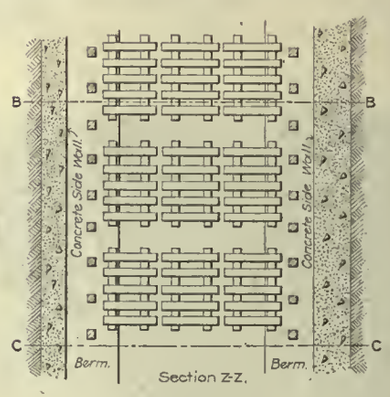


Sectional Plan K-K.

Showing method of making Excavation 5-5 from Top Heading to Bottom Heading by Successive Transverse Cuts A-B-C.



Section B-B.



Section Z-Z.

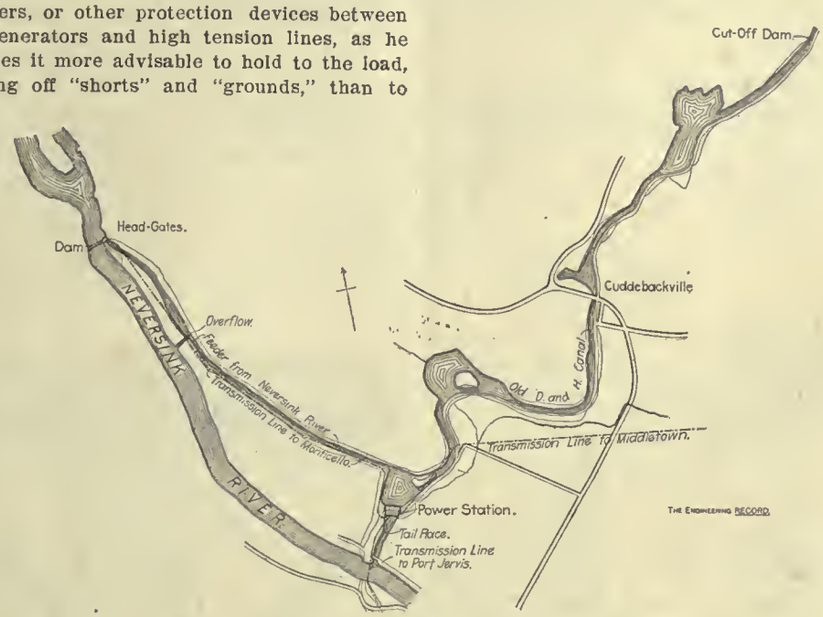
Section A-A after Excavation of Benches B and 1, and Erection of Cribs about Posts

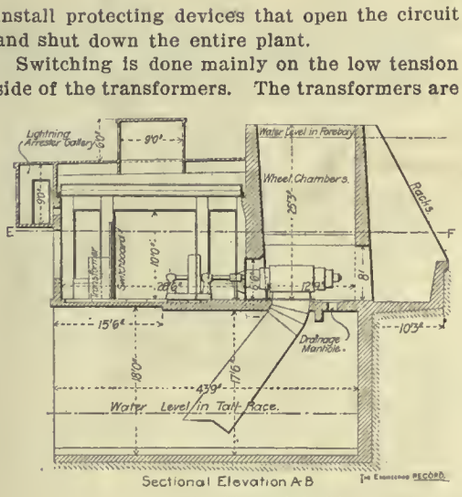
Excavating and Timbering, Park Avenue Tunnel, New York.

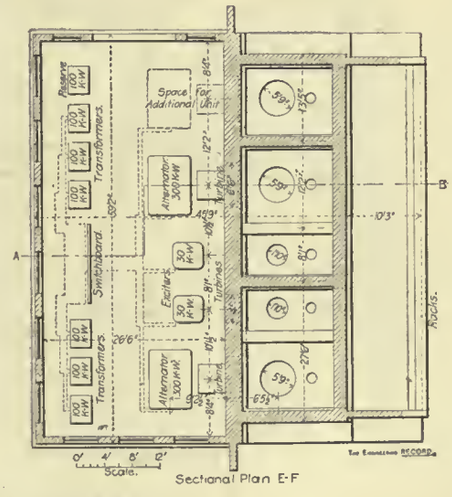
pressures according to the service supplied. With one transformer to each phase of each generator, there is still one remaining for a reserve in case of an accident to any one of the others. The switchboard is placed near the rear of the generator room close to the windows overlooking the tail race. It is of marble and consists of one exciter, two generator and two feeder panels, each supplied with the usual switches, measuring and recording instruments, rheostats, etc. The board has two sets of three-phase bus bars connected to the generators through two switches in series. It is worthy of remark that in accordance with the usual practice in hydro-electric plants designed by Mr. Henry Floy, the consulting engineer for this work, there are no fuses, circuit-breakers, or other protection devices between the generators and high tension lines, as he believes it more advisable to hold to the load, burning off "shorts" and "grounds," than to install protecting devices that open the circuit and shut down the entire plant.

Switching is done mainly on the low tension side of the transformers. The transformers are ordinarily operated in two sets, of three each, supplying two sets of high tension bus bars running the length of the station. Each conductor of all the three-phase distributing circuits may be connected by means of jaw switches—used only when there is no current on the line—to either set of the bus bars. This provides a perfectly flexible arrangement for supplying any line from any generator or operating the railway and motor load in all three towns, on one set of bus bars and its generator, and the lighting load on the other set with its generator, thus avoiding absolutely any chance of "winking" the lights.

The distributing feeders from the board pass through the rear wall of the building into a gallery overhanging the tail race, which contains the lightning arresters and by its isolated location minimizes fire risk. The lightning arresters are of the spark gap resistance type manufactured by the General Electric Company and designed for 10,000 volts. The wires are handled individually, each one passing through the wall at the center of a hole 12 inches in diameter, and supported on both sides by high tension insulators. The wires then make a sweeping right angle bend and leave the building through similar holes in the floor of the gallery with more special insulating supports, and are thence carried on poles to the towns where the current is used. Three cross arms are used, the upper two bearing a double equipment of power lines, one of copper and the other of aluminum, while the third arm, placed 3 feet below the others, carries two telephone wires. The line to Middletown is 10⅓ miles long, that to Port Jervis 8¼ miles, and the Monticello line 16 miles long. At the Port Jervis terminal, part of the current is stepped down to 385 volts and is used, after conversion to 550-volt direct current, for the supply of power to a local railway. At Monticello the current will be similarly utilized for a street railway. The lighting current is distributed in the towns after being stepped down to 2,200 volts, the incandescent lighting being further reduced to such pressures as may be desired. The static transformers at Port Jervis and Middletown are of Westinghouse make. The plant is owned and operated by the Neversink Light and Power Company and was designed and installed by the Henry Floy Company, of New York City.







The Neversink Light and Power Company's Plant.

Self-Supporting Steel Stacks.

By R. E. Newton, Assoc. M. Am. Soc. C. E., Consulting Engineer, Hathaway Building, Milwaukee, Wis.

Rivet Spacing and Anchor Strains.

In the recent design of several large self-supporting steel stacks, the writer had occasion to develop formulae which would give a simple solution for rivet spacing in the horizontal joints. These formulae are also capable of application for solving the strains in the anchor rods of all similar structures. In the development which follows, the only external forces considered are the live loads, or wind pressure. The dead load of the structure itself presents nothing unusual or difficult of solution. It may be well to note that the rivet spacing is not critically influenced by the horizontal shear at the joint. Proof of this statement is given below.

The following notation is used:

- M = Bending Moment (inch-pounds) at any horizontal section, due to wind pressure.
- t = Thickness of metal (inches).
- I = Moment of inertia of section.
- R = Radius of section (inches).
- $A = \pi R^2$.
- y = Perpendicular distance in inches of any point in section from neutral axis.
- f_y = Fiber stress per square inch at same point.
- K = Stress per circumferential inch of section, $= t\ f$.
- P = Pressure per vertical foot of stack.
- L = Distance in feet from top of stack to the section.

Then $I = \pi R^3 t$, and $My = f I = f \pi R^3 t$.

$$(1)\quad f_y = \frac{M}{A\,t} \times \frac{y}{R}$$

$$(2)\quad K_y = \frac{M}{A} \times \frac{y}{R}$$

For maximum values, $y = R$, and

$$(3)\quad f_{max.} = \frac{M}{A\,t} \quad \text{and} \quad (4)\quad K_{max.} = \frac{M}{A}.$$

Attention is called to the fact that formula (4) is independent of the thickness of metal used. In other words, the value of K is directly proportional to M, as A is a constant for any stack of approximately uniform diameter throughout its height.

As $M = P \times L \times L \times 12 \div 2 = 6\,P\,L^2$

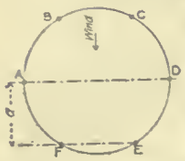
$$(5)\quad K_{max.} = \frac{6\,P}{A} L^2.$$

Rivet Spacing.—As $6\,P \div A$ is a constant, one setting of the slide-rule will be sufficient to solve for all values of K desired. Adding to K the proportionate dead load for weight of structure above this section, and dividing the value of one rivet by this sum, gives the required spacing in inches.

Anchor Strains.—If the area of the circle on which the anchor rods are located be used for A in (4), the value of K so obtained will be the imaginary strain on one circumferential inch of such circle, and this value multiplied by the length of arc between anchors will give an approximate result for the total wind reaction on one rod. If the exact figure is desired, the value of K for each inch of this length of arc may be computed from the proportion, $K_y : K_{max.} = y : R$, the values of y being obtained by scale; and the summation of these values will be the exact wind reaction. If W = total dead load, and N = number of anchor rods, the net maximum reactions will be $(W \div N) \pm$ wind reaction.

It is important to note that the method of solving for anchor rod strains, as given on page 429 in "Modern Framed Structures," by Messrs. Johnson, Bryan and Turneaure, is not

correct. By the method there given, the rods at A and D (see diagram) are assumed to be in tension as well as those at C and B, when the wind is in the direction indicated. As a matter of fact, the rods at A and D are on the neutral axis of the structure when wind is as shown, and therefore can receive no longitudinal strain at all, as within the elastic limit no fiber stresses occur at the neutral axis. And the pull on the rods at B and C is equal to $\frac{1}{4}\frac{M}{a}-\frac{W}{6}$ instead of $\frac{1}{5}\frac{M}{a}-\frac{W}{5}$, as given in that text-book. The discrepancy would be much greater, however, if a larger number of rods were used.



It is stated above that the rivet spacing is not *critically* influenced by the horizontal shear at the joint. Proof of this is as follows:

Let $s_{max.}$ = Maximum unit shear in the thin ring section.

D = Diameter of section in feet.

Then $s_{max.} = \frac{\pi}{\sqrt{2}}$ mean unit shear.

$$= 2.22 \frac{P L}{12 \pi D t}.$$

From above,

$$f_{max.} = \frac{M}{A t} = \frac{P L^2}{6 \pi D^2 t}.$$

Then $\frac{s_{max.}}{f_{max.}} = 1.11 \frac{D}{L}$ or $s_{max.} = 1.11 \frac{D}{L} f_{max.}$

$s_{max.}$ will exceed $f_{max.}$ when $1.11 D \div L > 1$, or when $L < 1.11 D$.

It is evident that specifications as to minimum spacing will govern within limits considerably in excess of $L = 1.11 D$, so that beyond such limits the spacing will be determined only by the maximum fiber stress from bending. It should be mentioned that the maximum unit horizontal shear does not occur at the point of maximum tension or compression from wind moment, but is 90 degrees distant circumferentially from such point. At the point of maximum moment stress, the unit horizontal shear is zero, and vice-versa. So that the maximum in the case of either stress is not increased by the other kind of stress.

[This article was submitted to the authors of the work criticized in one place in it, and the following comment has been received from Professor Turneaure: The method used by Mr. Newton in determining the rivet stress is perfectly correct, and is the same which I have used for stand pipes in the work on "Public Water Supplies," published by myself and Dr. Russell. In that work, on page 655, I have assumed the wind pressure to be 50 pounds per square foot on half the vertical projection of the tank. Formula 5, on that page, gives the stress per linear inch on a circumferential line due to this wind pressure, and is $S' = 1.33 h^2 \div d$, in which h is the distance of the point in question below the top of the tank and d is the diameter of the tank, both dimensions expressed in feet. This is the result which would be obtained from Mr. Newton's formula 5 by substituting for P, 50 pounds times the radius of the stack. His method for calculating stresses for anchor rods is also exactly the same as used by me on pages 659 and 660. This method is, as he says, different from that used in "Modern Framed Structures," but is, I believe, correct for stresses below the elastic limit. The method employed in "Modern Framed Structures" would, I think, be more nearly correct for ultimate failure, for in that case the tank would not fail by compression, but would fail almost wholly by tension.]

Types and Details of Bridge Construction.—VIII.

By Frank W. Skinner, C. E.

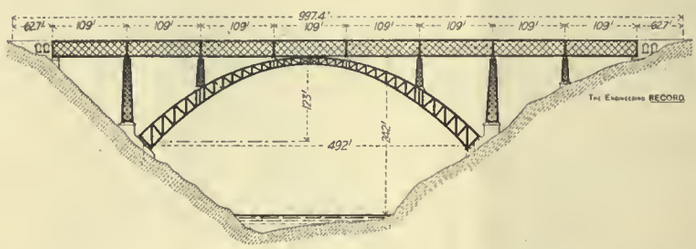
Trussed Arches, Continued.

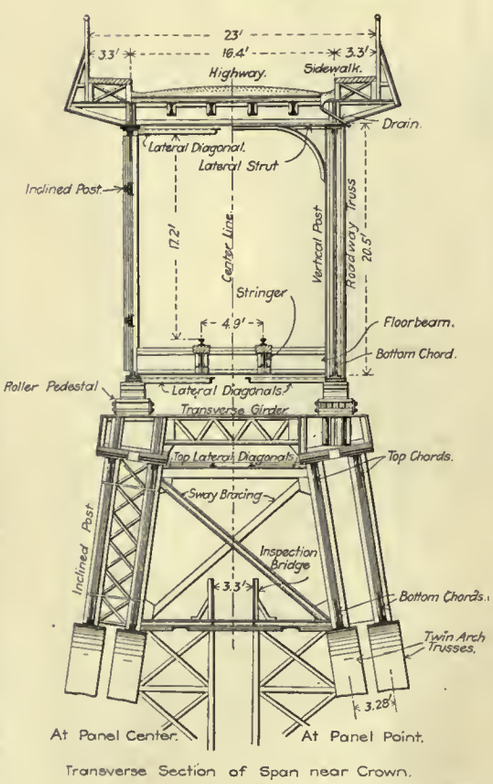
The Paderno viaduct over the Adda was described in The Engineering Record of October 13, 1888, and in "The Engineer," London, April 17, 1903. It has a center span with two riveted parabolic arch ribs, about 492 feet long and of 129⅓ feet rise on the center line, which are battered about 1:6 so as to be 56¼ feet apart at the skewbacks and 16½ feet apart at the crown. These ribs are each composed of two twin trusses, 3.28 feet apart on centers, which are divided by vertical posts into 34 panels of unequal length, with single diagonal members. The trusses have no hinges and the ends of both top and bottom chords are seated on the normally inclined surfaces of the skewback piers, which also receive the bases of the skewback tower separate from the arch trusses. The T-shaped chords are built of angles and plates and the adjacent vertical members of each pair are united by latticing. There are lateral X-brace systems in the planes of top and bottom chords of the horizontal and arch trusses.

The arch ribs support two main vertical towers at the haunches, each of which is composed of four posts battered longitudinally and transversely and latticed or X-braced together on all faces. The posts extend across the trusses from bottom to top chords and rise to the level of the crown. These towers with two skewback towers and two short bolsters on the top chords, near the crown, support the five 109-foot through spans of lattice-girder roadway trusses. These carry a single-track railroad at the level of their bottom chords and a 23-foot deck carriage way and two cantilever sidewalks at top chord level. An inspection foot walk is also carried by the lower lateral system in the center line of the bridge.

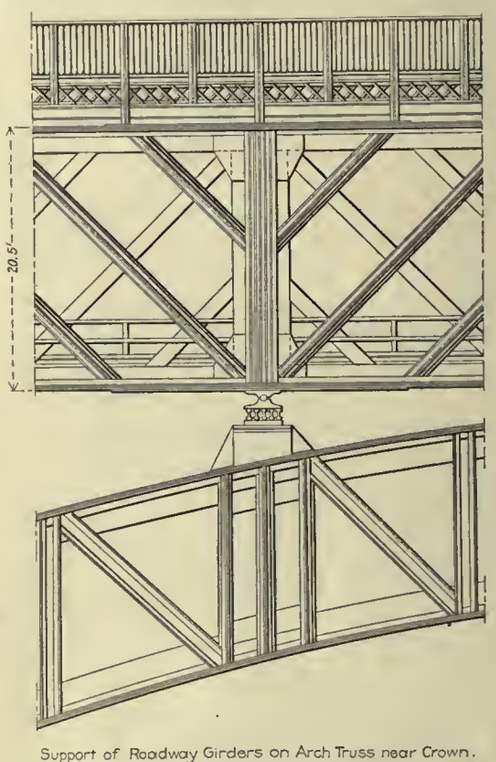
The roadway trusses have T-shaped angle iron chords 20 feet 4 inches deep and 15 feet apart in the clear connected by T-shape quadruple intersection web members. The lower deck, 242 feet above water level, has a solid corrugated iron floor on U-shaped joists and single-track rails laid on oak timbers on the longitudinal stringers. The upper deck, supported on four lines of stringers carried by floorbeams 10 feet apart, on the top chords, has a macadam pavement.

The bridge is constructed throughout of wrought iron with an ultimate strength of 43,000 pounds per square inch and a maximum total unit working load, including wind and temperature stresses, of 7,200 pounds. The weight of the arch span is 1,320 tons, and the bridge was completed within 18 months. The total computed loads carried by the main span at the four intermediate points, are 299, 255, 252 and 309 tons and the arch stresses were calculated from these values and from an assumed wind pressure of 167 pounds per linear foot. The live loads were assumed to be 1.55 and 1.2 tons per linear foot from the railroad and highway floors respectively. Three tests were made and the results announced to the recorder through speaking tubes. In the first test gravel to a weight of 1.2 tons per foot was spread uniformly over the whole length of the bridge; in the second test six 83-ton locomotives were placed on the span, and in the third test a 600-ton train of three 83-ton locomotives and 30 cars of gravel, was run several times across the span at a speed of 28 miles an hour. The maximum crown deflection was ⅜ inch and the maximum lateral vibration 3/16 inch.



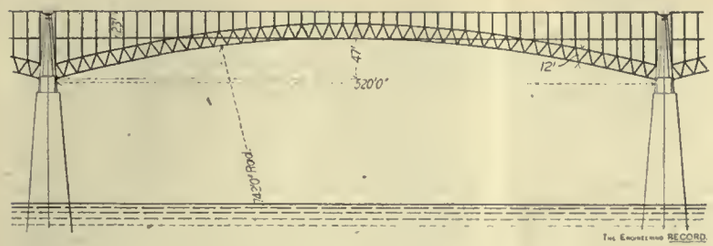


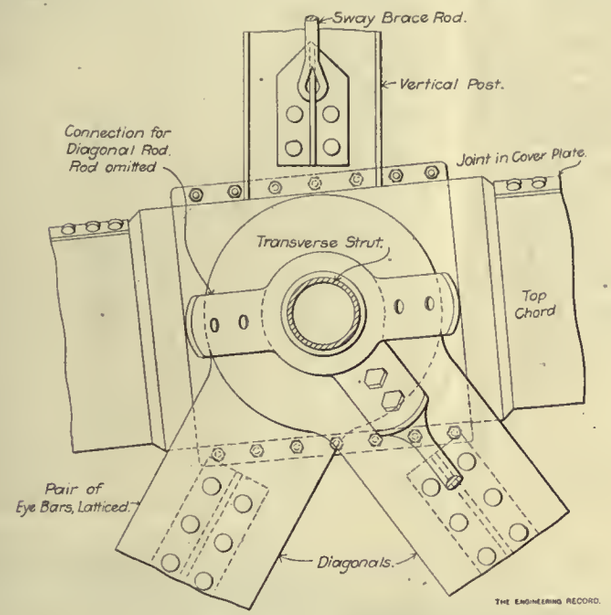
Transverse Section of Span near Crown.



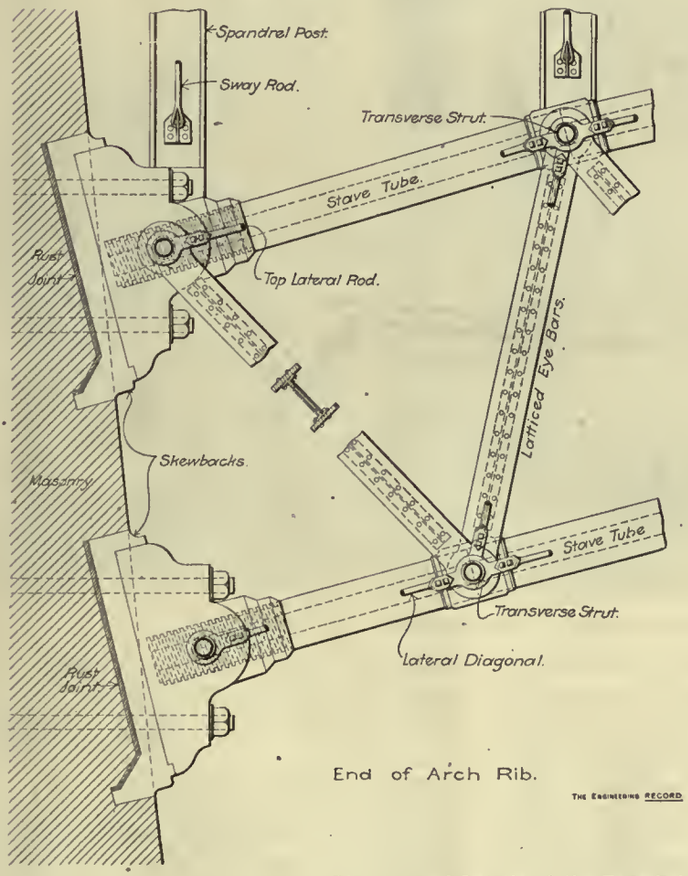
Support of Roadway Girders on Arch Truss near Crown.

Diagram and Details of the Paderno Viaduct, Italy.

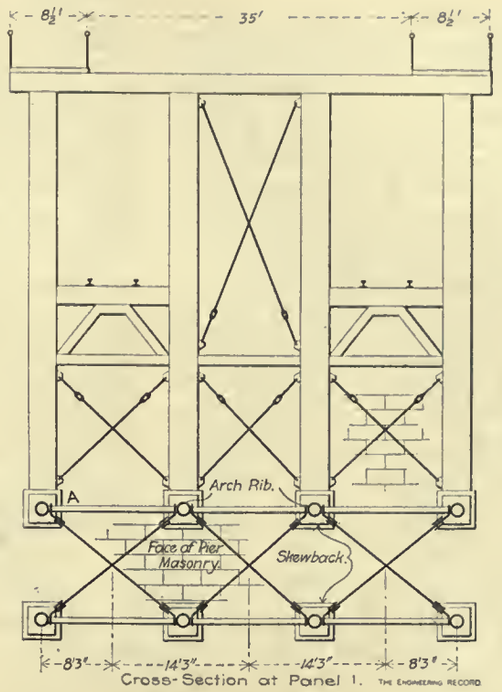




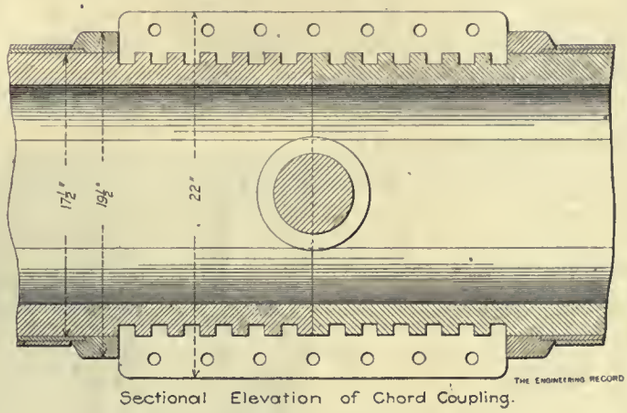
Side Elevation at Joint.



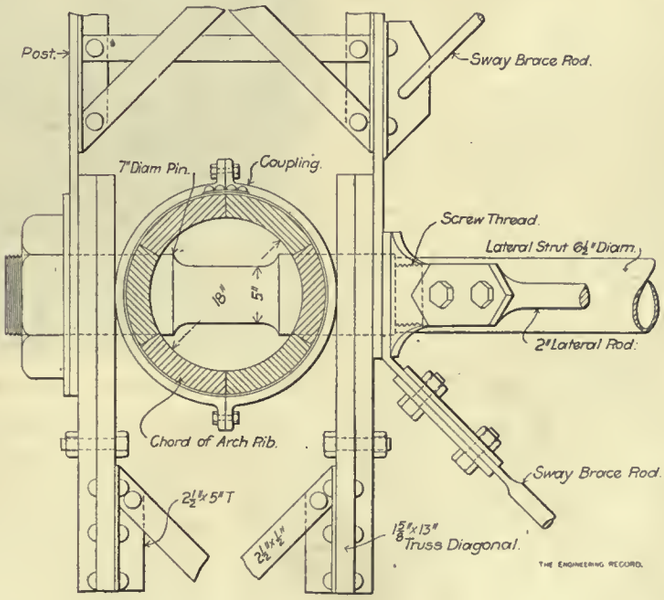
End of Arch Rib.



Cross-Section at Panel 1.



Sectional Elevation of Chord Coupling.



Sectional Elevation at Top Chord Panel Point.

Diagram and Details of the Eads Bridge across the Mississippi River at St. Louis.

The bridge was erected in ten months, on a timber falsework of unusual design with horizontal service platforms at water level, at skewback level and at the crown of the top chord. The two lower tracks each spanned openings of 153 and of 65 feet, above which the falsework bents were carried on combination trusses and on inclined bents and corbel brackets. The lower chords of the arch trusses were assembled on a convex platform above which vertical bents nearly 30 feet apart were carried up between the haunches to support the upper platform. The pier towers and approach spans were erected with falsework towers supporting corbel brackets and temporary deck spans, on which the erection platform and upper service track were carried. The trusses were assembled by two 15-ton jib derricks moving on gantries having A-shaped end towers. The gantry trusses cantilevered beyond the towers and carried hand windlasses on the overhangs to hoist materials from the service tracks. Each falsework bent was seated on the cap of a transverse row of seven piles and had six batter posts 10

panels, or 241 feet high at mid-span. The two center posts intersected about 100 feet from the bottom and carried a single vertical post on their heads. There was a double longitudinal horizontal timber at each intersection of the batter posts and horizontal struts at every story, and every panel of the outer faces of the falsework was braced by a longitudinal diagonal strut. The lowest service platform was through the center of the bents just above the first cross timber on the batter posts.

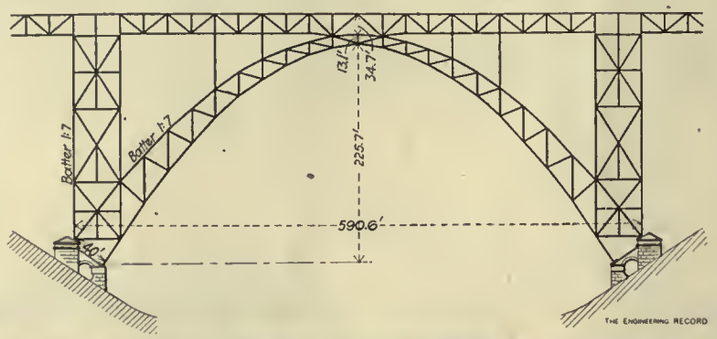
The Eads bridge across the Mississippi River, at St. Louis, was built about thirty years ago and was notable for being the first steel arch bridge, for its unprecedented span, for its great cost, for the difficulties of construction and erection, for the peculiarities of its design, and for the character of its details, which required unusually accurate and careful workmanship. The superstructure stands as a remarkable example of elaborate and difficult bridgework. It is unique, for it has not been, and never will be followed as a type for other bridges. It has three main spans, one of 520 feet over the channel, and one of 502 feet on each side. Each span has four hingeless segmental trussed arch ribs with a radius of 742 feet. The trusses are in vertical planes, and each has parallel top and bottom chords 12 feet apart on centers with a triangular system of pin-connected web members. The center span has 44 truss panels and a rise of 47 feet for the top chord; the side spans have a rise of 43¾ feet and 42 panels. The width of the bridge over all is 54 feet and the height in the center above low water mark is 144 feet. The total cost was about $10,000,000.

Each of the inner ribs is 6 feet from the longitudinal center line of the bridge, and each of the outer ribs is 22½ feet from it. The horizontal roadways are carried on vertical posts seated at panel points on the top chords of the trusses. The trusses are connected together by top and bottom transverse struts and by transverse sway-bracing diagonals, in the planes of the inclined web members. The vertical posts are connected in pairs by transverse horizontal struts and diagonal rods, and there are lateral braces in the floor systems. The truss chords are cylindrical, 18 inches in outside diameter. Each section, about 12 feet long, is made of six high steel, machined staves, enclosed in a thin steel jacket, forced on under heavy hydraulic pressure.

The machined ends of the chord sections abut, and are connected by heavy steel sleeve couplings, made in two pieces each, flange bolted together. Transverse rings on the inside of the coupling fit corresponding grooves turned in the ends of the chord sections. The pins pass through the centers of the chord joints and couplings, and engage the diagonal truss members and the jaw plates on the lower ends of the vertical posts. They are peculiar for having a reduced center diameter, between bearings. The diagonals are made of pairs of very wide eyebars with circular heads, and are stiffened by tee bars riveted to their inner faces and connected by lattice bars. On the inner sides of the trusses the pins are prolonged to engage bent wing plates which have double fish plates with a pair of secondary pins for the connection of each lateral and sway-brace rod. Beyond these plates the end of the pin screws into a coupling piece in the end of the pipe which forms the transverse strut. There are for each span sixteen skewback castings recessed into the pier masonry and secured to those of the adjacent spans by anchor bolts reaching through the piers. The chords have long square threaded screw bearings in the skewback castings.

The two railroad tracks are carried between the outer trusses and are approximately tangent to the lower chords at the centers of the spans. There is a deck platform 21 feet high in the clear above the rails, which is 54 feet wide over all, and has a 35-foot driveway in the middle, and two 8½-foot sidewalks.

The trusses were erected by the guyed cantilever method, the adjacent ends of both spans being simultaneously erected, with balanced re-



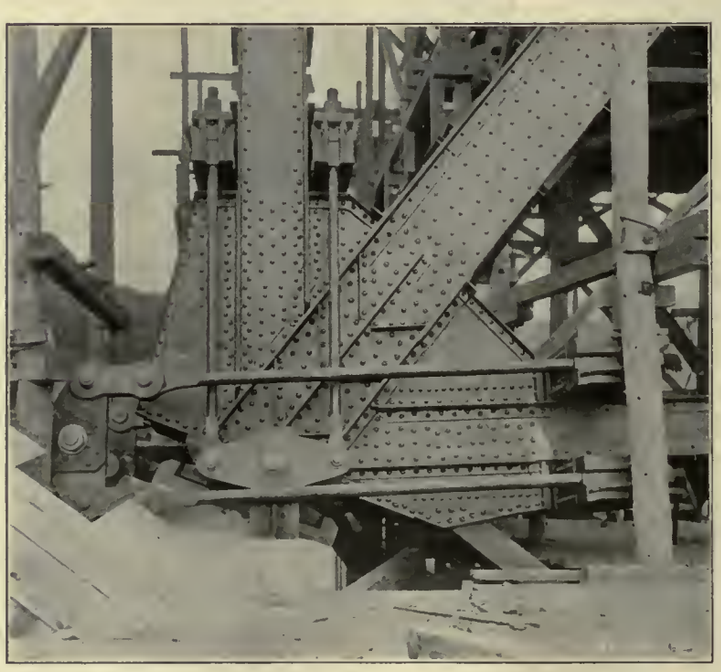


Diagram and Temporary Skewback Adjustment of Kaiser Wilhelm Bridge.

actions on the opposite sides of each river pier. All four trusses of each span were erected together for about one-quarter of their lengths from the skewbacks and then work on the side trusses was discontinued until the center trusses had been completed and were self-sustaining and served as platforms from which the former were erected. The cantilever ends of the trusses were supported at successive panels by multiple wire rope guys carried over wooden falsework towers seated on the tops of the masonry piers on special hydraulic presses by which they could be raised and lowered to adjust the positions of the trusses. The guy cables were supported over the cantilevered trusses by elaborate falsework bracing and were anchored at the west end to castings at the feet of wells cut 30 feet deep in solid rock. At the east end the guys were fastened to the middle of a 48x48-inch built oak beam bolted across four rows of 12x12-inch sheet piles driven in the bottom of a pit 30 feet deep backfilled with rammed sand. The middle guys had a tension of 432,000 pounds each and the outside ones 216,000 pounds each. The arch trusses were closed with great difficulty in hot weather, when the expansion of the steel ribs reduced the space in the center panel so that there was not sufficient clearance for the last chord sections. Troughs were built around one of the chords and packed with ice and finally the chord section had to be cut shorter than the computed normal length.

The double-track Kaiser Wilhelm bridge across the Wüpper River at Müngsten, Germany, was illustrated in The Engineering Record of June 10, 1899, and in the "Génié Civil" of July 2, 1898. The main span has two hingeless arch trusses, in battered planes, which carry the roadway trusses on skewback towers and vertical spandrel rocker bents. The eccentric parabolic top and bottom chords have spans of 590½ and 525 feet and rises of 225.7 and 238 feet respectively, and are 40 and 13 feet apart at skewback and crown. Each truss is divided by vertical posts into 22 equal panels with single diagonal braces. There is a horizontal transverse strut at every top and bottom chord panel-point and the panels between them are X-braced in lateral and sway systems. The chords have rectangular cross sections made of pairs of built channels with reinforced flanges, latticed with angles.

The skewback bearings are solid riveted shoes seated on the inclined surfaces of massive masonry piers, made in two parts connected by arches. The posts of the skewback towers and spandrel rocker bents form parts of the vertical posts of the trusses and are continued across them to the bottom chords. The roadway trusses are lattice girder spans, continuous between the inner faces of the skewback towers, where they have expansion seats. They are nearly 35 feet deep and 16 feet apart and are supported intermediately at the crown and on the spandrel bents. They have top and bottom diagonals and sway bracing and are in vertical planes, while the arch trusses are battered 1:7 so as to be 84 feet apart at the bottom. The double track roadway has a solid floor with narrow sidewalks cantilevered outside the trusses at a height of about 350 feet above the water. The center deflection under test load was about 6 inches. The weight of the main span and approaches is over 5,600 tons and the cost was $687,500.

Extensive shops were established near the top of the bank at one end of the bridge and a low level service bridge was built across the valley parallel to the alignment for the distribution of materials, which were lowered and raised on inclined planes at the ends. The skewback towers were first erected with very elaborate and costly interior false work. The approach towers and spans were then erected, and the material tracks and traveling derricks on them were used for the erection of the arch trusses by the cantilever method. The approach spans were continuously riveted together and connected to girders bedded in

concrete masonry in excavations quarried in the solid rock, so as to form anchorages for the erection reactions.

The roadway trusses were first built out as cantilevers from the tops of the skewback towers by overhead travelers, which also served for the erection of the arch trusses which were built as self-supporting cantilevers for the first few panels. After the first permanent vertical spandrel posts were erected, the top chords were guyed back from their feet to the tops of the skewback towers by wire cables with screw bearings on yoke beams having hydraulic jack adjustments. The remainder of the trusses were built as cantilevers without additional guys or supports, and when the center panel was reached the ends of the top and bottom chords were adjusted by hydraulic jacks until the trusses were revolved about the upper chord skewbacks and temporary shims were released and removed from under the lower chord skewbacks where they had been set to compensate for erection deflections. The jacks were slacked off until the chord joints closed and were riveted up. Then the skewback pressures were measured and the bearings adjusted by special hydraulic yokes attached to the ends of the top chords as shown in the detail of the skewback connection. Elaborate solid working platforms were provided for the erectors and most of the truss members were handled by revolving locomotive derricks. The bridge was erected in 22 months and was formally opened in March, 1897.



The Kaiser Wilhelm Bridge, Muengsten, Germany.

(To be continued.)

A Bee Line, something like the famous St. Petersburg-Moscow route laid out by the Czar with a ruler on a map of his realm, has been placed under construction by the Burlington road between Old Monroe and Mexico, Mo. In a distance of 63 miles there is a curvature of one degree and a maximum grade of 0.5 per cent. The contract has been let to the Flick & Johnson Construction Company, Davenport, Ia., and the construction will be under the general supervision of Mr. A. A. Newton, who is in charge of all new work on the Burlington, with headquarters in St. Louis.

Estimating Quantities of Soil Excavation from Wachusett Reservoir.

A paper, slightly condensed, by Charles A. Bowman, Division Engineer, Metropolitan Water Works, before the Boston Society of Civil Engineers, printed in the "Journal" of the Association of Engineering Societies.

The Wachusett reservoir requires the removal from more than 4,200 acres of all surface material containing any considerable amount of organic matter. To assist the inspectors in determining the minimum depth at which this requirement can be fulfilled, laboratory tests of soil from different depths are continually being made a little in advance of the soil-stripping work. Under eleven different contracts, 70 per cent. of an estimated total of 6,900,000 cubic yards have already been removed from 2,831 acres. The average depth over the area stripped is 1.06 feet.

Before making the real estate surveys which were necessary on the site of the reservoir, a system of triangulation was established, with some fifty stations along the margins and in the basin. In connection with these stations, by triangulation from trial points set from the land survey traverses, points on opposite sides of the valley were established on co-ordinate lines both north and south and east and west at intervals of 1,000 feet. From these points the intersecting lines were run out with a transit, and chestnut hubs 3 inches square and 3 feet long were set at the corners of 1,000-foot squares. By running out the diagonals of these squares and again intersecting from the centers thus established, similar chestnut hubs were set at each 500-foot corner. The errors of long tape measurements in an uneven area, much of which was not cleared, were thus avoided. Some fifty precise benches were set at convenient points near the flow line and within the basin. Each bench consisted of a ¾-inch iron rod 6 feet long, bolted to a cast-iron disk 18 inches in diameter, carefully set on concrete at such depth that the rod reached nearly to the surface. Each rod was surrounded by a casing of 2½-inch iron pipe, with a numbered cover.

Very careful levels were run with a precise level over these benches, the elevations adjusted and checked by cross runs. It was originally the intention to establish secondary benches on the wire nails in hubs at 500-foot corners for use in construction, and this method was used during the first year or two. There was often one and sometimes two or more winters between the taking of original and final levels, and, although the hubs were carefully set, these benches were never used a second year without carefully checking by level runs similar to those first made between precise benches. These test runs often showed unlooked-for changes of elevation in the hubs, and in order to avoid the necessity of careful readjustment it has been found advisable on the more recent work to set some 150 iron benches similar to the precise benches, and fifty or more bolts on outcropping ledge. Some old bridge iron was used for these intermediate benches, and they were not set on concrete, but carefully bedded in the natural material, thoroughly rammed.

At least four repetitions are required of the level runs between these benches before the elevations are adjusted, and if too great a variation from the average difference of elevation between any two points is found, additional runs are made before the adjustment of the chain of benches is completed. More than ordinary care is used in determining these bench elevations, because the average depth of excavation is so small that a slight error in bench elevation leads to a large per cent. of error in measurement of volume excavated. The method to be employed in the measurement of soil excavation is definitely stated in the specifications for each contract as follows:

"Soil excavation shall be measured in excavation and the amount of soil excavated shall be determined from levels taken when there is no frost in the ground, or if it shall become necessary to take levels when there is frost in the ground, the engineer shall make an allowance therefor. The first levels shall be taken before the contractor has commenced grubbing, and the final levels after he has completed the excavation of the soil. For convenience in estimating the quantity of soil excavated, the ground will be divided into squares 25 feet on a side, and the depth of excavation from each square will be determined by levels taken not more than 25 feet apart. In the case of partial squares, the estimates will be made as follows: If the area excavated is more than three-fourths of the area of the whole square, it will be estimated as a whole square; if from one-fourth to three-fourths of the area of the whole square, it will be estimated as if one-half of a square, and if less than one-fourth of the whole square, it will not be estimated."

On the larger contracts the areas to be stripped have been divided into three or more classes. The usual division is into Classes A, B and C. Class A being level country with few trees or stumps, on which tracks can be readily thrown and the soil shoveled directly into cars; Class B including mostly rolling country which is all accessible to carts and sometimes to cars, and Class C, comprising steep slopes, where it is necessary to cast the soil down or to build side-hill roads. The division lines between these classes are made on even 100-foot lines, and where they cut a 500-foot square separate estimate sheets are used for each class.

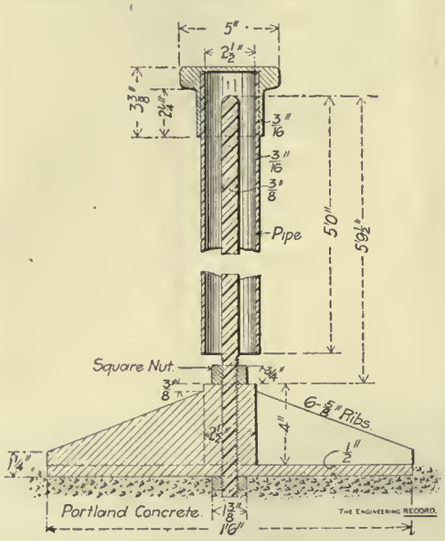
The 500-foot squares are cross-sectioned every 25 feet with transit and tape. The stakes used for this purpose were sawed from lumber obtained in clearing the reservoir site, generally pine or spruce, ⅝x⅝x18 inches, planed on two sides so as to be readily marked. A stake is set at the center of each 25-foot square. Owing to the uneven nature of most of the area, it is necessary to measure with considerable accuracy in setting these stakes, and especially

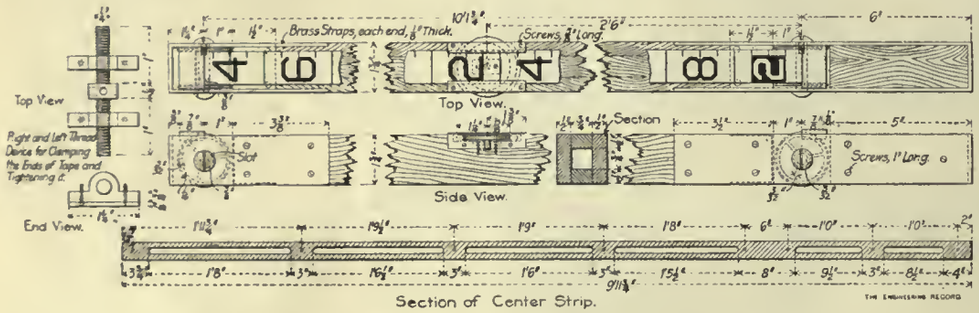
important that each stake in the final work should occupy the same position as the corresponding one for the original sections. It is customary to run out lines at intervals of 50 or 100 feet, setting the stakes with the transit, and then to fill in by stretching the tape between these lines. Sometimes the stakes are set by running out diagonal lines. The head of a cross-section party determines from inspection the best method to be used in each square, and makes a record so that the squares may be laid out in the same way after the excavation is completed. On some of the more level areas two or more squares are cross-sectioned together, the skeleton lines are run at greater intervals and a 200-foot Roe tape is used for filling in. The measurements between 500-foot corners during this work usually check within one or two tenths.

The levels are started from one of the precise or intermediate benches and each run is checked on to another bench or back to the starting point. The runs generally check within two hundredths or less, although three hundredths' error is sometimes allowed. Elevations are taken at each stake, reading to the nearest tenth of a foot. The parties on this work consist of five members—assistant engineer, instrumentman, two rodmen and an axman. When taking levels two rods are generally used, and in level country three are often used to one instrument. For running bench levels, tested Boston and New York target rods are used. A self-reading rod with sliding steel tape is used for all levels for estimates. With these rods the actual elevations are taken and recorded in the field. The tapes are of steel, 1 3/16 inches wide and 20 feet 9 inches long, graduated to half tenths and easily read to hundredths.

white lead paint and covering with colorless varnish. Tapes coated in this way will stand use for two or three seasons without repainting. The principal wear to these rods was from rattling about in the field wagons, and this is now prevented by providing each field wagon with a padded rack on the tail board, into which the rods are dropped and held securely. A set of brass stencils is used for graduating the tapes. A longer rod would often be an advantage on steep ground, but this advantage would be offset by the liability to 10-foot errors and the increased weight. The rod illustrated weighs 9¾ pounds. By the use of these rods all office reduction of notes is avoided and much time saved.

During the early part of the work the cross-





Bench Mark and Steel Tape Levelling Rod, Wachusett Reservoir.

The level is set up at any convenient point from which a rod reading can be obtained on a bench of known elevation, and the tape moved until the reading coincides with the units, tenths and hundredths of the bench elevation. The tape is then clamped and any readings taken from that set up give actual elevations, the recorder supplying the figures of the hundreds and tens column. The exposed part of the tape on the face of the rod is two or three hundredths more than 10 feet, and the sliding range is such that any graduation from 0 to 20 feet can be exposed so that it is possible to properly set the tape for any set up from which the rod can be seen.

It is especially important that the sliding tapes should be perfectly true, not kinky on the edges, and of proper elasticity; otherwise they will bind in the guides or on the rollers. I believe that it has been necessary to import these tapes, those obtained in this country proving unsatisfactory in these respects. The first tapes used were enameled and graduated by the manufacturers, but a day's use removed half the enamel by cracking it in passing over the rollers. After a second unsatisfactory trial of enameled tapes, we have found it best to paint and graduate them ourselves, using a pure

section notes were taken in the ordinary field book, but for convenience and economy of space a new form was adopted with pages in the same form as the estimate sheets, and the elevations are recorded as taken in the field, each in its proper square. Separate pages are used, however, for the original and final surfaces. The space at the right of the right-hand pages is used for recording bench elevations, turning points, etc. The limit lines of work for monthly estimates are located from stakes or by stadia and tinted on the estimate and progress sheets. Elevations for monthly estimates are not entered on the estimate sheets unless the stripping is completed at the points taken. Sometimes elevations only on skeleton lines are taken sufficient to give an average cut for the monthly estimates. The outline of area stripped for monthly estimates is often very irregular.

Owing to the variety of circumstances tending to modify the volume of carloads, it was not believed that car measurement would be of much use even as an approximate check on estimates, and many comparisons seem to prove this theory. Record is made of the measured capacity of cars and an account is kept of the number of carloads from each locality. In arable lands, especially where there is a sod and the soil is shoveled directly into cars without previous plowing, the cars, although apparently well filled, contain comparatively small volumes owing to the voids between unbroken lumps.

When the soil is grubbed or plowed, shoveled into carts, hauled a greater or less distance and loaded into cars from hoppers or long chutes, it becomes thoroughly pulverized and much larger volumes are transported. Besides the different methods of excavating and loading into cars, other factors which tend to vary the relation between car measurement and volume in excavation are the thorough pulverization of soil when cast over several times down steep slopes, the loose turf or leaves sometimes burned after the original levels are taken, the roots and stumps below the original surface which are burned on the ground and never transported, and the rivalry between foremen on secondary lines in their attempts to make a good record in number of cars.

The Bi-Centennial Memorial Buildings of Yale University.

The Bi-Centennial Memorial Buildings, at Yale University, New Haven, Conn., have been erected by the alumni in commemoration of the bi-centenary anniversary of the founding of the university. They comprise what is known as University Hall, the dining hall, for students, and a state dining room for the alumni—Woolsey Hall, a large auditorium, which is to be used for all university functions where there is likely to be a large audience, and the Memorial Vestibule Building, which contains the Memorial Vestibule—the corridors, which are also of a memorial character and which are used for circulation between the other two buildings—the reception room for the use of the president of the university and which is to be used on state occasions for receptions given by the president—and the Dome Room, which is to be used as a museum for the exhibition of the Steinert collection of musical instruments. The three buildings make the one group of what is known as the Bi-Centennial Memorial Buildings. They are located at College and Grove streets. The exterior is all executed in Indiana limestone, with strong base of Milford granite. The roofs are all in copper, so that practically the color scheme is the combination of the color of buff limestone—surmounted by the brown, tinged with verdigris, of the natural copper.

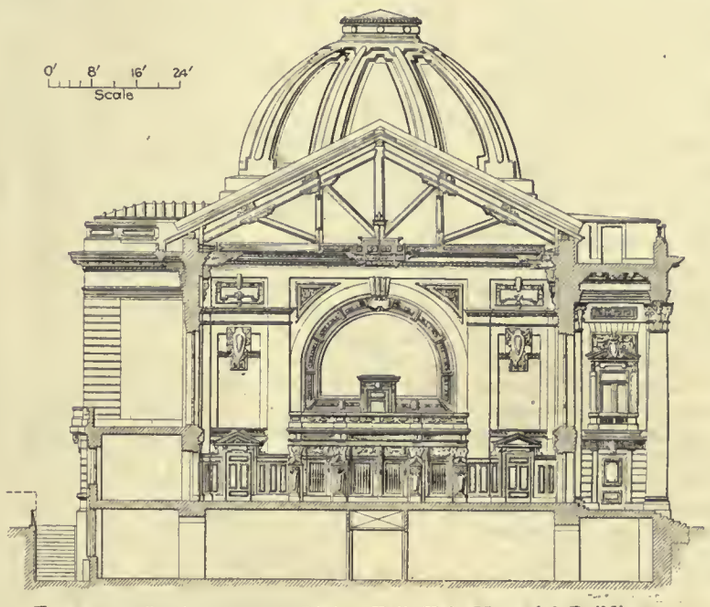
University Hall, parallel to and facing Grove Street, is a single room, with galleries at each end, pantry service rooms at the side, and the kitchen, laundry, power and other service in the basement below. It is 208 feet long, 65 feet wide, and the height to the trusses is 50 feet. The height to the apex of the roof is 70 feet. The walls, above a 10-foot wainscot of quartered oak, are all faced with a North Haven, Montowese brick—laid in white mortar and in a Flemish bond, every other brick being a header built into the body of the wall. Structurally and artistically, the result of this treatment is most effective, and gives a monumental tone to the room. The walls, which are massive, and look so, are laid into panels by the natural distribution of the piers that support the roof trusses, and into these panels decorative features of carved Longmeadow stone have been incorporated.

The roof trusses are of the queen-post type and are made specially heavy, to get into the proper scale with the rest of the room, and to further the monumental and memorial feature of the hall. The members are all of clear Oregon pine, and in all cases are solid and in single sticks. As the members are unusually heavy in section and the bottom chord, espe-

cially, is of considerable length, the material was difficult to obtain. The intersections are framed with molded blocks and are secured with forged iron straps, bolts, and steel plates. All of the truss features are actually constructural in their functions. The rafters are of yellow pine and exposed. They are covered with a finished boarding forming the ceiling of the room, and over this boarding are placed furring strips, and on them the roof boarding, thus forming an air space for insulation. The entire roof has been decorated simply and in such a way as to lend further dignity to the hall. The colors are all the primitive ones, thus insuring their permanency and, in decoration, furthering the memorial idea.

The roof finish is of 16-ounce hot rolled copper. It directly abuts the roof boarding and at every 2 feet it is taken over heavy beveled ribs. The joints are locked and soldered, the copper being tinned on all edges for this purpose. The joints running in the direction of the ribs are made on top of the rib, to guard against leakage, and to allow for the proper expansion and contraction of the metal. There is but one floor above the basement in the Dining Hall building, and it is supported on standard steel beams, with all riveted connections, resting on masonry walls on the outside, and on cast-iron columns in the center. The floor itself consists of a 3½-inch thick plate, of expanded metal and concrete, resting directly on top of beams and finished with 1½-inch Terrazzo and marble. The finished floor is designed in panels of a Terrazzo, with the frames or stiles of the marble.

Woolsey Hall, the auditorium, is one large room, with balcony, gallery, and stage, and the large memorial organ at the south end, 150 feet long and 105 feet wide. The side aisles are 14 feet wide between columns and wall, and the center space is 65 feet between the columns. The construction of this building is fireproof throughout; the floors, galleries and roof are all of steel construction, with expanded metal and concrete fireproofing similar to that in the Dining Hall. The plan of the building is such that it was desirable to carry the large galleries without columns. This was accomplished by cantilever framing, as shown, the longer cantilevers in the center of the balcony at the rear being carried through the large supporting trusses, which rest between the columns back of the seating space on the main floor. These cantilevers were calculated for three conditions of loading: First, for the loading of all of the seats—filled—in front of the line of the supporting girders; second, for equal loading with all seats filled, and the space back of seats, near the wall, also filled with persons standing; third, for the loads resulting from the movement of the audience in getting out, at which time all of the weight would be between the supporting girder and the wall. In consideration of the probable character of the audience, an ample allowance was made for vibration, resulting from foot applause, this factor being considered in excess of the allowance made for vibration on a dancing floor.



Transverse Section through Dining Hall, Yale Memorial Building.

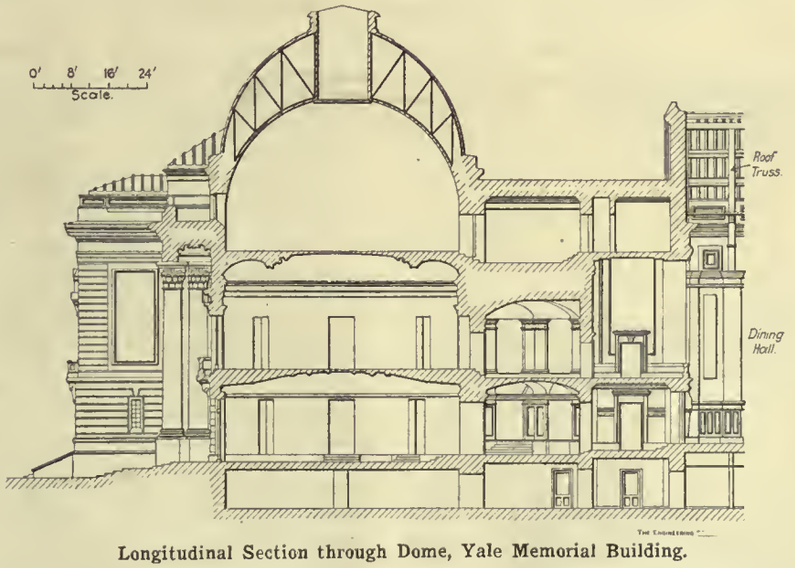
The cantilevers which pass through the trusses were shipped in sections, and assembled in position, with the riveted seat on the top flange of the girder connecting with the upper chord of the cantilever. As the rear end of some of the cantilevers did not run into the walls, but into openings, it was necessary to provide trusses to take both the re-action and the uplift. The fronts of the cantilevers were connected by continuous channel fascias. The gallery cantilevers are longer than those of the center rear portion of the balcony. They are inclined lattice girders as shown, about 40 feet in length and 4 feet deep, the entire projection beyond the supporting transverse girder being about 19 feet. The main roof is supported on steel trusses with all riveted connections. The lower chords are shaped to conform to the general line of the main ceiling, which is semi-elliptical in form, and the upper chords are pitched in the line of roof, and receive the rafters supporting the fireproof construction.

The plaster forms for ceilings, with their penetrations, arches and lunettes, and all special plaster features were formed of 1-inch steel channels, set at 12-inch centers, and supported by steel purlins and angles, which were hung to the structural steel above. The entire interior finish above the wainscot and base is of plaster. The proscenium arch is formed of steel furring, same as ceiling and is made self-supporting. The furring in this building is made particularly difficult and elaborate by the nature of the design of the room and the unusual amount of decoration and has been well executed.

The Memorial Vestibule building in the center of the group is surmounted by a large copper dome, and it connects University Hall with Woolsey Hall. In it will be concentrated, in the main, the university memorials such as statues, tablets, etc. The main floor in this building is carried on standard steel beams and expanded metal and concrete construction. The upper floors are supported entirely on Guastavino tile vaults. The vaults in the Circulation Corridor have clear spans of 24 feet, with only 2 feet rise. Those in the circular rooms under the dome, have clear spans of 50 feet with only 3 feet rise. The thickness of these circular vaults, or domes, are at the base six layers of 1-inch tile, or about 7 inches in all, and three layers, or about 3½ inches at the crown. The thickness at the center, from the finished floor to the finished ceiling on the underside is but 9 inches. These domes are held in position by steel girders, formed of three 6-inch angles, and eight vertical 12-inch steel web plates riveted together, which take up the thrust. The vaults and domes are perfectly rigid and show no vibration under any condition. The floors above them are of oak, in parquetry, or of mosaic. The parquetry floors cover a planed and matched under-flooring, which is laid on dove-tailed sleepers, set in concrete. The mosaic floors are divided by panels arranged to guard against cracking of the surface.

The dome frame is of 8-inch steel beams, placed radially and curved to conform to shape of dome, as shown. The feet of the ribs are riveted to a 6-inch plate, forming a ring around the base. The upper ends of ribs are framed against an 8-inch channel, leaving a well 13 feet in diameter and forming a base for the lantern wall which is about 8 feet high and is built entirely of expanded metal and concrete. The exterior of the dome is covered with 3½ inches of expanded metal and concrete fireproofing, and is then furred with expanded metal and concrete and a cement finish, ready for the paneling and ornamental work and copper.

The ceiling in the dome room approximately parallels the line of the dome and is formed entirely of steel furring, lath, and plaster, the same as the ceiling of the auditorium. It is



Longitudinal Section through Dome, Yale Memorial Building.

crowned with a large paneled ceiling light, glazed with an obscured glass, and this is connected to the skylight, surmounting the lantern above, with steel furring which makes a support for the upper part of ceiling, and at the same time forms a light well connecting the skylight and ceiling light. The buildings contain a very complete mechanical plant, dining hall outfit, heating and ventilating apparatus, and a plant for lighting the entire buildings, with provisions for the lighting and heating of future buildings.

Messrs. Carrere and Hastings were the architects of these buildings and the constructural engineering and specifications were done by Mr. Owen Brainard of the firm. The work was executed under the immediate direction of Mr. Carl F. Grieshaber and the entire contract, except that for the mechanical plant, was executed by Messrs. Norcross Brothers. Messrs. Hollis French and Allen Hubbard were the consulting engineers for the mechanical, heating and ventilating and electrical plant.

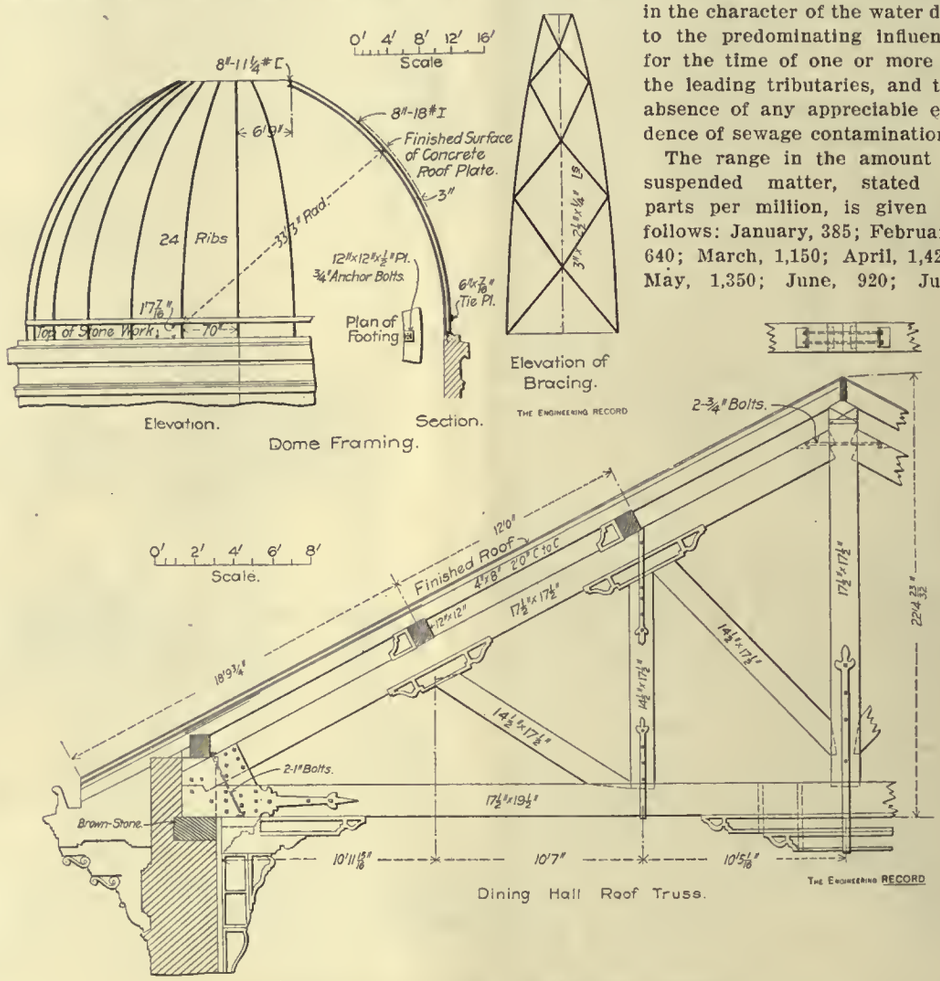
Water Purification Experiments at New Orleans.

When the problem of designing a system of works for purifying the Mississippi River water was discussed by the engineering advisers of the New Orleans Sewerage and Water Board, in 1900, the available information for the purpose was to be found mainly in the results of investigations at Louisville, Pittsburg and Cincinnati. A purification plant could doubtless have been planned from that amount of data which would have operated satisfactorily. It was probable, however, that such a plant would not be the most economical and efficient which it was possible to build, because definite information did not exist on which to base the size of the subsiding basins for the sedimentation of the raw water at New Orleans and the capacity of the subsiding basins for use with the water to which a coagulant had been added. Hence an experimental station was constructed at Audubon Park for the investigation of the character of the raw water and the effect on it of various methods of treatment. This station, which was illustrated in The Engineering Record of February 9, 1901, was placed in charge of Mr. R. S. Weston, whose report on the work has just been made public by Mr. George G. Earl, the general superintendent of the Board. In conducting the experimental work, Mr. Weston had the benefit of the advice of Mr. George W. Fuller as well as Mr. Earl.

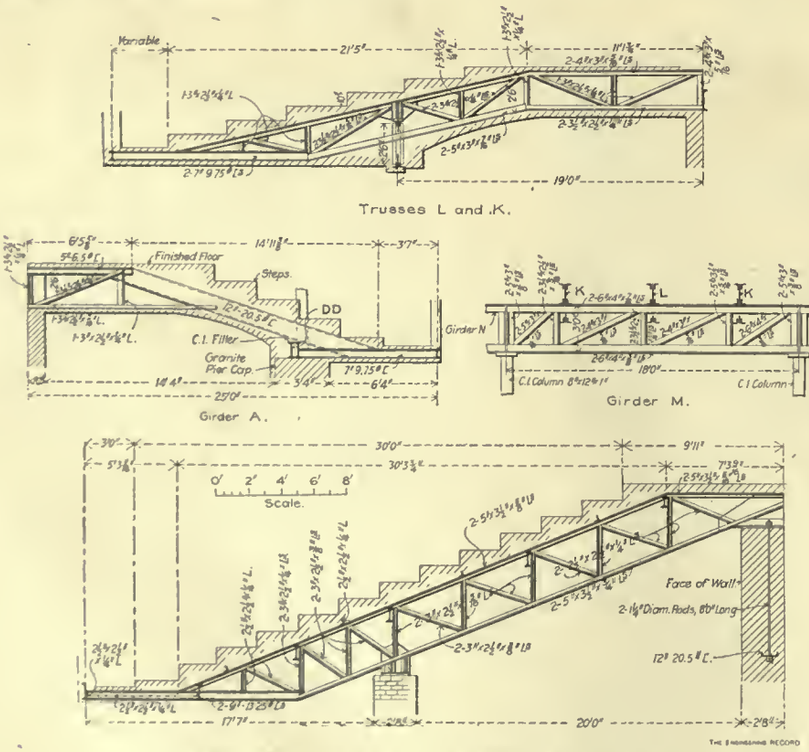
The water of the Mississippi at New Orleans possesses the following characteristics: A wide variation in the amount of suspended matter, fine clay particles forming a comparatively large proportion of the suspended matter, no sudden changes in the amount of suspended matter, frequent but not sudden changes in the character of the water due to the predominating influence for the time of one or more of the leading tributaries, and the absence of any appreciable evidence of sewage contamination.

The range in the amount of suspended matter, stated in parts per million, is given as follows: January, 385; February, 640; March, 1,150; April, 1,425; May, 1,350; June, 920; July, 600; August, 410; September, 290; October, 185; November, 160; December, 260. The average amount is 650 parts. It is this suspended matter which is the source of the only strong objection to the river water as a source of domestic and industrial supply. A million gallons of raw water contains about 2.7 tons of dry mud, and a purification plant for New Orleans must remove 108 tons of mud daily from the supply on an average and during the periods of maximum turbidity as much as 435 tons. The amount of suspended matter in the unfiltered water used for the supplies of other cities is as follows: Lawrence, 10; Albany, 15; Pittsburg, 50; Washington, 80; Cincinnati, 230; Louisville, 350; St. Louis, 1,000. The matter at St. Louis settles much more rapidly than that at New Orleans. The mechanical removal of this amount of sediment is a problem that demanded the most careful consideration. The purity of the water from a chemical and biological point of view is due to the opportunities for natural purification in the lowest few hundred miles of the river and to the small amount of sewage pollution it receives. The river banks are protected by levees which not only keep the water from the land but also keep the sewage from the river except at a few outlets. It is usually convenient for the towns immediately above New Orleans to carry their drainage away from the river so that almost no local pollution exists.

The experiments with plain subsidence showed that the percentages of suspended matter which can probably be removed in this manner are 33 after 12 hours of sedimentation, 45



Dome and Roof Framing, Yale Memorial Building.

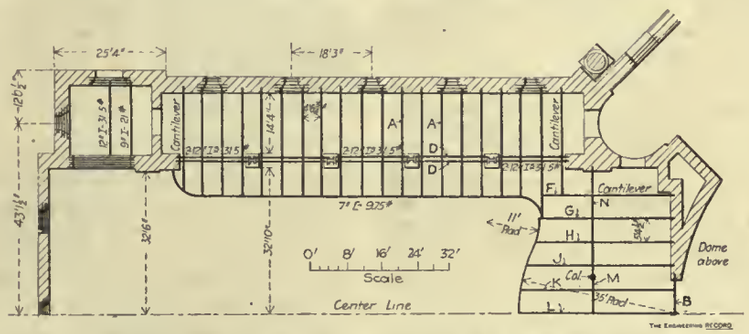


Gallery Framing Details, Yale Memorial Building.

after 24 hours, 54 after 48 hours and 59 after 72 hours. During the winter and at other times when the river water is fairly clear the percentages of removal will probably be considerably less than these, while during the warm months and when the river is more turbid, materially better results will be obtained. The sediment deposited from the raw water does not become compact enough in four months to prevent its being washed out easily with a hose; much of it, in fact, flowed through the washout pipe of the Station of its own account. If the basins of the proposed works are cleaned as often as once in four months, Mr. Weston believes that satisfactory conditions of operation, from a sanitary standpoint, will surely be obtained. The removal of bacteria by sedimentation was so slight as to be of no significance.

The experiments made with English or slow sand filtration were conducted with settled water and also with water which had been settled and acted upon by a coagulant. The water which has been allowed 72 hours of sedimentation contains the following average amounts of suspended matter, the figures representing parts per million: January, 150; February, 265; March, 460; April, 590; May, 575; June, 385; July, 225; August, 160; September, 125; October, 90; November, 70; December, 90; average, 265. The clay particles are somewhat gelatinous in their nature and act within certain limits as a substitute for the organic matter which forms films on the sand beds of filters. The clay particles are sub-microscopic in size, many of them being less than 0.00001 inch, and penetrate deeply into the sand when present in large numbers. The experiments showed that the filter produced an effluent of satisfactory character when the applied water did not contain more than 120 parts of suspended matter during the summer months, but it is doubtful if such results could be obtained steadily throughout the year. Even assuming that such an effluent can be purified satisfactorily at all times, the figures of the amount of suspended matter in water that has been settled for 72 hours show that for two-thirds of the year a slow sand filter cannot produce a satisfactory effluent at a rate of 2,560,000 gallons per day per acre. The reduction of the rate of operation within any practicable limits will not affect this conclusion. The cost of operating even to produce such an unsatisfactory result will be from three to six times that of similar work elsewhere on account of the amount of scraping necessary. Double filtration will not be a remedy owing to the turbidity of the effluent of the primary filter during portions of the year.

The second method of operating a slow sand filter involves the removal of part of the suspended matter by a coagulant. The latter can be added directly to the raw water or to water which has been partially clarified by subsidence. One interesting feature of coagulation is of importance in deciding which process to employ. When sulphate of alumina is added to water for this purpose a certain amount is absorbed by the suspended matter in the water and does not react with the dissolved carbonates to form alumina hydrate which is the substance that collects the suspended matter into masses large enough to be held by the filtering medium. Taking raw river water and subsided water with the same amount of suspended matter in each, it was found at New Orleans that the raw water required about 25 per cent. more coagulant than the other in order to produce equal clarification. Tables showing the amount and cost of chemical for each class of water and with various amounts of suspended matter were prepared, and with their help and the figures of the amount of turbidity in the raw and subsided waters during the different months it was possible to determine just how long it was best to conduct the subsidence before beginning the clarification by coagulation. It is unnecessary to review the steps of this computation at this time, but the results are of interest. Within the limits of the data employed, it was found that there would be but little difference in the cost of the filtered water whether plain subsidence were practiced for 12, 24 or 72 hours. The advantage seemed to be slightly in favor of a 24-hour period. Taking everything into consideration, including the smaller area of the basins from which sediment would have to be removed and the smaller area of ground, it was decided that under the local conditions the plain subsiding basins need not be larger than one-half the daily capacity for which provision must be made in the designs of the entire works.



Balcony Floor Framing for Auditorium, Yale Memorial Building.

The purpose of the coagulant is not only to furnish water which will enable the slow filter to operate satisfactorily but is also to increase the rate of filtration. Investigations elsewhere have indicated that water containing not more than 30 to 50 parts of suspended matter might be filtered in this type of works at a rate of 5,200,000 gallons per acre daily. The New Orleans experiments demonstrated that the amount of coagulant added to make this rate possible should be sufficient to keep the suspended matter somewhere between 20 and 12 parts per million. The former amount would require a filter running at the rate mentioned to be scraped every 13 days, and the latter amount every 20 days; with a head of four feet and other conditions similar to those at the experimental plant, these figures correspond to yields of 65,000,000 and 100,000,000 gallons per acre between scrapings. The coagulating basins necessary for this purpose must have a capacity of 24 hours flow.

The experiments showed that a purification plant on this modified English system would produce a satisfactory effluent. The cost of the works, on a basis of 40,000,000 gallons daily capacity, is estimated at $1,260,000, and their operating charges at $16.46 per million gallons, inclusive of interest and depreciation.

The mechanical filtration systems which were tested resembled the modified English system in that subsided water which was afterward clarified by coagulation was employed with them. They differ in the period of secondary subsidence required after the coagulation, because the mechanical filter is adapted to treat coagulated water containing a larger amount of suspended matter than is the slow sand filter. Two mechanical filters were employed in the tests, which differed mainly in their size and in the manner of agitating the sand during washing, one employing the air washing system and the other the older mechanical agitators. Their efficiency was found to be identical.

The limit to which it is advisable to reduce the amount of suspended matter in the water to be applied to a mechanical filter is found by a comparison of the cost of subsidence and coagulation with the cost of the water employed for washing the filter. Such a comparison in the case of the New Orleans conditions showed that the economical limits of the suspended matter were somewhere between 30 and 45 parts per million, which, it will be seen are higher than the limits for the modified English system. It is well known that after enough coagulant has been added to effect a fair degree of clarification, it takes but a trifle more of the chemical to obtain a considerably better result. The cost of this slight excess has to be compared with the cost of wash water saved by the procedure. In this particular case it was decided to make the comparative estimates on the basis of an applied water with the suspended matter reduced to about 45 parts. The result of the experiments and comparisons of cost showed that the most economical arrangement of plant would be one providing plain subsidence for 12 hours, then coagulation and supplementary subsidence for another 12 hours and finally filtration at a rate of 125,000,000 gallons per 24 hours. The report states that no choice could be made between the two systems of air and mechanical washing on the basis of efficiency and this matter would have to be decided on the basis of cost; indeed, it was stated that the experiments indicated the possibility of omitting agitation completely during washing, although this is not recommended.

The total cost of a 40,000,000-gallon plant of the rapid or mechanical type is placed at about $700,000, and its cost of operation at $15 per million gallons. As these figures are considerably less than those for the modified English system, the recommendation has been adopted and the plant will be constructed along the lines indicated.

The general features of the works are indicated in a report by Mr. Earl. The intake will be located above the city on a caving bank of the river, and its construction will be such that any slides at this bank will cause little trouble. The water will be drawn from near the surface, as the amount of suspended matter in the river increases with the depth. A pair of 48-inch suction mains will run to a first set of low-lift centrifugal pumps which will discharge into the primary subsiding basin, of 23,000,000 gallons capacity. Owing to the character of the land on which all the works must be built it is desirable to impose light unit loads on the foundations, and this basin will be shallow for this reason. As large conduits must run in some of its walls it has been decided to build the structure of concrete reinforced by steel passing through this reservoir the water will be baffled so as to ensure thorough

At the front end of this p[rimary basin] of weirs will deliver the [water] conduit in the wall be[tween the] coagulating basins, [which lead] to a well where the

added. Then it will pass into a distributing conduit having small holes in its bottom through which the water will enter the second basin. In a general way it may be said that 65 per cent. of the suspended matter will pass through the first reservoir and only 7 per cent. through the second one. From the latter the clarified water will flow by gravity to the mechanical filters, which it is proposed to construct somewhat after the system built at Little Falls, N. J., for the East Jersey Water Company, already illustrated in The Engineering Record. Owing to the difference in the character of the foundations the details will be different, but the extensive use of concrete-steel construction which is a feature of the Little Falls plant is proposed for the New Orleans works.

After passing the filters the purified water will enter a small equalizing reservoir immediately below them, connected by a gravity conduit with a second pump well located below the same pumping station that contains the machinery for the first or raw-water set of pumps. From this well the water will be taken, so far as possible, by main pumps of a sufficient capacity to operate under the direct-pressure system, as the topographical conditions of New Orleans make standpipes or service reservoirs impracticable. These main pumps will not take as much water as the filters can furnish during the night, while they may require much more during the day. For this reason, as well as to enable the filters to be operated uniformly, an essential feature of successful work, clear-water reservoirs of 12,000,000 gallons capacity will be constructed to balance the yield of the filters and the requirements of the pumps, and a second set of low-lift centrifugal pumps will be provided to elevate the water into these basins.

For emergency conditions which are never expected to arise but, should they happen during a great fire, might be immensely costly, the following cross-connections and by-passes will be provided: First, the second low-lift pumps can be connected with the suction main from the river and deliver water into the raw water reservoirs; second, the filters can be by-passed and the water sent directly from the settling basin to the pumps; third, the settling reservoir can be by-passed and the water sent to the filters or to the main pumps.

A New Oil Engine.

Taken collectively, the strongest objections to the present forms of gas and oil engines are the difficulty of starting, their expensive and noisy operation, the disagreeable smell emitted by the exhaust, and their great weight and size. An oil engine has recently been invented which bids fair to remove these objections to a large extent, since it is self-starting; will burn fuel oil, the cheapest oil known and one having little odor; will burn it gradually instead of explosively, reducing the noise and vibration; and being of the two-cycle rather than the four-cycle type, is capable of developing about double the power for the same size. The engine is the invention of Mr. Oscar P. Ostergren, a mechanical engineer and inventor, well known as the designer of the "Arrow" and one of the first to produce apparatus for the manufacture of liquid air in commercial quantities.

The construction of the engine may be seen on the accompanying sectional elevations taken at right angles to each other and showing the piston at opposite ends of its stroke. The piston is of the trunk pattern and works within a cylinder enclosed by heads at both ends. The upper face of the piston which receives all of the working impulses, is the only one ever in contact with the burning gases and is covered with a conical baffle plate, the utility of which will be manifested later. The lower hollow face compresses air which cleanses the cylinder above the piston between ignitions completely removing the products of combustion or any unconsumed oil therein, which might be the cause of a premature ignition on the next working stroke if allowed to remain. The clean air is drawn into the cylinder on the up-stroke through the valve surrounding the piston rod, the travel of which is limited by a stop, as indicated, and the opening and closing effected initially by friction on the rod, although the excess of pressure on alternate sides will produce the same results.

The cycle of operations is as follows: Starting with the piston at the upper limit of its stroke, as indicated in the left hand elevation, the cylinder below the piston is filled with clean air at, or a little below, atmospheric pressure. As the piston starts to descend the air admission valve is closed and compression follows throughout the down-stroke, being distributed through the lower part of the cylinder and the concentric air passage surrounding it. Concurrently the charge above the piston has been burning and expanding, producing the effective force, over and above that necessary to compress the air, which turns the crank shaft. For an instant as the piston nears the lower end of its travel, the exhaust is opened through the ports underlying the conical baffle plate and a reduction of pressure ensues. A slight further movement brings the piston to the end of its stroke, the circumferential ports of the air jacket register with those under the baffle plate, while the space above is fully opened to exhaust at atmospheric plus back pressure. The air in the jacket being at a pressure in excess of the atmosphere by about seven pounds, rushes under the baffle plate and out through the opening at its center in a vertical stream which impinges on the cylinder head and is deflected along the side walls removing the last traces of the burned gases through the regular exhaust ports. This purging of the cylinder by cold air between each working stroke has another beneficial effect in that the cooling produced is sufficient to obviate the necessity of a water jacket around the cylinder, at least on sizes smaller than 10 horse-power. What the results will be on larger engines remains to be seen; in any event less heat will have to be wasted through jacket water than is invariably the case with an explosive type of engine.

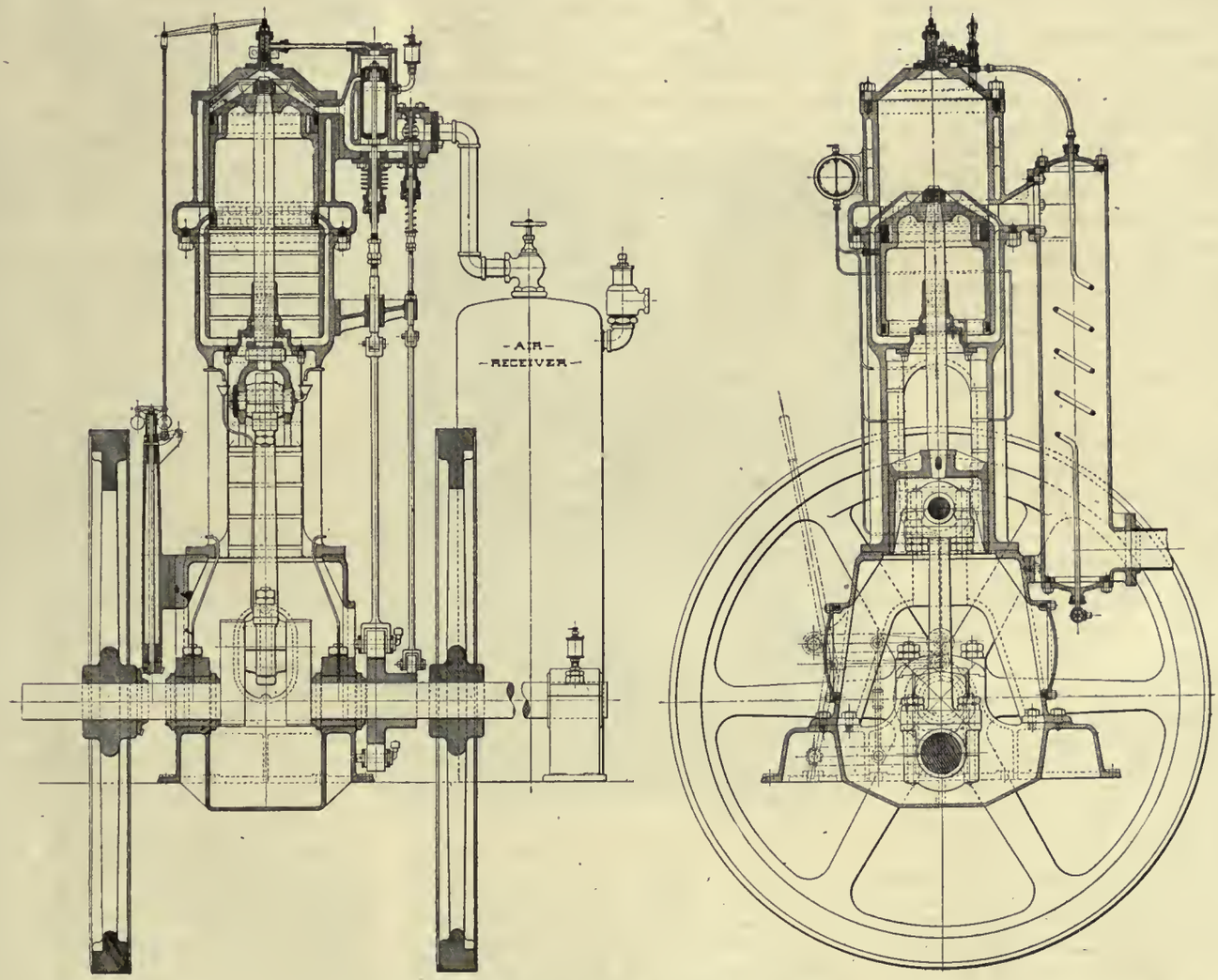
It will be noticed that the body of the piston also serves as a valve for all operations of admission and exhaust of air to the upper part of the cylinder. The oil admission is under entirely separate control, as will appear subsequently. As the piston begins the up-stroke the pressure above it has fallen very nearly to atmospheric, the exhaust and air ports close, air is admitted below the piston through the opening of the valve on the piston rod, and compression takes place above the piston. The second compression of the air is much higher than the first as it is crowded into the slight space left at the top of the cylinder and in the ports which communicate with the auxiliary valve for injecting the oil. As a matter of fact this compression reaches about 300 pounds per square inch, producing a temperature in the neighborhood of 780 degrees, which makes possible the ignition of the oil as fast as it is introduced. During three-fourths of the up-stroke the air has access to both ends of the plunger of the auxiliary valve leaving it in a balanced condition during this period. At the beginning of the last quarter the auxiliary valve is rapidly raised through the agency of the cam and follower mechanism, which closes the port near its upper face and by its more rapid motion produces a compression through the small pipe communicating with the head of the cylinder, much in excess of the cylinder compression. This causes the opening of the little pop valve in the cylinder head and the atomizing of the drop of oil contained therein, into the cylinder. The air in the cylinder being at the point of combustion ignites the oil as fast as it is received and expansion ensues throughout the down-stroke, although the introduction of oil lasts for only about one-quarter of the stroke. At the end of the stroke, the cam, being positive in its action, returns the oil pump plunger to its lower position producing a suction which draws the next charge of oil through three little check valves into the oil pocket on the cylinder head to be in readiness for the next succeeding ignition. The course of the oil may be followed by a reference to the right hand elevation, where it will be seen that initially it is required to pass through a coil in the exhaust pipe of the engine. By this provision a certain amount of preheat is imparted to the oil at the expense of heat otherwise lost, which is calculated to raise the oil to about the flashing point and facilitate its later vaporization. The construction of the oil retainer in the injection valve is peculiar. A spool consisting of a number of flanges perforated parallel to the axis is placed on the valve stem, and by virtue of its honey-comb construction and capillary attraction, acts as a sponge, spreading the oil in thin films over its surface so that it may more readily be converted into mist by the blast of injecting air.

The governing of speed and power is accomplished by regulating the amount of oil injected, the air charge and degree of its compression being constant. The throttling of the oil occurs prior to its passage through the three check valves, in an adjustable needle valve, shown at the right of the check valves in the right hand elevation. A coiled spring normally holds this valve open, while its depression is regulated through the governing mechanism shown on the other elevation, which is sufficiently clear to need no further explanation.

The mission of the air receiver is the storing of compressed air to enable the engine to start after a period of rest. When the engine is first installed it is necessary to charge the receiver by a hand pump or other means, through a connection for that purpose. Thereafter the charging is accomplished by the engine itself. As the drawing shows the receiver communicates with the cylinder of the engine through the port below the auxiliary valve. A check valve allows the compressed air to flow into the receiver until the pressure therein equals that in the cylinder. Subsequently as the pressure falls by the contraction of the air in cooling, the valve opens again continually restoring it to the maximum engine pressure. When it is desired to start up the engine the actuating rod below the check valve, carrying a follower at its end, is thrown into engagement with a cam by means of a hand lever. If the engine is in the proper position the valve is opened at once and a charge of compressed air flows into the cylinder. If not, there being no load on the engine, the fly-wheel may be revolved until the piston takes its right position to receive the charge of air. The ignition for the first few revolutions requires the use of an electric sparking plug, not shown on the drawings, which, with the check valve actuating mechanism is thrown out of operation as soon as the top of the piston becomes hot enough to sustain the temperature of combustion. Herein lies another advantage of

the baffle plate for being of thin construction and large surface it becomes heated very much sooner than the main heavy piston head could, and establishes normal running conditions in but a few strokes. As will be seen the stem of the air check valve is separated from its actuating rod when not in operation. This is to avoid the noise that would occur if the whole mechanism were lifted whenever the check valve rises.

The drawings herewith are for a 50-horse-power engine now building, which will run at about 280 revolutions per minute. So far the principles involved have been tried out only in a modified Lozier two-cycle gasoline motor. While this experimental engine can hardly be expected to adapt itself as successfully as one specially designed throughout to meet the peculiar conditions, it has, however, demonstrated the feasibility of using fuel oil, igniting it by the heat of compression of air, and omitting water jackets on small models. The engine is believed to have a future in the field of automobile, street car and ship propulsion, as well as in mills, factories, and lighting and pumping plants. The patents are controlled, and the engines being built by the Fuel Oil Company, 50 Wall Street, New York, of which the inventor, Mr. Ostergren, is the Vice-President.



The Ostergren Self-Starting, Two-Cycle Oil Engine.

The Average Cost of Brick Sidewalks in Somerville, Mass., during 1902 was 88 cents per square yard, and the cost of setting edgestones, 79 cents per linear foot. City Engineer E. W. Bailey states in his last annual report that 6,458 square yards of new brick sidewalks were laid, and 8,610 square yards relaid.

Boston Opinion on the Union Engineering Building.

A meeting of the corporate members of the American Society of Civil Engineers, in the vicinity of Boston, was held on the afternoon of June 1 at the room of the Boston Society of Civil Engineers, with a view to obtaining the sentiment on the offer of Mr. Andrew Carnegie to pay for the construction of a national engineering society building. This meeting was held in response to a circular letter signed by Frederic P. Stearns, Dexter Brackett, Henry Manley, Frederick Brooks, S. E. Tinkham, George A. Kimball, E. W. Howe, of which the following is a copy:

"Dear Sir:—There will be a meeting of the members of the American Society of Civil Engineers residing within about fifty miles of Boston, at the room of the Boston Society of Civil Engineers, 715 Tremont Temple, on Monday, June 1, at 4 P. M. for the purpose of considering and obtaining an expression of opinion upon the question of accepting Mr. Andrew Carnegie's offer to contribute $1,000,000 for the construction of a union building for the national engineering societies and a building for the Engineers' Club. As it is desired to obtain a full expression of opinion from the members in this vicinity, those who cannot attend the meeting are requested to express their opinion by the use of the appended form or in such other manner as they may desire, and mail the same to Frederic P. Stearns, 1 Ashburton Place, Boston. It is desirable that this form be used in order that the opinions may be tabulated, and that the replies be received on Monday, June 1.

"Mark an X opposite the statement which expresses your opinion.

"1. I am in favor of the acceptance of Mr. Carnegie's offer and the construction of a union building.

"2. I am not ready to express a decided opinion upon this question, but with my present information would favor the acceptance.

"3. I do not care to express an opinion upon this question.

"4. I am not ready to express a decided opinion upon this question, but with my present information would oppose the acceptance.

"5. I am opposed to the acceptance of Mr. Carnegie's offer and the construction of a union building."

The meeting was called to order by Mr. F. P. Stearns, thirty-two members being present. Mr. Henry Manley was elected chairman, and Mr. S. Everett Tinkham, secretary. There was a very general discussion on the subject, and several letters, expressing different views of some who were unable to attend, were read.

Statement.	Not present.	Present.	Totals.
1	34	15	49
2	29	6	35
3	6	1	7
4	6	2	8
5	3	6	9
Totals	78	30	108

One hundred and seventy-two circular letters were sent out, and a tabulation of the votes sent in is given above. The figures in the column headed "Not Present" include those received previous and a few subsequent to the meeting, while those in the column headed "Present" are the results of the votes cast at the meeting.

The Baynes Garbage Disposal Works at Buffalo.

A unique garbage disposal plant has been in operation for a short time in Buffalo, N. Y., by the Baynes Garbage Company, which has a contract with the city to dispose of the garbage delivered at the works by the city. The building contains three large ovens, in each of which are six revolving cylindrical dryers. These dryers are 48 inches in diameter and 13 feet long, placed in the oven at a slight slant to the horizontal and supplied with separate hard coal fires on grates of 15 square feet area. The heated gases from the fire are passed around and then through the dryer by a mechanical contrivance. Outside of the building are a cooling tower, an exhaust fan and a stack. The cooling tower is 7 feet in diameter and 10 feet high, plastered with cement and furnished with a 1½-inch water pipe spray and a drain to the city sewer. The lead coated fan is of the three-quarter housing top vertical discharge type of the Buffalo Forge Company, directly driven by a 6x8-inch horizontal, center crank Buffalo engine. The blast wheel is 78 inches in diameter, having blades 42 inches in width, and has a capacity of 24,000 cubic feet per minute at a speed of 280 revolutions per minute. The steel stack is 54 inches in diameter and 80 feet high, and is placed upon a heavy brick foundation, in which is a small furnace directly under the stack. The remaining apparatus includes four 125-horse-power boilers, four Merz grease extractors, two horizontal side crank engines of 75 horse-power each, a generating unit with capacity of 150 incandescent lights and several conveyors.

The garbage is dumped from the wagons, of 4 to 5 tons capacity each, into a large hopper, is immediately shoveled upon one of the conveyors and starts up an incline to the second floor, where it is ground into pieces which contain about one cubic inch. It is now passed through the same breeching that conveys the escaping gases to the cooling tower, into the revolving cylindrical dryer, entering at the front or high end of the cylinder. The garbage remains in the dryer for one hour and fifteen minutes, during which time, as the cylinder slowly revolves and the garbage passes from the front to the rear, it is not only subjected to the heat of the fire beneath and all around the cylinder, but by an arrangement at the back of the dryer, the gases are returned through the cylinder and thus brought into direct contact with the garbage. The gases pass from the back, where the garbage is dryest and requires the greatest heat, to the front where the garbage has just entered. The refuse which now has had all animal life destroyed is removed from the cylinder at the back and transferred by conveyors to the Merz improved extractors, where the grease is removed by the use of a solvent. After leaving the extractor the tankage, as it is now termed, is ground and screened and sold to fertilizer manufacturers.

The gases, which contain acetic, nitric and sulphuric acid, the exact composition depending entirely on the nature of the garbage, are sucked through the breeching to the cooling tower, where their temperature is reduced below their dew point depositing a large quantity of the watery vapor and purifying the gas to a considerable extent. The remaining gases are sucked on into the exhaust fan and immediately discharged into the stack. These gases are saturated when they enter the stack, but as they pass over the furnace in the bottom of the stack and mix with the hot gases from this furnace, the dew point of the mixed gas is lowered while the temperature is increased. The passing of the gas over this fire also destroys any remaining offensive odors that would otherwise escape into the atmosphere.

Although this plant has reduced as much as 175 tons of garbage per day, averaging about 80 per cent. of water, or, in other words, has handled 140 tons of watery vapor per day, the gases discharged at the top of the stack were odorless and almost invisible. The conduit for the conveyance of the vapors from the dryers was furnished by the Buffalo Forge Company and is the result of experiments extending over a number of years.

Letters to the Editor.

Reasons for an Engineer's Success.

Sir:—On page 567 of your issue of May 30 you comment on the remarkable success of a certain consulting engineer. I do not know to whom reference is made and for my purpose am glad that such is the case, because I believe that this gentleman's modesty prevented him from stating the true cause of the success. The two rules of procedure stated by him probably are applied by many other consulting engineers. The real reasons for his success are probably the following:

First: A strong character; second: Self confidence based on knowledge; third: A pleasant personality which has brought him a wide circle of friends and acquaintances. Not everyone can comply with the first two conditions because natural ability necessarily enters into them to a certain extent, but any one can if they will comply with the third, without which the other two never can bring an unqualified success.

Occasionally we see in advice to young engineers the desirability of cultivating the human side, but I have never seen it emphasized in the way that it should be, and I find too frequently that the men whom we should take for an example set a bad example in this respect. Your paper cannot possibly do any young engineer a greater service than to impress on his mind as the most important rule of life the desirability of pleasant or courteous treatment of *all* and the corollary thereto that that day has not been entirely profitable that does not see a new friendship made or an old friendship renewed.

Respectfully, Geo. Hill.

New York, June 1, 1903.

Tractive Resistance of Steel Wheelways.

[This communication was published once, but as about two lines were accidentally omitted it is republished.—Editor.]

Sir:—In your issue of April 25, 1903, page 438, are some data by General Roy Stone on the tractive resistance of the Murray Street, New York City, steel wheelway, which I desire to compare with that of the Transit Avenue steel wheelway in Chicago. General Stone states a result for the tractive resistance of the Murray Street wheelway which is equivalent to 14 pounds per ton on the level, while my results for the Chicago wheelway when clean was 19 pounds per ton on the level. As the New York trackway is laid in a stone-block pavement, the surface of the wheelway was probably clean, and therefore the two values are comparable. The results agree very well. The Chicago wheelway was made of a very light channel which was not well bedded, and therefore it should show the greater tractive resistance. Notice, however, that both of these results are much larger than is frequently claimed for a steel wheelway. It is claimed that some experiments conducted by an engineer of Pittsburg showed a tractive resistance of 3½ pounds per ton; but the axle resistance alone would be nearly, if not quite, that amount.

Incidentally General Stone gives the resistance of the "stone pavement" adjoining the wheelway as the equivalent of 45 pounds per ton. Photographs of the New York steel wheelway show the adjoining pavement to be rough stone blocks. Experiments by the writer on Chicago pavements (see page 29 of the author's Treatise on Roads and Pavements) gave a resistance for two pavements composed of "carefully dressed granite blocks" of 29 and 30 pounds per ton respectively, and for an "ordinary" granite block pavement 36 pounds per ton. These results seem entirely consistent with those for the New York pavement, since apparently the latter was much the rougher. There seems to be a considerably greater difference between the New York pavement and the "ordinary" Chicago granite block than between the latter and the special dressed block, and consequently the New York pavement should have considerably the greater tractive resistance.

Yours truly, Ira O. Baker.

Champaign, Ill., May 15, 1903.

Book Notes.

Storage Battery Engineering, A Practical Treatise for Engineers. By Lamar Lyndon, B. E., M. E. New York: McGraw Publishing Company. 382 pages, 6x9 inches, 178 illustrations. Price, $3.

A thorough knowledge of storage battery engineering is possessed by so few electrical engineers, outside of those allied with manufacturers, that it is believed that Mr. Lyndon's book will be welcomed by many electrical engineers, also by users of storage batteries, particularly because of the simple and straightforward manner in which the subject is treated. The work is intended to assist the practicing engineer in designing, installing and maintaining storage battery equipments, to guide him in making a selection and to give information regarding the advantages and limitations of the storage battery in practice. The absence of complex mathematics and the simple treatment of the subject from a chemical standpoint are worthy of favorable comment in view of the author's intentions in this respect. The general theory and requirements of the storage battery are first taken up, then a discussion of the active materials and the electrolyte. This is followed by the effect of rate of discharge, temperature of batteries, their efficiency, diseases and their remedies, the formation of plates of different types, testing, etc. The second part of the work is devoted to the application of storage batteries and their auxiliaries, to end cells, end cell switches, different types of boosters, etc. The application of batteries to different types of plants and an example giving the calculations necessary in the application of a battery to an isolated plant close the volume. The work is well written and will find a high position in the literature of electrical engineering.

Notes on Track: Construction and Maintenance. By W. M. Camp. Auburn Park, Chicago; published by the author. Cloth, 9½x6 inches 1214 pp., profusely illustrated; $3.

Like that eminent engineer, Herbert Spencer, who sank from railway construction to philosophy, Mr. Camp confesses that his first book sought in vain for years for a publisher. Finally it appeared serially in the Chicago contemporary of which he became editor, and received the benefit of criticism from its readers. The articles were revised, brought down to date, and enlarged 70 per cent. to form this volume. It is intended to be a treatise on the construction and maintenance of track, and on this account many elementary subjects are carefully explained and numerous trifling yet still import-

ant details are discussed in a manner calculated to make the experienced engineer somewhat weary. This feature is explained by the author as follows: "In order that the book may accomplish the highest usefulness, the learned engineer must occasionally find what to him is unnecessary explanation. It is hoped, however, that what has been deemed necessary for the trackman to know or use will be found intelligible to him; and what unnecessary explanation the engineer may find certainly cannot mislead him."

The introductory chapter, 69 pages, is a general discussion of what constitutes good track, and has an explanation of the latest standards of culverts on numerous roads which deserves particular mention. Chapter II., 87 pages, is on track materials, including ballast. Chapter III., 55 pages, relates to track laying, and explains the organization of crews for the purpose, the tools employed, and the special mechanical plant used where a large amount of such work is done. Chapter IV., 17 pages, is devoted to the best methods of ballasting and the types of cars for handling ballast expeditiously. Chapter V., 63 pages, explains the elementary problems of curve location, the effect of curvature on the wear of rails and wheels, the use of transition curves, and the various braces employed on curved track. Chapter VI., 228 pages, is an elaborate description of the various switches, frogs, switch stands, interlocking and signaling plant employed in this country and on some foreign roads. Chapter VII., 103 pages, is a valuable explanation of the methods of track maintenance which have been adopted by numerous roads, and contains a section on tie plates which is of special interest. Chapter VIII., 15 pages, describes the methods of double-tracking which have been followed on a number of noteworthy undertakings. Chapter IX., 67 pages, gives an account of the tools employed in track work and their use and care. Chapter X., 112 pages, describes work trains for crews, ditching, distributing rails and ties, ballasting, wrecking and fighting snow. Chapter XI., 245 pages, is of a varied nature, and discusses among other subjects the clearing of track after slides and washouts, fences and other guards on the right-of-way, tie preservation, automatic block signaling, and many other details not coming under previous divisions of the subject. Chapter XII., 83 pages, is an account of the or-

Chapter XII., 83 pages, is an account of the organization of the maintenance-of-way departments of a number of leading companies, and shows forcibly the rather surprising variety in such organizations. The book closes with 52 pages of notes and tables, useful in explaining or illustrating portions of the main text but not essential for a general comprehension of the subjects.

A track man with the zeal and diligence needed to read these 5½ pounds of notes, enough intelligence to apply the knowledge properly, and sufficient tact to raise the standard of work among his fellows, ought to rise rapidly in his calling. The above summary will indicate that the book is a useful encyclopædia to the engineer.

Fall River, Mass., with a population of 108,728, has, according to the report of the water board for 1902, 7,282 service connections and 6,973 meters. Of a total 1,593,250,000 gallons pumped during the year, 21.47 per cent. was unaccounted for. The consumption per consumer per day was 40.54 gallons.

Carl Waldemar Buchholz.

When Mr. C. W. Buchholz recently resigned as chief engineer of the Erie Railroad Company, this action did not imply the severing of his relations with that corporation or his retirement from engineering work. The company whose engineering department he has managed for so many years has retained him as consulting engineer and will thus have the benefit of his long experience, while he will gain the freedom from detail work to which his years of service have entitled him. Few engineers have had such a record of a lifetime of practically continuous service under but two corporations. With the exception of a few months spent in Brazil and two years as president and chief engineer of the Philadelphia elevated railway proposed about twelve years ago, Mr. Buchholz has given all his years of active endeavor to the Reading and the Erie companies.

He came to this country from Germany, and in May, 1865, secured employment as a rodman on the Reading system. At that time the Reading was engaged in the construction of numerous branches into the anthracite coal fields, and the work was one in which a young man able to push things had an excellent opportunity for advancement. Other companies were also rushing into these regions, for no road had then become the owner of coal lands and the traffic accordingly went to the line which gave the best service. The purchase and development of coal lands was a policy which was introduced later by the Lehigh and thus forced on all the competing roads. Under these conditions, Mr. Buchholz rose through the various grades of the engineering department to division engineer, resident engineer and finally engineer of construction.



C. W. Buchholz.

This last position he held in December, 1885, when he was appointed chief engineer of the Erie. His selection came about in an interesting way. One of the young men who had served in his corps a number of years before was S. M. Felton. The latter's career is an example of steadfast devotion to railroading. His father was a prominent railway manager, and as the son's inclinations were in the same direction he attended the Massachusetts Institute of Technology. His vacations were spent in field work, and after graduation he sought service in every branch of his chosen business. In this way he was at one time one of Mr. Buchholz's assistants, and acquired such a respect for the latter's work that later, when he undertook the rehabilitation of the Erie, the selection of the new chief engineer for this task was a matter of course.

The Erie at that time had a roadbed and a bad reputation but not much else. Its bridges were notorious, and even in the neighborhood of New York some of the important structures were so flimsy that the passengers held their breath every time they went over them. There was no switch and signal system worth mentioning, and the train crews ran along on a gait of their own, crossing from track to track or to sidings as occasion arose, without any system. Facing point switches were the rule. The ties were of a character not to be mentioned in polite society, the stations were sheds and the terminal facilities little better. To add to the difficulties of the new engineer's work, he had hardly any money to spend. The original location was well done; in fact the topographical conditions made any other location out of the question. The new management recognized that the passenger traffic could never be so important as the freight movement and the straightening of curves was accordingly made secondary to the reduction of grades. The first important work was the preparation of standards for all classes of construction and maintenance, and the rebuilding of the roadbed to conform to them. This was a slow task but was eventually accomplished, and enabled Mr. Buchholz to turn over a good track to a maintenance-of-way department which was organized at his suggestion. Bridges were rebuilt whenever necessary and funds permitted, and many of them contain novel features which have been illustrated in The Engineering Record, particularly the new Kinzua viaduct described on December 1, 1900. The injury to the track by washouts has recently led to a careful investigation of the best methods of flood protection, a work in which the company is acting in harmony with the New York State commission which is looking into the subject. In short the good physical condition of the Erie to-day bears strong testimony to the value of the work done by Mr. Buchholz on slender resources and in the face of great difficulties. Now that it is finished it is not surprising that he desires to leave the execution of new projects to the younger men whom he has trained in a school of strict economy and high ideals.

A Triple-Expansion, Non-Condensing steam pump is used in the plant of the Prudential Building, Atlanta, Ga., in connection with the elevator equipment. There are four Otis passenger elevators rising through the building, and under ordinary conditions the system is operated from the pump mentioned, which is a duplex Laidlaw-Dunn-Gordon pump, of 8½, 12 and 20-inch steam cylinders, 8½-inch water plungers and 18 inches stroke. Steam is furnished at 110 to 120 pounds pressure from two 150-horse-power Oil City tubular boilers, and the exhaust is used for heating purposes under the Webster vacuum system of distribution. The plant also provides lighting from two direct-connected 115-volt General Electric dynamos and 75-horse-power compound McEwen engines having 8½ and 14-inch cylinders and 12-inch stroke.

Directory of National Engineering Societies.

American Society of Civil Engineers. Annual convention at Asheville, N. C., June 9 to 12. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal.

Mr. Edwin G. Nicewarner has been appointed superintendent of the bureau of highways and sewers, of Pittsburg, Pa.

The John Stewardson memorial scholarship in architecture has been awarded to Mr. Walter W. Judell, of the University of Pennsylvania.

Mr. S. T. Wilson was recently elected president of Tippett & Wood, of which company he was previously vice-president and chief engineer.

Mr. G. S. Leavenworth has been appointed division engineer of the Buckhannon & Northern Railroad, at Fairmount, O., a part of the Wabash system.

Mr. Conway B. Hunt, computing engineer of the District of Columbia, has recently been appointed to the new office of engineer of highways, the change to take effect July 1.

Mr. Henry B. Hughes has resigned as assistant engineer, Bureau of Filtration, Philadelphia, and will engage in private practice, his office being in the Land Title Building.

Mr. Edwin P. Dawley, M. Am. Soc. C. E., has been promoted from division engineer to assistant chief engineer of the New York, New Haven & Hartford Railroad, with headquarters in Boston.

Mr. D. L. Ellis, formerly connected with the engineering department of the Great Northern Railway, was recently appointed city engineer of Great Falls, Montana, to fill the vacancy caused by the resignation of Mr. C. W. Swearingen.

Mr. Joseph T. Richards, M. Am. Soc. C. E., has been promoted to be chief engineer of maintenance of way of the Pennsylvania Railroad. He entered the company's employ in 1869 and has been an engineer of maintenance of way since 1893.

Messrs. George H. Benzenberg of Milwaukee and John W. Alvord of Chicago have been appointed members of the board of appraisal to determine the value of the Omaha Water Company's plant. They will select a third member of the board.

Mr. Chas. E. Russell, recently re-elected city engineer of Boone, Ia., has resigned this office and that of superintendent of water works, which he also held, to enter the service of the Government as inspector of harbor work at Waukegan, Ill.

Lieut. E. W. Laws, U. S. N., has been ordered from the Naval Academy, Annapolis, Md., to the Indiana as instructor in marine engineering, and Lieut. M. E. Trench, U. S. N., from the Sandoval to the Hartford as instructor in marine engineering.

Mr. H. O. Dunkle, former superintendent of the New Castle division of the Baltimore & Ohio Railroad, has been made superintendent of the Meadville division of the Erie Railroad, and will be succeeded by Mr. H. N. Donaldson, former superintendent of the Mahoning division of the Erie Railroad.

Obituary Notes.

Henry G. Morse, president of the New York Shipbuilding Company of Camden, N. J., died suddenly in New York on June 2, of apoplexy. Mr. Morse was born in Poland, Ohio, April 10, 1850, and was graduated from Rensselaer Polytechnic Institute in 1871. He was connected successively with the Wrought Iron Bridge Company, of Canton, O., the Morse Bridge Company, of Youngstown, O., the Edgemoor Bridge Works, of Wilmington, Del., and the Harlan & Hollingsworth Company, also of Wilmington, before the organization of the New York Shipbuilding Company in 1899. Mr. Morse was a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers and several clubs.

Bruce Price, a prominent architect of New York City, died on May 29 in Paris, whither he had gone to recuperate after an operation for severe stomach trouble. Mr. Price was born in Cumberland, Md., December 12, 1845. Instead of being sent to college, he was put into the office of Niernsee & Neilson, architects, of Baltimore, with whom he studied for four years and then went abroad for one year. In 1873 he commenced practice with Mr. George Baldwin, of Baltimore, as partner, and in 1877 came to New York. He designed a number of large office buildings in New York City; Georgian Court, the country residence of Mr. George Gould, at Lakewood, N. J.; Tuxedo Park, the country seat of Mr. Pierre Lorillard; Chateau Frontenac, at Quebec; Banff Park hotel, on the Canadian Pacific Railway in the Rocky Mountains; the Hunt Memorial, in New York City, and several memorial buildings at Yale University. Mr. Price was a member of several clubs and president of the National Architectural Society.

William Wright, reputed to be one of the oldest engine builders in the country, died at his late home in Brooklyn, N. Y., on May 26, at the age of 85, having been born in Newark, Wayne County, N. Y., May 17, 1818. As an amateur he built his first engine when 18 years old, and soon after was apprenticed to a local machinist. Later he began engine building in Palmyra and from there went to Rochester, where he was successful as a builder of rotary engines. From the latter city he went to Providence, R. I., where he became superintendent for Corliss, Nightingale & Company, and while in their service invented a rotative valve which became one of the distinguishing features of the Corliss engines. From Providence, Mr. Wright went to Brown Bros., of Waterbury, Conn., then to Woodruff & Beach, of Hartford, and afterwards to Newburgh, N. Y., where he organized, and for twenty-five years conducted, William Wright's Engine Works. He designed and superintended the construction of the massive engines for the Ridgewood and Mount Prospect pumping stations of the Brooklyn water works and the engines of the United States gunboat "Kearsarge." From 1863 to 1866 he was a member of the New York Steam Engine Company, and built the engines of a number of warships. For twenty years he conducted the Washington Iron Works, at Newburgh, N. Y.

Notes.

The Memphis Engineering Society will hold its annual meeting on June 9.

Another Tunnel under the North River between New York and Jersey City was explained briefly at a meeting of the Rapid Transit Railroad Commission of the former city on May 26. The project is advanced by Mr. Wm. G. McAdoo, and consists essentially of twin tunnels running from Exchange Place in Jersey City to Fulton and Cortlandt streets in New York, with a connection between these two streets under Church Street. The same people are interested in this tunnel that are engaged on the completion of the old tunnel at Morton Street.

The Chicago Drainage Canal affords opportunities for the development of valuable water power, and, indeed, one at Joliet has already been made useful by means of an interesting low-head plant recently described in these pages. Another and larger development is proposed at Lockport, in accordance with an enabling act passed at the last session of the state legislature in connection with the annexation of the Calumet and Evanston districts to the original sanitary districts. The power plant will present a number of special features because of the low head and the necessity of providing at all times for the navigation interests using the neighboring Illinois & Michigan canal, part of which will be taken over in connection with this work.

The Municipal Engineers of the City of New York, the society recently formed among the technical staffs of the city departments, adopted the following resolutions on May 27: "Whereas, Mr. Andrew Carnegie has, in a letter addressed to the four national engineering societies and the Engineers' Club, generously offered to give the sum of about one million dollars for the construction of a building to be devoted to the general interests of American engineering; and whereas, The spirit and dimensions of the gift indicate the intention of the liberal donor that the building should be used in the broadest and fullest extent by American engineers; therefore, Resolved, That this society desires to express its profound appreciation of the broad interest taken by Mr. Carnegie in American engineering and the generous gift by which he has characterized this interest and, Resolved, That this Society of Municipal Engineers of the City of New York hereby expresses its earnest hope that the five organizations to which Mr. Carnegie addressed his offer will unanimously accept the magnificent gift and work in the fullest harmony to carry out the trusts imposed upon them by the donor for the advancement of American engineering."

A Twenty-Stall Round-House at Portsmouth, Ohio, on the Norfolk & Western Railway has recently been equipped with a Sturtevant heating system. The plant consists of a large exhaust fan and heater from which air is forced through brick flues and galvanized iron pipes into each engine pit. By delivering the warmed air at these points, any snow or ice on the engines as they come from the road is melted; another advantage is that as the warm air rises it carries the smoke and steam upward from the level at which the men work. During warm weather the fan is run without steam in the heating coils, thus affording ventilation.

Furnace Slag for a Macadam roadway has been tried in Cleveland, Ohio. The different sizes of slag were rolled in 2-inch layers, the voids being filled by adding slag dust, washing it in, and then rolling. After one 2-inch layer was thoroughly compacted, another was added and the same process repeated. After completing 12 inches in this manner a top coating of fine trap rock 2 inches thick was added. All the teaming of the material for the construction was carried on over the roadway without serious damage. This road has now been through a winter season, and Mr. William J. Carter, chief engineer of the department of public works, states that it is in excellent condition.

The Cotton Mills of the Hope Mills, N. C., Manufacturing Company have been equipped with a hot-blast system of heating. The finishing building and weave shop each contain two stories, and, in addition to warming them, and the second story of the storehouse, provision has been made for heating the first story of the latter sufficiently to prevent the freezing of the automatic sprinkler system. One section of the steam coils of the heater receives the exhaust from the fan engines and the other sections the exhaust from the mill engines; it is proposed to use live steam at 90 pounds at night. The equipment was designed and installed by the B. F. Sturtevant Co. under a guaranty to maintain an interior temperature of 70 degrees with an out-door temperature of 10 degrees.

Transverse Breaking Tests of plate glass furnished by several different makers were recently made at the Watertown Arsenal. The thickness of the glass varied from ⅛ inch to 1 inch, and the span from 8 inches to 24 inches. The modulus of rupture, which ranged from 2,000 to 8,000 pounds per square inch, was generally greater with the lesser thicknesses. Of the various kinds of glass tested, rough, ribbed, polished and wired, there was little difference in strength; except in the case of the wired glass, which showed somewhat greater strength than the other kinds; the strength being also greater for the sandwich rolled than for the solid rolled wired glass. The strength of glass set in frames was practically double that of the specimens tested transversely. Very little difference appeared between samples of the same kind of glass submitted by different factories.

Tensile Tests of Wrought Iron Bars, showing the effect of overstraining followed by intervals of rest, were made at the Watertown Arsenal upon four kinds of wrought iron; Common Refined, Best Puddled, Burden's Best and Norway. One test on each kind was made in the ordinary manner. With the other specimens, an overstraining load was applied, ranging from 25,000 to 45,000 pounds per square inch, followed by an interval of no load, after which the loading was resumed until rupture was reached. The gain in the elastic limit produced by the overstraining loads was well shown throughout the series, and ranged from 2,000 to 6,000 pounds per square inch. It was also apparently shown, although these effects are not so well marked, that the greater the magnitude of the overstraining load and the longer the interval of rest between the two loadings, the greater was the gain in the elastic limit. No effect of the overstraining load upon the contraction of area was apparent.

The Cost of Pumping the water supply of Mankato, Minn., during the year 1902 was $14.73 per million gallons based on the station expense alone, or $50.69, based on total expense, including interest on bonds, depreciation, etc. The average daily consumption was 870,391 gallons, and the head of water pumped against, 223 feet. The source of supply is two artesian wells, 8 and 10 inches in diameter, respectively, and 650 feet deep. The water is supplied direct from the pumps as well as from the 870,999-gallon reservoir. The average daily use per capita for the 7,248 consumers (free water excepted) was 109 gallons, according to the last annual report of City Engineer J. R. Thompson. The number of gallons pumped during 1902 was 13,311,000 less than during the previous year.

Annexation of Calumet and Evanston to the Chicago Sanitary District is provided for in a bill recently signed by Governor Yates of Illinois. Although the bill had a stormy passage through the two houses of the legislature and was nearly buried under objectionable amendments because of opposition to it by those interested in the Illinois and Michigan canal, it has been passed in almost its original form. A referendum clause has, however, been added to it which provides that in case a petition signed by not less than 3 per cent. of the legal voters of the territory within the limits of the sanitary district of Chicago as enlarged is presented within 60 days after the passage of the act, the act shall be submitted to a vote of the electors in the sanitary district at the general election in November, 1904.

The Use of Wide Tires has been made the subject of a New Hampshire law approved March 7 of this year, which provides that the selectmen of towns and city assessors may abate a portion of the tax assessed against owners of "freight, express and farm wagons, carts, coaches or carriages constructed before January 1, 1900, having tires less than 3 inches in width, provided the owner or possessor thereof will change the wheels on said vehicles so that the rims or felloes of the wheels used on a vehicle carrying more than 2 tons in weight and less than 4 tons, shall be at least 4 inches wide; for carrying more than 4 tons and less than 6 tons, so that the rims or felloes shall be at least 5 inches wide; and for carrying more than 6 tons the rims or felloes shall be at least 6 inches wide, provided that the abatement shall not exceed $5 in any one year for each vehicle, the wheels of which are changed as herein provided, nor more than $15 for any one vehicle changed as aforesaid."

The Automatic Sewage Sprinkler employed at the Reigate disposal works in England has been commended in a report by Dr. J. C. Thresh, medical officer of Essex County. These works have already been described in this journal, and it need only be mentioned now that there is a primary bed with an area of 38½ square yards and a secondary bed of 50 yards, both filled to a depth of 3½ feet with coke. The sewage contains considerable tannery refuse, which is difficult of treatment, and is distributed over the primary bed by a Candy revolving sprinkler; the effluent from this bed is similarly distributed over the secondary bed. The sewage remains in each bed about 15 minutes. The beds were found to remove 91 per cent. of the suspended matter, all of the free ammonia, 92 per cent. of the organic matter and some of the chlorides. This excellent result is attributed by Dr. Thresh very largely to the mothod of distributing the sewage over the beds, as in other respects the works are not different from a number in his own county which are not giving satisfaction.

The Enforcement of Sanitary Ordinances in Chicago is to be more strict in the future than heretofore, and in order to educate careless persons, it is even proposed to place at the sidewalk corner such legends as these: "Don't throw it in the street," "Carry it to a paper box," "Don't spit on the sidewalk." In New York City a similar enforcement of the law is also being carried out. The street cleaning department has distributed cards stating on one side that it is forbidden by city ordinance to throw any discarded article into the street—paper, ashes, dirt, garbage, banana skins and the like—and on the other side of the card are given three lists of waste matters, which are to be put into garbage receptacles, ash receptacles, and rubbish bundles, respectively. The rubbish bundles must be kept indoors, and when ready for removal a red card with "P. & R." printed on it is hung out, and the driver of the paper cart calls for it on his next round.

Asphalt Repairs due to insufficient foundation have been extensive in San Antonio, Tex., according to a recent report of City Engineer J. D. Rullman, who states that the contract for some original paving was signed in October, 1900, and the final estimate given February, 1902. Uvalde (Texas) asphalt was used, and the street railway company was required to pay for that laid between the rails and 1 foot outside. On two streets where 9,396 and 2,258 square yards were thus laid for the railway company, 981 and 174 square yards, respectively, were repaired during April last. In these two cases the ties were simply laid on rolled ground, while elsewhere there was 4 inches of concrete under the ties and they were completely surrounded with concrete, which was carried up to within 2 inches of the finished grade. Of the 35,481 square yards laid for the railway company, 1,567 were repaired during April.

A Metallurgical Laboratory for the Michigan College of Mines, at Houghton, is assured. The legislature has passed a bill appropriating $171,900 for the college for the biennium beginning July 1 next. The most important item of this appropriation is that of $45,000 for the construction of a metallurgical laboratory. The college intends to erect a substantial building for this purpose and to thoroughly equip it for experimental work and instruction in the different classes of metallurgical processes. Cyaniding and other wet methods of concentration will be exemplified in the equipment and electrometallurgy will receive special attention. It is intended to install furnaces of larger capacity than is usual in college laboratories. The board of control of the college is taking steps to create a separate department of ore dressing and metallurgy. The equipment for this department will be housed in the new metallurgical building and in the ore dressing mill now possessed by the college. A man to fill the new chair has not been selected. Besides the amount for a metallurgical laboratory the bill carries appropriations for extending the equipment of the department of mining engineering, which now occupies its new building erected last year, and for completing the equipment of the chemistry building also erected last year.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 29, 30, 31, 32 and 35.

WATER.

Alexandria City, Ala.—T. W. Harris, City Clk., writes that the citizens voted June 1 to issue bonds for water works.

Oakland, Cal.—An ordinance has been introduced in Council instructing the City Engr. to prepare plans and estimated cost of a distributing system for water supply, together with the estimate for cost of pumping stations and plants for distributing reservoirs.

San Bernardino, Cal.—The City Engr. is stated to have been instructed to prepare plans and specifications for the new water works.

Dunsmuir, Cal.—The Dunsmuir Water, Light & Power Co., of Dunsmuir, capital $100,000, has been incorporated. J. B. Dougherty, Chas. O. Clarke, and John M. Campbell, of Dunsmuir, are the directors.

San Francisco, Cal.—The Mussel Slough Water Co. has been incorporated, with a capital of $60,000. Principal place of business, San Francisco. Jos. P. Chamberlain, San Francisco; Geo. W. Towle, Jr., San Rafael, and Chas. A. Wilhelm, Alameda, are among the directors.

The Bd. of Supervs. is stated to have directed the Bd. of Pub. Wks., through City Engr. C. E. Grunsky, to prepare plans and specifications for the establishment by the city and county of a salt water system for fire protection.

Colorado Springs, Colo.—City Engr. E. W. Case in his report on present irrigation system recommends that several new and larger reservoirs be constructed, and that sewer pipe be substituted for ditch boxes.

La Veta, Colo.—The citizens are stated to have voted May 25 to issue $15,000 bonds for a gravity system of water works.

Montrose, Colo.—The Uncompahgre Valley Water Users' Assoc. has been incorporated, with a capital of $100,000, by John C. Bell, Geo. S. Conklin, A. H. Stockham, and others. This association was organized under instructions from Secretary of the Interior at Washington, D. C., to acquire the Gunnison tunnel and distributing canals to be built by the government. Its objects are to distribute and supply the waters provided by the tunnel for irrigation, domestic, mechanical and power purposes, to construct reservoirs and to comply with all the government regulations. The territory thus to be supplied is the Uncompahgre Valley, including lands from the north line of Ouray County northward to Gunntson River. Main office to be in Montrose, with a branch in Delta.

Ft. Collins, Colo.—Surveyors under City Engr. McAnnelly and Consulting Engr. C. P. Allen, of Denver, are about to begin work on the final survey for the proposed water works; estimated cost, $160,000.

Shelton, Conn.—The City Water Supply Co. has been chartered by the General Assembly, with a capital of $150,000. It is granted a franchise to divert water from Four-mile Brook, a tributary of Housatonic River in town of Seymour; it also has power to distribute water to the Shelton Water Co. in the town of Huntington. Incorporators: Wm. S. and Chas. N. Downs, of Derby, are among the incorporators.

Atlanta, Ga.—The Special Com. of Water Bd., which has had under consideration the question of expending the $150,000 to be derived from the sale of bonds for improvement of water works, has recommended that $75,000 be expended in laying small pipe for domestic consumers and $75,000 in duplicating big main from river to reservoir.

American Falls, Idaho.—Lyman Skeen, of Ogden, Utah, is stated to have secured the contract for constructing the canal system for the American Falls Canal & Power Co., for $325,000.

Julietta, Idaho.—D. Mackintosh, of the Julietta Water Co., writes that it is proposed to construct water works, at a cost of $3,000. Engineer, H. W. Weber.

Oro Fino, Idaho.—See "Power Plants, Gas and Electricity."

Decatur, Ill.—Fred. Litterer, Ch. Engr. of Water Wks., in his annual report recommends the building of a new settling basin, 26 ft. wide, 56 ft. long and 10 ft. high, 4 steel tanks for the filtering plant, the replacing of the East Allis plunger with a new pump, a new intake and the cleaning of the present one.

Rockford, Ill.—The Fire and Water Com. is stated to have approved the laying of about 6,000 ft. of water main extension.

Chicago, Ill.—Bids will be received June 10 by the Bd. of Local Improv. for constructing water supply pipes in portions of numerous streets. Andrew M. Lynch, Pres.

Goshen, Ind.—It is stated that bids are wanted June 15 for a well 40 ft. in diameter and 30 ft. or more deep. B. C. Bender, City Clk.

Chickasha, Ind. Ter.—The citizens are stated to have voted May 23 to issue $135,000 bonds for water works and a sewerage system.

Manchester, Mass.—The citizens are stated to have voted to expend $5,000 for new water mains.

South Deerfield, Mass.—Bids are wanted June 15 for pipe castings, hydrants, valves, etc., as advertised in The Engineering Record.

Merrimac, Mass.—See "Power Plants, Gas and Electricity."

Ishpeming, Mich.—It is stated that the Bd. of Pub. Wks. will add 400 water meters this season.

Truman, Minn.—J. L. White is stated to have secured the contract for water works system, at $6,000.

Minneapolis, Minn.—Bids are wanted June 23 by Joshua Rogers, City Compt., for $815,000 municipal bonds. Said bonds are issued for the following purposes: $100,000 for extending the water works system; $215,000 for building, repairing and improving bridges; $150,000 for street improvements, etc.

Bagley, Minn.—P. H. Pederson, Village Recorder, writes in regard to water works that he is ready to receive plans and prices on water works. The village is figuring on a tank and about 4 blocks of water mains. A vote will be taken on the question.

Thief River Falls, Minn.—It is reported that H. Fant contemplates installing a system of water works.

Pickens, Miss.—The city is disposing of bonds for constructing water works. J. F. Wilburn, Clk.; Kirkpatrick & Johnson, Engrs., Jackson.

Tupelo, Miss.—The citizens are stated to have voted May 29 to issue $60,000 bonds for water works.

Gulfport, Miss.—The citizens are stated to have voted May 29 to issue $40,000 bonds for water works.

Yazoo City, Miss.—See "Power Plants, Gas and Electricity."

Jefferson Barracks, Mo.—See "Government Work."

Emerson, Neb.—The Council has decided to install water works, and Arnold C. Koenig, 514 Bee Bldg., Omaha, Neb., has been employed to furnish the plans and specifications. Webb Kellogg, Mayor.

Camden, N. J.—Bids are wanted June 9 for removing old reservoir; amount available, $10,000. L. E. Farnham, City Engr.

Wantagh, L. I., N. Y.—Bids will be received June 16 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, N. Y. City, for remodeling and extending the Wantagh pumping station, including the pumping plant, pump well and infiltration gallery system, with appurtenances.

Yonkers, N. Y.—The Bd. of Water Comrs. has adopted the recommendation of Engr. Church that the dam at Grassy Sprain Lake be raised 15 ft. in place of 10 ft., as proposed.

Syracuse, N. Y.—It is stated that the State Fair Comrs. will construct a $10,000 water works at the Fair grounds at Syracuse.

Gouverneur, N. Y.—The citizens are stated to have voted May 20 to expend $7,000 to enlarge the water works.

Horseheads, N. Y.—The Com. appointed to investigate the advisability of having water works is stated to have reported recommending that bids be called for construction.

Cando, N. D.—The contract for constructing water works (bids opened May 25) has been awarded to W. D. Lovell, of Des Moines, Ia., for $7,990. H. D. Skinner, City Aud.

Dayton, O.—The Bd. of Pub. Service is stated to have recommended the extension of the water works at a cost of $56,000.

New Bremen, O.—G. A. Kunning, Clk. Bd. Pub. Affairs, writes that all bids received May 19 for construction of water works were rejected as being too high. New bids will be received in a few weeks.

Barberton, O.—W. F. Robison, Village Clk., writes that the village has in contemplation the construction of new water works.

Toledo, O.—W. F. Brown, 55 Law Bldg., has completed plans for a 20-in. submerged water main across Maumee River; estimated cost, $32,000.

Lorain, O.—The Crystal Water Co., of Lorain, has been incorporated, with a capital of $25,000, by Richard Conrad, W. H. Cumidon, W. A. Middleton, and others.

Wooster, O.—J. B. Minier, City Aud., writes in regard to new water works that no definite action has yet been taken. Geo. Boegner, Supt. of Water Wks., is experimenting with driven wells under direction of Bd. of Pub. Service. Philip Markley is City Engr.

Cleveland, O.—Bids will be received on June 13 by the Secy. Bd. Pub. Service for furnishing about 248 tons of manhole rings and covers, as advertised in The Engineering Record.

Bids are wanted June 12 for furnishing and installing in the engine house Kirtland St. pumping station, the steel, c. i. and brass work for the main floor; columns, balconies, stairways, etc. W. J. Springborn, Pres. Bd. Pub. Service.

Milford, O.—Bids are wanted June 30 for $25,000 bonds to be used for constructing water works and supplying water to the inhabitants of Milford. H. G. Murphy, Village Clk.

Vale, Ore.—The Dept. of the Interior at Washington, D. C., is reported to have sent its engineers to Malheur County to make surveys for irrigation works, to cost about $2,000,000.

Coopersburg, Pa.—Bids are wanted June 15 for furnishing material and constructing a gravity system of water works, embracing approximately 10,500 ft. of 8-in., 4,500 ft. of 6-in., and 5,000 ft. of 4-in. pipe, 25 double nozzle fire hydrants, 25 8x6x4-in. valves and boxes, and a 300,000 gal. reservoir. Warren F. Cressman, Engr., Sellersville.

Reading, Pa.—Bids are wanted July 7 for a 15,000,000 gal. pumping engine and 4 horizontal water tube safety boilers, as advertised in The Engineering Record.

Millersville, Pa.—G. A. Brenckman, Post-Master, writes that it is proposed to sink an artesian well. J. M. Porter, of Easton, has the matter in charge.

Latrobe, Pa.—It is stated that charters have been granted to the Ligonier Township Water Co. and the Cook Township Water Co., both of Latrobe, with capital of $5,000 each, and the following officers: G. W. McHenry, Latrobe; D. B. Peoples, Milwood, and J. A. R. Ruffner, of Greensburg.

Erie, Pa.—Bids are wanted June 27 for furnishing and laying submerged c. i. intake water pipe, both advertised in The Engineering Record.

Mt. Penn, Pa.—The Mt. Penn Water Co. is reported incorporated, with a capital of $10,000. C. M. Kline, G. C. Hartline and J. T. Miller, of Mt. Penn, are among the incorporators.

Scranton, Pa.—Jas. Kerr, of Clearfield; Wm. L. Connell, of Scranton, and others, are about to apply for a charter for the City Water Co., of Scranton, Pa.

Chattanooga, Tenn.—The Wilder Springs Water Co. has been organized, with a capital of $10,000, for the purpose of supplying Sherman Heights and East Chattanooga with water. N. H. Brown, O. L. Lockwood, and Norris Headrick, are the incorporators.

Sherwood, Tex.—The Irion County Irrigation Co. of Sherwood has been incorporated; capital, $3,240. Incorporators: Frank Olney, W. H. Blanks, and others.

Elgin, Tex.—L. A. Sessums, City Secy., writes that the contract for constructing water works (bids opened May 27) has been awarded to M. Griffin O'Neil, of Dallas.

Glen Flora, Tex.—The Kinchelor Irrigating Co. of Glen Flora has been incorporated; capital, $75,000. Incorporators: David Dickey, F. W. Bullock and C. H. Waterhouse..

Salt Lake City, Utah.—The Parley's Canyon Irrigation Co. has been incorporated, with a capital of $25,000, by John Gabbott, Willard B. Richard, and others. The company will own and operate a portion of the waters of Parley's Canyon Creek.

Danville, Va.—A commission consisting of Nesbit Wingfield, of Augusta, Ga.; G. C. Whipple, of New York, and Prof. Wm. P. Mason, of Troy, N. Y., has been appointed to investigate the water supply of Danville, Va., with reference to present and future conditions. The commission is to report about June 20 to a joint committee of City Council and the Dan River Power & Mfg. Co.

Ft. D. A. Russell, Wyo.—See "Government Work."

Haines, Alaska.—See "Government Work."

Ottawa, Ont.—The Water Works Com. on May 26 received a report from City Engr. Kerr recommending the construction of a reservoir as an adjunct to the pumping station in the supply of water for fires.

Grimsby, Ont.—The Council is reported to have decided to purchase 22 acres of land from Mr. Beamer, for the purpose of boring for water and erecting a pump house.

Niagara Falls, Ont.—Bids are wanted June 25 for one 3,000,000 gal. pump, as advertised in The Engineering Record.

Marieville, Que.—Engineers Dupont & Leduc, of Montreal, write that the following bids for constructing reservoir and pumping station with gasoline engine, at Marieville, were opened May 20: The John McDougall Caledonian Iron Works Co., Ltd., Montreal, bid for a Worthington two-gauge turbine pump, 465 gal., 65 ft. pressure, and a lazier gasoline engine of 35 H.-P., $2,760, and H. Hubert, of Marieville, for a reservoir and pump house, $3,895.

SEWERAGE AND SEWAGE DISPOSAL.

Birmingham, Ala.—Local press reports state that bids will be opened June 15 by the Jefferson Co. Sanitary Comn. for $100,000 sewer bonds.

Sacramento, Cal.—The Martin Pipe & Fdry. Co. is stated to have submitted the lowest bid May 18 for the sewer c. i. pipe at $47,000.

Moultrie, Ga.—The City Council is reported to be considering the question of constructing a sewerage system.

Rochelle, Ill.—The Council is reported to be considering the construction of the Spring St. sewer outlet, at a cost of $7,000.

Rockford, Ill.—The Bd. of Local Improv. is reported to be considering the construction of a new trunk line sewer for the east side of river connecting streets in 1st and 3d Wards, and extending to city limits in Highland. Edwin Main, City Engr.

Moline, Ill.—It is stated that there is an ordinance before Council providing for sewers in the 5th and 6th Wards.

East St. Louis, Ill.—E. G. Helms, City Engr., is stated to have been requested by City Council to prepare plans and specifications for a main sewer for eastern part of city.

Chickasha, Ind. Ter.—See "Water."

Ft. Dodge, Ia.—Bids will be received June 8 by the City Council for furnishing material and constructing an 8-in. sanitary sewer in portions of 3 streets; also 20 and 24-in. storm water sewer in portions of 3d and 4th Sts. D. A. Weller, City Clk.

Sioux City, Ia.—The contract for constructing storm water sewers (bids opened May 26) has been awarded to M. L. Flinn, of Sioux City, at $20,095. This work includes 7,050 ft. of sewers 12, 15, 18, 20 and 24-in., 1,000 ft. 54-in. and 1,000 ft. 60-in. in diameter, 55 manholes and 75 catch basins. The same contractor also secured the contract for 4,500 ft. 8-in. sewer and 14 manholes (bids opened May 12) at $1.15 per ft., or a total cost of $5,945. J. M. Lewis, City Engr.

Ottumwa, Ia.—The contract for constructing 4,100 lin. ft. of South Ottumwa trunk sewer (bids opened Apr. 6) was awarded May 16 to J. W. Scott, of Ottumwa, at $7.07 per lin. ft., size 7x5 ft. brick in Portland cement, average cut 17 ft.

Waterloo, Ia.—It is stated that bids are wanted June 9 for constructing 8 to 12-in. pipe sewer in portions of several streets. B. G. Stewart, City Clk.

Ann Arbor, Mich.—City Engr. E. W. Groves estimates the cost of a storm sewer from Allen's Creek to the intersection of E. University Ave. and Packard St. at $11,822.

Winona, Minn.—Bids are wanted June 22 for 740 ft. 28-in. and 1,800 ft. 30-in. brick or vitrified pipe storm water sewer. G. P. Coleman, City Engr.

Yazoo City, Miss.—See "Power Plants, Gas and Electricity."

Atlantic City, N. J.—According to press reports City Engr. J. W. Hackney, in conjunction with E. Kluehling, Consulting Engr., have prepared plans for draining the section bounded by Magillan, Pacific, Massachusetts and Georgia Aves.; the lowest estimate places the cost at $231,500. The plan recommended by City Engr. Hackney, which provides for a concrete conduit, is estimated to cost $326,100.

Canajoharie, N. Y.—Sewer bonds amounting to $36,000 are reported sold.

Mt. Vernon, N. Y.—The Council has passed resolutions authorizing the preparation of plans and specifications for the new sewerage system for n. e. section of city; also for the construction of a sewer in Madison St.

Lestershire, N. Y.—The following bids were opened for sewer work by the Bd. of Village Trus. June 1 (Engineers, Knight & Hopkins, of Rome): Thos. O'Dea, Cohoes, $74,980; Eveline Contr. Co., Waterford, $79,346, and Geo. B. Stucker, Harrisburg, Pa., $81,795. This work includes 48,000 ft. of brick and pipe sewers from 6 to 24 in. in diameter, 102 manholes, 67 catch basins, and 40 flush tanks. The trench is expected to average 9 ft. in depth, and will be excavated in sand, gravel and clay. All bids were rejected, the price of pipe quoted for the work running the bids above the appropriation.

Schenectady, N. Y.—Sewer construction bonds amounting to $125,000 have been sold.

Buffalo, N. Y.—Bids will be received until June 9 by the Bd. of Pub. Wks. for constructing 24, 30 and 36-in. brick and 10 and 12-in. tile sewers in portions of 3 streets. Francis G. Ward, Comr.

Brooklyn, N. Y.—Bids will be received June 17 by J. Edw. Swanstrom, Boro. Pres., for furnishing and constructing small quantity of pipe sewer in portions of several streets; also 799 lin. ft. 30 and 36-in. brick sewer in portions of E. 34th St.

Henderson, N. C.—H. T. Powell, Town Clk., writes that the citizens voted June 1 to issue $40,000 bonds for constructing a sewerage system and for street improvements.

Cincinnati, O.—Bids will be received June 18 by the Bd. of Pub. Service for furnishing material and constructing sewers and drains in portions of 3 streets; also June 29 (readvertisement) for constructing a trunk sewer and drains in portions of 3 streets. Geo. F. Holmes, Clk.

Jersey Shore, Pa.—Bids are wanted June 24 for the construction of certain main sewers, as advertised in The Engineering Record.

Altoona, Pa.—Harvey Linton, City Engr., writes that Jos. P. Horney, of Altoona, has received the contract for sewer work (bids opened May 29) at $6.15 per ft., or a total of $4,717. This work includes 767 ft. of brick sewers, 48 in. in diameter, and 3 manholes. The trench is expected to average 10 ft. in depth, and will be excavated in shale, in old sewer trench.

Contracts for 8,247 ft. of 8-in. pipe sewers were ratified by City Councils June 1. The contractors are: Thos. Farrell, W. W. Saupp, Isaac Bender and Chas. B. Clark, all of Altoona.

Harrisburg, Pa.—The following bids are reported to have been opened May 26 by the Highway Comrs. for the Seneca St. sewer: J. S. Bayard, $11,994; Bradley & Caldwell, $10,825; W. H. Opperman, $10,537; Geo. B. Stucker, $10,600; Fisher & Lynch, $11,165; Conwny & Lynch, $11,998; H. Opperman, $12,739.

Ingram, Pa.—Bids are wanted June 18 for constructing approximately 6,195 ft. 24, 27 and 30-in. vitrified pipe sewer. John McBride, Boro. Engr.

East Providence, R. I.—Perry & Shaw are stated to have secured the contract for sewers in Mauran and Burgess Aves.; probable cost, $10,000.

Providence, R. I.—The City Council has passed resolutions for sewers in W. Park, Bath, and N. Main Sts. and Reservoir Ave., at a total cost of $13,485.

Nashville, Tenn.—Foster & Creighton, Berry Blk., are stated to have secured the contract for a sewer to be run through the Murphy property at $39,695, and Jeff Davis is stated to have secured the contract for building a brick sewer, 7 ft. in diameter, from Lick branch sewer, for $9,528.

Houston, Tex.—City Engr. Dormant is reported to be in favor of issuing bonds as follows: $175,000 for gravel paving, $300,000 for drainage and storm water sewers and $250,000 for sanitary sewers.

Milwaukee, Wis.—Local press reports state that the Bd. of Pub. Wks. will recommend the construction of septic sewer tanks to carry Judge Tarrant's order in the Thill case, that a remedy must be found for the offensive discharge from the 30th St. sewer tunnel.

Beloit, Wis.—Bids are wanted June 12 for 8,578 ft. of 8-in. and 650 ft. of 15-in. pipe sewers, 30 manholes and 2 flush tanks. R. R. Caldwell, City Engr.

Marshfield, Wis.—The citizens are stated to have voted May 26 to issue $40,000 bonds for the construction of a sewerage system.

Haines, Alaska.—See "Government Work."

BRIDGES.

Pueblo, Colo.—The City Council has passed an ordinance appropriating $120,000 for the construction of bridges.

Hartford, Conn.—The House has passed a bill authorizing the city of Hartford to issue $1,709,000 bonds, with which to pay the city's share of the cost of constructing the bridge across Connecticut River.

Atlanta, Ga.—The Council is reported to be considering the building of a bridge at Edgewood Ave., to cost about $75,000.

Marseilles, Ill.—The proposition to issue $10,000 to aid in the building of a $17,000 bridge at Main St. is reported to have carried at the recent election.

Pekin, Ill.—Bids will be received by the Roads & Bridge Com. until June 12 for constructing a concrete arch bridge in Pekin Township. S. S. Smith, Chmn.

Chicago, Ill.—See "Government Work."

Terre Haute, Ind.—Press reports state that the Cleveland, Cincinnati, Chicago & St. Paul R. R. Co. is contemplating replacing the present bridge across Wabash River, in this city, with a 9-pier structure. G. W. Kittredge, Ch. Engr., Cincinnati, O.

Anderson, Ind.—Press reports state that the Co. Engr. has completed plans for the Delaware Ave. bridge. Appropriation, $18,000.

Indianapolis, Ind.—Bids will be received June 12 by the Bd. of Co. Comrs. for constructing bridges in Lawrence, Perry and Decatur Townships and 1 at W. Newton; also June 26 for bridges in Pipe and Wayne Townships. Harry B. Smith, Co. Aud.

Wabash, Ind.—Bids will be received June 17 by the Bd. of Co. Comrs. for constructing 8 concrete arch bridges. B. F. Clemens, Co. Aud.

Tulsa, Ind. Ter.—The Tulsa Commercial Bridge Co. is reported to have been incorporated with a capital of $75,000, and granted a franchise to construct a steel bridge in this city across Arkansas River. Incorporators: G. T. Williamson, L. M. Poe and M. B. Baird, all of Tulsa.

Council Grove, Kan.—Press reports state that the Main St. bridge across Noosho River has been carried away by the recent flood.

Newport, Ky.—Bids are wanted June 22 for constructing a 2-span steel bridge, 1 span 130 ft., the other 60 ft. W. J. Hissem, Co. Judge.

Burnside, Ky.—The County Clk. at Somerset writes that it is proposed to construct a bridge over south fork of Cumberland River at Burnside, to cost $20,000. J. N. Minton, Chmn. Bridge Com., Burnside.

Lake Charles, La.—The Carolina Steel Bridge Co., of Burlington, N. C., is reported to have received the contract to construct a steel girder bridge, 600 ft. long and 16 ft. wide, across English Bayou, for $9,100.

Skowhegan, Me.—The American Bridge Co. is reported to have received the contract to construct the bridge across Kennebec River. Appropriation, $15,000.

Cumberland, Md.—Press reports state that the Allegany Co. Comrs. and the Mineral Co. (W. Va.) Comrs. have decided to build a bridge across Potomac River, at Cumberland, in place of the Blue Bridge. The structure will cost about $10,000.

Springfield, Mass.—The following bids are reported to have been received by the Bd. of Superv. June 1 for raising the South-end bridge. There were 4 propositions on which bids were to have been submitted, as follows: First, for raising the bridge its full length, and the 2d for raising the 4th span, and then doing the work according to the city's plans, the other 2 propositions were for doing the work according to individual ideas: Chas. R. Trask, 3d $13,500, and 4th $14,500; he also submitted another bid at $15,500, agreeing to do the work and keep the bridge open during repairs; The Springfield Construction Co. bid $15,500, $17,000, $14,500 and $15,500 on the 4 propositions; Eastern Bridge Construction Co., 1st. $21,257, and 2d, $17,000; Donoghue & Childs, 1st, $15,000, and 2d, $15,400.

Palmer, Mass.—Bids will be received June 12 by John O. Hamilton, Chmn. Com. on New Bridges for constructing a steel bridge, also stone arch bridge in this town.

Lansing, Mich.—Governor Bliss has signed the bill authorizing the city of Lansing to issue $25,000 bonds to pay for the Washington Ave. bridge. A vote will be taken on the proposition.

Grand Rapids, Mich.—Bids are wanted June 27 for constructing a steel bridge across Grand River at North Park, as advertised in The Engineering Record.

Duluth, Minn.—Local press reports state that the City has been authorized to readvertise for bids for constructing a suitable bridge across the Canal, the City Engr. to furnish general specifications and the contractors to submit their own plans.

Judson, Minn.—The Comrs. of Blue Earth Co. are reported to be considering the building of a bridge in Judson.

Minneapolis, Minn.—See "Water."

New York, N. Y.—Bridge Comr. Lindenthal has, according to local press reports, ordered plans prepared for 2 bridges to be built across Harlem River, 1 to replace the present Madison Ave. bridge, the other to be built at Fordham Heights, and to be known as the Fordham Heights Bridge. The latter bridge is to be about 1,300 ft. long and 60 ft. wide.

Lowville, N. Y.—It is stated that $7,000 has been appropriated for the building of an iron bridge across Black River, between Lowville and Watson.

Binghamton, N. Y.—The building of a bridge at Front St. is reported to be under consideration.

Troy, N. Y.—Press reports state that the Governor has vetoed the bill authorizing the Troy & Colonie Bridge Co. to construct a bridge from Troy to Green Island.

Corning, N. Y.—The Owego Bridge Co. is reported to have secured the contract to construct the Gibson bridge for $30,000.

Rochester, N. Y.—Local press reports state that the N. Y. Central & Hudson R. R. Co. will build 3 bridges in this city, 1 each at Oak, Kent and Smith Sts., at a total cost of about $25,000. H. Fernstrom, Ch. Engr., N. Y. City.

Tonawanda, N. Y.—It is reported that $17,000 has been appropriated by the Legislature for the building of a bridge at Seymour St.

Buffalo, N. Y.—Local press reports state that the Comr. of Pub. Wks. has been authorized to award the contracts for constructing the viaducts over the Erie tracks and the Lake Shore tracks to Frank J. Reap, for the substructures at $63,587 and $122,162, respectively, and the American Bridge Co. for the superstructures at $88,667 and $69,049, respectively.

Ottawa, O.—Bids will be received by the Co. Comrs. until July 1 for constructing 2 steel or iron bridges over Blanchard River, 1 at Glanfor to be 167 ft. long, the other ½ mile east of Ottawa, known as Gypsy Lane, to be 232 ft. long. L. N. Welde, Co. Aud.

New Philadelphia, O.—Reports state that bids will be received June 15 by C. C. Frensell, Co. Aud., for constructing a 262 ft. bridge over Tuscarawas River at Zoar station.

Columbus, O.—Bids are wanted June 25 for furnishing material for constructing superstructure, substructure, approaches, etc., for the Cleveland Ave. bridge, in Marion Township. L. E. Jones, Co. Aud.

Columbus, O.—Local press reports state that the Co. Comrs. have awarded contracts for constructing the Hayden Run Bridge, as follows: substructure to Cook, Grant & Brode, at $46,632; superstructure, to the Indiana Bridge Co., at $41,000; approaches, to Reed & Snauffer, at $10,271.

Torresdale, Pa.—The Grand Jury of Bucks Co. recommends the building of a new bridge across Poquessing Creek at Torresdale, at the joint expense of the city of Philadelphia, the State and the Co. of Bucks.

McKeesport, Pa.—Local press reports state that the time for receiving bids for constructing the Whites Hollow bridge at Versailles Ave. has been changed. The plans have been altered, and new bids are to be received on the revised plans.

Nashville, Tenn.—Reports state that the Tennessee Central R. R. Co. intends extending its line to Harriman, which will necessitate the building of a steel bridge across Emory River. W. N. McDonald, Ch. Engr., Nashville, Tenn.

Georgetown, Tex.—Q. C. Horton, of Austin, is reported to have secured the contract to construct 4 steel bridges in Williamson Co. for $17,744.

Spokane, Wash.—The Bd. of Pub. Wks., according to local press reports, received the following bids May 21 for constructing the south approach of the Monroe St. bridge: *a*, superstructure; *b*, cement piers; *c*, approach; Minneapolis Steel & Machinery Co., *a*, $11,600; Puget Sound Bridge & Dredging Co., steel work as designed, $13,000; foundation of the company's design, including steel work, $24,400; Wm. Oliver, *c*, $14,600; *b*, $15,400; American Bridge Co., *a*, $12,500; Alfred W. Burrell, piers and abutments, $15,000; *a*, $15,670; Peter Costello, *b*, $14,500; Jas. C. Brond, *b*, $13,463; August Ilse, *b*, $13,456; McCreary & Willard, *a*, $13,200; Deeks & Co., informal, $12,982.

Piedmont, W. Va.—The Counties of Mineral, W. Va., and Allegany, Md., and the towns of Piedmont and Westernport (Md.), are reported to be contemplating the construction of a bridge at a cost of $14,000, between the 2 towns.

Portage du Fort, Que.—Bids are wanted June 9 for constructing the masonry and roadway approaches of the bridge across the north channel of the Ottawa River at Portage du Fort. Fred. Geiinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

PAVING AND ROADMAKING.

Bay Minette, Ala.—The Co. Comrs. are reported to have under consideration the building of a road, 100 miles in length, and intend calling an election to vote on the proposition to issue $150,000 bonds, to be used to build said road.

Helena, Ark.—The citizens have voted bonds to pave the streets with vitrified brick. Maj. Purvis, Helena, Ark., Engr.

Newport, Ark.—The City Council is reported to have decided to pave with vitrified brick on a portion of Front St.

Denver, Colo.—The Bd. of Pub. Wks. has passed a resolution to grade and curb with stone in the 13th St. Improv. Dist., at a probable cost of $42,000.

The Bd. of Pub. Wks. is stated to have received the following bids for paving on 14th St. from Lawrence St. to Colfax Ave.: Colorado Paving Co., with either Bermudez or Trinidad Lake Asphalt, $1.40 per sq. yd., and the Warren Kiola Asphalt Co. at $1.29 per sq. yd. It is reported that there are 18,743 sq. yds. to be paved.

S. Norwalk, Conn.—C. W. Blakeslee & Sons are reported to have secured the contract to pave Washington St. for $8,724.

Hartford, Conn.—The House has passed a bill appropriating $450,000 for State highway improvements during the next 2 years, ending Sept. 30, 1905.

Ansonia, Conn.—Bids will be received June 15 by the Bd. of Pub. Wks. for grading and macadamizing a portion of Wakelee Ave. Wm. H. Crook, Chmn.

Boise, Idaho.—Press reports state that the Northwestern Bridge & Construction Co., of Boise, has secured the contract to construct the wagon road from Roosevelt to Scott's Valley, a distance of 72 miles, for $35,500.

Danville, Ill.—The contract for paving on North and Van Buren Sts., for which bids were received by Bd. Local Improv. May 28, has been awarded to J. H. Palmer, of Danville, Ill., at $1.19½ and $1.23 per sq. yd. W. H. Martin, City Engr.

La Grange, Ill.—It is stated that bids are wanted June 13 for constructing 12,000 sq. ft. of cement sidewalks. J. A. Dillon, Village Clk.

Normal, Ill.—The town of Normal will pave a portion of Main St., which is 30 ft. wide, with Boston block.

Paxton, Ill.—It is proposed to pave Center and Washington Sts. with brick. C. F. Helman is City Engr.

Elgin, Ill.—Local press reports state that bids will soon be asked by the Bd. of Pub. Wks. for paving on Grove Ave. Estimated cost is reported to be $29,991.

Chicago, Ill.—The paving of a portion of La Salle St. with asphalt, at a cost of $128,000, is reported to be under consideration.

Chicago, Ill.—See "Miscellaneous."

Charleston, Ill.—The cost of paving with brick on 10th St. from Jackson to Lincoln Sts., 10,021 sq. yds., has been estimated at $18,496.

Plymouth, Ind.—The contract for paving about 38,000 sq. ft. on Liberty St. with brick on a gravel foundation, for which bids were received by A. E. Rhodes, City Clk., May 25, has been awarded to W. W. Hatch & Sons, of Goshen, at $1.52 per sq. yd., and for cement curb, 22 cts. per lin. ft.; total cost about $5,000.

Paoli, Ind.—The citizens of Southeast and Northwest townships are reported to have voted in favor of building a number of miles of free gravel roads in said townships.

New Albany, Ind.—Eugene L. Brisby, City Clk., writes that no bids were received on May 18 for paving with asphalt and vitrified brick portions of numerous streets.

Winamac, Ind.—The Pulaski Bd. of Co. Comrs. has ordered the immediate reconstruction of 10 miles of the Winamac and Medaryville road with gravel and crushed stone, at a cost of $26,000.

Versailles, Ind.—It is reported that Brown, Ottor Creek and Shelby Townships, Ripley County, have voted in favor of building pikes; aggregate cost, $65,000.

Indianapolis, Ind.—The Bd. of Pub. Wks. is considering paving with brick and macadam on a portion of Roosevelt Ave. at an estimated cost of $17,000.

Crownpoint, Ind.—Bids are wanted June 20 for constructing approximately 11,000 sq. yds. brick pavement around the public square. Nat. L. Smith, City Clk.

Sioux City, Ia.—The contract for paving portions of Jackson St. with sheet asphaltum, 42,000 sq. yds., for which bids were received by City Council May 26, has been awarded to the Barber Asphalt Paving Co., Omaha, Neb., at $2.05 per sq. yd. J. M. Lewis is City Engr.

Clinton, Ia.—Bids are wanted June 9 for furnishing material and macadamizing portions of several streets. W. E. Russell, City Clk.

Ottumwa, Ia.—The City Council has passed an ordinance to pave about 1,000 ft. on Maple St.

Des Moines, Ia.—It is reported that the resurfacing with asphalt the brick pavement on a portion of W. Grand Ave. is being considered.

Marshalltown, Ia.—Wm. Bremner, City Engr., writes that the following bids for (*a*) 15,500 sq. yds. asphalt paving, (*b*) 8,800 ft. of combined curb and gutter, and (*c*) extra grading per cu. yd. were received by the City Council May 25: The Barber Asphalt Paving Co., Equitable Bldg., Des Moines, *a*, $1.97; *b*, 65 cts.; *c*, 30 cts. (awarded contract). Western Constr. Co., Lafayette, Ind., *a*, $1.98½; *b*, 75 cts.; *c*, 36 cts.

Bids will be received by City Council June 8 for about 13,700 yds. asphalt paving and 8,000 ft. of combined curb and gutter. Wm. Bremner, City Engr.

Towson, Md.—W. W. Crosby, Engr. County Roads, writes that the contract for improving Eastern Ave. (bids opened May 26) has been awarded to Geo. F. Nardin, 773 W. Pratt St., Baltimore, for $11,250.

Annapolis, Md.—See "Government Work."

Hagerstown, Md.—The Council has passed ordinances providing for the paving of Baldwin House Alley and E. Washington St.

Dalton, Mass.—The town of Dalton is reported to be contemplating the building of a stone road at a cost of about $5,000.

Boston, Mass.—McGawley & Coughlin, of Boston, have secured the contract for paving Massachusetts Ave. with granite blocks on a concrete base, graveled pitch joints, at $11,047.

Supt. of Sts. Jas. Donovan has under consideration the following bids: For constructing a macadam road in Walter St., West Roxbury Dist., 8 bids, the two lowest being T. F. Welch, $7,975, and T. F. Menton, $8,134; for paving with granite blocks, on a concrete base, Austin St., Charlestown Dist., 12 bidders, the two lowest being J. J. Sullivan, $2,993, and W. H. Ellis, $3,050.

Pittsfield, Mass.—Press reports state that bids will be received by the Street Paving Com. until Jun. 8 for paving with asphalt on a portion of North St.

Fitchburg, Mass.—Walter A. Davis, City Clk., writes that about $10,000 will be expended on new paving, material to be granite blocks, tar and pitch joints.

Chelsea, Mass.—The Bd. of Aldermen has passed over the Mayor's veto an ordinance appropriating $3,000 for paving 2d St.

Natick, Mass.—Jas. McManus, Town Clk., writes that it is proposed to macadamize W. Central St., at a cost of about $14,500, part to be done by State Highway Comn.

Ithaca, Mich.—The Council has adopted a resolution to appoint a committee who will engage an engineer to prepare plans, specifications and an estimate of the cost of paving Center St.

W. Bay City, Mich.—The City Council has instructed the City Engr. to prepare estimates of the cost of paving with both brick and asphalt on Linn and Henry Sts.

Saginaw, Mich.—The following bids are reported to have been submitted May 21 for paving 120,000 sq. yds. with asphalt, brick, bitulithic, asphalt block and macadam: The prices given are on a 5 and 10-year guarantee respectively, excepting the Barber Asphalt Paving Co., which bid only on a 10-year guarantee (prices given are per sq. yd.): Barber Asphalt Paving Co., Trinidad Pitch Lake asphalt, $1.79; Trinidad Land asphalt, $1.60, and Bermudez, $1.76. Cleveland Trinidad Paving Co., sheet asphalt, $1.64 and $1.73, or brick, $1.54 and $1.64. John Scanlan, Trinidad or California asphalt, $1.71 and $1.88, or bitulithic macadam, $1.63 and $1.84. Central Bitulithic Paving Co., bitulithic macadam, $1.96 and $2.10. Z. & J. Laloned, macadam, 99 cts.

Ann Arbor, Mich.—Lennane Bros., of Detroit, are reported to have secured the contract to pave on 4th Ave., at $6,528.

Menominee, Mich.—The City Council has decided to pave with a concrete foundation, on Main St., at an estimated cost of $55,491.

Detroit, Mich.—Local press reports state that the Governor has signed a bill authorizing the issue of $50,000 bonds, for the purpose of improving Michigan Ave., in Springwells Township. A special election is to be held in the Township on the question of issuing these bonds.

Geo. E. Currie is reported to have secured the contract to repave with brick on portions of Beaubien and Catharine Sts., at $6,528 and $3,958 respectively. The contract for repaving on portions of 4 streets is reported to have been awarded to Currie & Conn, as follows: 1st St., $9,219; Hastings St., $6,722; Chene St., $11,882, and Baker St., $20,010.

The Cleveland Asphalt Paving Co. is stated to have secured the contract to pave with sheet asphalt on Brainard and Pitcher Sts., for $17,696.

Minneapolis, Minn.—See "Water."

St. Paul, Minn.—Local press reports state that the City Engr. is preparing plans and specifications for paving with sandstone on 5th St. from Bway. to Pine St.

Fielding & Shepley are reported to have submitted the lowest bids for paving with brick on portions of E. 7th and Mississippi Sts., at $42,200 and $13,400 respectively.

Duluth, Minn.—The City Council has authorized the expenditure of $90,000 for street improvements. This includes the paving with sandstone on a portion of Lake St. and the paving of E. Superior St. from 23d to 16th Aves., with anything but asphalt.

Cape Girardeau, Mo.—The Scott Co. Macadamized Road Co. of Cape Girardeau has been incorporated to build a macadamized road from this city to Kelso, Scott County; capital, $15,000. Incorporators: Gibboney Houck, Edw. C. Blomeyer and others.

Freehold, N. J.—Bids will be received June 15 by the Com. of the Bd. of Chosen Freeholders for constructing portions of the Manalapan and Freehold macadam road. John Guire, Dir.

Atlantic City, N. J.—The Mayor has signed the ordinance providing for the paving of Houston and Congress Sts. and Bellevue Ave., at a cost of about $15,000.

Mt. Holly, N. J.—Bids will be received until June 20 by the Co. Bd. of Freeholders for constructing a macadam road, 2½ miles long, from Beverly to the intersection of the stone road running from Burlington to Bridgeboro; also a gravel road, about 3 miles long, from Bass River Township to Ocean Co. line. John E. Darnell, Dir.

Ventnor, N. J.—This city is reported to be contemplating the construction of a 24-ft. wide steel, iron or concrete boardwalk.

Brooklyn, N. Y.—Bids will be received June 13 by J. Edw. Swanstrom, Boro. Pres., for regulating and repaving with asphalt, asphalt and granite block, medina sandstone, also laying cement sidewalks on portions of numerous streets. Engineer's estimate, 413,001 sq. yds. asphalt, 19,480 sq. yds. asphalt block, 19,000 sq. yds. granite block, 5,720 sq. yds. medina sandstone, 52,572 cu. yds. concrete, 19,053 cu. yds. earth excavation, 64,665 sq. ft. cement sidewalks, etc.

Sandy Hill, N. Y.—Orson C. Richards, Engr. of Pavements, writes that the following bids for laying 30,000 yds. of brick pavement, including curb and excavation, the village to furnish the brick, were opened May 28:

	17,000 cu. yds. excav.	15,000 lin. ft. 6"x24" curb.	30,000 sq. yds. pav't.	420 lin. ft. 6" sewer pipe laid.	12 catch basins.	22 water taps.	460 lin. ft. of ¾" water pipe.	90 gas taps.	1,000 lin. ft. 1" gas pipe.	Totals.
McGahey & Linehan, Little Falls..	$0.73	$1.65	$1.47	$0.35	$50.00	$6.00	$0.50	$2.00	$0.30	$83,119
Mulderry Bros., Albany.....	.38	1.34	.98	.63	70.00	3.00	.50	1.50	.25	57,971
Thos. Fitzgerald, Fredonia.....	.38	1.60	1.30	1.00	50.00	4.00	.50	3.00	.20	71,448
F. E. Gibson, Sandy Hill.....	.45	1.30	1.20	.50	50.00	1.00	.20	1.00	.20	64,544
Flood & Sherrill, Sandy Hill.....	.50	1.20	1.15	.60	60.00	1.00	.25	1.00	.25	62,674
Flood & Sherrill, Sandy Hill.....	.50	.50	.98	.60	60.00	1.00	.25	1.00	.25	47,074

Flood & Sherrill will receive the contract, as per last figures. The specifications will be changed from 6"x24" bluestone for curb to 6"x21" cement curb, and the cement in concrete will be changed from Portland to Shields Improved. This change will bring the cost below the appropriation.

Albany, N. Y.—City Engr. Roemer has completed plans and specifications for paving and curbing upper Bway., 3d, 4th and Columbia Sts., and Fowler and 2d Aves. The number of sq. yds. of paving is estimated at 34,509, and the curbing at 19,107 ft.

Albany, N. Y.—The Schenectady Contracting Co. is stated to have secured the contract to resurface with asphalt on a concrete base, on Bway. from Steuben to State Sts., at $17,940.

Buffalo, N. Y.—The German Rock Asphalt & Cement Co. is reported to have submitted the lowest bid for repaving Elmwood Ave. at $14,782.

Bids will be received by the Bd. of Pub. Wks. until June 9 for constructing and repairing hard material sidewalks from date of contract to June 30, 1904. Francis G. Ward, Comr.

Oswego, N. Y.—Local press reports state that bids will be received by the Bd. of Pub. Wks. until June 15 for paving with either asphalt, vitrified brick or bituminous macadam on portions of W. 3d, 4th and Mohawk Sts.

Rochester, N. Y.—The Rochester Vulcanite Pavement Co. is reported to have received the contract to pave with asphalt on West St. for $20,210.

The Rochester Vulcanite Pavement Co. is reported to have submitted the lowest bid for paving with asphalt on Almira St., at $8,234.

Henderson, N. C.—See "Sewerage and Sewage Disposal."

Cincinnati, O.—Bids will be received June 18 by the Bd. of Pub. Service for furnishing material and improving by grading, macadamizing, etc., portions of Grandin road; also June 29, for improving by grading, curbing and paving with brick portions of Columbia and Grayden Aves. Geo. F. Holmes, Clk.

Cleveland, O.—Bids are wanted July 1 for paving with brick portions of Euclid road and W. Madison Ave. Julius C. Doern, Clk. Bd. of Co. Comrs.

Portland, Ore.—The paving of Hood and Water Sts., at a cost of $40,000, is being considered.

According to local press reports Albina Ave. is to be paved with wooden blocks on a broken stone or gravel foundation.

Philadelphia, Pa.—Local press reports state that the following bids were received by Dir. of Pub. Wks. Costello for paving with Trinidad Lake or Bermudez Lake asphalt on portions of 86 streets, involving an expenditure of about $500,000: Filbert Paving & Construction Co., $2 to $2.21 per sq. yd.; W. S. P. Shields, $2.05 to $2.07 per sq. yd., and Vulcanite Paving Co., $1.79 to $2.22 per sq. yd.

New Castle, Pa.—The City Council has passed an ordinance to grade, curb and pave with asphalt block on a portion of Hamilton St., at an estimated cost of $17,000.

Mayor Jackson has signed the ordinances providing for paving with asphalt on Garfield Ave. and Liberty and Hamilton Sts.

Butler, Pa.—Press reports state that $40,000 is to be spent this year in street improvements.

Gettysburg, Pa.—It is stated that bids will be received until June 10 by the War Dept., Gettysburg National Park Comn., for grading, and constructing 3,882 ft. of road on Chamberlain Ave. J. P. Nicholson, Chmn.

No. Braddock, Pa.—The Wallace Construction Co. is reported to have secured the contract to grade and pave on a portion of Brinton Ave., for $16,728.

Spartanburg, S. C.—The citizens are reported to be in favor of issuing an additional $100,000 bonds for street paving purposes.

Ft. Worth, Tex.—Local press reports state that it has been decided to pave with asphalt on Houston St.

Houston, Tex.—See "Sewerage and Sewage Disposal."

Dallas, Tex.—The Barber Asphalt Paving Co. is stated to have secured the contract to pave with asphalt on a portion of Main St. at $2.40 per sq. yd. Total cost reported to be about $24,000.

Seattle, Wash.—The Barber Asphalt Paving Co. is stated to have secured the contract to grade and pave with asphalt, on First Ave., in all about 20,000 sq. yds., at $106,965, and the contract for a 10-year maintenance is also stated to have been secured by this Co. for $7,318.

The Com. on Streets has decided to recommend the regrading of 3d Ave. from Pine St. to Yesler way, at an estimated cost of $145,000.

Milwaukee, Wis.—Bids are wanted June 9 for grading, macadamizing, curbing with cement, and laying cement sidewalks in portions of numerous streets. Chas. J. Poetsch, Chmn. Comrs. Pub. Wks.

Hartford, Wis.—The citizens have voted in favor of issuing $12,000 bonds for paving Main St.

La Crosse, Wis.—Bids will be received June 20 by the Bd. of Pub. Wks. for furnishing material and improving by grading, curbing and paving with brick portions of 3d and 5th Sts. Approximate quantities: 15,075 sq. yds. pavement on 6-in. concrete foundation, 5,996 lin. ft. curbing, 9,654 cu. yds. grading, etc. H. J. Beckwith, Chmn.

Haines, Alaska.—See "Government Work."

Montreal, Que.—The City Council has adopted the reports of the Finance and Road Committees and has authorized the expenditure of $60,000 for flagstone sidewalks.

POWER PLANTS, GAS AND ELECTRICITY.

Russellville, Ala.—There is reported to be a movement on foot here to put in an electric light plant.

Stockton, Cal.—The citizens are reported to have voted on May 28 to issue $160,000 bonds for the construction of a municipal electric light plant.

Oakland, Cal.—Frank R. Thompson, City Clk., writes that the contract for lighting the streets and public buildings (bids opened May 25) has been awarded to Oakland Gas Light & Heat Co., at $7.25 per light per mo. all night and every night except full moon, night preceding and night following, 2,000 c. p. arc; lighting public buildings—incandescent lights, 5 cts. per 1,000 watts, and gas, 90 cts. per 1,000 cu. ft.

San Francisco, Cal.—The Humboldt Power Co. has been incorporated by Chas. P. Doe, of Alameda; Jas. Stanley, of Sausalito; C. Alvin Baird, of Eureka, and others, to supply consumers with electric light and power; capital, $500,000.

Winder, Ga.—The citizens are reported to have voted to issue $15,000 electric light bonds.

Oro Fino, Idaho.—F. M. Mitchell, of Grangeville, is reported to be preparing to install an electric light plant and a water works at this place. Power for generating the electricity and running the pumps will be obtained from the waters of Oro Fino Creek, which will be utilized by means of a flume about 1,500 ft. in length.

Galesburg, Ill.—The City Council has granted Wm. McKinley and associates a franchise to establish and maintain a heating plant.

Marseilles, Ill.—Michael Hayes, of Janesville, Wis., is stated to have secured the contract to develop the water power for the Marseilles Land & Water Power Co. The work consists of excavation of head and tail races and the erection of two large dams; contract reported to amount to $90,000.

Sterling, Ill.—A press report states that a dam is to be constructed at once across Rock River, 12 miles west of this city, to cost $200,000, which will develop about 150,000-H.-P. The power will be used for propelling many of the electric railways that are now under construction in this part of the State.

Galesburg, Ill.—The City Council is stated to have granted the McKinley syndicate, which recently purchased the local street car system, a franchise to build a central heating plant. It is reported that the company will expend $1,500,000 in this and other enterprises here, one feature of which will be the immediate construction of an electric street car line from here to Monmouth.

Brazil, Ind.—The Brazil Electric Co. has been organized, with a capital of $60,000. The company closed the deal for the new electric light plant here on May 25 and the ten-year contract for lighting the city. The company also secured a franchise north to Diamond, to which place it contemplates building a street car line from this city. Major Collins, Pres.; H. D. Falls, Secy.

Anderson, Ind.—Frank A. Sharp, City Clk., writes that the following bids for improving and enlarging the electric light plant were opened May 12: General Electric Co., Schenectady, N. Y., bid for generator, switchboard and turbine, $18,200; Westinghouse, Church, Kerr & Co., Pittsburg, Pa., bid for generator, switchboard, boilers, stokers, Corliss engine, $49,000, and using turbine, $39,750 (awarded contract); Anderson Elec. Co., Anderson, Ind., bid for generator, switchboard, boilers, stokers, Corliss engine, $47,554, and using turbine, $43,154; Stirling Co., Chicago, bid for boilers bricked, $11,000. The Detroit Automatic Stoker Co., Detroit; Green Engineering Co., Chicago, and Murphy Iron Wks., Chicago, bid for stokers, $3,665, $4,444, and $4,690 respectively; Brown-Corliss Engine Co., Corliss, Wis., for engine, $14,500; and Ridgeway Dynamo & Electric Co., for exciter and generator, $585.

Armstrong, Ia.—B. Burkhead, Town Clk., writes that the citizens voted May 18 to grant a franchise to the Armstrong Light & Htg. Co.

Schleswig, Ia.—W. H. Schultz, and others, are reported to have formed a company to install a gas plant.

Ft. Riley, Kan.—See "Government Work."

Harrodsburg, Ky.—It is stated that bids will be received by C. D. Thompson until June 27 for $18,000 electric light plant bonds.

Sanford, Me.—The Sanford Light & Power Co., of Portland, has been incorporated, to make and supply electricity or gas to the town of Sanford; capital, $50,000. C. A. Bodwell, Pres.; W. J. Bodwell, Treas., both of Sanford, Me.

Merrimac, Mass.—The town is reported to have voted to establish water works and a lighting plant.

Mansfield, Mass.—The citizens are stated to have voted May 25 to issue $40,000 bonds for an electric light plant.

Ford, Mich.—The citizens are reported to have voted to issue bonds for an electric light plant.

Fergus Falls, Minn.—Reports state that bids will be received by G. H. Gard, City Clk., until June 9 for furnishing f. o. b. 3,000 incandescent lamps of 4, 8, 16 and 32 c. p.

Two Harbors, Minn.—The Council is stated to have decided to install new electric machinery on specifications by Oscar Clausen, of St. Paul, Engr. Cost about $9,000.

Yazoo City, Miss.—Engineers Kirkpatrick & Johnson, of Jackson, Miss., have plans for water works, sewers and electric light plant for Yazoo City, comprising, approximately, 12 miles of sewers; 12 miles water mains with building, pumps, boilers, etc.; 300-Kw. generators with engines, etc.

McHenry, Miss.—The City Council is stated to have granted the Bauer Lumber Co. a franchise for an electric light plant.

Laconia, N. H.—The plant of the Laconia Electric Light Co. was destroyed by fire May 26, and will be rebuilt at once.

Rockaway, N. J.—The Rockaway Gas Co., of Rockaway, N. J., has been incorporated for the manufacture of gas; capital, $15,000. Incorporators: John H. Miller, Wm. H. Mott, Frank S. Downnells and others, of Rockaway.

Waterloo, N. Y.—The Bd. of Village Trus., of Waterloo and Seneca Falls are stated to have granted permission to the Geneva, Waterloo & Seneca Falls Gas Co. to lay mains through the streets.

Youngstown, O.—C. D. Hauk, of New York, N. Y., and C. H. Struble, of Pittsburg, Pa., are stated to have authorized their Consulting Engr. to prepare plans for the gas plant to be erected here or near Girard. The site, including the pipe lines, excavations, etc., will cost between $900,000 and $1,000,000.

Salem, Ore.—Bids will be received until July 6 by the Bd. of Pub. Bldg. Comrs. at the Capitol Bldg., Salem, for lighting the Capitol, Penitentiary, Insane Asylum and Blind School at Salem. W. N. Gatens, Clk. of Bd.

Palouse, Wash.—It is reported that D. G. Klinefelter, of Shelton, Wash., proposes to establish an electric light plant here.

Grantsburg, Wis.—Bids are wanted June 25 for $8,000 bonds, said bonds to be used for the erection of an electric light plant. A. A. Anderson, Village Clk.

Vancouver, B. C.—It is reported that bids are wanted June 15 for constructing an electric light plant in N. Vancouver.

Toronto, Ont.—Bids will be received by Thos. McLaughlin, 16 King St. W., Toronto, for rock excavation, concrete work, etc., for a power house.

Owen Sound, Ont.—Bids will be received by Alfred J. Spencer, Town Treas., until June 18 for $39,000 gas plant, and $36,000 electric light plant bonds.

Blind River, Ont.—D. S. Pindell, of Sault Ste. Marie, Mich., writes that he will construct a power plant at Blind River, to cost $5,000.

ELECTRIC RAILWAYS.

Phoenix, Ariz.—J. B. Girand, representing the Cataract Creek Power Co., is surveying for an electric railway to start at the terminus of the steam railroad at Bright Angel, and run westward into Cataract Canyon and along the Grand Canyon of the Colorado River.

Riverside, Cal.—A franchise for a double-track electric railway from Riverside to Corona has been sold to H. E. Huntington. The line will be extended from Arlington, the present terminus, and new lines from Riverside to West Riverside and Colton are in contemplation.

San Rafael, Col.—The City Trus. have granted the North Shore R. R. Co. a right of way along 2d St. to Petaluma Ave., where a new terminal is to be built.

Jewett City, Conn.—The Senate has passed a resolution incorporating the Voluntown & Jewett City St. Ry. Co.

New Haven, Conn.—The R. R. Com. of General Assembly has reported favorably the resolution authorizing the Fair Haven & Westville Ry. to make numerons extensions. L. A. Farnham, Ch. Engr., New Haven.

Hartford, Conn.—The R. R. Com. of General Assembly has reported favorably the resolution incorporating the Woodbury & Waterbury St. Ry. Co. and the resolution incorporating the Plainville & Farmington Tramway Co. The latter is capitalized at $50,000, and is to build in Farmington and Plainville. Incorporators: Jas. T. Patterson, J. B. Cornwall and Arthur Perkins.

Windsor Locks, Conn.—The Windsor Locks & Rainbow St. Ry. Co. has been authortzed to increase its capital from $100,000 to $300,000. The company will build a continuous trolley line between Hartford and Springfield.

Ellington, Conn.—The Rockville, Broad Brook & East Windsor St. Ry. Co. has organized, with Frank Grant, Pres., and Clayton E. Harwood, Secy., of Rockville. The company proposes to build 11 miles of road from Rockville to Ellington, Broad Brook and East Windsor.

Wilmington, Del.—The Delaware Suburban Ry. Co. has secured a franchise to build a line on Banning St. The company will build a road to Elkton, Md. H. R. Fothergill, Mgr.

Washington, D. C.—The Old Dominion & Great Falls Electric Ry. Co. has purchased a site for its power house, on the Va. side of Potomac River.

Bradentown, Fla.—The Manatee Light & Traction Co. has been incorporated, with a capital of $100,000, to build an electric railway and operate light, heat and power plants. Incorporators: John A. Graham, W. A. Carter and Nina H. Graham.

Augusta, Ga.—It is said that interests identified with the Twin City Power Co. are interested in a plan to build an electric railway from Augusta to Elberton.

Mt. Vernon, Ill.—The Southern Illinois Electric Ry. has been incorporated, with a capital of $50,000, with principal offices at Mt. Vernon. The road is to be constructed from East St. Louis through the counties of St. Clair, Clinton, Washington, Marion, Jefferson, Hamilton and White, to a point on the Illinois side of the Big Wabash River near Maunie, Ill. Incorporators: John R. Piercy, Geo. F. M. Ward, Saml. Casey, and others, all of Mt. Vernon.

Galesburg, Ill.—See "Power Plants, Gas and Electricity."

Decatur, Ill.—Articles of incorporation have been filed here by the Decatur, Springfield & St. Louis Ry. Co., with a capital of $500,000, to build an electric railway from Decatur, by way of Springfield and Carlinville, to East St. Louis.

Brazil, Ind.—See "Power Plants, Gas and Electricity."

North Vernon, Ind.—The City Council has granted an electric railway franchise to Hubbard, Rominger & Yodel, of Indianapolis. The plan is to build an electric railway which will connect Madison with Columbus and make connection with the interurban from Columbus to Indianapolis.

Evansville, Ind.—Council has granted franchises to the Evansville, Boonville & Rockport Traction Co., and to the Evanaville & Henderson Traction Co.

Alexandria, Ind.—The Union Traction Co. has secured right of way from Alexandria to Muncie. A. J. Black, Ch. Engr., Anderson.

Richmond, Ind.—The City Council has granted franchises to the Eastern Indiana Traction Co. and to John A. Caldwell and others for an electric railway to be built from Hamilton to Richmond. The former will build from Richmond to Gas City.

Danville, Ind.—The preliminary work has been completed on the Danville, Indianapolis & Rockville Electric Ry., and the contract for building the line will be let at once. Work to commence July 1.

Kokomo, Ind.—The Indiana Interurban Constr. Co., which is building a line from Kokomo to Marion, has purchased a site near this city, for a power house.

Osgood, Ind.—Johnson and Shelby townships have voted $15,500 and $13,000, respectively, as a subsidy in aid of the Madison, Greensburg & Indianapolis Electric R. R. Co.

Des Moines, Ia.—Business Associations and Capitalists of Logan, Harlan and Shelby, Audubon, Panora, Yale, Guthrie Center, Dallas Center, and J. S. and H. H. Polk, Presidents, respectively, of the Des Moines City Ry. Co., and the Interurban Ry. Co., are reported interested in the organization of a company to build an electric railway westerly from Des Moines to Shelby or Logan.

Davenport, Ia.—The Mayor has signed the ordinance granting the Tri-City Ry. Co. a franchise for the extension of its lines from 8th and Harrison Sts. to Mercy Hospital and other sections of Northwest Davenport, a distance of 2 miles.

Louisville, Ky.—Plans are being discussed for building an electric railway from Louisville to New Albany, and in West Baden and Salem. Judge J. T. Buskirk is interested.

Maysville, Ky.—The Maysville & Mt. Olivet Traction Co. has been organized to build an electric railway between Maysville and Mt. Olivet, a distance of about 25 miles. John Duley, Pres.; Jas. W. Fitzgerald, Secy.

Pittsfield, Mass.—Bids will be received June 10 by Dolan Bros., Mgrs. Hoosac Valley St. Ry. Co., for constructing the East Side Line of the Hoosac Valley St. Ry., in all about 6 miles. Durkee, White & Towne, Engrs., 292 Main St., Springfield.

Fitchburg, Mass.—The Bd. of Aldermen have granted a franchise to the Worcester Consolidated St. Ry. Co. to extend its tracks in South and Otis Sts. The company also secured a franchise in Sterling. F. H. Dewey, Pres., Worcester.

Plymouth, Mass.—It has been voted to appropriate $15,000 to assist in construction of the Plymouth, Carver & Wareham St. Ry.

Springfield, Mass.—The Springfield St. Ry. Co. is to reconstruct a portion of its Worthington St. line and will put in heavy rails.

Battle Creek, Mich.—The Michigan Central Traction Co. will shortly build an electric line from Battle Creek to Lansing, taking in Grand Ledge, Charlotte, Belleville and Oliver. The contract for its construction has been awarded to M. W. Burwell, of New Haven, Conn.

Huron, Mich.—The Huron & Michigan Ry. Co. has been incorporated, with a capital of $2,300,000, to build an electric railway from Grand Rapids through Kent, Ionia, Montcalm, Gratiot and Saginaw Counties to Saginaw, a distance of about 100 miles. Directors: Leslie J. Hanes, Henry W. Lake, and others.

Elizabeth, N. J.—The Essex Cross Ry. Co. has secured a franchise here.

Albuquerque, N. M.—O. E. Cromwell has secured an electric street railway franchise.

Owego, N. Y.—The Highway Comrs. of Owego have granted the Binghamton Ry. Co. the right to construct an electric railway in that town. J. P. E. Clark, Mgr., Binghamton.

Lockport, N. Y.—The Common Council has granted the International Ry. Co. permission to lay a double track on Main St. and West Ave., and to extend its lines on East Ave. to the city line. T. E. Mitten, Gen. Mgr., Buffalo.

Canastota, N. Y.—The Oneida Ry. Co. has secured a franchise for an extension of its lines through Canastota. H. C. Stone, Vice-Pres., Oneida.

Asheville, N. C.—The Asheville & Craggy Mountain Ry. will build an extension 1½ miles and a 4-mile extension when the W. T. Weaver plant is completed.

Toledo, O.—Willis F. Brown, 55 Law Bldg., has completed the survey and is preparing plans and specifications for first 60 miles of railway the People's Rapid Transit Co. proposes constructing from Toledo to Cincinnati. Construction work to begin at once.

Ellis Bartholomew, promoter of the Toledo, Columbus, Springfield & Cincinnati Ry., claims that the entire issue of $4,500,000 has been disposed of and that work on the line will be renewed in the near future.

Youngstown, O.—The Council has granted a franchise to John Stambaugh, Jr., and S. D. L. Jackson on Market St., Ridge Ave. and Mahoning Ave. to the steel plant.

Contracts for the construction of the first 15 miles of the Youngstown & Southern Railway are to be closed at once. R. L. Andrews, of Cleveland, Gen. Mgr.

The Mahoning Valley Ry. Co. has called for bids for the construction of an electric railway from Youngstown to Struthers. John Wolf, Ch. Engr., Youngstown.

Kenton, O.—The Sandusky Southwestern Ry. Co. has completed its final surveys through this section, and it is expected that actual construction will be pushed in this section at once. The company has established offices in the Scioto Blk., Kenton.

Marietta, O.—T. M. Ripley has completed preliminary surveys for the proposed Marietta-Barnesville Electric Ry., and the right of way is now being secured.

Dayton, O.—The Interstate Traction Co., with a capital of $100,000, has been incorporated by J. D. Boroff, G. W. Woodman, and others, to build an electric railway from Dayton to Indianapolis.

Upper Sandusky, O.—It is reported that Willard, Muchmore & Co., of New York, N. Y., have completed negotiations for the purchase from O. C. Stutz and others of the right of way and franchises for the proposed electric railway from Marion to Tiffin.

Cleveland, O.—The Cleveland, Ravenna & Southern Ry. Co. has been incorporated, with a capital of $1,000, to build an electric railway from Cleveland to New Baltimore through Cuyahoga, Geauga, Portage and Stark Counties. Incorporators: F. E. Dellenbaugh, C. A. Bingham, and others.

Sidney, O.—Bids will be received at the office of C. E. Lippincott, City Aud., until June 22 for constructing and operating street railway Route No. 4.

Fairchance, Pa.—The Pittsburg, McKeesport and Connellsville Electric Ry. (W. A. Bishop, Ch. Engr., Pittsburg, Pa.) will be extended from Fairchance to the State line to connect with the W. Va. line.

York, Pa.—The York County Traction Co. has decided to build a branch from Manchester to Mt. Wolf, and it is possible that this line will be extended as far as New Holland.

Easton, Pa.—The Easton & Washington Traction Co. has filed articles increasing its capital from $100,000 to $1,250,000. This company contemplates building an electric railway from Easton to Hackettstown. The power house will be built at Washington, N. J. R. M. Petty, Pres., Washington, N. J.

Ridgeway, Pa.—Arrangements are now being made for a survey of the Elk County St. Ry. The road will extend from St. Marys, via Daguscahonda, Ridgeway, Johnsonburg, Rolfe and Wilcox to Kane; total length, 34 miles. W. S. Ravenscroft, of Ridgeway, is interested.

Chambersburg, Pa.—The Chambersburg & Gettysburg Electric Ry. Co. proposes extending its lines to connect Chambersburg and Waynesboro and pass through Mont Alto, Quincy, Pondtown, Tomstown and Black's Gap.

Pittsburg, Pa.—The Morningside St. Ry. ordinance, granting the Pittsburg Rys. Co. the right to build a line connecting Butler St. with the East End, has been approved by the joint corporations committee and returned to Councils with an affirmative recommendation.

Columbia, S. C.—The Columbia Electric St. Ry., Light & Power Co. has completed arrangements for the issue of $1,000,000 bonds, to be used for the taking up of two previous debts, the better equipment of the road and for acquiring the property of the Columbia Gas Light Co.

Beaumont, Tex.—The Beaumont Traction Co. will build an electric railway at once to Spindle Top.

Everett, Wash.—J. J. Hill, of the Everett Improv. Co., has decided to build a 13-mile electric railway between Everett and Snohomish; estimated cost of construction is $200,000.

Tacoma, Wash.—E. J. Felt has secured a franchise in Tacoma for an interurban line to Steilacoom.

Sistersville, W. Va.—The Tennis Constr. Co., of Philadelphia, Pa., has secured the contract for a 12-mile electric railway for the Taylor Ry. Co. from Sistersville to New Martinsville, W. Va.

Fairmont, W. Va.—The Fairmont, Morgantown & Cheat River Trolley Co. has secured franchises through Monongahela and Marion Counties, W. Va., to the Pennsylvania State line. About 40 miles of road will be built, commencing at Fairmont.

Montreal, Que.—The contract for the completion of the North Shore Power & Ry. Co.'s works at Seven Islands is stated to have been awarded to Michael Connolly. Contract involves expenditure of $1,000,000.

RAILROADS.

Brilliant, Ala.—It is stated that the Canton, Aberdeen & Nashville R. R. will be extended in Alabama from Brilliant, north to Tuscumbia and Sheffield, and west, paralleling the Tennessee River to the Mississippi-Alabama line, just north of Iuka. It will also be connected with the extension projected from Jackson, Tenn., southeast to the Tennessee-Mississippi line and across Tishomingo County, Miss., to the Alabama line.

Mountain Home, Ark.—The White River and Mountain Home Ry. Co. has been incorporated to construct a line from Cotter to Mountain Home, a distance of 12 miles; capital, $150,000.

Washington, D. C.—A press report states that the Southern Ry. will be double-tracked between Washington and Atlanta, and that $25,000,000 will be expended on betterments, including double trackage. W. H. Wells, of Washington, Engr. of Construction.

Pelham, Ga.—Application has been made to the Secy. of State for the incorporation of the Flint River & Northeastern R. R. Co., with a capital of $100,000, to build a railroad from a point on east bank of Flint River to Pelham, with branches to Hartsfield and Carlisle. D. M. Rodgers and W. B. Hutchinson, of Pelham, and J. W. Mallette, of Albany, are among the incorporators.

Adel, Ga.—It is stated that the South Georgia & West Coast R. R. is to be extended to Adel. E. D. Lumsden, Ch. Engr., Quitman, Ga.

Decatur, Ill.—The Decatur, Springfield & St. Louis Ry. Co., with principal office at Springfield, has been incorporated. The road will run from Decatur to East St. Louis; capital, $500,000.

Sioux City, Ia.—It is stated that the Burlington & Missouri River R. R. Co. want bids for the construction of an extension from Ashland to Sioux City. G. W. Holdrege, Gen. Mgr., Omaha, Neb.

Ruston, La.—C. H. Sargent is reported to be surveying for a line for the Arkansas Southern R. R. from Ruston south, a distance of about 100 miles. J. W. Walsh, Gen. Supt., Ruston.

Mexico, Mo.—The contract for building the Alton-Burlington cut-off, between Mexico on the Alton line and Old Monroe on the Burlington road, is stated to have been awarded to the Stubbs-Johnson Constr. Co. It will be 63 miles in length, and will cost about $1,000,000.

Ellwood City, Pa.—The surveyors of the Baltimore & Ohio R. R. Co. are stated to have completed another route for the reconstruction of the line between Pittsburg and Ellwood City. J. M. Graham, Ch. Engr., Baltimore, Md.

El Paso, Tex.—It is stated that an engineering party has been placed in the field by the Missouri, Kansas & Texas R. R. to locate the route for a line from a point in Okla. to El Paso. J. W. Petheram, Ch. Engr., Dallas.

Vera Cruz, Mex.—Andrew MacKenzie, of Mexico City, Mex., is stated to have secured a concession from the Mexican Government to construct a railroad to start from Los Xuchiles and terminate at Juan de la Punta, both in the County of Cordoba; also to construct and operate a branch to the line from Tierra Blanca to Vera Cruz. Principal offices to be located at Mexico City, Mex.

PUBLIC BUILDINGS.

Hot Springs, Ark.—Bids will be received June 18 by the Bd. of Pub. Affairs for erecting the City Hall and Auditorium, including masonry, brick work, plumbing, roofing, etc. W. E. Russell, Archt., St. Charles Hotel. Geo. R. Belding, Chmn.

Savannah, Ga.—H. W. Witcover, of Savannah, has been engaged by City Council to prepare plans for a new City Hall; approximate cost to be $125,000.

Chicago, Ill.—It is stated that the Emanuel Congregation of the German Evangelical Assoc. will erect a brick church at Wabash Ave. and 38th St.; estimated cost, $25,000.

Crawfordsville, Ind.—It is stated that bids are wanted June 15 for remodeling the court house. Address County Auditor.

Indianapolis, Ind.—Bids are wanted June 25 for a boiler plant at the Central Hospital for Insane, as advertised in The Engineering Record.

Boston, Mass.—Plans have been filed by John C. Hasty, Archt., 68 Devonshire St., for a mortuary chapel to be located on Wordsworth St., East Boston Dist., to be of brick, 1 story, 60x29 ft. Owner, Ohabei Shalon Society. Builder, A. Belvasky & Son, 30 Court St.

Rockland, Mich.—Bids are wanted June 16 for erecting a M. E. Church. H. Gillingham, Pastor.

Marquette, Mich.—Bids are wanted June 10 for erecting a library. Patten & Miller, Archts., 153 La Salle St., Chicago, Ill. A. E. Delf, Secy., Peter White Pub. Library.

St. Paul, Minn.—It is stated that the Outlook Sanitarium Assoc. will erect a hospital at St. Anthony Park, to cost about $50,000. Dr. H. Lougstreet is reported interested.

Jackson, Miss.—The Bd. of Supervs. (W. W. Downing, Clerk) will let contract for jail at July meeting. Architects, Hull Bros., Jackson.

St. Louis, Mo.—Matthews & Clarke, 705 Olive St., are reported to be preparing plans for an edifice for the Carondelet Methodist Episcopal Church south, to be erected at Virginia Ave. and Haven St.; probable cost, $30,000.

Concord, N. H.—Noyes Whitcomb, of Boston, Mass., has secured the contract for erecting a $100,000 church in Concord for Mrs. Eddy, Christian Scientist.

Freehold, N. J.—It is stated that bids are wanted June 10 for erecting a court house. John Guire, Dir. Bd. Freeholders.

New York, N. Y.—Bids will be received June 22 by the Dept. of Bd. of Health for furnishing material and erecting a storehouse at the Riverside Hospital, North Brothers Island, Boro. Bronx. Ernst J. Lederle, Pres.

Granville, N. Y.—Bids are wanted June 25 for erecting the Methodist Church, including masonry, plumbing, etc. D. D. Woodard, Chmn. Bldg. Com.

Gloversville, N. Y.—It is stated that plans will be received until June 15 for a library. Address A. L. Peck.

Brooklyn, N. Y.—The lowest bid received by the Dept. of Pub. Charities, N. Y. City (J. McKee Borden, Secy.), for erecting a dining-room and kitchen building for the Kings County Hospital (bids opened June 1) was submitted by Danl. J. Ryan, 723 3d Ave., Brooklyn, for $77,086.

Randalls Island, N. Y.—The lowest bid received by the Dept. Pub. Charities, N. Y. City, for erecting and completing the gymnasium at the New York City Children's Hospital and Schools at Randalls Island (bids opened June 1) was submitted by Edmund D. Broderick, 115 E. 90th St., N. Y. City, for $17,900.

Buffalo, N. Y.—The following are stated to have been the lowest bids received for erecting the municipal hospital: Masonry, E. C. Rumrill, $31,612; carpentry, Max Krieger, $5,862; ventilating and heating, Volk & Co., $6,000; plumbing, C. A. Criqui, $6,282.

Ogdensburg, N. Y.—T. E. McGarr, of Albany, Secy. State Lunacy Comn., writes that the contract for alterations to steam plant at St. Lawrence State Hospital, Ogdensburg (bids opened May 13) has been awarded to Home & Bassett, of Rochester, for $6,474.

Binghamton, N. Y.—Bids are wanted July 1 for erecting a public library, as advertised in The Engineering Record.

Fargo, N. D.—Hancock Bros., of this city, are reported to be preparing plans for a 4-story addition to the St. John's Hospital; estimated cost, $40,000.

Jamestown, N. D.—Bids are wanted June 9 for erecting a cold storage plant, addition to the Assembly Hall and congregate dining room at the State Hospital for the Insane. M. E. Beebe, Archt., Fargo. S. G. More, Secy. Bd. of Trus.

Dayton, O.—Bids will be received June 24 by the Bd. of Trus. for furnishing material and completing the concrete brick, cut stone, sheet metal and roofing ornamental steel and cast iron work, etc., for a new Infirmary building for the Dayton State Hospital. A. F. Shepherd, M. D., Secy.

Hamilton, O.—Bids will be received June 15 by the Trus. of Mercy Hospital for erecting a hospital. Geo. W. Barkman, Archt., 2d Natl. Bank Bldg.

Guthrie, Okla. Ter.—Local press reports state that bids will be received by the City Clk. until June 11 for erecting the Fire Dept. Headquartera.

Harrisburg, Pa.—John E. Stott, Secy. Pub. Grounds & Bldgs., writes that contracts for steam-heating plant for the State Arsenal has been awarded to Johnstown Supply House, at Johnstown, Pa., for $6,895, and for boiler house to Coder & Miller, of Harrisburg, for $2,778.

Avalon, Pa.—It is stated that the contract will soon be let for erecting the Borough Hall at School St. and California Ave. The structure will be brick, 60x90 ft., and cost $25,000. M. Nirdlinger, Archt.

Pottsville, Pa.—Jas. Nagle & Son, of Allentown, are reported to have received the contract for erecting the Methodist Episcopal Church here, for $57,468.

Providence, R. I.—Architects of Rhode Island are invited to submit until June 20 competitive plans for erecting the Rhode Island building for the Louisiana Purchase Exposition at St. Louis, Mo. Geo. N. Kingsbury, Executive Com.

Chattanooga, Tenn.—Bids will be received by Sol. Moyses, Secy., until June 15 for erecting a church. Adams & Beardens, Archts., Chamberlain Bldg.

Davenport, Wash.—T. K. Dow, of Spokane, has prepared plans for an addition to Lincoln County Court House; cost, $35,000.

Madison, Wis.—Bids will be received June 9 by the State Bd. of Control for furnishing 5,150-H.-P. boilers for State institutions as follows: 1 for State Hospital for Insane, Mendota; 1 for State Prison at Waupun; 2 for Northern Hospital for Insane, Winnebago; 1 for Home for Feeble-Minded, Chippewa Falls.

BUSINESS BUILDINGS AND DWELLINGS.

Berkeley, Cal.—John G. Howard, Superv. Archt. Univ. of California, is stated to have been selected to prepare plans for a 5-story building to be erected at Center St. and Shattuck Ave. for the First National Bank; estimated cost, $75,000.

Wilmington, Del.—The Du Pont Powder Co. is reported to be considering the erection of an office building at 10th and Market Sts.; probable cost, $1,000,000.

Chicago, Ill.—It is stated that Martin A. Ryerson will erect an 8-story building at Adams and Market Sts.; estimated cost, $100,000.

Peoria, Ill.—H. E. Hewitt, 14 Arcade Bldg., is reported to have prepared plans for a 2-story office building to be erected at Chestnut and Adams Sts., by F. E. Welte, at a cost of $22,000.

Cedar Rapids, Ia.—A company has been formed and necessary stock subscribed to build a fireproof hotel at 3d Ave. and 3d St.; estimated cost, $250,000. A. J. Averill is reported interested.

Baton Rouge, La.—Bids are wanted June 20 for the following work at the Istrouma Hotel: Electrical machinery, with boilers complete, plumbing, heating, tiling, electric elevator, etc. Plans and specifications can be seen at the office of Robt. Palestine, 311 Machecn Bldg.

Baltimore, Md.—Wm. T. Levering is reported interested in the erection of a 7-story office building to be erected at Charles and Mulberry Sts.; probable cost, $100,000.

Boston, Mass.—Henry J. Preston, Archt., 112 Water St., has filed plans for a block of apartment houses, with stores to be located on Talbot Ave., Dorchester Dist.; estimated cost, $40,000. Owner, Caroline Jackson Estate, 67 Leverett St. Builder, Frank C. Cutter, 29 Nantasket Ave.

Fire Island, N. Y.—The Fire Island Hotel is reported destroyed by fire May 27. B. Sire, Owner.

New York, N. Y.—Architects Ludlow & Valentine, 100 Bway, have plans for a 6-story apartment house with stores, to be built on Amsterdam Ave. and 166th St., size 104 ft. 7 in. x 100 ft. The building is to be equipped with electric elevator, dumb waiters, usual plumbing, etc. The exterior will be of Indiana limestone for 2 stories, and brick trimmed with Indiana limestone above. Owner, Walter A. Dick.

Cleveland, O.—The General Cartage & Storage Co. is stated to have decided to erect an 8-story building at Merwin and Superior Sts.; probable cost, $250,000.

Oklahoma City, Okla. Ter.—Plans are stated to have been approved by the 'Frisco System (C. D. Purdon, Ch. Engr., St. Louis, Mo.) for a passenger station to be erected here, at a cost of $50,000.

Pittsburg, Pa.—It is stated that Max Friedman (Vice-Pres. Star Enamel & Stamping Works Co.) proposes to erect a 10-story office building at 412 Grant St., at a cost of $200,000.

Philadelphia, Pa.—The corporation of the College of Physicians of Philadelphia are stated to have selected a site at 22d and Market Sts. for the erection of a 130x80 ft. building.

Nashville, Tenn.—The Penn Mutual Life Insurance Co. is reported to be considering the erection of a 10-story office building.

NEW YORK, N. Y.

230 Clinton St, 6-story br tenemt and store: c, $30,000; o, Levin & Packtman; a, Sass & Smallhelser.

81 Nassau St, 6-story br store; c, $40,000; o, Herman L R Edgar; a, Chas Volz.

11 Rivington St, 6-story br tenemt; c, $45,000; o, I Lippman; a, Bernstein & Bernstein.

Stanton and Pitt Sts, 6-story br tenemt; c, $50,000; o, Abraham Dworsky; a, A E Badt.

98 Ave D, 6-story br tenemt; c, $55,000; o, Saml Klein; a, Geo F Pelham.

Ave D and 8th St, 6-story br tenemt; c, $17,500; o, Lena Michaelsen; a, Geo F Pelham.

Bway and 9th St, 14-story br store bldg; c, $3,100,000; o, John Wanamaker; a, D H Burnham & Co.

1st Ave and Houston St, 6-story br tenemt and store; c, $45,000; o, A Goodman; a, Bernstein & Bernstein.

115th St and Pleasant Ave, 6-story br flat; c, $45,000; o, August Reis; a, Moore & Landsidel.

152d St and Amsterdam Ave, 5-story br tenemt; c, $55,000; o, Wm M Jaupole; a, F J Welher, Jr.

2424 7th Ave, 6-story br tenemt; c, $75,000; o, M Pizzutiello; a, M R D'Armora.

SCHOOLS.

St. Charles, Ill.—Reports state that bids are wanted June 20 for erecting a school. Jenny, Mundle & Jensen, Archts., Chicago, Ill. N. W. McLain, Secy.

Indianapolis, Ind.—Bids will be received June 11 by the Bd. of School Comrs. for erecting a school on Senate Ave. and Walnut St. Thos. A. Winterrowd, Archt., 17 Aetna Bldg. John E. Cleland, Bus. Dir.

Thorndike, Mass.—Bids will be received June 8 by the School Bldg. Com., of Palmer, for erecting an 8-room brick school. F. R. Richmond, Archt., Masonic Bldg., Springfield.

Boston, Mass.—Bids will be received until June 8 by the Schoolhouse Comrs. for the masonry, carpentry and other work in the Bowditch School, Jamaica Plain Dist.; also bids for installing a plumbing system in said building. R. Clipston Sturgis, Chmn.

Plainview, Minn.—It is stated that bids will be received by the Bd. of Educ. until June 30 for erecting a high school. G. F. Sylvester, Clk.

McComb City, Miss.—L. W. McDaniel is stated to have received the contract for erecting a school here, for $24,533, and bids will be received by the Bd. of Mayor and Selectmen, according to reports, until June 9 for ventilating and heating with a combination direct and indirect steam-heating system in said building.

Savannah, Mo.—J. H. Felt, of St. Joseph, is reported to have prepared plans for the high school to be erected here, at a cost of $35,000.

Kansas City, Mo.—W. E. Benson, Secy. Bd. Educ., writes that the contract for erecting a school at 41st and Main Sts. (bids opened May 25) has been awarded to J. B. Neevil, 410 New Ridge Bldg., for $49,986.

Plymouth, N. H.—A. N. Gilbert, of Berlin, is reported to have received the contract for erecting the high school here, for $30,500.

Jersey City, N. J.—The Bd. of Educ. is stated to have selected John T. Rowland, 55 Montgomery St., to prepare plans for a high school to be erected here; estimated to cost $350,000.

New York, N. Y.—The following bids were opened by C. B. J. Snyder, Supt. School Bldgs., June 1, for ventilating and heating apparatus for (*a*) School No. 24, Boro. of Manhattan; (*b*) School No. 34, Boro. of Bronx, and (*c*) School No. 123, Boro. of Brooklyn: Wm. N. Tobin, 109 W. 42d St., *a* $20,111 (awarded contract), *b*, $14,121 (awarded contract), *c* $18,374 (awarded contract); E. Rutzler *a*, $21,550, *b* $15,664, *c* $18,900; United Htg. Co., *a* $20,112, *b* $14,641, *c* $18,772; Blake & Williams *a* $22,626, *c* $19,737; F. Dobson, *a* $20,985, *b* $15,383, *c* $19,470; John Neal's Sons, *a* $20,257, *b* $15,442, *c* $19,669; Jas. Curren Mfg. Co., *a* $20,342, *b* $15,875.

The following bids were opened at the same time and place for sanitary work at new Public School 24, Boro. of Manhattan: Kirschof & Brown, $10,300; Jas. Fay $9,343; John Renehan, $9,600; Jere. J. Deady, 146 E. 16th St., $9,254 (awarded contract).

New York, N. Y.—Plans are stated to have been filed for 2 6-story extensions to the 5-story school and library at 16 W. 44th St. R. S. Townsend, Archt., 29 E. 19th St.

Brooklyn, N. Y.—Bids will be received until June 15 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures and electric bell system in School No. 123, Boro. of Brooklyn.

Greenport, L. I., N. Y.—The Bd. of Educ. is stated to have decided to erect a brick high school here, to cost $25,000.

Richmond, S. I., N. Y.—Bids will be received until June 15 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for additions and repairs to present ventilating and heating apparatus and building a new boiler house at School No. 20, Boro. of Richmond.

Fargo, N. D.—The Fargo Heating & Plumbing Co. is stated to have received the contract for installing the heating and power plant at the Agricultural College, for $26,000.

Grand Forks, N. D.—Bids will be received June 17 by A. E. Morrison, Secy. Bd. of Trus., for erecting a gymnasium; also an administration building at the State Univ., Grand Forks. Jos. Bell De Remer, Archt.

Cleveland, O.—Bids are wanted June 22 for erecting a south high school. Starr Cadwallader, Dir. Bd. Educ.

Martins Ferry, O.—Bids will be received June 18 (not June 13, as previously stated) by S. F. Dean, Clk. Bd. of Educ., for furnishing material and erecting a high school; separate bids are required for ventilating and heating. Thos. H. Green, Archt., Martins Ferry.

Glenville, O.—Bids will be received June 29 by C. A. Judson, Clk. Bd. of Educ., for furnishing material and erecting a 12-room brick school, including ventilating, heating, plumbing, sewers, gas fitting, structural iron and steel, electric wiring, etc.

Edmond, Okla. Ter.—The plans of S. A. Layton, of El Reno, are stated to have been accepted for the Normal School to be erected here, at a cost of $35,000.

Newtown, Pa.—It is stated that a dormitory for boys will be erected at the George School; estimated cost, $25,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Terre Haute, Ind.—Local press reports state that bids are wanted June 10 for the collection and removal of all city garbage.

Hoboken, N. J.—Press reports state that the following bids were opened by Council May 27: For the removal of ashes and garbage for the year: P. Padavana, $6,700; Chas. T. Vassel, $6,945, and Thos. Kavanagh, $7,000.

East Orange, N. J.—Chas. E. Anen is stated to have secured the contract to perform the scavenger work for 3 yrs. from Aug. 1st for $25,000.

Buffalo, N. Y.—Local press reports state that the following bids were opened May 29 by Col. Ward, Comr. of Pub. Wks., for (*a*) the collection and removal of garbage per ton; (*b*) ashes per cu. yd.; (*c*) rubbish per cu. yd.; (*d*) destruction of garbage per ton: Buffalo Sanitary Co., *a*, $2.19; *b*, 31 cts.; *c*, 37½ cts. Thos. McDonough, *a*, $2.30; *b* and *c*, 36 cts. Mosler & Summers, *a*, $1.85 or $13,750 per mo.; *b* and *c*, 37½ cts. Henry P. Burgard, *a*, $1.55; *b*, 35 cts. John Gallivan, *a*, $1.78; *b*, 38 cts.; *d*, $1.92. The Baynes Garbage Reduction Wks., *d*, 79 cts., or $92,950 for a term of 5 yrs.

Massillon, O.—The question of constructing a garbage crematory is reported under consideration.

Reading, Pa.—Elmer H. Beard, City Engr., writes that the contract for cleaning streets paved with sheet asphaltum, etc., for a period of 1, 3 or 5 yrs. (bids opened May 21) has been awarded to John A. Raun, 10th and Chestnut Sts., at $8.98 per square per mo.

GOVERNMENT WORK.

Washington, D. C.—Bids are wanted June 17 for installing a conduit, electric wiring and gas-piping system for the National Bureau of Standards. Jas. Knox Taylor, Superv. Archt.

Plans for the new National Museum building, as drawn by Architects Hornblower & Marshall, 1509 H St., N. W., are stated to have been formally accepted by the Exec. Com. of Bd. of Regents of Smithsonian Inst.; probable cost of building is $3,500,000.

The Bd. of Governors of the Soldiers' Home are stated to be preparing to erect 2 new buildings and a large addition, to cost in all about $800,000. Architect. W. M. Poindexter, 807 17th St., N. W.

Bids are wanted June 17 for plumbing system for the National Bureau of Standards. Jas. Knox Taylor, Superv. Archt.

Thos. Ryan, Acting Secy. Dept. of Interior, writes that the contract for the construction of a subway at Government Hospital for Insane has been awarded to the Cranford Paving Co., 1418 F St., N. W., at $11,045.

Chicago, Ill.—Bids will be received at U. S. Engr.'s office, June 27, for the construction of 4 riveted steel highway bridges, as advertised in The Engineering Record.

Burlington, Ia.—A press report states that all bids received for erecting an addition to the post office at Burlington have been rejected. Amount available, $40,000.

Des Moines, Ia.—The following bids were received on May 26 by Major R. B. Turner, 8th Infantry, Constructing Q. M., for construction of (*a*) roads, (*b*) walks, and (*c*) drains, at Ft. Des Moines, Ia.: Monarch & Shugart, *a*, $16,505. O. P. Herrick, *a*, $22,157; *b*, $7,379; *c*, $3,024. S. A. Robertson, *a*, $16,854; *b*, $6,672; *c*, $2,562. Likes Improv. Co., *a*, $20,470; *c*, $4,364. Shepard & Hanrahan, *b*, $5,991; *c*, $3,829. Harvey Kizer, *b*, $6,423. J. C. Likes, *b*, $6,465. Dunnigan & Sullivan, *c*, $3,057. Bidders all of Des Moines.

Ft. Riley, Kan.—Bids are wanted June 15 for constructing several buildings, including plumbing, heating and electric wiring where applicable; also an electric lighting system for this post, as advertised in The Engineering Record.

New Orleans, La.—Bids are wanted July 1 for constructing about 380,000 cu. yds. of earthwork in the Lower Tensas Levee Dist. Capt. Chas. S. Bromwell, Corps Engrs., U. S. A.

Annapolis, Md.—E. W. Callahan, Ch. Clk. Bureau of Navigation, Washington, D. C., writes that the contract for paving at the U. S. Naval Academy, Annapolis (bids opened May 6) has been awarded to J. C. McGuire, Havemeyer Bldg., New York, N. Y., for $26,239.

Annapolis, Md.—Ernest Flagg, 15 Broad St., New York, N. Y., is reported to be completing plans for a granite chapel to be erected at the Naval Academy. The building will be about 100x120 ft., and will cost about $400,000.

Boston, Mass.—The following bids were opened May 29 at Bureau of Yards and Docks, Navy Dept., Washington, for constructing a fireproof floor, stairways, etc., in Bldg. No. 103, Navy Yard, Boston: Coleman Bros., Everett, $19,450; Conners Bros., Boston (4 bids), from $19,500 to $24,000; C. M. Ellinger & Co., Boston (5 bids), from $17,500 to $28,600; Thos. A. Leech, Boston (2 bids), $22,883 and $26,510, and Thos. J. Hine, Boston (2 bids), $26,750 and $28,750.

Bids were opened at same time and place for installing 6 direct-connected electric elevators, in Bldgs. Nos. 42, 103 and 107 Navy Yard, Boston: Whittier Machine Co., Boston (3 bids), $23,300 to $26,428; Eltron Mfg. Co., Boston (2 bids), $17,627 and $20,387; C. F. Kurwen, Salem (4 bids), $18,550 to $21,805; Marine Engine & Machine Co., Paterson, N. J. (4 bids), $22,525 to $26,040; Otis Elevator Co., East Orange, N. J. (3 bids), $23,275 to $26,755; and Baltimore Machine & Electric Co., Baltimore, Md. (3 bids), $23,300 to $26,428.

Pipestone, Minn.—A. C. Tonner, Acting Comr. Indian Affairs, Washington, D. C., writes that the contract for furnishing material for constructing an addition to a stone dormitory at Pipestone (bids opened May 23) has been awarded to Geo. S. Redmon, of Pipestone, for $13,484.

Jefferson Barracks, Mo.—Bids are wanted June 10 for improving the water supply system at this place. Address W. C. R. Colquhoun, Depot Q. M., St. Louis.

West Point, N. Y.—The plans of Cram, Goodhue & Ferguson, of Boston, Mass., are stated to have been accepted for the proposed improvement of West Point Academy. The plans call for the erection of 21 new buildings, a new architectural layout for the entire reservation, and an elaborate landscape setting, the latter being arranged by Olmstead Bros. of Brookline.

Portland, Ore.—Press reports state that the Northwest Constr. Co., of Astoria, Ore., has secured the contract for furnishing 2 lots of stone for extending jetty at mouth of Columbia River. The first contract, for immediate use, is for 150,000 tons, delivery to be completed within 4 mos., while the second contract is for 475,000 tons, to be delivered within 8 months; the stone to be furnished at 91 cts. per ton.

Philadelphia, Pa.—The following bids were opened May 26 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing power plant equipment at Navy Yard, League Island, Pa.: Hoffman Eng. & Constr. Co., Philadelphia, $127,950; Keller, Pike & Co., Philadelphia, $100,060; D'Oller Eng. Co., Philadelphia, $128,900; Penn. Equipment Co., Philadelphia, $132,370; McIntosh, Seymour & Co., New York, N. Y., $120,000; Providence Eng. Wks., Providence, R. I., $116,000.

Bids will be received June 26 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a coaling pier at the Navy Yard, League Island. Amount available, $47,000.

Ft. Greble, R. I.—Capt. Thos. H. Slaven, Q. M., U. S. A., Newport, writes that the following contracts have been awarded for work at Ft. Greble (bids opened May 20): Roads to Lane Constr. Corporation, Meriden, Conn., $8,536, and walks to P. B. Elkins Co., 8 Beacon St., Boston, Mass., $2,700.

Bradford, R. I.—Bids will be received until July 15 by R. B. Bradford, Ch. of the Bureau of Equipment, Navy Dept., Washington, D. C., for coaling plant extension, Narragansett Bay Coal Depot, Bradford.

Ft. Mead, S. D.—Bids are wanted June 15 for constructing post exchange and gymnasium at this post. Address Capt. C. B. Vogdes, Ft. Mead.

Chattanooga, Tenn.—According to press reports Capt. H. J. Slocum, Q. M., U. S. A., at Chattanooga, writes that on May 28 the following bids were opened for work at Chickamauga Park: For the construction of the water works and a sewerage system—A. L. Patterson & Co., of Macon, Ga., $33,000; Dyer & Duncan, Chattanooga, $49,683; and the T. J. Mooney Co., Nashville, $31,800, and for erecting a purification plant—Williams & White, of New York, N. Y., $11,475; Municipal Eng. Co., of New York, N. Y., $12,772; Cameron Septic Tank Co., of Chicago, Ill., $12,250; and the T. J. Mooney Co., of Nashville, $17,000.

Memphis, Tenn.—Bids are wanted July 1 for the construction of 12 material barges for use in 3d Dist., as advertised in The Engineering Record.

Johnson City, Tenn.—J. E. Unkefer is stated to have secured the contract for 4 additional barracks at Johnson City (bids opened May 14) for $500,000.

Ft. Ethan Allen, Vt.—Bids will be received by Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, Vt., on June 22 for constructing 4 brick additions to hospital at this post, as advertised in The Engineering Record.

Ft. D. A. Russell, Wyo.—Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, writes that contracts have been awarded as follows: For sinking 2 and not exceeding 6 tubular deep wells, to Ekstrom & Carlstrum, of Pine Bluff, Wyo., at $1.80 per lin. ft. for wells sunk and cased; $5 per lin. ft. for Cook strainer, in place, and $48 per day of 24 hrs. for additional test. For constructing the new water works, the Holme & Allen Pipe & Constr. Co., of Denver, Colo., secured the contract at 95c. per lin. ft. for 6-in. pipe, in place, and 65 cts. per lin. ft. for 4-in. pipe; for making taps, from $3 to $8; for stops and waste cocks, from $2.10 to $7.50 ea.; for 6-in. Gate valves, $22.50 ea.; 4-in. Gate valves, $16.50 ea., and fire hydrants, $50 ea.

He further states that this office will, in a few days, invite bids for the construction of about 11,000 ft. of 12-in. irrigating conduit for Ft. D. A. Russell. Plans and specifications are now being prepared.

Haines, Alaska.—Bids are wanted June 13 for constructing a water distributing system, sewer system, necessary roads and walks and grading the site of the new army post on Portage Cove. Address Capt. W. P. Richardson, Constructing Q. M., Skagway.

NEW INDUSTRIAL PLANTS.

The Alma Cement Co., which is erecting a 1,500 bbl. cement plant at Wellston, O., from the plans of Lathbury & Spackman, Ltd., Philadelphia, will put up two more works of 3,000 bbls. capacity each at Oreton, O. These will be built from the plans of the same engineers, who are also working on the drawings for a 6-kiln rotary plant which will be started in Canada in two months.

T. Abbott & Son, proprietors of the Terrell, Tex., Iron Works, recently burned, intend to rebuild at once. The following buildings will be erected: A 65x80-ft. foundry equipped with a 5-ton traveling crane, a 6-ton cupola and other equipment; a 40x60-ft. machine shop, and a 30x60-ft. pattern shop.

The C. Rossler Mfg. Co., 507-509 Ellicott St., Buffalo, N. Y., maker of automobiles and gasoline motors, intends to erect three 2-story buildings, each covering about 40x100 ft.

P. J. Moera, Lansing, Mich., boilermaker, will erect a new power house next year.

The International Grain & Elevator Co., Minneapolis, Minn., has recently been organized and will erect country elevators of 25,000 to 45,000 bu. capacity.

Christopher Beck, 2949 Michigan Ave., St. Louis, Mo., will erect a brewery at Cairo, Ill., to have an annual capacity of 40,000 bbls.

MISCELLANEOUS.

West Memphis, Ark.—Bids will be received July 1 by St. Francis Levee Bd. for constructing levees, in all about 2,837,000 cu. yds. H. N. Pharr, Ch. Engr., Randolph Bldg. O. N. Killough, Pres. of Bd.

Boise, Idaho.—A. J. Wiley, of Boise, is stated to have been employed by eastern capitalists to prepare plans for a dam to be constructed near the head of Rindenbaugh Canal; probable cost of work reported to be $50,000.

Chicago, Ill.—The citizens voted June 1 to authorize the South Park Bd. to issue $3,000,000 bonds to provide for improvements in the South Park system, which contemplate the completion of Grant or Lake Front Park, the making of a new park in the town of Lake and one near Pullman, and improving Jackson and Washington parks; also to authorize the Lincoln Park Bd. to issue $1,000,000 in bonds with which to enlarge Lincoln Park and to build a sea wall and driveway.

Jefferson, Ia.—Bids are wanted June 29 for constructing the Walton ditch in Paton Township. J. J. Linn, Co. Aud.

New York, N. Y.—Bids will be received June 15 (readvertisement) by McDougall Hawkes, Comr. of Docks, for furnishing material and dredging the East and Harlem Rivers; also furnishing and delivering rip-rap stone; also June 16 (readvertisement) for furnishing and delivering granite stones for bulkhead or river wall; also dredging the Cedar St. section of North River.

Rochester, N. Y.—City Engr. E. A. Fisher is stated to have prepared an ordinance providing for the construction of a retaining wall along west bank of river as a safeguard against flood; probable cost of work is $18,055.

New York, N. Y.—The following bids for furnishing all labor and material required for dredging at Peck Slip section on East River were received by Dept. Docks & Ferries May 27—*a*, 81,000 cu. yds. of mud; *b*, 13,200 cu. yds. crib, price given per cu. yd.: P. Sanford Ross, 277 Washington St., Jersey City, N. J., *a*, 22 cts.; *b*, 90 cts. R. G. Packard, 130 Pearl St., *a*, 16 cts.; *b*, 60 cts. (awarded contract). W. H. Beard Dredging Co., 10 Bridge St., *a*, 18 cts.; *b*, 60 cts.

The following bids for (*a*) building a pier, with appurtenances, near ft. of Jefferson St., East River, and (*b*) 7,340 cu. yds. riprap, per cu. yd., were received by Dept. Docks & Ferries May 27: Bernard Rolf, 39 Cortlandt St., *a*, $37,000; *b*, 65 cts. Wm. H. Jenks, 130 Pearl St., *a*, $35,999; *b*, 55 cts. (awarded contract).

The following bids for furnishing all labor and material required for dredging on East and Harlem Rivers (100,000 cu. yds.) were received by Dept. Docks & Ferries May 25, price given per cu. yd.: Morris & Cumings Dredging Co., 17 State St., 50 cts., and International Contracting Co., 17 State St., 39 cts. (Bids rejected.)

The following bids were received by Dept. Docks & Ferries May 27—*a*, 15,000 cu. yds. cobble; *b*, 20,000 cu. yds. rip-rap, price given per cu. yd.: Murray & Co., 263 Ave. C, *a*, 67½ cts.; *b*, 62 cts. Phoenix Towg. & Transpt. Co., 17 State St., *a*, 59 cts. (awarded contract). O'Brien Bros., 54 South St., *a*, 69 cts.; *b*, 60 cts. H. C. Pearce, 431 W. 23d St., *a*, 62½ cts.; *b*, 58½ cts. (Bids on rip-rap rejected.)

The following bids were received by Dept. Docks & Ferries May 25 for delivering granite stones for bulkhead on river wall—*a*, 19,400 cu. ft. headers and stretchers; *b*, 7,000 cu. ft. coping, price given per cu. ft.; John Pierce, 277 Bway, N. Y. C., *a*, 99 cts.; *b*, $1.29. John Hynes, 637 Carroll St., Bklyn., *a*, $1.07; *b*, $1.23. M. Baird Contg. Co., 433 E. 99th St., N. Y. C., *a*, $1.14; *b*, $1.29. M. McGrath & Co., 81st St. and E. R., *a*, $1.19; *b*, $1.27. Booth Bros. & H. I. Granite Co., 207 Bway., *a*, $1.22½; *b*, $1.35. Bart. Dunn, 320 E. 68th, *a*, $1.20; *b*, $1.35. J. C. Rodgers, 536 W. 152d St., *a*, $1.28; *b*, $1.28. (All bids rejected.)

The contract for 1,000 piles (bids opened June 2) has been awarded to Naughton & Co., 258 Bway, for $12,400.

Brooklyn, N. Y.—Bids will be received June 17 by J. Edw. Swanstrom, Boro. Pres., for furnishing and delivering engineer's and draughtsmen's supplies to the Bureau of Pub. Bldgs. and Offices; also engineemen's supplies to the Bureau of Sewers at the 26th and 31st Wards sewage disposal works and sewer repair yard.

Buffalo, N. Y.—Grade crossing bonds amounting to $383,823 have been sold.

Lorain, O.—The City Council is stated to have passed an ordinance authorizing the issue of $200,000 bonds for the improvement of Black River by deepening, widening, and otherwise improving it.

Ashland, Wis.—Bids will be received June 22 by W. A. Jones, Comr. of Indian Affairs, Washington, D. C., for furnishing material and constructing employees' quarters and hospital at the Hayward Boarding School, Lapointe Agency.

Hamilton, Ont.—It is stated that the International Harvester Co. is to construct a large wharf on Sherman Ave., B. A. Kennedy, Mgr.

Montreal, Que.—Bids will be received June 11 by L. O. David, City Clk., for street superstructure and flooring of St. Denis St. subway; probable cost of tunnel is $45,000.

BUSINESS NOTES.

The plant of the Old Colony Foundry Co., East Bridgewater, Mass., which was recently burned, will be rebuilt. A 40x80-ft. machine shop and pattern storehouse of fireproof construction and a 25x35-ft. brass foundry will be built. The power plant was not damaged. All contracts have been let.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Menominee, Mich., Sugar Co., two engines of 150-H.-P. direct-connected to Crocker-Wheeler generators; Penna. R. R. Co., for Altoona shops, a 450-H.-P. tandem compound engine direct-connected to a General Electric alternator, this being the fifth of this size and make bought within 2 years.

The Damascus Brake Beam Co., St. Louis, Mo., maker of improved railway appliances, has bought 24¼ acres at Sharon, Pa., and let contract for a 240x70-ft. building and equipment, including a 50-H.-P. engine, bulldozers, punches, grinders, riveting machines, etc.

During the past week the Pencoyd Works of the American Bridge Co. produced the largest tonnage in the history of the plant, turning out over 16,600,000 lbs., or about 8,300 tons structural steel and bridge work.

The London County Council at a recent meeting closed a contract with the British Westinghouse Co., amounting to about $590,000, and calling for 200 tramcars to be used on its lines south of the Thames. This is said to be the largest order ever given for electric cars in England. One-half of the cars are to be of the single-truck type, 32 tenders having been received for these. The remaining 100, for which 26 tenders were received, will be double-deck bogie-truck tramcars which are to be delivered in 28 weeks.

The Wilmington, N. C., Stone & Construction Co. has been organized to manufacture hollow concrete building blocks by the Palmer process. The officers are: President, W. F. Robertson, superintendent of the Clarendon Water Works Co.; Vice-President, Walker Taylor; General Manager, S. P. Adams, City Engineer; Secretary and Treasurer, H. E. Bonitz.

In addition to the equipment previously purchased from the Westinghouse Electric & Mfg. Co., the Bishop & Babcock Co., Cleveland, O., recently installed a 175-Kw., two-phase engine-type generator, direct-connected to a Ball engine, together with an exciter and four 40-H.-P. and one 20-H.-P. type C induction motors. Geo. S. Rider & Co., of Cleveland, were the consulting engineers.

Within the short period, less than 5 years, during which the Westinghouse Machine Co. has manufactured large Corliss engines, a total of over 160,000-H.-P. in engines have been sold, comprising four distinct types: Vertical 3-cylinder compound, vertical cross-compound, horizontal cross-compound and horizontal tandem compound. The equipments now in service include such plants as the New York Edison, Brooklyn Edison, Third Avenue Railway and Boston Elevated Railway, etc., each representative of the most advanced power station construction. This record is particularly gratifying to the Westinghouse interests in that it represents but one branch of effort in the engine building business.

PROPOSALS OPEN.

Bids Close.		See Eng. Record.
	WATER WORKS.	
Jun. 8.	Winnipeg, Man., Adv., May 30	May 30
Jun. 8.	Lancaster, Pa., Adv. May 16, 23	May 16
Jun. 8.	Schenectady, N. Y., Adv. May 23, 30	May 23
Jun. 9.	Camden, N. J.	Jun. 6
Jun. 9.	Long Island City, N. Y.	May 30
Jun. 9.	New Brighton, S. I.	May 30
Jun. 9.	Ilion, N. Y., Adv. May 30	May 23
Jun. 10.	Chicago, Ill.	Jun. 6
Jun. 10.	Camden, N. J.	May 30
Jun. 10.	San Jose, Cal.	May 30
Jun. 10.	Meadville, Pa.	May 30
Jun. 10.	Ruston, La.	May 30
Jun. 10.	Dillon, Mont., Adv. May 23, 30	May 23
Jun. 11.	Brooklyn, N. Y.	May 30
Jun. 12.	Cleveland, O.	Jun. 6
Jun. 13.	Cleveland, O., Adv. Jun. 6	Jun. 6
Jun. 13.	Washington, D. C., Adv. Jun. 6	Jun. 6
Jun. 15.	Coopersburg, Pa., Adv. Jun. 6	Jun. 6
Jun. 15.	Goshen, Ind.	Jun. 6
Jun. 15.	South Deerfield, Mass., Adv., Jun. 6	Jun. 6
Jun. 15.	Halsted, Minn.	May 30
Jun. 15.	Great Falls, Mont.	May 30
Jun. 15.	Tacoma, Wash.	May 30
Jun. 15.	North Tonawanda, N. Y. Adv. May 23 to Jun. 6.	May 23
Jun. 16.	Wantagh, L. I., N. Y.	Jun. 6
Jun. 18.	Brooklyn, N. Y.	May 30
Jun. 20.	Oakland City, Ind., Adv.	May 30, Jun. 6
Jun. 23.	Gouverneur, N. Y., Adv. Jun. 6	Jun. 6
Jun. 25.	Niagara Falls, Ont., Adv. Jun. 6	Jun. 6
Jun. 27.	Erie, Pa. (2 Prop.), Adv. Jun. 6	Jun. 6
Jun. —	Pump, Niagara Falls, Ont.	May 9
Jul. 1.	West Point, Va.	May 23
Jul. 7.	Reading, Pa., Adv., Jun. 6	Jun. 6
Jul. —	West Manchester, O.	May 30
	SEWERAGE AND SEWAGE DISPOSAL.	
Jun. 8.	Ft. Dodge, Ia.	Jun. 6
Jun. 8.	Milburn, N. J., Adv. May 23 to Jun. 6	May 23
Jun. 9.	Buffalo, N. Y.	Jun. 6
Jun. 9.	Waterloo, Ia.	Jun. 6
Jun. 9.	St. Louis, Mo.	May 30
Jun. 9.	Bound Brook, N. J.	May 23
Jun. 10.	Hoboken, N. J.	May 30
Jun. 10.	Coldwater, Mich., Adv. May 30, Jun. 6	May 30
Jun. 10.	Brooklyn, N. Y.	May 30
Jun. 10.	Grand Rapids, Minn. Adv. May 30, Jun. 6.	May 30
Jun. 10.	Pine Bluff, Ark.	May 23
Jun. 12.	Beloit, Wis.	Jun. 6
Jun. 15.	Johnstown, N. Y.	May 30
Jun. 15.	Webster City, Ia.	May 23
Jun. 15.	Burlington, Ia., Adv. May 30, Jun. 6	May 16
Jun. 17.	Brooklyn, N. Y.	Jun. 6
Jun. 18.	Cincinnati, O.	Jun. 6
Jun. 18.	Ingram, Pa.	Jun. 6
Jun. 20.	Washington, D. C. Adv. May 16 to Jun. 6.	May 16
Jun. 22.	Winona, Minn.	Jun. 6
Jun. 24.	Jersey Shore, Pa., Adv., Jun. 6	Jun. 6
Jun. 26.	Shreveport, La., Adv. May 30, Jun. 6	May 30
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. —	Little Rock, Ark.	May 30
Jun. —	Ballard, Wash.	May 9
Jul. 1.	Geneva, O.	May 30
———	Greensboro, N. C.	May 30
	BRIDGES.	
Jun. 9.	Portage du Fort, Que.	Jun. 6
Jun. 10.	Terre Haute, Ind., Adv. May 16	May 16
Jun. 10.	Rushville, Ind.	May 23
Jun. 11.	Mishawaka, Ind.	May 23
Jun. 12.	Palmer, Mass.	Jun. 6
Jun. 12.	Indianapolis, Ind.	Jun. 6
Jun. 12.	Pekin, Ill.	Jun. 6
Jun. 12.	Belleville, Ont.	May 30
Jun. 15.	New Philadelphia, O.	Jun. 6
Jun. 15.	Holston, Va.	May 30
Jun. 15.	Burlington, Ia., Adv. May 30, Jun. 6	May 16
Jun. 17.	Wabash, Ind.	Jun. 6
Jun. 18.	Shreveport, La.	May 30
Jun. 20.	Marion, Ind.	May 30
Jun. 22.	Neport, Ky.	Jun. 6
Jun. 22.	Olivet, S. D.	May 16
Jun. 25.	Columbus, O.	Jun. 6
Jun. 27.	Grand Rapids, Mich., Adv. Jun. 6	Jun. 6
Jul. 1.	Ottawa, O.	Jun. 6
Jul. 10.	Castlewood, S. D.	May 2
	PAVING AND ROADMAKING.	
Jun. 8.	Marshalltown, Ia.	Jun. 6
Jun. 8.	Pittsfield, Mass.	Jun. 6
Jun. 8.	Mt. Holly, N. J.	May 23
Jun. 8.	Albany, N. Y., Adv. May 16 to 30	May 16
Jun. 9.	Buffalo, N. Y.	Jun. 6
Jun. 9.	Clinton, Ia.	Jun. 6
Jun. 9.	Milwaukee, Wis.	Jun. 6
Jun. 9.	Binghamton, N. Y.	May 30
Jun. 9.	Ashland, Wis.	May 23
Jun. 10.	Gettysburg, Pa.	Jun. 6
Jun. 10.	Bowling Green, O.	May 16
Jun. 10.	West Boylston, Mass., Adv. May 30	May 30
Jun. 10.	Washington, D. C. Adv., May 30, Jun. 6.	May 30
Jun. 11.	Bloomington, Ill.	May 30
Jun. 13.	Lagrange, Ill.	Jun. 6
Jun. 11.	Newark, N. J., Adv. May 23, Jun. 6	May 23
Jun. 11.	Seymour, Ind.	May 16
Jun. 12.	Napoleon, O.	May 30
Jun. 12.	Bridgeport, Conn. Adv. May 23 to Jun. 6.	May 23
Jun. 12.	Wauseon, O.	May 23
Jun. 12.	Bloomington, Ind.	May 16
Jun. 13.	Brooklyn, N. Y.	Jun. 6
Jun. 13.	Scottsburg, Ind.	May 30
Jun. 13.	Celina, O.	May 30
Jun. 13.	Mt. Vernon, Ind.	May 30
Jun. 13.	Washington, D. C. Adv., May 30, Jun. 6.	May 30
Jun. 15.	Oswego, N. Y.	Jun. 6
Jun. 15.	Ansonia, Conn.	Jun. 6
Jun. 15.	Freehold, N. J.	Jun. 6
Jun. 15.	Burlington, Ia., Adv. May 30, Jun. 6	May 16
Jun. 15.	Neptune, N. J.	May 30
Jun. 15.	Anderson, S. C.	May 23
Jun. 15.	Houston, Tex.	May 23
Jun. 16.	Camden, N. J.	May 30
Jun. 16.	Rensselaer, N. Y., Adv. May 30, Jun. 6	May 30
Jun. 17.	Providence, R. I.	May 30
Jun. 18.	Cincinnati, O.	Jun. 6
Jun. 20.	Crownpoint, Ind.	Jun. 6
Jun. 20.	La Crosse, Wis.	Jun. 6
Jun. 20.	Mt. Holly, N. J.	Jun. 6
Jun. 22.	Jasper, Ind.	May 30
Jun. 22.	Bowling Green, O.	May 30
Jun. 23.	La Crosse, Wis.	May 30
Jun. 24.	Cincinnati, O.	May 30
Jun. 26.	Indianapolis, Ind.	Jun. 6
Jun. 26.	Shreveport, La., Adv. May 30, Jun. 6	May 30
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. —	Charlevoix, Mich.	May 30
Jul. 1.	Cleveland, O.	Jun. 6
	POWER, GAS AND ELECTRICITY.	
Jun. 8.	Greene, N. Y.	May 30
Jun. 8.	New Orleans, La.	May 23
Jun. 10.	Ruston, La.	May 30
Jun. 15.	Vancouver, B. C.	Jun. 6
Jun. 15.	Fergus Falls, Minn.	Jun. 6
Jun. 15.	Vernal, Utah	May 16
Jun. 16.	Buhl, Minn.	May 30
Jun. 18.	Portland, Ore., Adv. Apr. 18 to May 2	Apr. 18
Jun. —	Napoleon, O.	May 16
Jun. —	North Yamkill, Ore.	Apr. 4
Jul. 6.	Salem, Ore.	Jun. 6
Sep. 1.	Corona, Cal.	May 16
———	Toronto, Ont.	Jun. 6
———	Caledonia, Minn.	May 23
	GOVERNMENT WORK.	
Jun. 8.	Prescott, Ariz., Adv. May 30, Jun. 6	May 30
Jun. 8.	Ft. Terry, N. Y. Adv. May 23 to Jun. 6.	May 23
Jun. 8.	Ft. Ethan Allen, Vt. Adv. May 23 to Jun. 6.	May 23
Jun. 9.	Washington, D. C.	May 30
Jun. 9.	St. Augustine, Fla., Adv. May 16 to 30	May 16
Jun. 9.	Htg. P. O., Paducah, Ky. Adv. May 9, 16.	May 9
Jun. 10.	Jefferson Barracks, Mo.	Jun. 6
Jun. 10.	New York, N. Y. Adv. May 16 to Jun. 6.	May 16
Jun. 10.	Ft. Wayne, Mich.	May 30
Jun. 10.	Rapid City, S. D.	May 23
Jun. 10.	St. Paul, Minn.	May 2
Jun. 11.	Ft. Howard, Md.	May 30
Jun. 11.	Ft. Monroe, Va.	May 30
Jun. 11.	Albuquerque, N. M.	May 23
Jun. 11.	Rock Island, Ill.	May 23
Jun. 11.	Bldg. P. O., Paducah, Ky. Adv. May 9, 16.	May 9
Jun. 12.	Lawrence, Kan.	May 23
Jun. 12.	Philadelphia, Pa.	May 16
Jun. 13.	Haines, Alaska	Jun. 6
Jun. 13.	Annapolis, Md.	May 30
Jun. 15.	Bradford, R. I.	Jun. 6
Jun. 15.	Ft. Mead, S. D.	Jun. 6
Jun. 15.	Ft. Riley, Kan., Adv. Jun. 6	Jun. 6
Jun. 15.	Washington, D. C. Adv. May 30, Jun. 6.	May 30
Jun. 15.	Ft. Douglas, Utah	May 30
Jun. 15.	Norfolk, Va., Adv. May 23, Jun. 6	May 23
Jun. 15.	Manila, P. I., Adv. Mar. 14 to May 9	Mar. 14
Jun. 16.	Washington, D. C.	May 30
Jun. 16.	Roads, Ft. Caswell, N. C. Adv. May 23, 30.	May 23
Jun. 16.	Hospital, Ft. Caswell, N. C. Adv. May 30.	May 30
Jun. 16.	Alexandria, Va., Adv. May 16, 30	May 16
Jun. 17.	Washington, D. C.	Jun. 6
Jun. 17.	Saugatuck, Mich. Adv. May 23 to Jun. 6.	May 23
Jun. 18.	Boone, Ia.	May 23
Jun. 19.	Ft. Leavenworth, Kan. Adv. May 23 to Jun. 6.	May 23
Jun. 20.	Charleston, S. C.	May 30
Jun. 22.	Ft. Ethan Allen, Vt., Adv. Jun. 6	Jun. 6
Jun. 22.	Ashland, Wis.	Jun. 6
Jun. 22.	Stillwater, Minn., Adv. May 23, 30	May 23
Jun. 22.	Baltimore, Md., Adv. May 23 to Jun. 6	May 23
Jun. 22.	New Haven, Conn. Adv. May 23 to Jun. 6.	May 23
Jun. 23.	Ft. D. A. Russell, Wyo.	May 23
Jun. 24.	Petoskey, Mich., Adv. May 30, Jun. 6	May 30
Jun. 24.	Tompkinsville, N. Y. Adv. May 23 to Jun. 6.	May 23
Jun. 25.	Ft. Ethan Allen, Vt. Adv. May 30, Jun. 6.	May 30
Jun. 25.	Leadville, Colo.	May 23
Jun. 26.	Philadelphia, Pa.	Jun. 6
Jun. 26.	Mobile, Ala.	May 30
Jun. 27.	Chicago, Ill., Adv. Jun. 6	Jun. 6
Jun. 27.	New Orleans, La.	May 30
Jun. 30.	Philadelphia, Pa., Adv. May 16, 23	May 16
Jun. 30.	New Orleans, La., Adv. May 9, 16	May 9
Jul. 1.	Memphis, Tenn., Adv. Jun. 6	Jun. 6
Jul. 1.	New Orleans, La.	Jun. 6
Sep. 14.	Providence, R. I.	May 30
	BUILDINGS.	
Jun. 8.	School, Thorndike, Mass.	Jun. 6
Jun. 8.	School, Boston, Mass.	Jun. 6
Jun. 8.	Hospital, New York, N. Y.	May 30
Jun. 8.	School, New Brighton, N. Y.	May 30
Jun. 8.	School, Brooklyn, N. Y.	May 30
Jun. 8.	School, New York, N. Y.	May 30
Jun. 9.	Hospital, Jamestown, N. D.	Jun. 6
Jun. 9.	Pub. Bldgs., Madison, Wis.	Jun. 6
Jun. 9.	Htg. School, McComb, Miss.	Jun. 6
Jun. 9.	School, Indianapolis, Ind.	May 30
Jun. 9.	Court house, Iola, Kan.	May 30
Jun. 9.	Library, Franklin, Ind.	May 30
Jun. 9.	Court house, Denison, Ia.	May 23
Jun. 9.	Hospital, Brooklyn, N. Y.	May 23
Jun. 9.	School, Akron, O.	May 23
Jun. 9.	Dormitories, Columbus, O.	May 23
Jun. 10.	Library, Marquette, Mich.	Jun. 6
Jun. 10.	School, Indianapolis, Ind.	Jun. 6
Jun. 10.	Courthouse, Freehold, N. J.	Jun. 6
Jun. 10.	School, St. Paul, Minn.	May 30
Jun. 10.	School, Brycelyn, Minn.	May 30
Jun. 10.	School, Hankinson, N. D.	May 16
Jun. 11.	Pub. Bldg., Guthrie, Okla. Ter.	Jun. 6
Jun. 12.	Capitol, Augusta, Me., Adv. May 30	May 30
Jun. 12.	Pub. Bldg., New York, N. Y.	May 30
Jun. 15.	Church, Chattanooga, Tenn.	Jun. 6
Jun. 15.	Hospital, Hamilton, O.	Jun. 6
Jun. 15.	Htg. School, Richmond, S. I., N. Y.	Jun. 6
Jun. 15.	Courthouse, Crawfordsville, Ind.	Jun. 6
Jun. 15.	Library, Gloversville, N. Y.	Jun. 6
Jun. 15.	Schools, Findlay, O.	May 30
Jun. 15.	Church, Rossville, Ill.	May 30
Jun. 15.	Pub. Bldg., Danville, Ill.	May 30
Jun. 15.	Bank, Dunkerton, Ia.	May 30
Jun. 15.	Bank, Houston, Tex.	May 30
Jun. 15.	School, Beaumont, Tex.	May 23
Jun. 15.	School, Cleveland, O.	May 23
Jun. 15.	School, Scotch Ridge, O.	May 16
Jun. 16.	Church, Rockland, Mich.	Jun. 6
Jun. 16.	School, Hempstead, N. Y., Adv.	May 30
Jun. 16.	Jail, etc., Two Harbors, Minn.	May 30
Jun. 16.	School, Bayonne, N. J.	May 30
Jun. 16.	Hospital, Los Angeles, Cal.	May 23
Jun. 16.	School, Bedford, Ind.	May 2
Jun. 17.	Gymnasium, etc., Grand Forks, N. D.	Jun. 6
Jun. 18.	School, Martins Ferry, O.	Jun. 6
Jun. 18.	City Hall, etc., Hot Springs, Ark.	Jun. 6
Jun. 18.	School, Dayton, O.	May 30
Jun. 18.	Pub. Bldg., Sandusky, O.	May 23
Jun. 20.	Hotel, Baton Rouge, La.	Jun. 6
Jun. 20.	School, St. Charles, Ill.	Jun. 6
Jun. 20.	Pub. Bldg., Providence, R. I.	Jun. 6
Jun. 22.	School, Cleveland, O.	Jun. 6
Jun. 22.	Hospital, New York, N. Y.	Jun. 6
Jun. 22.	Church, Topeka, Kan.	May 30
Jun. 22.	Fire Station, Houston, Tex.	May 16
Jun. 24.	Infirmary, Dayton, O.	Jun. 6
Jun. 25.	Hospital Boiler Plant, Indianapolis, Ind. Adv. Jun. 6	Jun. 6
Jun. 25.	Church, Granville, N. Y.	Jun. 6
Jun. 29.	School, Glenville, O.	Jun. 6
Jun. 30.	School, Plainview, Minn.	Jun. 6
Jun. —	Hotel, La Crosse, Wis.	May 23
Jul. 1.	Library, Binghamton, N. Y. Adv. Jun. 6.	Jun. 6
Jul. 1.	Court house, Boonville, Ind.	May 30
Jul. 1.	Court house, Carnesville, Ga.	May 30
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jul. 13.	Court House, La Grange, Ga.	May 9
Jul. —	Jail, Jackson, Miss.	Jun. 6
	MISCELLANEOUS.	
Jun. 9.	Ditch, Nevada, Ia.	May 16
Jun. 10.	El. Ry. Work, Pittsfield, Mass.	Jun. 6
Jun. 10.	Garb. Disp., Terra Haute, Ind.	Jun. 6
Jun. 10.	Dredging, Brooklyn, N. Y.	May 30
Jul. 10.	Ditch, etc., Beardstown, Ill.	May 23
Jun. 11.	Subway Work, Montreal, Que.	Jun. 6
Jun. 11.	Supplies, Brooklyn, N. Y.	May 30
Jun. 12.	Garbage, St. Joseph, Mo.	May 16
Jun. 15.	Dredging, etc., New York, N. Y.	Jun. 6
Jun. 15.	St. Ry. franchise, Los Angeles, Cal.	May 30
Jun. 15.	Garb. Disp., Shreveport, La.	May 30
Jun. 22.	St. Ry., Sidney, O.	Jun. 6
Jun. 29.	Ditch, Jefferson, Ia.	Jun. 6
Jun. 30.	R. R., Denver, Colo.	Jun. 6
Jul. —	Levee, West Memphis, Ark.	Jun. 6
Jul. —	Removal of earth, Camden, N. J.	May 30
———	El. Ry. work, Columbia, Mo.	May 30
May 2. '04.	R. R., Oodnadatta, So. Australia	Feb. 21

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Timber as a Structural Material.

The extensive development of iron or steel and masonry in their various classes has been so rapid and has covered such large fields that not only the amount of timber used for structural purposes at the present time is lost sight of, but also the importance of its continued growth and development as a useful structural material. The forest supplies of this country were originally so abundant and so useful in a great variety of ways that they were cut and brought to market with a lavish wastefulness which should never have been tolerated and which should have been checked long ago. The obvious importance of iron or steel and masonry and the present unavailability of timber in nearly all impressive engineering structures have created a widespread idea that timber as a structural material is of comparatively small value. As a matter of fact it would be difficult to find any impression more unwarranted or more erroneous.

This latter statement finds a demonstrable justification in the numerous lumber interests that are centered about the various large cities in the United States and in the further fact that no matter how small the town the lumber business in it is an important factor and takes prominence among the business interests catering to the needs of the community. In addition, however, to all the many and varied structural uses of timber wherever a town or village or city may be found throughout the entire country, not less than about 175,000 feet board measure are required on the average for the ties, bridges, telegraph poles and other structures for every mile of new single track railroad built, and not far from one-sixth of that amount for the renewals or maintenance of every mile of single track railroad. There is such a small amount of railroad track in this country laid with steel ties that the preceding estimates may be without reasonable error applied to all the railroads of this country, amounting approximately to 260,000 miles.

The significance of these figures was well brought out by two papers read before the New York Railroad Club at the meeting of April 17 by Professors H. von Schrenk and B. E. Fernow, on "The Use of Timber by Railroads and its Relationship to Forestry" and "Railroad Interests in Forest Supplies." These papers were devoted particularly to the economic interests of railroads in the preservation of the forest lands of this country, but the fundamental ideas underlying the treatment of the general subject are far wider in their scope than their authors perhaps intended. They show what vast demands are made upon our timber supplies by railroads only, and what may be sources of income from timber to those railroad companies. The authors of these papers further show how by judicious care of our forests, including intelligent and systematic cutting, it is possible not only to prolong indefinitely our timber supply but also to make it of profit both to the owners of the timber lands and to the railway companies. While these matters are of a purely engineering character the preservation of our timber supplies by the proper management and development of forests would serve far broader engineering purposes. There is no reason to believe that the legitimate demands for timber will ever be any less than they are now. Indeed, with the general extension of engineering construction the demands for timber will grow wider and become of greater volume in spite of the fact that in certain constructions iron or steel and masonry may displace it. There are few engineering constructions of great magnitude in which the best classes of timber, such as long leaf yellow pine, Oregon pine, or even spruce, to say nothing of other timbers frequently required, are not demanded in considerable quantities. In certain foundation work large amounts of our best timbers are needed, and at the present time nothing can take their places without great sacrifice of economy. It is a matter, therefore, of the greatest practical interest to engineers and for certain reasons to engineering students to give this matter of reasonable timber protection careful thought, and of such a kind as to make it effective in time to save for useful purposes the remaining forests yielding structural timber.

Both Professors von Schrenk and Fernow indicated in their papers not only why our forest management should be improved but also how our railroad companies could make it to their financial interest to do so. More broadly speaking, it is the duty of our institutions of learning, particularly those in which professional courses of engineering study are found, to make forest development and the cutting and treatment of structural timbers subjects of intelligent study, so that engineers may be qualified to aid effectively in the shaping of public sentiment toward the conservation of one of the most important engineering supplies at our command. But few universities have yet taken up the subject of forestry, but the active support of such work in at least a few of our most advanced institutions of learning is certainly encouraging. Without good structural timber engineers would lose one of their most valuable resources in many lines of construction, and it is for them as professional men to aid in their capacity as such toward a business-like and effective administration of forest supplies for the future.

The Development of the Commerce of the Great Lakes.

It was most appropriate that the subject chosen for the presidential address at Asheville, this week, before the American Society of Civil Engineers, was the development of the Commerce of the Great Lakes. No one has taken a more useful and responsible part in this great work than Mr. Noble, although the extent that the shipping industry is indebted to him is not recognized as it deserves. It is desirable to state this so clearly because, although the great works at Sault Ste. Marie set the gauge to which all improvements throughout the lakes were planned, Mr. Noble nowhere indicates that in their design and construction he played a leading role, while his studies as a member of the Deep Water Ways Commission contributed very largely to the value of its investigations.

The early days of commerce on the Great Lakes were influenced by the lack of any navigable waterway around St. Mary's Rapids and from Lake Erie to the seaboard. It is true that in an enclosure adjoining the offices of the Consolidated Lake Superior Company at Sault Ste. Marie, Ont., there are carefully preserved the remains of a lock built about 1798 to assist the passage of bateaux around the rapids. This lock had a lift of only 9 feet, but half the fall of the rapids, and the remainder of the passage was by portage with ox teams. The lock was of little importance, however, as the commerce passing through it was solely the fur trade with the Indians, and its destruction in 1814 by American troops was without influence.

The first great step in the development of the Great Lakes shipping followed the opening of the Erie Canal. In a part of the address noteworthy for its concise clearness, Mr. Noble shows how absolutely impossible the development of the Northwest would have been at that time without the cheaper transportation afforded by the canals. A few months before the inauguration of construction on the Erie Canal, a committee of the New York legislature reported that the cost of transportation from Buffalo to Montreal was $30 a ton and the charges on the return route from $60 to $75. The expense of transportation from Buffalo to New York was stated to be $100 per ton and the length of passage twenty days. Thirty-five years later Mr. Israel P. Andrews commented on these rates in the following forcible words: "Upon the very route through which the heaviest and cheapest products of the West are now sent to market, the cost of transportation equaled nearly three times the market value of wheat in New York; six times the value of corn; twelve times the value of oats; and far exceeded the value of most kinds of cured provisions."

The consequences of the construction of the Erie Canal, at first only a little ditch 4 feet deep and 28 feet wide on the bottom, were momentous in the development of the central states. In fifteen years the tonnage increased from 2,450 to 55,180 tons, and soon after the expiration of this period, about 1840, the rate of development began to rise in a marvelous manner. Steam vessels for passenger service were placed in commission which were not equalled until recently in their speed or elegance, but the opening of the Lake Shore Railroad caused them to be abandoned.

Up to 1836, the direction of grain shipments through the Straits of Mackinaw was toward the West. In that year the first cargo of grain from Lake Michigan was received at Buffalo,

and by 1840 this traffic had become securely established. Chicago quickly took first place as a shipping point, its shipments increasing from 10,000 bushels in 1840 to upward of 28,000,000 in 1860. The present grain movement of the Lakes is about 200,000,000 bushels annually. In recent years, however, this movement, once the largest item in Lake commerce, has taken a place second in importance to iron ore from the Lake Superior ranges.

The portion of the address relating to the development of the enormous commerce from Lake Superior is one of great importance, because Mr. Noble, whose work at Sault Ste. Marie was largely instrumental in making it a possibility, emphasizes the unusual conditions which make the total tonnage so large now and will tend to make it smaller ultimately.

The first demand for a ship canal around St. Mary's Falls came from parties interested in the important fisheries in Lake Superior. Nothing was done, however, until the copper and iron mining corporations attained such prominence that such an outlet for the shipping of Lake Superior became imperative. The opening of the first canal marked a stage in the development of Lake commerce hardly less important than the opening of the Erie Canal thirty years before, not only because of the traffic through it, which, Mr. Noble is careful to state, increased but slowly, but because it fixed for many years the depths to be obtained in the Lake harbors and channels, and, consequently the dimensions of vessels and the cost of transportation. In fact, the locks at St. Mary's Falls may be termed the gauge to which all other improvements in harbors and channels are built. The increase in commerce through these locks and the improved waterways has been hardly comprehensible from the mere figures and has led to the construction of new American and Canadian locks whose features were briefly described in the address.

The Detroit River, undoubtedly, carries more tonnage than any other navigated channel in the world, the freight tonnage being estimated at 40,000,000 to 50,000,009 per year. St. Mary's River, with its freight tonnage of nearly 36,000,000 in 1902, may be the second. Of the leading articles transported, grain receipts at Buffalo increased nearly 300 per cent. from 1884 to 1898, the receipts there in the year last named being nearly 270,000,000 bushels, or about 7,000,000 tons. The coal movement is somewhat greater, while the movement of iron ore is three or four times as much as either. Several lessons of importance, in the design of ship canals, are taught by experience with these waterways, which are peculiarly applicable to the project for an Isthmian Canal.

One of these lessons is that a very large traffic can be carried through a canal with locks. During the navigation season of 1894, embracing 234 days, a tonnage of 16,800,000 tons, net register, was passed through a single lock, the vessels averaging less than 940 tons each. During the last season, of 264 days, the net registered tonnage passed through the triple system of lockage was nearly 32,000,000 tons, the vessels averaging 1,410 tons; of this tonnage upward of 22,000,000 passed through one of the three locks. In the two months of July and August the tonnage through the St. Mary's Falls Canal was almost exactly equal to the tonnage through the Suez Canal during the entire previous year, allowance being made for difference in methods of measurement.

A second lesson is that a canal with locks operated carefully is a safe waterway, as far as the locks are concerned. It is not necessary to give the space to this consideration that its importance seems to warrant, for the proof can be summed in a single sentence. During the forty-eight years since the opening of the St. Marys Falls Canal to navigation the stoppages at locks have probably not averaged two days per year, or one day for 3,000,000 tons passed. With locks in duplicate, the stoppages of navigation are almost nil.

The third lesson is the importance of a wide channel. The unfortunately narrow width adopted for the Suez Canal, only about half that originally intended, but made necessary to prevent the cost exceeding twice the estimate, has been a harmful precedent. It has been increased there, and will, doubtless, be further increased as traffic increases. In the channels connecting the Great Lakes, where 300 feet width was generally first adopted for the 20 feet navigation, the width is being increased to 600 feet or more, and the principle is adopted that the width of channel should be greater than the length of the largest ship. This principle may be considered applicable generally where currents are strong, the traffic great, and the cutting not too deep.

The freight on the Lakes consists mainly of a few items, and facilities for handling them have reached a greater degree of efficiency than anywhere else. Iron ore is loaded from pockets in lofty piers and falls directly into the hold of the ship. The ore piers have now a storage capacity of nearly 1,000,000 tons. During the last season a ship received its full load of 5,290 tons in 68 minutes, through nineteen hatches. The equipment for unloading is almost equally perfect, a cargo of 5,300 tons having been unloaded in 3 hours and 45 minutes. Coal is loaded from cars at the rate of 1,000 tons per hour. The use of elevators in loading and unloading grain, mainly a development of Lake commerce, is too well known to need further reference.

It should not be understood that these periods represent averages, or define the stay in ports. Ore-carrying ships require from one-half to one day in the receiving port and about three days in the discharging port, getting a dock and unloading; coal-carrying ships require about one day more at each end of the route. Grain ships require about one day in the receiving port and two in the discharging port. There is still room for improvement in port facilities in Mr. Noble's opinion.

The most remarkable feature of Lake commerce is the marvelous development of the mining and shipment of iron ore. In 1888 it exceeded 5,000,000 tons for the first time. It doubled in the next seven years and again doubled in the next six years, passing 20,500,000 tons in 1901. In that year the Lake Superior mines furnished 74 per cent. of the entire amount produced in the United States. In 1902 the output was increased by 7,000,000 tons, making a total of 27,500,000 tons, which was equal to the total output during the thirty years from the first shipment to 1885, while the increase alone was greater than the entire output of any year previous to 1889. While the output in the United States at large doubled between the years 1888 and 1901, the production of the Lake Superior mines quadrupled during the same period, furnishing nearly all the increase in the ore production of the country.

From the study of Lake navigation some general principles governing cheap transportation were deduced by Mr. Noble which will be applicable to other places.

1. For the cheapest water transportation there must be adequate depth in the channels, so that large ships can be used. Freight rates on iron ore from Lake Superior to Lake Erie ports were, during prosperous years, about $2 per ton when the limiting depth was 15 feet and less than $1 with the present limiting depth of 19 feet.

2. There must be adequate facilities for handling cargo, so that the delay in port may be reduced to a minimum. The Lake ports have probably the best facilities existing anywhere, and these are important factors in the low freight rates which obtain, notwithstanding the facts that the vessels lie up 4 or 5 months during the year, and, during the season of navigation, make short voyages compared with seagoing ships.

3. Different classes of freight require different rates of speed. Lake ships carrying package freight, some of it perishable, some of high value, run 12 to 14 miles per hour, but for those carrying ore a speed of 10 to 12 miles has been found more economical, conforming closely to the usual speed of tramp ships on salt water.

4. Transhipment must be avoided as far as possible. The Erie Canal, with its 7-foot navigation and transhipment at Buffalo, has shown a steadily decreasing business in the transportation of vegetable foods, and in 1900 carried only one-third as much as 1869, and only one-fifth of the amount in the maximum year, 1880. The Welland Canal has barely held its own during the same period, although its depth has been increased from 9 to 14 feet. The New York Central and Erie Railroads increased their tonnage in this class of freight six times during the same period.

The fourteen-foot navigation of the St. Lawrence to Montreal, completing this navigation from the Lakes to tide-water and to seagoing ships, has been opened too recently to predict its consequences safely. It still lacks the necessary terminal facilities at Montreal, but neither this lack, nor the hazardous navigation of the Lower St. Lawrence, from Montreal to the Atlantic, has prevented a great increase in the receipts of grain at Montreal by rail.

5. The prime requisite, after all, for cheap transportation is the existence of great natural resources in the tributary districts. So much misleading discussion of the benefits of water routes has been indulged in, in recent years, Mr. Noble stated; such broad inferences have been drawn from the traffic through the St. Marys Falls Canals as to results to be expected from the opening of other waterways, that it seems necessary to state this truism seriously. The freight tonnage through these canals consists almost entirely of a few articles; first of these is iron ore, which in 1902 was 67 per cent. of the total; next is coal, 13 per cent.; then flour and grain, 10 per cent.; then lumber, 6 per cent.; these four articles making 96 per cent. of the total. In the natural course of events the iron ore and lumber will be exhausted; but for their accidental and temporary existence, the traffic would not be more than 27 per cent. of its present amount; and doubtless even less than this because the development of these two articles has powerfully promoted the development of others. The lumber shipments will soon diminish and before many years will practically cease.

The ore shipments will reach a much higher amount than the present before the decline, which is inevitable, sets in. In the meantime the shipments of coal and of agricultural and manufactured products will increase, and, possibly, after the exhaustion of the ores the traffic may remain as large as at present or even become much greater. However this may be, it is clear that the present development is due to a combination of agricultural and mineral resources not found anywhere else in the world, and to a spirit of daring enterprise and restless energy hardly paralleled in the history of industrial effort.

A Third-Rail Interurban Railroad.

Within very recent years many miles of surface and elevated railway for passenger traffic have been equipped for operation electrically by means of the third rail. This method of operation, however, is not yet so old that a 35-mile double-track third-rail line, built and equipped for carrying freight as well as passengers, has not a great deal of interest for even those engineers who are most advanced in this line of traffic. There are many details of the equipment and operation of such roads which are yet in a measure unsettled, and many of these problems can be finally solved only by aid of practical trials in service. For these reasons additional engineering importance attaches to the Lackawanna & Wyoming Valley Railroad, in the anthracite coal region of Pennsylvania, of which a brief and general preliminary description is published elsewhere in this issue. As the chief engineers of the road are closely connected with one of the great electrical equipment manufacturing corporations, which latter in turn is financially interested in the property, it is reasonably to be expected that some things will be pretty thoroughly tried, and some lessons will be learned of which immediate advantage will be taken.

Besides this interest for what may be termed its experimental value, and for its engineering features, this railroad is an exemplification of an especially interesting phase of advanced engineering practice; namely, the recognition of a public need; the inception and development of a project for meeting the need, and the complete creation of the property required. Talent of this order is in demand not only in private practice and in the corps of great railroad and industrial corporations, but also in the public service. It is the same kind of ability that fits a man to foresee a community's need for a water supply; to originate and further the necessary legislation; to select, after suitable examination, the proper source of supply, and to plan the works and superintend their construction, as is necessary to perceive an opportunity for the construction of a paying line of railroad, to promote the project and to bring the completed property into physical being. The personal equipment for such achievements is to be gotten from broad, active experience and contact with men of many stations in life, rather than from books, although knowledge of technical facts is also necessary.

The Union Engineering Building, New York.

On account of the wide interest that attaches to the proposed Union Engineering Building in New York City, The Engineering Record presents the following telegraphic report of the action of the American Society of Civil Engineers, at its meeting at Asheville, N. C., this week. It resolved that the Board of Direction be authorized to ascertain whether suitable accommodations can be obtained for the Society in the proposed new building, with provisions for future needs, and also to make such investigations and hold such conferences as may be necessary on advisability of the acceptance of Mr. Carnegie's proposition by the Society. It was also resolved that the Board of Direction be authorized to co-operate to this end with the other organizations concerned, and that it be requested, provided it is satisfied that suitable accommodations can be obtained and that acceptance of the proposition is otherwise practicable, to send members of the Society a letter ballot, by means of which direct expression of the wishes of the Society in the matter may be secured, and to accompany such ballot by statement of the reasons for and against uniting in the scheme with the other organizations. It was resolved that the Board of Direction, in case a majority of the members, as shown by the letter ballot, are in favor of uniting with the other organizations, is authorized to proceed in behalf of the Society in carrying out the project. It was also voted that the letter ballot provided in the foregoing resolution should be presented to the Society with the usual sixty days' notice and an opportunity for discussion at the next annual meeting.

Notes.

Centrifugal Pumps for Elevator Service are in use in the Equitable Building, Atlanta, Ga. There are four hydraulic elevators with the traveling sheaves placed horizontally in the basement, supplied from the usual pressure tank in which a pressure of 130 pounds is maintained. Two No. 5 Worthington turbine pumps are ordinarily employed, connected in series so that the discharge from one is passed to the other, and each is driven by a 80-horse-power 220-volt Westinghouse direct-current motor, running at 1,350 revolutions per minute. A smaller unit, driven by a General Electric 2-horse-power motor, supplies the house system under a pressure of 65 pounds. For the air pressure in the elevator pressure tank, there is a Worthington 3x4-inch duplex pump, belt driven, with a tightener from a 7½-horse-power General Electric motor on the same bed plate with it. There is also a 4x8-inch Worthington triplex pump for safe lifting and a 8x12x20x9x-15-inch Worthington triple expansion duplex steam pump, now held as a relay to the electric pumps for the general elevator system.

The Installation of Meters throughout the entire city is recommended in the report for 1902 of Mr. W. N. Calkins, superintendent of the water department of Rockford, Ill., who states that the per capita pumpage is 125.8 gallons. The city contains 3,887 taps, of which 395 are metered, and the revenue per metered tap is $26.96 while that per unmetered tap is $8.41. Mr. Calkins states that the daily pumpage of 2,933,400 gallons is fully 50 per cent. in excess of what it would be under an entire meter system, and that the fuel bill could be reduced from 35 to 45 per cent. with all taps metered. He believes that two years should be taken to make the full change, the commercial and manufacturing portions of the city being metered first, and that all meters should be owned and maintained by the city. A thorough house to house inspection is recommended for a revision of the water rates, and attention is called to the need of tests to find out what electrolytic action is taking place in the water mains.

The Wear of Brick and Asphalt pavements is mentioned in the last report of City Engineer Robert Hooke, of Chattanooga, Tenn. Chestnut Street and McCallie Avenue were both paved in 1891, the one with brick and the other with asphalt. The traffic in each case has been mainly along an 18-foot strip in the center of the roadway. With the brick pavement, on the 9 feet each side of this central strip there has been no considerable wear and no observable deterioration from weather exposure. In the central portion, however, there are now innumerable depressions from ½ to 1¼ inches in depth, which render the pavement so rough that vehicles are now driven more to the sides. On the other hand, the asphalt pavement has received more repairs on the sides than in the middle. There are innumerable cracks along the sides and the failure of the asphalt there has resulted almost entirely from disintegration. The middle portion is almost free from cracks, and the repairs which have been made necessary there have been due to the traffic, the thickness of the asphalt having been reduced to about one-half of that on the less used sides. While these results are interesting they are, of course, of little definite value without more complete information concerning the pavements than the report furnishes.

A Novel Method of Road Construction is being carried on at Weaverville, Cal., where a natural bank of quartzite, ready broken by nature is hydraulicked down on to the roadway in flumes. The road on which this remarkable piece of macadamizing is done is about two miles long, on the side of Oregon Mountain. Above it is a bank of quartzite, or broken rock about 5 feet high, the pieces of stone ranging in size from ¼ inch to 3 inches. The water supply comes from West Weaver creek through a ditch and syphon built two years ago. The water is taken from the syphon under pressure to the quartzite through a 700-foot pipe line, where it is used to cut down the bank and wash the rock into the flume, about half a mile from the road. Several box flumes are arranged with holes in the sides to let the rock out on the road, and when enough has been deposited at one place, that particular hole is shut and the rock goes on to the next hole in the next box. It is put on the road about 2 feet thick and for a width of about 12 feet. The flume is 12 inches wide and deep, and about 40 miner's inches of water are used for the work. From 120 to 150 feet of road per day are built in this way, with the employment of six men, and there is no interference with the traffic during construction. Mr. J. H. Boyce, of Weaverville, who furnished the above information, states that about three-quarters of a mile of road has already been completed in this manner at the time of writing.

The Milwaukee Gas Light Company, Milwaukee, Wis., is installing an interesting gas power plant at its new works, which will be one of the largest in the country, and will be in accord with advanced practice in modern gas engineering. Although no electricity will be generated for outside lighting, an electrical plant driven by gas engines will be employed for furnishing motive power to the various auxiliaries, all of which will be run by electric motors. A large machine shop will also be operated by electric motors. Coal will be unloaded from boats elevated to the storage bins by electrical hoists and conveyors, the retorts will be charged and drawn by electrical appliances, and the final disposition of the coke will be accomplished by means of electric power apparatus. The entire electrical distribution system will operate at 250 volts direct-current, from a central power generating plant, employing gas engines connected directly to the gas mains. The present equipment comprises one 250-horse-power Westinghouse horizontal, double-acting gas engine, driving a 150-kilowatt generator, and three 125-horse-power vertical engines, belted to 75-kilowatt generators. Provision has been made for future extensions of the equipment with a second power unit of the former type. The 250-horse-power engine is of the new horizontal type. Its principal features are a pair of cylinders in tandem, and operating upon the double-acting principle, a single crank and water-cooled pistons, cylinders and combustion chambers. The engine is particularly adapted to generator driving by reason of its speed regulation.



General Map of Lackawanna & Wyoming Valley Railroad.

THE LACKAWANNA & WYOMING VALLEY RAILROAD.

A GENERAL DESCRIPTION OF THE ROAD AND THE TRIBUTARY REGION.

In the mountainous coal mining region of northeastern Pennsylvania are the beautiful Lackawanna and Wyoming valleys, in which are situated twenty miles apart the cities of Scranton and Wilkes-Barre. Between these cities and as far as Carbondale on the north and Nanticoke on the south are many towns and villages, along the north branch of the Susquehanna River and the Lackawanna River. The industries of this district, attracted by the cheapness of fuel, are many and varied, and it contains a large traveling population. The five steam railroads which operate in this district, although making important connections at Scranton and Wilkes-Barre, respectively, are interested chiefly in the transportation of coal from local mines, with the result that although each of the cities is well served by one or the other of the east and west trunk lines, interurban communication has been comparatively limited and the service less frequent and enjoyable than could be desired.

Both cities have street railway systems, each of which runs a line into the adjacent valleys meeting the other half way between the cities. These extensions are, however, located along the highways, where their speed is necessarily restricted; the cars are small and the service consequently quite inadequate for handling extensive interurban traffic. The territory is prosperous and contains about a half million people, Scranton being the fourth largest city in Pennsylvania, with 102,000 inhabitants. It was, therefore, apparent that if proper inducements were offered to travel comfortably at high speed, at frequent intervals and at reasonable prices, there existed here a fertile field to be entered by a properly projected railway adapted to both passenger and freight traffic, with electricity as the motive power.

The enterprise was inaugurated in 1900 by New York, Boston and Philadelphia capitalists, prominent among whom was Mr. George E. Lee, of Philadelphia, who were impressed with this necessity for the increased transportation facilities in this vicinity. Although local opinion held that possible locations for a high class railroad property between Scranton and Wilkes-Barre had already been preempted, a comparatively direct route between termini avoiding steep grades and sharp curves, was secured intersecting the more important intervening towns. High speed and ability to handle heavy traffic were considered to be of prime importance, and although the district to be traversed is hilly, and presents unusual problems of construction, all engineering and legal obstacles were finally overcome, and a route secured comparing more than favorably with any in the vicinity.

A comparatively direct route passing through Pittston, the principal intervening city, was laid out between Scranton and Wilkes-Barre, intersecting as many towns as possible, and later extended to Carbondale, 17 miles from Scranton. The general location of the main line is shown on the map. General railway charters were obtained for the Northern Lackawanna Railroad from Scranton to Carbondale, the Scranton and Northeastern Railroad from Scranton to Pittston, and the Central Valley Railroad from Pittston to Wilkes-Barre. At an early stage of the project, the Westinghouse companies became interested in the road as a field in which to work out the practical solutions of a number of problems in heavy electric railway work, and Westinghouse, Church, Kerr & Company were selected as chief engineers, auditors and contractors for the equipment of the road.

The right of way covers in all about 35 miles of double track railway and the entire property was secured by purchase so that the road was laid on its own private right of way. At present the road to Carbondale has extended only a mile and a half, this part being used temporarily pending the completion of a tunnel at Scranton which will avoid a considerable grade and all grade crossings within the city, and reduce the distance to Wilkes-Barre by more than a mile. The location involved many crossings of steam railroads, highways and water systems and consequently much heavy construction. The roadbed has been built for the heaviest locomotives and freight cars, and to meet the demand for rapid transit the third rail electric system was adopted.

The terminal properties of the road comprise 90 acres of land at Scranton a few blocks from the center of the city, and about 10 acres in Wilkes-Barre adjoining the Union Station, jointly occupied by the Pennsylvania, Lehigh Valley and Delaware & Hudson Railroads. Upon each of these terminal properties are passenger and freight stations, thoroughly equipped for the class of service to be rendered. The property at Scranton lies along the north bank of the Roaring Brook, and extends for about one-half mile in the rear of the terminal station. Track connections with the Delaware, Lackawanna & Western Railroad provide the necessary traffic connections with outside territory. The ground occupied by the Scranton terminal was formerly occupied by the North Works of the Lackawanna Iron & Steel Company, which were razed and the ground leveled off for the accommodation of the new buildings, comprising the power house, car house at the east end, and the station, and freight house at the west end. The architectural design of the buildings and the arrangement of the terminal track loop are features of the property. In all the building construction, concrete blocks, moulded upon the ground were employed, in place of cut stone, for sills, lintels, copings, cornices, etc. This construction proved to be less expensive than cut stone, and greatly facilitated building construction. The foundations are all of concrete, and the floors and roofs are generally of concrete and expanded metal upon steel framing construction. In the freight station, however, where the floor is subject to much hard usage, a heavy pine mill floor has been put in. In this building, as also in the receiving platform of the station baggage room, the concrete sills and corners of posts are protected by steel plates and angles securely anchored in position.



General View of the Power Station and Car House at Scranton.

The main station at Scranton is a two-story E-shape building fronting on Cedar Avenue, and located just south of the Delaware, Lackawanna & Western Railroad Company's tracks, and only about one block south of Lackawanna Avenue, one of the principal streets of Scranton. The station is surrounded by a concrete platform and is provided in the rear with a

covered platform of unique design. The building contains upon the first floor, the main waiting room, separate waiting rooms for men and women, baggage room and dispatcher's office. As the station is the official headquarters of the company, the second floor is devoted entirely to offices, draughting room, etc. The striking feature of the station is the curved platform, which surrounds about 90 degrees of the track loop, and it is constructed of southern pine framing, with slate roof, extending over the loop to a sufficient distance so that passengers when alighting are protected from rain. The concrete floor is of such a height as to approach within a few inches the bottom step of a car standing upon the siding, and the cars are provided with five steps so that the loading and unloading of passengers is rendered a very easy matter, and high steps are avoided.

The loop terminal system is employed at Scranton and Wilkes-Barre and arranged so that cars may receive and discharge passengers while standing upon the loop which is of easy curvature. In the center of the loop are laid two tracks which are utilized for storage purposes. Upon these tracks a sufficient number of reserve cars are kept in readiness for placing instantly in service, these being but a short distance away from the dispatcher's office, so that time need not be lost in obtaining cars from the car house which is located about one-half mile away.

At Wilkes-Barre an extensive terminal station will be located at the intersection of Market and Canal Streets, facing the square now occupied by the Union Station, which is used jointly by the Pennsylvania, Lehigh Valley and Delaware & Hudson Railroads. This station will be equipped similarly to that at Scranton, where ample facilities for accommodating passenger, express and freight service have been provided. Another important station is located at Pittston, Pa., one block from Main Street. Two buildings are provided, accommodating the passenger and freight departments, respectively. At various points along the line open or covered platforms have been erected for the convenience of patrons at which trains will stop upon signal. The ultimate locations of these stations, however, will be largely determined by the development of local traffic.

The car house and repair-shops are built of brick, concrete and steel, and are of fireproof construction throughout. The building is divided into independent bays with fireproof division walls and a complete fire system is provided so that adequate means are available for preventing the spread of an incipient conflagration. In the repair shop, located in the north side of the building, a concrete lined inspection pit is provided and a complete machine-shop equipment for taking care of repairs and renewals to the rolling stock.

A telephone system is installed for furnishing communication between stations, and also for train dispatching, and for controlling the operation of work trains during construction work. A temporary running schedule has been inaugurated between Scranton & Pittston averaging 28 4/10 miles per hour with seven stops, and the present headway of twenty minutes will be shortened as necessitated by the requirements of passenger traffic. This schedule between Scranton and Pittston is easily accomplished in 25 minutes, and with five minute lay-overs at terminals, one hour at present is consumed in making the round trip. An express run has however easily been accomplished in less than 18 minutes, which is at an average speed of 40 miles per hour.

The power house is rectangular, 90x133½ feet and 42 feet high in the clear to the roof of the engine room. A brick fire wall separates the boiler and engine rooms and its pilasters support one of the runways for the traveling crane in the engine room. The boiler and engine rooms each have basements and a semi-octagonal projection from the latter has three floors to accommodate the condensing and lubricating apparatus and the engineer's office. The boiler room is 128 feet 10 inches by 42 feet and 26 feet 6 inches high and contains five Babcock & Wilcox 400-horse-power water tube boilers and provision for two additional boilers. The boilers are supported independent of the brick settings and the building columns are designed so as to support the front part of the boiler drums as well as the coal bunkers overhead. The boilers are equipped with Roney mechanical stokers, as shown in one of the views. Taking advantage of local conditions, the boiler plant has been designed to burn culm, if found desirable, several immense piles of which have been purchased by the company.



Terminal Station at Scranton.



Main Station at Pittston.



Curve between the Pittston Stations.



William Street Station, Pittston.

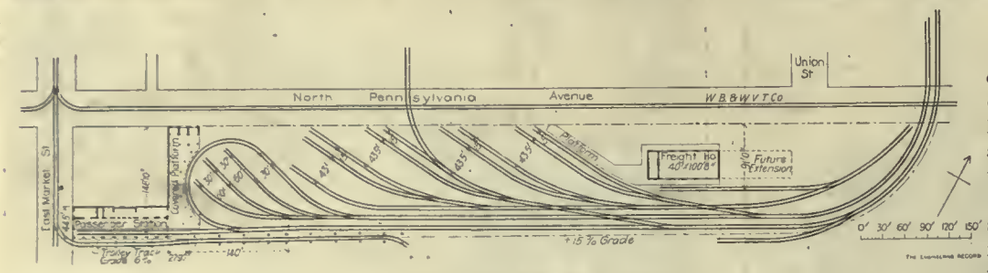
Coal is delivered to the power station in cars upon a track which parallels the boiler room at the yard level and rests upon a wooden trestle 12 feet above the boiler room floor. Beneath this trestle are steel-lined bins with chutes directed toward a hopper over a Robins belt conveyor driven by a Westinghouse 10-horsepower motor. The conveyor has a capacity of 25 tons per hour at a speed of 350 feet per minute and distributes the coal in the 250-ton capacity bunkers above the boiler fronts. The ashes fall into hoppers beneath the grates, from which they are dumped into an 18-cubic-foot Koppel ash car running on a 20-inch-gauge track the full length of the basement. The car is lifted to yard grade by a 3,000-pound hydraulic hoist, and may then be run to any desired point over portable tracks. Sufficient draft for burning ordinary sizes of coal is furnished by the Custodis chimney 118 feet high with an internal diameter of 9 feet 10 inches, but for burning culm forced draft is provided by two three-quarter housed special design blowers direct-connected to a small Standard engine. Feed water is supplied to the boilers by two Worthington plunger pumps which have duplicate connections to draw water from Roaring Brook, flowing through the yard, the city water system, the hot well of the condensing system or an intake well located beside Roaring Brook reservoir contiguous to the power house. The water passes through a specially designed horizontal closed feed-water heater.

The steam piping is all of standard full weight wrought iron pipe with extra heavy flanged fittings and extra heavy gate valves completely covered with molded magnesia blocks and canvas. The piping is arranged at the boilers in a system of manifolds having a main and two auxiliary headers, interconnected and valved so that any part of the system may be isolated without interfering with the running of the plant. The main header is connected to the boilers by flanged wrought iron pipes having large-radius bends and is dripped automatically to the boilers by the Holly gravity return system. Steam is supplied to each main engine through a horizontal pipe bend and a separator of special design.

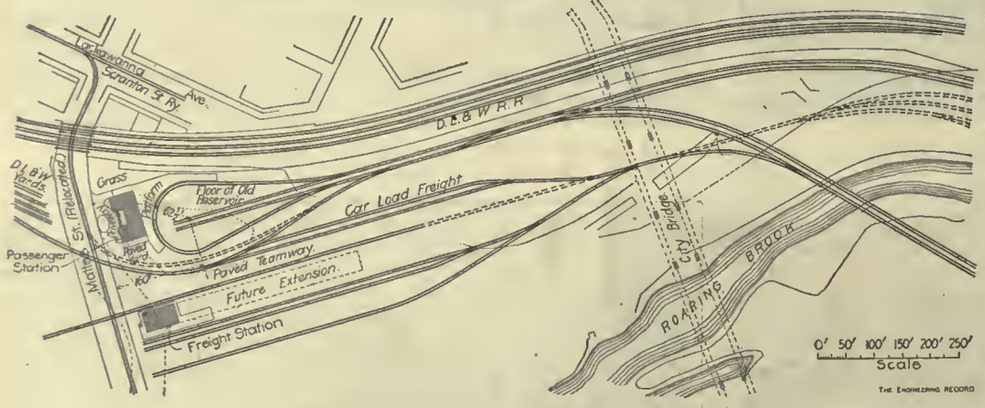
The main exhaust pipe of each engine is cast-iron pipe and connects by easy bends with a special condenser entrainer set upon the second floor of the condenser addition. A gate valve hydraulically operated from the engine platform cuts off each engine from the condensing system when the latter is not in operation, and a relief valve is connected in on the engine side of each gate valve, which in case of loss of vacuum automatically opens to the atmosphere through a pipe which extends to the roof and is capped by an exhaust head. The principal feature of the condensing system is a 30-inch Worthington elevated jet condenser with a capacity to condense 75,000 pounds of steam per hour and maintain a vacuum of 26 inches with condensing water at 80 degrees Fahrenheit. The main circulating pump is of the Worthington turbine type, with 14-inch suction and discharge, direct-connected to a 12x10-inch Westinghouse Junior engine, and has a capacity of 6,000 gallons per minute. The condensing water is drawn from the Roaring Brook reservoir intake and discharged through a 36-inch concrete conduit back into the reservoir at the dam about a half mile below.



One of the Passenger Cars.



Passenger and Freight Depots, Wilkes-Barre Terminal.



Passenger and Freight Depots, Scranton Terminal.

The engine room is 128 feet 10 inches long and 44 feet high in the clear. The front is 54 feet 8 inches wide, while the rear is 10 feet narrower, the additional space in front being required for switchboards and accompanying apparatus. The room contains two main engines and a foundation for a third and has a 35-ton overhead traveling crane. The two engines now running are duplicates and either is sufficient to operate the road at present. They are Westinghouse vertical cross-compound engines with Corliss valves and of 2,000 indicated horse-power normal capacity. An 8-inch Westinghouse air brake steam compressor is located on the engine room wall and connected to a standard receiver tank, from which the air is piped for cleaning generators, switchboards, motors, car seats, etc., and for operating pneumatic tools and hoists in the power station, car house and repair shop.

The generators are double-current machines of 1,250-kilowatt capacity each, and are excited



Avoca Viaduct, Showing the Crossing over Five Track Levels.

by 62½-kilowatt dynamos in duplicate. There are two marble switchboards, one for the direct and the other for the alternating current system, with ample provision for future extension. Four water-cooled 800-kilowatt transformers step the alternating current up from 390 volts at the machine terminals to 22,000 volts for transmission over a line of three No. 4 Brown & Sharpe copper wires.

The permanent way is of the highest grade steam railroad construction, double tracked over the whole line with cross-overs at intervals for convenience of service. The rails in the main line to Wilkes-Barre are standard A. S. C. E. section weighing 90 pounds per yard; for the short line toward Carbondale they will be of 75-pound section. Spring frogs and long point switches are provided at all switches and cross-overs, and rail braces and guard rails at all curves. The ballast is of broken limestone throughout with a depth of from 6 to 15 inches under ties, which are southern yellow pine 7x9 inches by 8 feet spaced 2,640 to the mile. Every fifth tie is 6 inches longer than the others and supports a reconstructed granite third rail insulator resting upon a cast-iron shoe bolted to the tie. The track is bonded with 200,000-circular-mil protected rail bonds placed under the fish plates. Cross-bonds of 250,000 circular mils are placed every 500 feet along the line. The third rails are of 75-pound A. S. C. E. section, and they are bonded with two 400,000-circular-mil foot bonds, and at the few grade crossings that occur at country roads, and at stations, are broken and their ends connected with two 300,000-circular-mil cables laid in creosoted wood conduit.

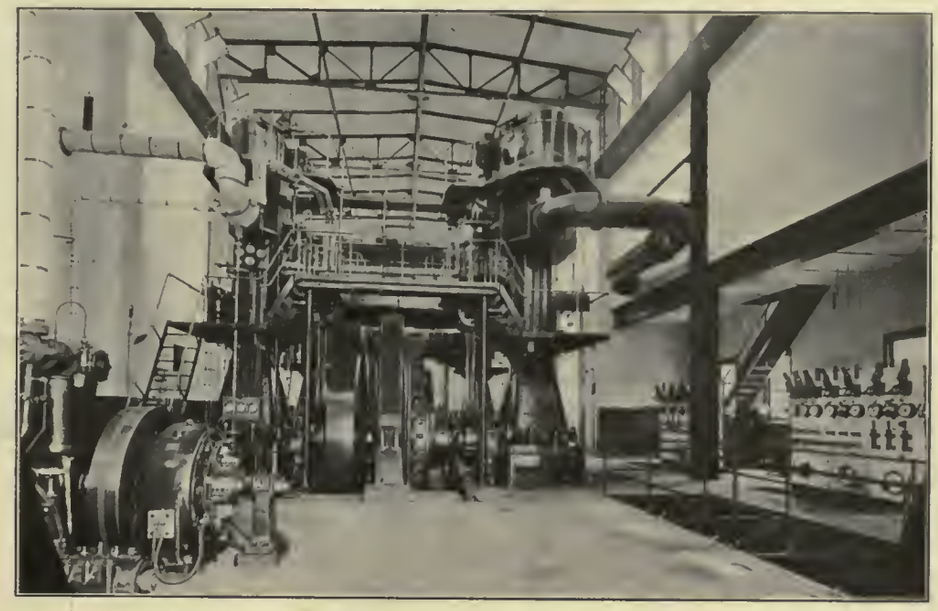
The right of way varies in width from 60 to 150 feet, depending upon the nature of the fill or cut, and is enclosed by a galvanized wire mesh fence 5 feet high with 5-inch cedar posts spaced 15 feet and set 3 feet into the ground.

All grades have been kept as low as possible and excepting on a temporary cut-off, none exceed 2 per cent. The alignment is as straight as practicable, there being only one curve of 12 degrees, and all curves are eased by spirals. To attain this desirable condition of grade and alignment some heavy cuts through a great variety of materials and extensive fills as well as much difficult construction and engineering work of other kinds have been necessary. The sides of some of the cuts had to be supported by retaining walls, as is shown in the view of the Williams Street station at Pittston. Portland cement concrete was used for all walls.

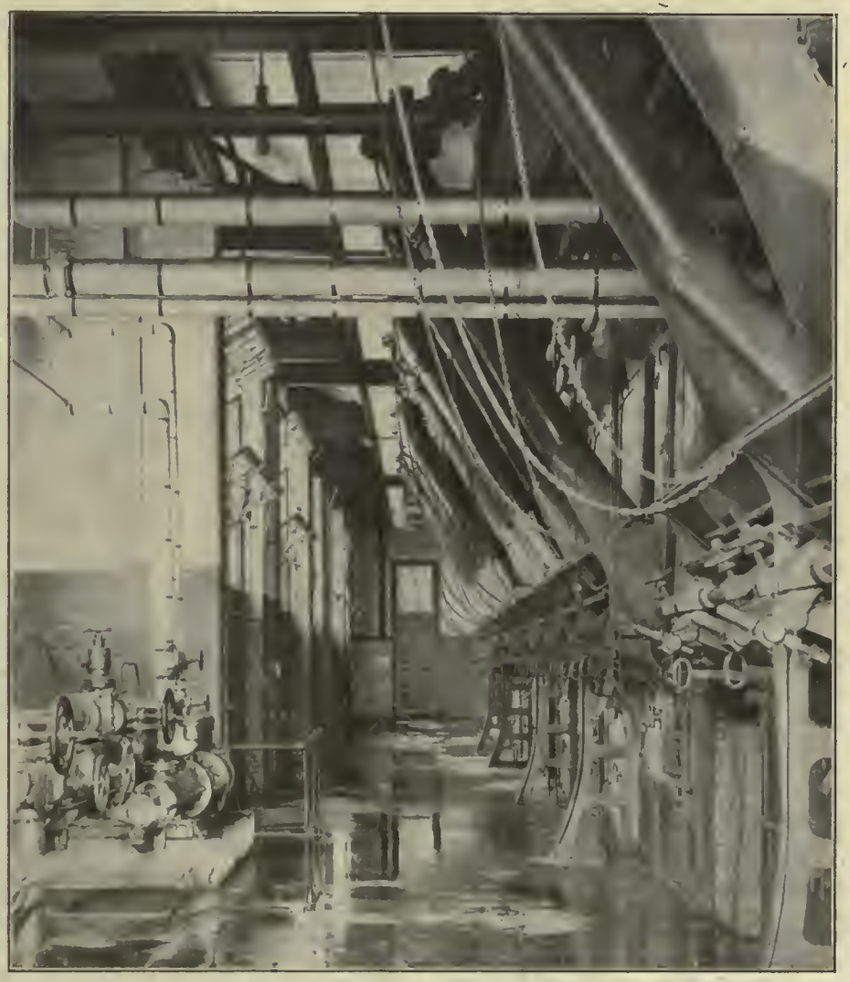
A 5-foot concrete waste water tunnel extends under the right wall at this station throughout the entire length connecting about 1,000 feet below with an open concrete channel. Not only have wagon roads and residences had to be moved, but some of the steam railroads have had to be shifted to one side or the other to prevent sharp curves and diversions. In crossing highways and railroads either underneath or overhead and in crossing streams, many steel bridges were built, supported on concrete or stone abutments. At Avoca is a viaduct 682 feet long with a maximum height of 60 feet, composed of one triangular riveted truss span and 8 plate girder spans, varying in length from 50 to 102 feet, spanning the tracks of the Lehigh Valley and the Delaware & Hudson railroads and the Scranton Traction Company. The pedestals are pin-connected and roller bearings are provided at all expansion points. This viaduct was built and erected by the King Bridge Company. One of the illustrations is a view of this viaduct.

The roadbed is finished and all equipment installed from Scranton to Pittston, and in these 12 miles there are fourteen bridges varying in span from 26 to 93 feet and twenty-one box culverts. In the approach to Wilkes-Barre a viaduct 554 feet long is being constructed to carry the road over the highway, and the tracks of the Wilkes-Barre Traction Company and the Lehigh Valley and New Jersey Central railroads. At this crossing the tracks are 30 feet above the ground, and the embankment south of the viaduct extends for 1,000 feet along the Susquehanna River, passing under the bridge of the Wilkes-Barre & Eastern Railroad, the first span of which is being rebuilt to allow sufficient head room. The bridge work at this point is being executed by the McClintic-Marshall Construction Company. One of the illustrations shows one of the substantial cars which are being run over the portion of the road now in operation.

The design, construction and equipment of the entire road has been carried out by Westinghouse, Church, Kerr & Co. The organization of the road is as follows: George C. Smith, president; Charles F. Conn, vice-president; W. Phelps, secretary; Carl M. Vail, treasurer; Chester P. Wilson, superintendent; B. F. Wyly, traffic manager.



Engine Room, Power House, Scranton.



Boiler Room, Power House, Scranton.

Types and Details of Bridge Construction.—IX.

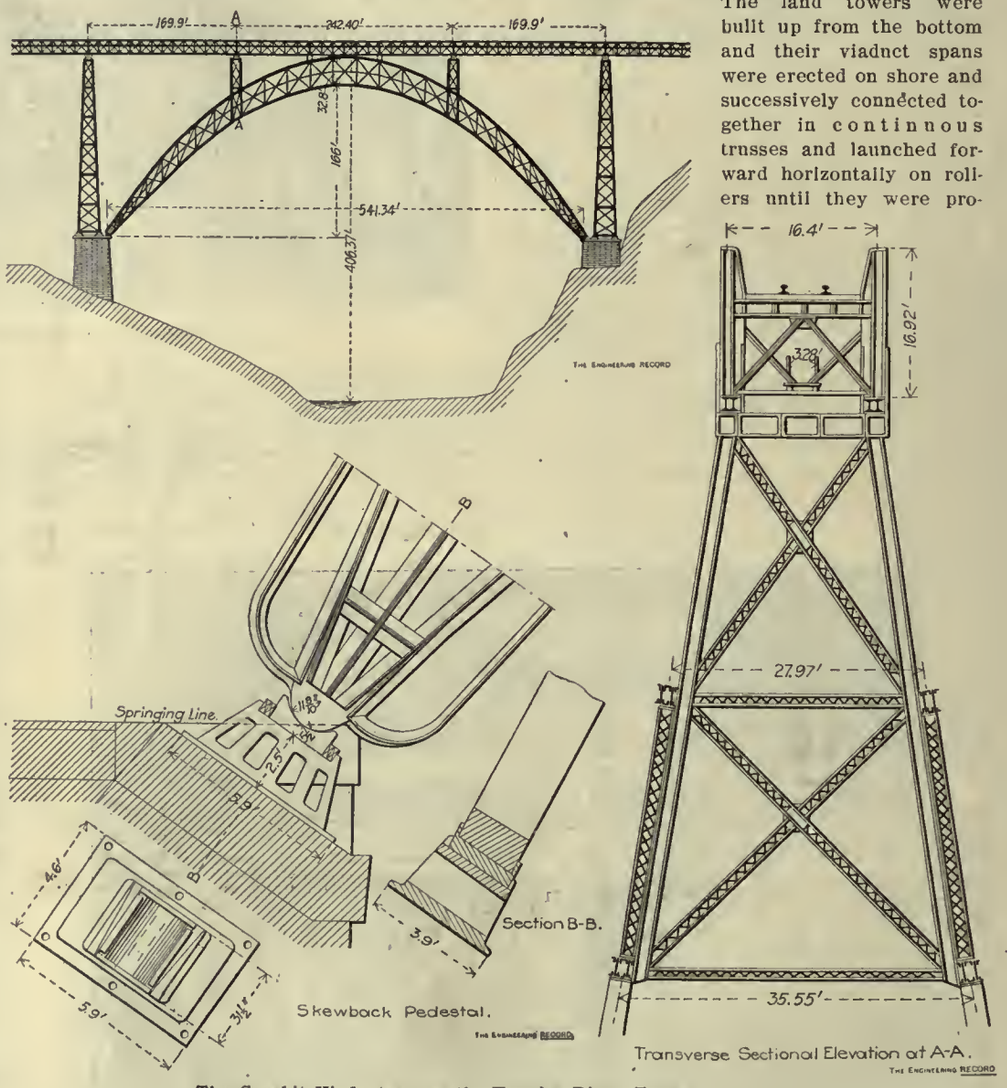
By Frank W. Skinner, C. E.

TRUSSED ARCHES—CONTINUED.

The Garabit viaduct, a single-track railroad structure across the Truyère River, France, was described in The Engineering Record, March 7, 1891. The center span combines greater length and height than any other bridge of the same type and is remarkable for this and for slender proportions and conspicuous position. The center span has a pair of two-hinge lune-shaped arch trusses in battered planes. The top and bottom chords are eccentric parabolic curves with a common chord of 541.3 feet, depth of about 33 feet, and rise of lower chord of about 166 feet. The trusses are inclined 11:100 from the vertical and are divided by vertical members into 29 unequal, X-braced panels. They are about 65½ feet apart at the skewbacks and 20½ feet apart at the crown, and are connected by transverse struts at all panel points and diagonal braces in the planes of the top and bottom chords and vertical posts. The lateral diagonals make angles of approximately 45 degrees with the chords so that near the ends of the trusses they extend across two panels and have triple intersections; in the middle of the span they extend across single panels only.

The web members of the trusses are stayed by a curved line of longitudinal struts through their center points; midway between the top and bottom chords. The chords have rectangular trough shaped cross-sections latticed with angles on the inner sides. They are uniformly 25½ inches wide and 23½ inches deep except in the end panels where the top and bottom chords have common web plates making a deep closed box-girder section. The web members have I-shaped cross sections made with pairs of angles riveted together back to back, latticed, and riveted at the ends to the chord webs. The intersecting diagonals have the flanges of their angles turned in opposite directions so as to clear at intersections and rivet on opposite sides of the chord webs at the ends. The rounded ends of the trusses are about 7 feet deep and the chord angles and the center line strut angles converge to afford bearing for the semi-cylindrical hinge about 11½ inches in diameter and 2½ feet long. This is seated in a concave bearing block with a slightly larger radius, which is flat on the opposite side and engages a cast-iron pedestal on which it is adjusted by pairs of wedges between top and bottom flanges, as shown in the detail.

The pedestals are seated on the chamfered upper corners of massive masonry piers about 37 feet wide and 82 feet long on top. The piers are battered 4:100 longitudinally and 12:100 transversely and have separate footings connected by a longitudinal full-centered arch of about 20 feet radius. The trusses are anchored to the piers by a pair of rods at each end of each truss tangent to the center line of the truss. The rods are in vertical planes and their upper ends engage the opposite sides of a rocker bearing plate across the top flange of the end lateral strut. They clear the pedestal and, entering the pier on a diagonal line, pass through a narrow inclined well to a chamber under the center of the tower, where they have cotter wedges engaging a saddle on the under sides of reaction beams built into the arched roof of the chamber. The spandrel posts are parallel to the truss vertical posts and extend across the trusses from bottom to top chords. In each haunch there are four, battered in both directions and braced on all faces to make a tower which has longitudinal and transverse girders across the tops of the posts and supports the roadway trusses on expansion pedestals. The roadway trusses are about 17 feet deep and 16½ feet apart and are continuous lattice girders in vertical planes. They carry a single track railroad about half way between top and bottom chords and a footwalk at lower chord level which is on the center line of the bridge and passes through the sway bracing, clearing the diagonal members. The skewback towers are about 201 feet high, made with four posts, battered transversely and longitudinally. Transversely they correspond to the inclinations of the arch trusses, and longitudinally they are 23 feet long at the bottom and about 9 feet long at the top. Each post has an anchor rod 28½ feet long engaging a reaction beam built into the pier masonry, and there is a spiral staircase inside each tower affording passage from ground level to the roadway. The tower is divided into six equal stories by horizontal transverse and longitudinal struts and each vertical panel is braced with two panels of X-braces, besides which there are horizontal X-braces at each story.



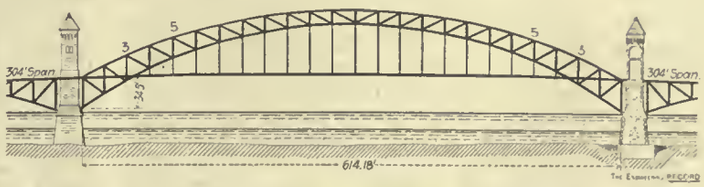
The Garabit Viaduct across the Truyère River, France.

The wind pressures were assumed at about 30½ pounds and 55 pounds per square foot for loaded and unloaded trusses, and 5.3 square feet per linear foot of train surface. The maximum combined wind and train loads produce unit stresses of about 8,534 pounds per square inch and the maximum temperature stress is about 900 pounds per square inch. The calculated deflections for live and dead loads at the crown are 1.37 and 0.65 inches, plus 2.05 inches for a fall of 30 degrees Centigrade in the temperature. The lateral displacement at the crown, from wind pressure is calculated to be 0.93 inch. The weight of the main span, three land towers and three 182-foot spans and two 170-foot spans similar to those above the arch trusses is about 7,333,500 pounds, and its cost, including about 24,400 yards of pier masonry, about $620,000.

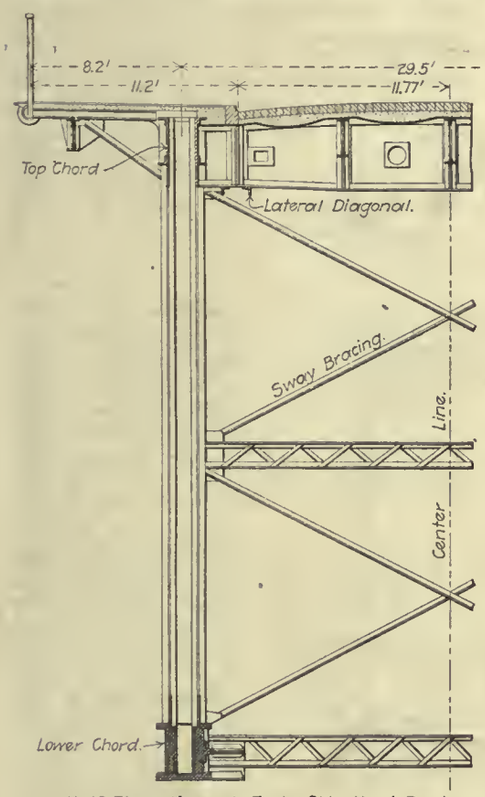
The building of the masonry and the erection of the superstructure was facilitated by the initial construction of a $4,000 service bridge 25 feet wide, over 100 feet high and nearly 500 feet long across the river, under the main arch span. It was built with framed trestle bents about 40 feet apart with knee braces dividing the stringers into three nearly equal parts. The land towers were built up from the bottom and their viaduct spans were erected on shore and successively connected together in continuous trusses and launched forward horizontally on rollers until they were projected from the abutments to a few panels beyond the tops of the skewback towers, when the shore ends were each anchored to the approach masonry by 28 steel cables. The first two panels at each end of the arch trusses were erected on falsework. All materials were delivered on the service track nearly 100 feet below springing line, and the remainder of the arch trusses were erected by revolving locomotive hand derricks on the roadway trusses and by trolley hoists on cableways stretched between two temporary wooden towers on top of the skewback towers. The arch trusses were guyed back to the tops of the skewback towers by 24 steel cables, the ends of which engaged reaction beams at the tower top and the bights of which engaged cylindrical bearings on the truss. They were adjusted by hydraulic jacks.

The center panel connections were made without difficulty, and the erection was accomplished in about four years.

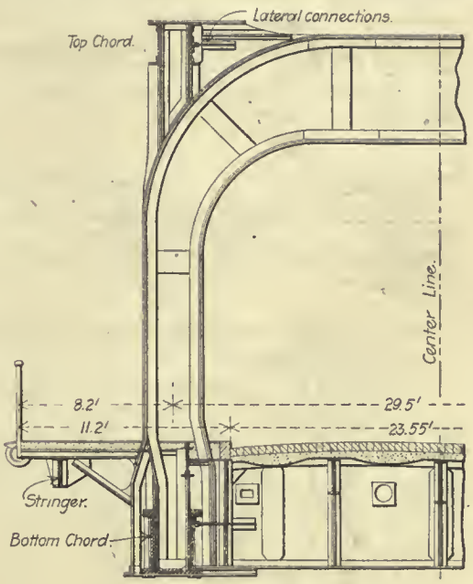
The highway bridge across the Rhine, at Bonn, Germany, was described in Paris "Genie Civil" of May 20, 1899, and in London "Engineering" of March 30, 1900. It is a very handsome and imposing structure of large dimensions and graceful design, with three arch spans across the channel, a long span, high level through arch in the center and two symmetrical low level deck side spans, with monumental piers and abutments. Between the trusses there is a 29½-foot roadway with two street car tracks and outside of them there are two 8¼-foot cantilever sidewalks. The concrete and wooden pavement is carried on curved throughout to circular arcs, of 640 and 530 feet radius, respectively. The depths of the trusses are 15 feet 8 inches at the crown and 34 feet 6 inches at the skewbacks. They are divided by vertical posts into twenty-four 25½-foot panels. The rise of the lower chord is 96¾ feet, and its extreme height above mean water level is 137¾ feet. All verticals and diagonals are compression members, riveted to the double webs of the chords with pairs of



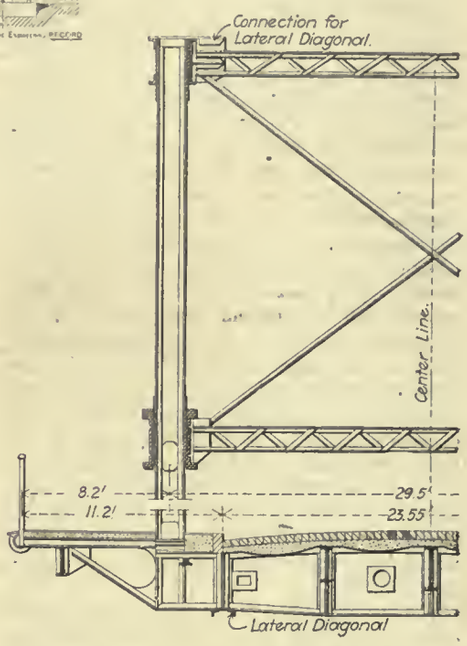
were planed simultaneously to accurate curves on both edges and are made with widths of 20.7 and 10 inches for the inner and outer plates respectively. The top chords are made with 5½x5½-inch angles and have a maximum cross-section of 155 square inches, and the bottom chords with 6.3x6.3-inch angles and a maximum cross-section of 253 square inches. The end vertical posts and those in the portal bents have extra heavy cross-sections and double pairs of flange angles, and the latter are forked and connected to the lower chord transverse diaphragm plates on both sides of each web plate, as shown in the details. The ends of the



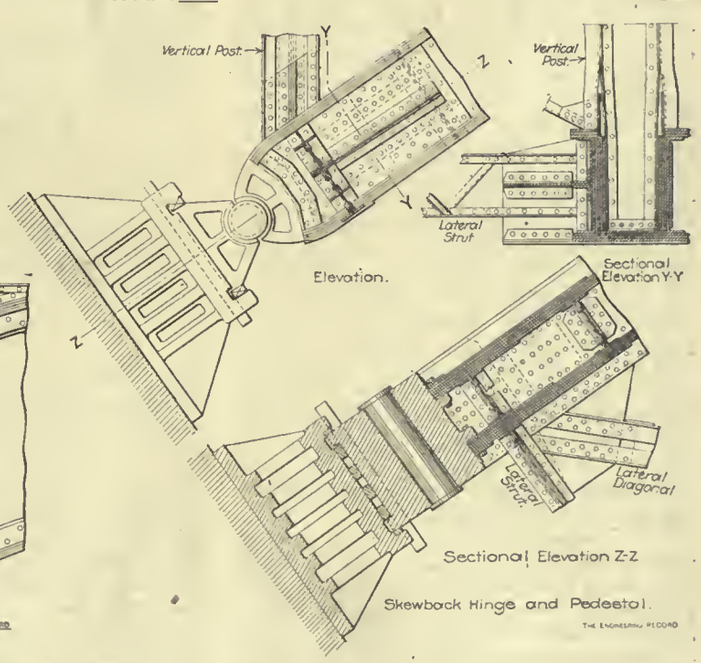
Half Elevation at End of Vertical Bent.

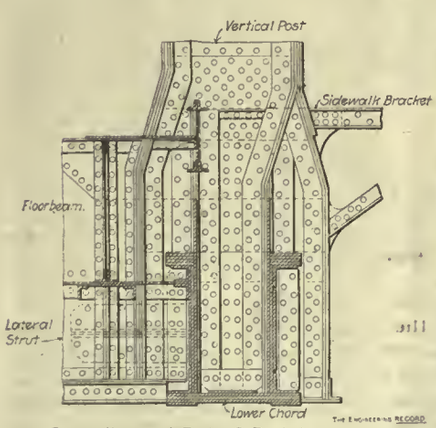


Portal at Panel No.3.

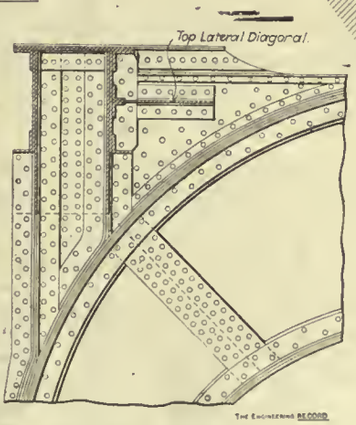


Sectional Elevation at Panel 5.





Connections at Foot of Portal.



Connection of Portal to Top Chord.

Diagram and Details of Bridge across the Rhine at Bonn, Germany.

galvanized iron buckle plates, concave side down, supported on lattice girder stringers about 25½ feet long. The floorbeams are plate-girders 29½ feet long and 47½ inches deep in the middle, tapering to 39½ inches at the ends and having their webs pierced for drain and gas pipes. The center span has two 614 foot two-hinge arch trusses in vertical planes 29½ feet apart. The top and bottom chords are gusset plates having curved edges. The diagonals are made with double pairs of angles latticed, and the verticals with plates and angles built into I-shaped cross-sections. The chords have rectangular cross-sections made with pairs of built channels and lattice bars or cover plates, arranged in the usual manner, and with peculiar reinforcements, as shown in diagrams of special panels. The chord webs lower chords have concave flanges engaging cast-steel bearings for 10-inch skewback pins 36½ inches long. The pin has a solid flange or collar at each end, locking it to the cast-steel shoe, which is adjustable with pairs of steel wedges on the sides and bottom with the 10-ton cast-iron pedestal which has a 1/6-inch lead cushion on the granite coping. The 71x 86.6-inch pedestal base sustains a maximum

pressure of about 711 pounds per square inch.

At the ends of the span the floorbeams are web-connected to the chords and the vertical posts. In the middle they pass through and are web-connected to extensions of the vertical posts below the lower chords. The floor system is discontinuous longitudinally at its intersection with the lower chords so as not to take horizontal stress from the arch trusses, and at the third panel points from the ends of the trusses there is very heavy portal bracing between the trusses. These connections to the top chords are very rigid, as shown in the detail, and the portal girders are richly decorated with relief work and colors.

There are transverse horizontal struts and X-bracing in all panels of the top and bottom chords and in the planes of the bottom flanges of the floorbeams, besides the solid buckle plate floor. The transverse struts have rectangular cross-sections, made with four angles tapered towards the ends and latticed on all four sides; the diagonals have I-shaped cross-sections made with two pairs of angles, riveted back to back and latticed. There is transverse sway bracing between the vertical posts in the two end panels under the floor and at all panel-points between the portals there is vertical sway bracing between the top and bottom chords. The bridge was proportioned to carry a 13-ton roller and as many wagons as possible on the roadway, to have the sidewalks filled solid with people, and to sustain a wind pressure of 31 pounds per square foot on the surface actually exposed, plus a strip 8¼ feet high. The most unfavorable conditions were found to be when the bridge was fully loaded except one sidewalk which was empty, and the maximum stresses allowed were about 18,000 pounds per square inch, reduced by compression formulae.

The 69x45-foot channel piers were built in coffer dams with double walls 13½ feet apart filled between with puddle. The inner wall was made with vertical I-beams having their webs alternately in its plane and at right angles to it, and driven about 30 feet into the sand and gravel. The outer wall was made of wooden sheet piles about 8 inches thick. A concrete footing about 16 feet thick was deposited over the entire area of the coffer dam through chutes extending to the bottom and moving slowly back and forth on an overhead traveler so as to continuously distribute the submerged concrete without exposing it to washing. The water was pumped out above the footing and the ashlar masonry and concrete backing of the upper parts of the piers were laid by derricks and travelers moving on or spanning the coffer dams and operated by electric motors. Rows of ¾-inch holes were drilled by electricity through the I-beam sheet piles close to the concrete footings and the tops of the beams were bent back and forth until they broke off and the lower portions were left permanently in position.

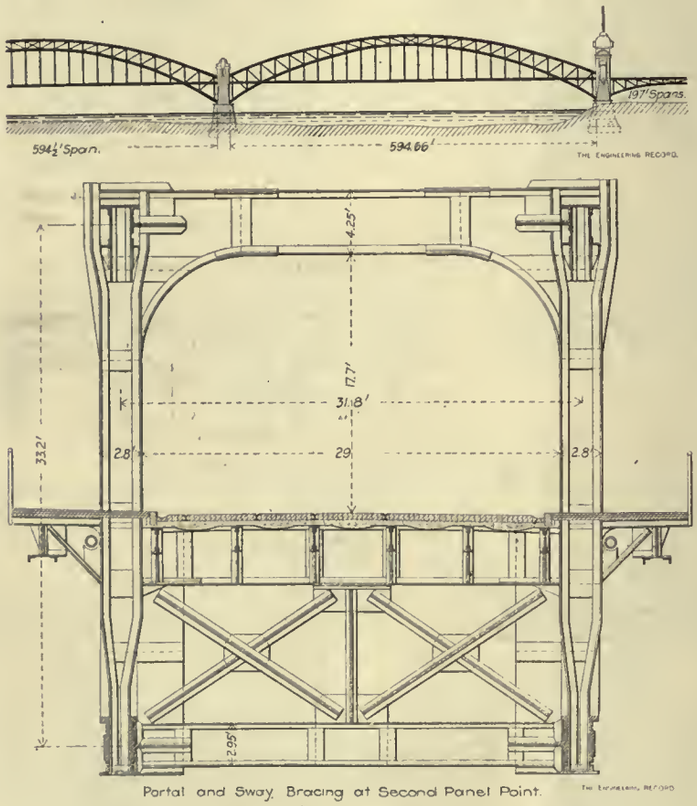
The span was erected on pile falsework with bents at panel-points, reaching to the lower chord level and having two 82-foot openings for navigation. Two rows of vertical posts on each side of each truss supported a horizontal upper platform above the highest point of the top chord, on which two travelers moved and handled all the truss members. These had maximum weights of 7½ tons and were delivered on boats. The lower chords were assembled on jack screws and were frequently adjusted during erection on account of the settlement of the falsework. The total dead load on the falsework was about 1,650 tons and the span was erected in about 12 weeks and deflected only 2½ inches under dead load.

The two 307-foot deck spans have spandrel braced arch trusses with horizontal top chords at roadway level. The bottom chords are curved to radii of 516 and 416 feet, have a rise of 31 feet, and are 4 feet below the top chords at the center. They were erected in about one month each by methods similar to those for the center span. The bridge was finished in 1898 at a total cost of about $637,000, and weighs about 3,000 tons.

The highway bridge across the Rhine at Düsseldorf, Germany, very closely resembles that at Bonn, and was described in Paris "Genie Civil," May 27, 1899. It has a total length of 2,093 feet, including four short spandrel-brace deck arch spans and two channel spans, with a main pier in the center of the river and one on each shore. It has a 27-foot roadway and two 10-foot sidewalks about 62 feet above mean water level. Each main span has two two-hinge arch trusses, 594½ feet long and 32.8 feet apart on centers, from which the floor platform is suspended. The top and bottom chords are arcs of eccentric circles in vertical planes and are about 16½ feet apart at the crown and twice as far apart at the skewbacks. The truss is divided into 25 panels by vertical posts which extend below the lower chords to carry the floorbeams. The trough shaped top chord has 30-inch webs 19 inches apart made with three plates riveted together, and the cover plate is made with two thicknesses of 32-inch plates. The lower flange angles are reinforced with two 5½-inch horizontal plates. The bottom chords are made with two built channels 36 inches deep and 20 inches apart, latticed top and bottom. The diagonal members have rectangular cross-sections made of four angles, latticed on all sides, and the verticals are I-shaped, made with a web plate and four flange angles. There are transverse struts at all top and bottom panel points, between which there is X-bracing in the planes of both chords and in the transverse vertical planes. There is a third lateral system at the floor level. The floorbeam webs are field riveted between the flange angles of the vertical suspenders and project beyond them to form tapered cantilevers for the sidewalks. There are six lines of roadway stringers unsymmetrically placed with regards to the two street car tracks, which carry buckle plates, concave upwards, filled with concrete and paved with wood blocks. The two lines of sidewalk stringers have their lower flanges projecting below the cantilever floorbeams and stiffened laterally by wide horizontal plates having flange angles on the edges.

The greatest difference between this bridge and that at Bonn is in the design of the portal braces which are at the second panel points and are made with solid plate girders between the top and bottom chords and deep solid web knee braces at the ends of the top struts. The vertical posts at this panel point are of special design with I-shaped cross-section. The flange angles converge at the feet of the posts to be riveted to the insides of the lower chord webs, and diverge at the top to form forked connections engaging the outsides of the top chords. and the ends of the portal girders, besides which a center extension has vertical flange angles riveted across the insides of the top chord webs.

(To be continued.)



Portal and Sway Bracing at Second Panel Point.

The Duesseldorf Bridge, Germany.

A Cast-Grid Rheostat, in which the resistance units are directly connected to the contact studs, has been brought out by the Stanley Electric Manufacturing Company, of Pittsfield, Mass. It consists of fifty to sixty iron sections, of extended radiating surface, all arranged radially about the spindle of the contact mover. Each is formed with a projection extending at such an angle from the plane of the unit proper as to allow direct connection with the next unit, and a contact stud passes through two adjoining units at this point, furnishing electrical connection between the units, supporting them in place and supplying contact surface for the contact arm. The circular group of grids is mounted between two slate slabs and the whole rheostat is enclosed in substantial, ventilated iron case. A feature of the apparatus is its compactness.

The Petroleum Wells in Russia are in some cases 1,750 feet deep, and some are cased with riveted pipe, with the interstices filled with cement to exclude the ground water. The waterproofing is effected with a solution made with 100 parts of Portland cement and 122 parts of Caspian Sea water, which is delivered into the well through a ¾-inch pipe, and hardens within two days. Sometimes a pressure of 40 atmospheres is used. It is considered that sea water is preferable to distilled water, and that grout made with it hardens more rapidly under pressure. The temperature of the water does not affect the hardening, but it is more satisfactory with pure cement than with cement and sand mixed.

The Cause of the Cementing Value of Rock Powders.

Abstract of a paper by Allerton S. Cushman in the "Journal" of the American Chemical Society.

In the course of the investigation of rocks as road-building material, it early became apparent that in addition to the hardness, resistance to wear, and other physical, mechanical, and economical conditions that required consideration, the binding power, or as it has come to be called, the cementing value, was one of the most important factors in deciding as to the nature and value of the material.

The description of methods of reducing the materials to powders, the formation from these powders of briquettes under constant pressure, and the subsequent impact testing by which the cementing value is obtained, has already been thoroughly described by Mr. L. W. Page, to whom the development of the study of the cementing value of rocks and the methods of impact testing is due. An outline description of the methods employed is all that is necessary here. The stone or other material is ground in a ball mill until it passes a screen with 40 meshes per centimeter. This sifted powder is then mixed with sufficient water to make a stiff "dough." After standing twenty-four hours, cylindrical briquettes are made of standard size (25x25 millimeter) at a standard pressure of 100 kilograms per square centimeter. This is done in a specially designed hydraulic press. The briquettes are then dried in an air-bath at 100 degrees and tested in an impact machine which delivers a standard blow of 1 kilogram, falling 1 centimeter. The cementing value is measured in this laboratory by the average number of standard blows that a series of briquettes made from a rock powder will stand.

It was realized from the beginning of the investigation that the phenomenon of the cementing power of rock dusts was possibly the result of several if not many causes. Among those which might be expected to have more or less influence, may be mentioned: (1) Solubility, however slight, of the material or of certain ingredients of the material; (2) Size and shape of the particles; (3) Chemical reactions set up on moistening the powders, as in the cases of Portland cements, mortar, etc.; (4) Crystalline forces operating under either 1 or 3, as in the cases of plaster-of-paris, mortar, cements; (5) Physical nature or condition of the particles and their relations to water: (a) Unbound water; (b) hygroscopic water; (c) water of crystallization; (d) water of constitution, or combination.

After many experiments in this laboratory, the conclusion was reached that, although the causes put down under the first four headings are to a certain degree operative in many cases, and even perhaps of paramount importance in exceptional ones, it is under the fifth heading that the true cause of cementing power and plasticity must be sought. If a rock powder is ignited at a temperature at which all the water of combination is expelled, the cementing power is invariably totally destroyed. No better indication could be had that the binding power is a function of the combined water or of some condition of the particles which is invariably accompanied by the presence of combined water. Early in the investigation the idea had suggested itself that there must be a physical difference in the nature of the particles. Powders which cement well must be composed of particles which present to one another more or less "sticky" or adherent surfaces. As a matter of fact, a trained eye can at once detect a powder that is likely to give a high cementing value. A plastic powder when poured on a flat surface will form a more or less cone-shaped heap, while a non-plastic powder, to use the language of the clay worker, "squats." Most authorities have rejected the notion that water of combination conditions the plasticity, for the simple reason that many totally non-plastic earthy deposits and minerals have a high water content. The difficulty has probably arisen from a failure to distinguish *different kinds* of water of combination.

Experiments by the writer show that plastic powders molded into briquettes under a given pressure apparently suffer a certain compression which is not shown by the material after the plastic condition has been destroyed by ignition. We have now to inquire if any reason can be found not only for this compression but for the fact that it seems to accompany the plastic condition.

Compressibility may be conditioned by: (1) Porosity and plasticity of the particles which would allow of their being "squeezed" into closer contact and configuration. (2) Shape and size of the particles governing their resistance to close contact and the inclosure of voids.

In this work it was found that the ignited powder always contained a much larger proportion of impalpably fine dust than the raw hydrated powders. This is shown not only by microscopic examinations but proved by dropping the respective powders into water, when it is easily seen that the former contains a greater proportion of fine material which remains longer in suspension.

It is conceivable that a hydrated material may possess a porosity so fine that the magnitude of the interstitial spaces is submicroscopic, perhaps not far removed from that of the water molecules themselves. The heating by ignition of a powder consisting of such hydrated particles would have a bursting or disrupting effect upon the particles which would thus fall down to a more impalpable dust.

In order to investigate the effect of size of particle on the volume of briquettes it was decided to prepare glass powders of different degrees of fineness. A quantity of the best French plate glass was accordingly powdered in the ball mill and sifted through a 0.25-millimeter mesh screen. A quantity of the sifted powder was shaken up with a large excess of distilled water and allowed to settle for ten minutes. The portion in suspension was then decanted to another vessel and allowed to settle again for thirty minutes; the decantation was then repeated and the third or finest portion allowed to settle completely. The three portions were thoroughly dried in an air-bath, and the three powders examined under a high-power microscope, fitted with a micrometer eye-piece, with a view to getting some notion of the comparative size of the particles in the respective samples. As the size of the different particles was in no case uniform, the best that could be done was to measure the largest particle that presented itself in each field and then select one that seemed more nearly to represent an average; 20-gram briquettes were then made from each of the three powders, and carefully measured.

The extreme compression observed between the minimum and maximum volume in these glass briquettes is 9.5 millimeter; this corresponds to a calculated difference of 0.7 of a unit in the specific gravity. That is to say, if the powder had a specific gravity equal to 2.5, the finest would have to have a specific gravity equal to 1.8 in order to account for the variations. It is impossible to believe that such a homogeneous material as plate glass could be separated into portions of such widely differing gravities, and, moreover, in spite of the difficulties attending the determination of the specific gravity of very fine powders, such wide differences could not escape experimental detection. As a matter of fact, determinations carefully carried out showed little or no deviations in specific gravity.

The question then is, how are we to explain these results? As far as the writer is aware there is little information available in the literature on the volume relations of fine powders under given pressures. If the glass is crushed to fragments these fragments can be compressed to a certain degree by a given pressure; if we break these fragments still smaller, the resulting fragments, however tiny, are made up of particles arranged in more compact order and in less space than they could be arranged again if once set free. From purely theoretical consideration, therefore, we may say that in reducing the fineness of a powder we are approaching an ideal condition of unit particles which can not be forced by any ordinary pressures into the same space they occupied as part of fused masses.

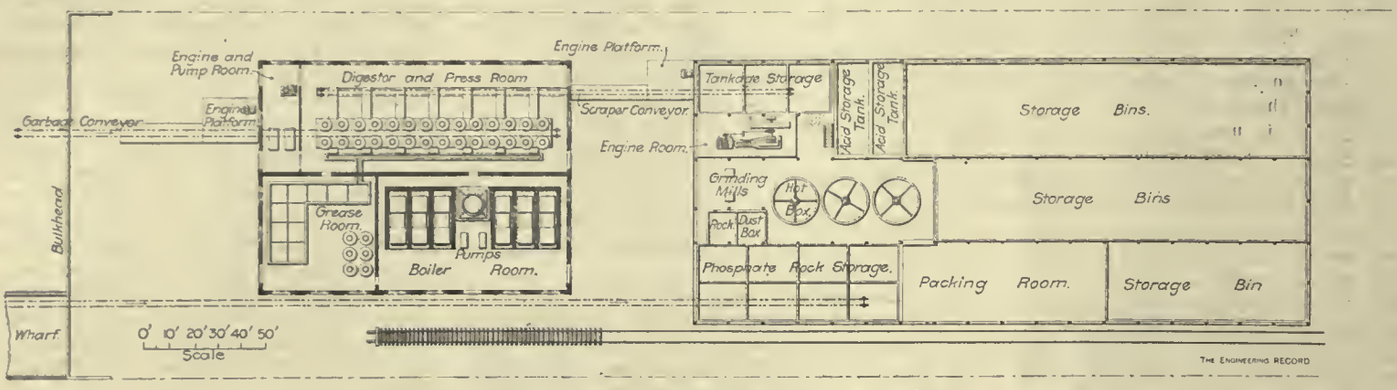
Turning again to the results on rock powders we are led to the conclusion that the driving off of water of combination breaks up the particles to a finer dust, also that this destruction of the particles leads to loss of plasticity. As there were on hand in this laboratory a large number of thoroughly air-dried samples of rock powders and clays, of which the cementing value was known, it was decided to determine the water content of these, with a view to seeing if indeed any relation could be traced between cementing value and water of combination. The determinations were made by igniting the powders in a platinum boat contained in a hard glass tube and absorbing the water set free in a weighed sulphuric acid bulb-tube.

An inspection of the results shows that high cementing values have a decided tendency to accompany a high water content. At the same time there are several exceptions revealed, and it is probable that an even greater number of results would show other discrepancies, as it is well known that many minerals with high water content do not yield plastic powders. On the other hand, if a certain kind of water of combination invariably accompanies the plastic condition, this active water would be added to the inactive and an explanation furnished, not only for the general tendency, as shown above, but also for the exceptions to it.

We have to inquire what is meant by water of combination. Probably no term in chemistry has been more loosely used than this. Ordinarily speaking, it refers to the water which is contained in a substance in such a way that no amount of drying at 100 centigrade is able to dislodge it. In this way it is differentiated from unbound water and probably from hygroscopic moisture. Such a definition, however, would include as a general thing water of crystallization, which is not usually meant when we speak of water of combination.

Nearly all metallic oxides and many salts have the power of entering into that peculiar hydrated, non-crystalline condition which Graham in 1861 denominated colloid or glue-like. As a result of extensive investigations Van Bemmelen adopts the suggestion of Nageli of the micellian structure of colloids, that is to say, that these curious substances consist of heterogeneous molecular complexes which possess a submicroscopical, web-like, porous formation, one of the distinguishing characteristics of which is the peculiar relation to and dependency upon water which they exhibit. The water content of these hydrogels (inorganic colloids) varies continually with the temper-

ature and the vapor-pressure of the atmosphere in which they find themselves. Dried at high temperatures up to a certain critical point, they will lose nearly all their water, only to take it back again eagerly when allowed to cool in free air or in moist atmospheres. This dehydration and rehydration can be repeated indefinitely unless the temperature of drying is carried too high, when the faculty is gradually lost and finally destroyed. We have here to do with a certain kind of water of combination which we shall denominate micellian water. It is just as much a characteristic of the plastic or colloid condition as water of crystallization is a characteristic of many crystals, although we can have the water in these colloids replaced by organic liquids.



General Plan of the Garbage Reduction Plant at Baltimore.

Micellian water is absorbed into the structure of the particles of a powder of an inorganic hydrogel without changing the physical appearance, even under the microscope. Hygroscopic water is usually absorbed on the particles, producing a distinct appearance of wetness. Heating does not usually destroy the hygroscopic qualities of a substance; it invariably destroys the absorptive power of the micellian structure, if pushed far enough.

It is not the purpose of this paper to review the work that has been done on colloids. The immediate object is to call attention to certain significant qualities which are shared in common by such inorganic hydrogels as silicic acid, and ferric hydroxide on the one hand, and plastic clays and rock powders on the other. Both contain combined water; both lose water on heating, and take it up again on cooling in moist atmospheres. Both gradually lose this power on continued heating at high temperatures, and finally lose it entirely, together with plasticity, if the heating is pushed far enough. Very highly plastic clays and rock powders, after working up with water, usually shrink and deform on drying out; this quality is also universally noted in the case of the hydrogels. Silicic acid which has been air-dried can have water pressed out of it by subjecting it to very high pressures; the same phenomenon is known in the case of clays in the manufacture of hydraulic pressed brick. It has been frequently claimed that the cause of plasticity is to be sought in the aluminum silicate (kaolin) which forms the essential ingredient in all clays.

If plasticity is a question of a colloid condition of the particles, it seemed that plastic clays and rock powders ought to show the same peculiar relation to water as is shown by the hydrogels, and in a diminishing degree as the plasticity diminishes. In order to study the subject, a special form of furnace was devised that could be heated by a blast-lamp to any desired temperature up to 1100 degrees Centigrade. The temperatures were measured by means of a Le Chatelier platin-rhodium pyrometer. No difficulty was experienced in maintaining the temperatures constant to within a few degrees. The mode of procedure was as follows: Exact, 2 gram samples of the various substances were heated in the furnace for exactly one hour, cooled in a desiccator over concentrated sulphuric acid for one hour, weighed as quickly as possible and finally exposed under a large bell-jar over dilute sulphuric acid (24 per cent.) which had a vapor-pressure of about 18 millimeter at 24 degrees Centigrade. At this vapor-pressure, water does not absorb on the surface of glass or the particles of a powder so that all gains in weight are a true measure of affinity for water. As nearly as possible, the bell-jar was kept at a constant temperature during the experiments, but when any considerable variation occurred, corrections were made to the results. The silicic acid hydrogel was prepared by neutralizing sodium silicate with dilute hydrochloric acid, and washing the jelly by dialysis until the salt was entirely removed. The pure jelly was dried to a certain point on the steam-bath and finally allowed to air-dry. The resulting white powder, which had every physical appearance of being dry, was found to contain about 20 per cent. of water. The hydrogels of iron, alumina and magnesia were precipitated by dilute solutions of sodium hydroxide, thoroughly washed by decantation and finally air-dried. Finally three samples of clay were selected for comparison. Clay No. 1 was highly plastic, clay No. 2 less so, and clay No. 3 contained an unusual amount of calcium carbonate. The results indicate that identically the same peculiar power of absorbing water, which is gradually destroyed by heating, is possessed by clays and colloids. The difference is merely in degree. No amount of heating will destroy the power of lime, magnesia and alumina to take up water again. Whatever theory we may hold as to the relation of water to these substances in the process of "slaking" it is quite certain that it is an altogether different phenomenon from the process which goes on when water is absorbed into the peculiar structure of a colloid.



Charging Floor in the Digestor Room of the Baltimore Garbage Reduction Plant.

A question that naturally arises is how are we to account for the well-known high-binding powers of many homogeneous crystalline rocks such as limestones and dolomites. As a matter of fact, pure calcium carbonate has no cementing value whatsoever; this quality is provided by certain hydrated impurities such as silica, ferric oxide or even clay. The amount of these impurities need not necessarily be very large, but the distribution throughout the mass is probably of a very intimate nature. It has long been known to practical road builders that the binding power of many rocks increases as

time goes on, under the combined influence of the action of traffic and water. Every potter knows that the plasticity of clay increases under the action of kneading and working with water. In some industries, clay mixtures are stored away for considerable periods under wet blankets. This process is called "sweating" and is believed to be very beneficial. It has lately been suggested that bacterial fermentations are responsible for the improvement in the quality of clays under such treatment. The writer has no data on this subject but it is well known that many of the nitrifying bacteria flourish in media composed of inorganic colloids, which suggests that the presence of bacteria may be a concomitant rather than the cause of improvement. Experiments in the laboratory have shown that the cementing value of briquettes is increased, if the dough made from a rock dust is allowed to stand for some time before being molded, and it is still more increased if the dough is kneaded.

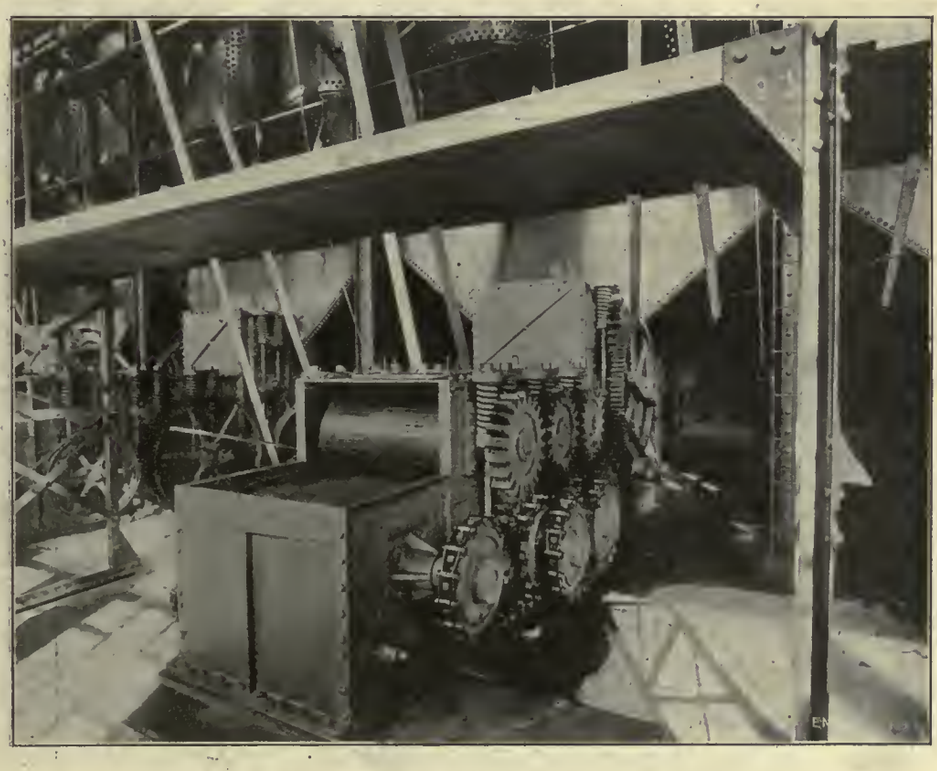
In summarizing the results as presented in this paper it may be said that it has been pointed out: (1) That the cementing power of rock powders is a property similar to the plasticity of clays. (2) That all rock powders that have cementing power show the same peculiar relation to water that is shown by substances that possess an amorphous colloid structure, i. e., they can be dehydrated and rehydrated, until, by prolonged high heating, the structure is destroyed.

It is not the intention of the writer to maintain that the gelatinous mass in which silicic acid separates from a dilute solution is in any way comparable to a plastic clay mass. The question is purely one of the condition of the particles which go to make up the mass of plastic rock-powder or clay. In the opinion of the writer, particles which are entirely crystalline in their nature have nothing to do with plasticity except to act as a diluent. It is the amorphous particles which, by reason of their characteristic structure, are able to absorb water and assume the condition which causes them to exhibit that coherence which in the mass we denominate plasticity.

The Garbage Reduction Plant at Baltimore.

There has recently been put into operation in Baltimore, Md., a garbage reduction plant of a type already well known from its use in New York, Boston and Philadelphia. The Arnold-Edgerton system is the one employed, and several improvements have been made in the process since the first plants were installed. The works at Barren Island, New York City, were described in The Engineering Record of August 27, 1898, and February 4, 1899; and a very complete and detailed description of the Boston plant was given in the issue of September 14, 1901. One of the main features of the Boston plant was the coking process that was gone through with in order to prepare the tankage for use as a fertilizer base. This feature has not been reproduced in the Baltimore plant, but otherwise the process is practically the same, and only its general outlines will be given here. Mr. Charles Edgerton is the designer of this plant, and the Baltimore Sanitary Contracting Company has a 10-year contract for the disposal of the city's refuse by this means.

The site selected for the Baltimore plant is upon deep water and in close proximity to the railroads. The garbage is delivered both by wagons and by scows, and the specifications under which the plant was constructed state "All garbage, dead animals and market refuse must be within the digesting tanks, or within the process of actual disposal not later than 6 o'clock A. M. on the day following their receipt at the plant for such disposal, and this material must be completely disposed of within 24 hours after its collection." From the scows the garbage is carried up over the tops of the digesters by means of a long water-tight steel-trough conveyor, entirely under cover. Valves are so arranged at the tops of the digestors that the use of any digestor can be discontinued without interfering with the other units, and swinging arms are provided, as shown in one of the photographs, through which the garbage is fed to any one of each battery of four digestors. The part of the main building in which the digestors are located is two stories high, and the rest only one story. Ample ventilation is provided in the roof.



One of the Roller Presses in the Baltimore Garbage Reduction Plant.

The reduction process is thus described in the specifications: "The system of final disposal shall be thorough sterilization of all material by the use of live steam at a temperature of not less than 292 degrees, Fahrenheit, the material to be subjected to this temperature in an enclosed vessel absolutely steam tight, at a working pressure of not less than 60 pounds per square inch, for not less than 8 hours. All gases and vapors are to be drawn off and condensed. From the time the material is delivered into the said enclosed vessel it shall not be handled in the open air until after it has been pressed so that the solid part of the material shall contain moisture not exceeding 55 per cent., after which it may be finally disposed of by cremation, acidulation or reduction to commercial dryness, for use as a fertilizing material."

There are twenty-eight 10-ton digestors, making the total capacity of the plant 560 tons per 24 hours, which is somewhat in excess of the requirements of the city. The digestors are made of ⅝-inch open hearth steel plates, and are made to withstand a pressure of 160 pounds. The discharge openings of each battery of four digestors are connected with a pressing machine for separating the liquids from the solids. A platform extends along each side of the digestors, at a level with their bottoms, from which the valves controlling the discharge into the presses are operated. These heavy roller presses were designed by Mr. Charles Edgerton, and constructed by the Kutztown Foundry & Machine Company, of Kutztown, Pa. It is stated that they contain several improvements over those used in Boston and Philadelphia. A photograph of one of these presses, showing the digestors above it, accompanies this article. The trough directly above the press is for the return of the scraper conveyor by which the pressed tankage is carried out of the digestor room. The seven presses are driven by belting from an overhead shaft. From the presses, the liquids flow through a trough into the grease room, where, after cooling, the grease is skimmed off for use in soap making and in the manufacture of lubricating oil, while the rest of the liquid is evaporated under vacuum. After this evaporation it is known as "stick," and is mixed with the dried tankage (the solid matters) to form a fertilizer base. The tankage is carried from the press room to another part of the plant, where it receives a further treatment with phosphate before being used as commercial fertilizer.

Steam for the plant is furnished by a battery of six horizontal return tubular boilers of 200 horse-power capacity each, constructed for a working pressure of 125 pounds steam. They are arranged so that any of them can be discontinued without affecting the others. These boilers, made by the Coatesville Boiler Works, are supplied by duplex high duty pumps with modern heating device. The presses are driven by a 50-horse-power Hamburg horizontal engine, and the conveyors by vertical engines, all of the high duty type. The various conveyors used in the plant were supplied by the Aultman Company, of Canton, O. The entire plant occupies a plot of ground 160x600 feet, practically the whole lot being occupied by the various buildings.

A Two-Generator Three-Wire Electric System supplies the Hotel Hillman, Birmingham, Ala. There is an 80 and a 150-horse-power Harrisburg engine, each direct connected to two General Electric dynamos.

The Springville Bridge.

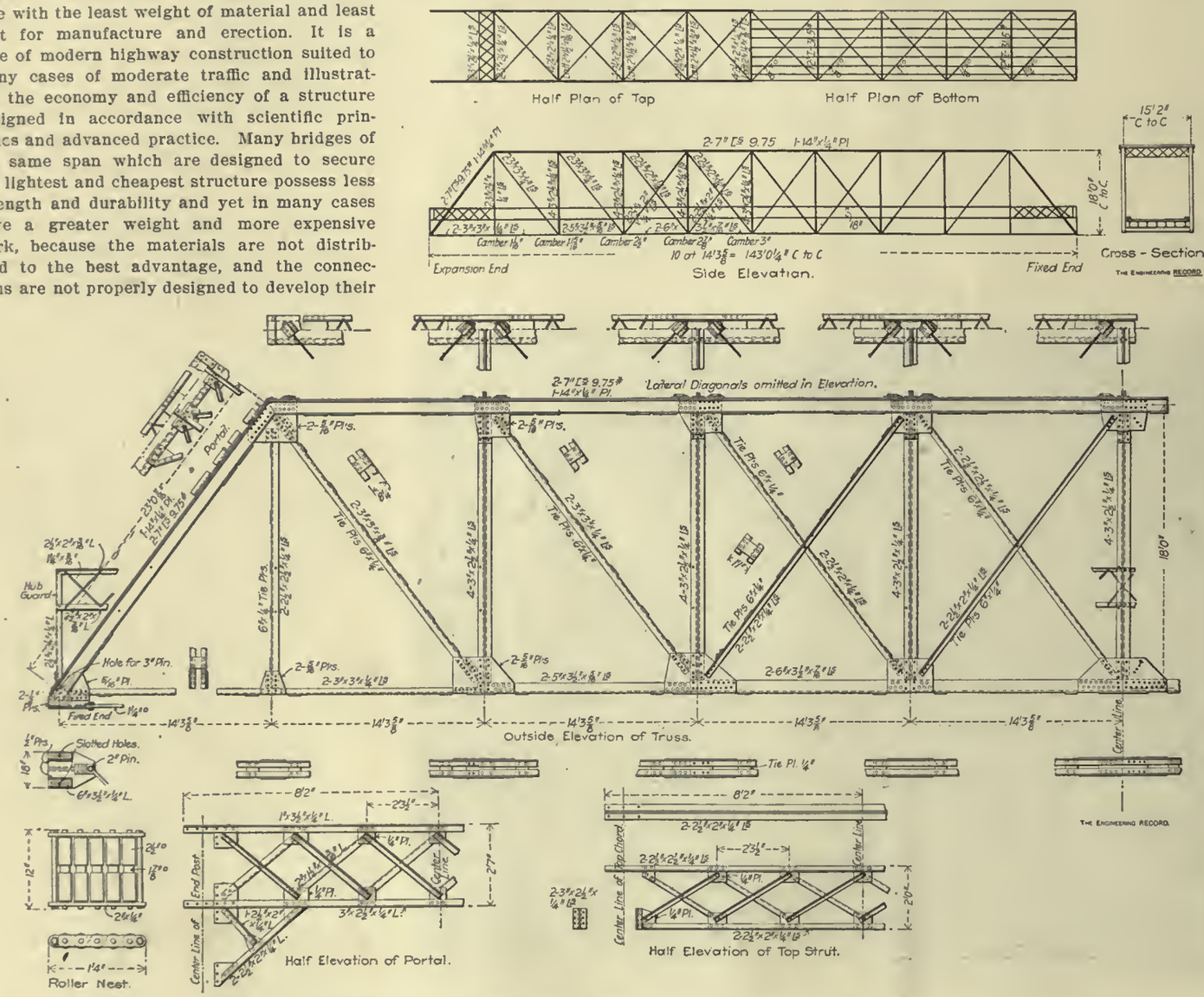
The 143-foot through steel truss bridge at Springville, New York, carries the highway between the towns of Concord and Ashford. It has two riveted Pratt trusses 18 feet deep and 15 feet 2 inches apart on centers, built entirely with channels and angles having riveted connections, and is braced transversely with adjustable lateral-diagonal rods. The transverse floor planks are carried on five lines of longitudinal I-beam stringers and two lines of channels which are supported on 12-inch I-beam floorbeams. The design was worked out with a special effort to provide a rigid and durable structure for a given moderate service with the least weight of material and least cost for manufacture and erection. It is a type of modern highway construction suited to many cases of moderate traffic and illustrating the economy and efficiency of a structure designed in accordance with scientific principles and advanced practice. Many bridges of the same span which are designed to secure the lightest and cheapest structure possess less strength and durability and yet in many cases have a greater weight and more expensive work, because the materials are not distributed to the best advantage, and the connections are not properly designed to develop their whole strength and afford advantageous construction and erection.

The roadway is 14 feet wide in the clear and is proportioned for a live load of 1,000 pounds per linear foot, the dead weight of the bridge being estimated at 600 pounds per linear foot. The stresses and materials are as noted in the strain sheet, and most of the connections are shown in the half elevation. The chords were shipped to the site in two-panel lengths, spliced on panel points by the gusset web-plates, which were shop-riveted to one end of the chord section, and thus formed jaw plates to receive the adjacent chord piece and the web members and promote the convenience of assembling in the field. The vertical and diagonal members of the truss are all of the same width as the chord pieces, and were arranged on theoretical center lines with sufficient clearance to enable all the field rivets to be driven with ease, thus facilitating the most difficult of the erection operations.

The top chords and end posts are of uniform dimensions throughout, but the U-shaped stiff bottom chords are made of pairs of angles with their sizes varying to correspond with the stresses in the successive panels. Both flanges of these angles are spliced with cover plates developing the full strength of the net cross-section. The floorbeams are web-connected to the vertical posts and the lower chord angles through the regular field-rivet holes in the gusset plates for the connections of the truss members, thus avoiding extra riveting. The 6-inch I-beam stringers rest directly on the top flanges of the floorbeams and the 3-inch planks and 4x6-inch wheel guard pieces were secured to them by hook bolts.

Sway bracing is provided by the portal struts and the transverse top lateral struts, both made in the form of light lattice-girders. The former are 30 inches deep and have pairs of 3x2½-inch flange angles in the planes of the inclined posts. The latter are 24 inches deep with pairs of 2½x2-inch flange angles, both being made with single 2x½x3/16-inch lattice angles riveted to gusset plates between the flange angles. At each end of the portal strut one of the angles in each flange is cut away, so that the back of the other flange angle could be field-riveted across the end post cover plate, making a simple and rigid connection. The knee brace at the lower side of the portal has a shop-riveter connection plate engaging field rivets in the edge of the inclined post. The intermediate upper transverse struts have their top flange angles carried across the top chords and field-riveted to them, their lower flange angles cut to clear the vertical posts, and their end lower gusset plates shop-riveted to vertical connection angles field-riveted to the flanges of the vertical posts. The top lateral diagonals are round bars with nuts and washers at each end which engage bent plates riveted obliquely to the top chord cover plates. The bottom chord lateral rods have upset ends with nuts bearing on bevelled plates, except at the abutments where they have loop eyes engaging pins through the projecting base plates of the pedestals. Lattice-girders about 20 inches deep with single 2½x2-inch flange angles are riveted horizontally across the inner faces of the web members to form a guard preventing impact from vehicles against the vertical and diagonal posts.

This bridge was designed and constructed by The United Construction Company, Albany, N. Y., Mr. Jas. R. Watt, president, and Mr. Walter R. Marden, C. E., vice-president and chief engineer, to whom acknowledgment is made for data.



Details of the 143-Foot Span Highway Bridge at Springville, New York.

Automatic Modules for Regulating the Speed of Filtration.

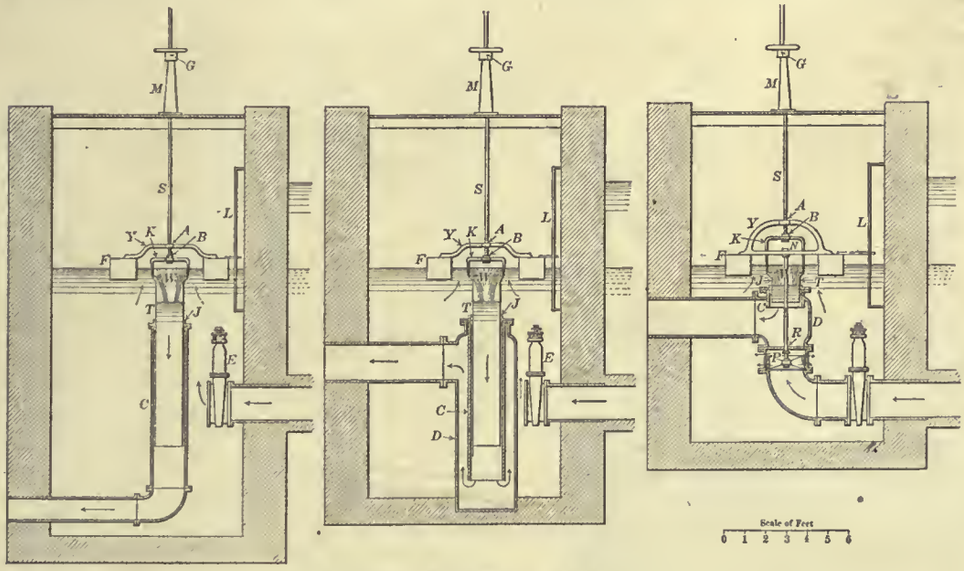
In the "Proceedings" of the American Society of Civil Engineers for May, 1903, Mr. John H. Gregory, associate member, in discussing a paper of the above title by Mr. Charles Anthony, Jr., M. Am. Soc. C. E., describes three interesting forms of semi-automatic modules designed for the Philadelphia filtration works. These works were described in The Engineering Record of January 3, March 28 and April 11, 1903, and in connection with these articles Mr. Gregory's discussion is of particular interest, as he has had considerable experience in the last few years in designing apparatus of both automatic and semi-automatic types, and in watching the operations of both. Three sets of hand-regulated apparatus of the type shown in the accompanying illustration, reproduced from the "Proceedings," were designed under Mr. Gregory's direction, the drawings being made for reproduction only in sufficient detail to indicate the general design and operation of the apparatus. In each case the adjustment is accomplished in the simplest manner possible, that is, by turning a hand-wheel on an indicator stand.

In the first figure is shown the type which was first designed, and which is now in use at the six filters at the Lower Roxborough plant. This consists of a circular copper float, F, in the form of a torus, carrying above and secured to it a four-armed cast-iron spider, Y, through which is threaded a stem, S, at the hub, A. On the lower end of the stem, S, is carried a smaller four-armed spider, K, made of brass, so joined to the stem at B that it can turn freely in a horizontal direction, but without any vertical movement on the stem. This spider, K, supports a vertical brass pipe, T, which, for convenience, may be called the telescopic pipe, the top of which forms a sharp-crested weir, W, over which the water flows. This telescopic pipe is enclosed in a cast-iron casing, C, the lower end of which connects with the main pipe leading to the filtered-water basin. The telescopic joint, J, through which the pipe, T, passes, is a brass ring, and is arranged with grooves so that light packing could be inserted if desired. The stem, S, is of brass, the lower end only being circular and threaded; above, it is of square brass tubing, and passes up through a circular hole in the floor, which serves to guide the stem. Above the floor is placed an indicator stand with a hand-wheel. The stem passes up through this stand without being connected to it, the hub of the hand-wheel having a square hole through it slightly larger than the stem.

As shown, water is passing over the crest of the weir, thereby giving a certain rate of filtration on the filter. If it is desired to change the rate, this is accomplished by turning the hand-wheel on the indicator stand. By doing so, the stem, S, is turned, and, as it is threaded through the spider at A, the telescopic pipe, T, is raised or lowered with reference to the water level, correspondingly decreasing or increasing the rate. In order that the float, F, shall not turn with the stem, a small projecting piece is fastened to it, moving along the guide, L, which is fastened to the wall.

The rate of filtration is indicated by a pointer moving over a small horizontal dial at G, directly under the hand-wheel. The movement of this pointer is accomplished by means of a brass collar, with a square hole, fitting around the stem, and forming the worm of a train of gearing. The graduation of the dial is determined from experiment rather than from computation.

The weak point in apparatus of this type is, of course, at the joint, J. When it came to designing this joint, three styles were considered, one being that shown, another a thin plate with a hole very slightly larger than the telescopic pipe, and the other a cup leather. The writer rather leaned toward the leather joint or the thin plate, but after discussion it was finally decided to adopt the one shown, with the provision, however, that the design should be such that either of the others could be substituted if it was found desirable. It should be remarked that with either of the types which do not make a tight joint at J, there will be a certain amount of leakage, greater, of course, at the first of the run when the head is greater; but, in the writer's opinion, this leakage would be so small, compared with the amount passing over the weir, that it would not be a serious matter. This leakage, however, is to be avoided if possible. After this apparatus was installed it was found that with the joint as designed it did not operate satisfactorily. The writer understands that the cup leather has now been substituted and is giving very satisfactory results.



Semi-Automatic Modules for Sand Filters.

In designing both sets of apparatus it was intended to provide access for air under the sheet of water, and it was thought that sufficient opening has been provided at the four points where the spider, K, was joined to the pipe. It was expected, however, that there would be some entrained air carried along in the solid column of water passing down through the telescopic pipe, due to the agitation at the surface produced by the falling sheet of water. In either event it was not anticipated that it would amount to much. It seems that such, however, was not the case, and that there has been some little trouble caused by air being sucked in. The writer has not had the opportunity of studying the apparatus for any length of time while in operation, and hence cannot suggest what he would consider the best way of remedying it; but, from his knowledge of all the details, several methods have suggested themselves. The trouble with the air in the water passing out through the apparatus, however, does not affect the satisfactory operation of the filter.

When it came to designing the Upper Roxborough and Belmont plants it was found desirable to raise the elevation of the effluent pipe leading from the regulating chambers. This resulted in a modification of the design of the regulating apparatus, which modification is shown in the second figure. The upper part of the apparatus is the same as that just described. The change in the lower part is indicated clearly in the drawing. The object in providing the internal casing, C, was to prevent a possible cramping of the telescopic pipe, T, in the joint, J, due to the lateral movement of the water as it passed out into the effluent pipe leading from the chamber. This modified type of apparatus was also included in the designs of the Torresdale plant, to be used for all the filters except one, in which was to be installed a still further modified type.

All the apparatus was designed to run for a maximum rate of filtration of 6,000,000 gallons per acre per 24 hours, and with a maximum loss of head on the filter of 5½ feet. It is readily seen, then, that when the filter is first started after scraping, the water passing over the weir falls several feet, causing the agitation mentioned previously. It should also be noted that during the run the telescopic pipe has a vertical movement corresponding to the total loss of head, and a consequent variation in leakage if a tight joint is not used at J, as before stated. It was in an attempt to improve both these features that the apparatus illustrated in the third figure was designed.

The indicator stand, the stem, S, the joints, A, B and J, and the float, F, are the same as described previously. The spider, K, is lengthened vertically, but has no connection with the spider, Y, except through the stem, S, although the drawing might seem to indicate otherwise. The spider, Y, is a double one, the upper part being similar to the one described previously, and serving the same purpose; the lower part carries a vertical valve stem at N. The telescopic pipe, T, is made much shorter, while the outlet casting, D, is quite different in form. Below this outlet casting, D, there is a solid plate with an opening at R for the valve stem, and below the plate there is a balanced piston-valve, placed on the end of the main effluent from the filter. This valve consists of a hollow internal cylinder or piston, P, with openings, surrounded by an annular casing, also with openings. The position of the piston, P, is controlled by the float, F. The method of changing the rate of filtration, as with the other types, is by changing the level of the crest of the weir, W, relative to the water level in the chamber.

The operation of the apparatus may be described as follows: When the filter is started, after scraping, the piston, P, will be at its lowest position, with its openings opposite those in the annular casing. The water will pass out through the piston-valve into the chamber, ris-

ing up around the float and passing over the weir. When the water has reached a sufficient elevation, the float will rise, carrying with it the piston, P, and thereby partly closing the openings in the annular casing. The float will rise to such a position that the water discharged through the piston-valve will be the same as that passing over the weir, in which position the apparatus will be in equilibrium. The difference in head between the water level on the filter and in the chamber, minus the head lost in passing the filter, will be used up in passing through the piston-valve. At the beginning of a run this head will be several feet, but at the last end will be only a small amount. If at any time the rate is changed, the position of the float and piston will be altered slightly to correspond to the new condition of affairs.

It will be seen, then, that with this type of apparatus the water level in the chamber will remain practically constant, varying at the most only a few inches instead of fluctuating several feet, and thereby giving practically a constant leakage at J, if a tight joint is not used. The telescopic pipe, T, will have a vertical movement of only a few inches, and its length has been reduced to a minimum. A cup-leather joint, preferably, would be used at R, to prevent leakage at this point. Mr. L. M. Lloyd and Mr. F. C. Dunlap made several valuable suggestions in working out the details of the three types of apparatus just described.

Brick Paving in Iowa.

The paving brick committee of the Iowa Engineering Society after two years of painstaking investigation of its special subject made a report at the annual meeting of the society held at Cedar Rapids in January, 1902, which report together with the discussion it elicited has recently been published in pamphlet form. It contains complete and detailed information not only regarding practically every yard of brick pavement in the state of Iowa, but also such allied information as the cost of asphalt, macadam and other pavements, in the cities where brick is used. An abstract of this very valuable report follows. It was originally proposed that the committee, which is composed of Prof. A. Marston, Ames, Ia., chairman, and Messrs. C. R. Allen, C. P. Chase, C. S. Magowan, and Wm. Steyh, should prepare a set of standard specifications for brick paving, but this was not done, it being thought that on account of the variation in local conditions it would be better to present the entire data, and let each engineer draw his own conclusions.

The results of the investigation show how very important brick paving is in Iowa in comparison with other pavements. The cedar block pavements formerly laid in some of the larger cities have in every case proved unsatisfactory, and many of them have already been replaced with brick. Cedar Rapids, in reply to the question as to whether brick had proved satisfactory as compared with other pavements, says: "It is much better than cedar blocks, of which we have had plenty, but not as satisfactory as we would like." Macadam has been laid extensively in some places, due mainly to its cheapness, and occasionally it has been used later as a foundation for brick. At the present time there is also a strong tendency in Iowa to construct asphalt pavements on residence streets, where financial considerations permit, and where well built these pavements have proved satisfactory. Nevertheless, by far the greatest area of paving in the state has been of brick, and brick will probably continue to be the main pavement of Iowa in the future. The returns from 23 cities and towns gave as totals: 4,030,696 square yards of brick pavement, 192,884 square yards of asphalt, and 364,937 square yards of wood block pavements in the state.

Some of the general results of the investigation may be summarized as follows: Horseshoe wear on the brick pavements has been found of more consequence than the wear due to wheels. The general opinion seems to be that repressed bricks are the best, though some city engineers thought not. There seems to be no marked preference for either end or side-cut bricks; but it is generally considered that round-edged bricks wear better than the square-edged ones. Concrete is considered the best foundation, but this depends much on the location. The majority of the cities prefer a 1½ or 2-inch sand cushion for the bricks, although it varies from 1 to 5 inches. There are so many different recommendations for determining the cross-section of the roadway that it is impossible to draw any general conclusions. An exposure of 6 to 8 inches of the face of the curb is recommended, and it is not as a rule considered worth while to point curb joints with cement mortar. The curbs are generally set on sand. The combined concrete curb and gutter has not been much used in Iowa, but is considered to be very good. Occasionally there was some heaving due to severe cold weather, and in a few cases rumbling of the pavement was noticed at the same time; but as a rule such results were not noticeable. Several engineers recommend a special brick for use along street railway tracks.

In the report of the committee there are given typical cross-sections of the brick pavements in all of the principal cities of Iowa and as much of the information as possible has been compiled into a table, from which the table accompanying this article has been condensed. In the table the cost of the round untreated cedar block paving in Sioux City is given as $1.33 per square yard, there being 212,437 yards in the city. In Council Bluffs the cost is given as $1.40 to $1.59, there being 152,500 square yards in that city. The cost of limestone block in Burlington is given as $1.25 per square yard, and granite block as $2.75.

STATISTICS OF BRICK PAVING IN IOWA.

City.	Pop., 1900.	Amount of paving.—Brick.—Miles.	Brick.—Sq. yds.	—Asphalt.—Sq. yds.	Cost per sq. yd. in dollars.—Brick.	Asphalt.	Foundations for brick.	Fillers used.	Curb.—Kind.	Curb.—Cost per ft.
Des Moines	62,139	58.4	1,099,441	Small amount	1.15—1.80	1.92	2-course and 6" concr.	Port. cem. or sand	.....	.....
Dubuque	36,297	4.75	130,008	0	1.50—1.70	...	6"—8" concr.	Sand	Limestone	0.45
Davenport	35,254	23.00	589,949	0	1.30	...	Concrete	.....	Sandstone	0.37
Sioux City	33,111	4.40	100,069	141,794	1.71—1.83	2.56	6" concr., 2-course	Sand or Port. cem.	Sandstone	0.60 to 0.69
Council Bluffs	25,802	11	210,000	0	1.25—1.79½	...	6" concr., 2-course	Sand or cem.	Concrete	0.30
Cedar Rapids	25,656	13.5	332,093	7,591	0.97—1.25	...	6" macadam with 1 and 2 course	Sand	Sandstone	0.44
Burlington	23,201	11.93	263,361	0	1.30—1.84	...	2-course	Sand	Stone	0.43
Clinton	22,698	13	345,000	0	1.20—1.36	...	6" macadam	Sand	Brick Stone	0.20 0.50 to 0.62
Ottumwa	18,197	6.5	175,755	20,499	1.40—1.58	1.58	Macadam, concr., and 2-course	Sand, Port. cem. or pitch	Sandstone	0.50 to 0.58
Keokuk	14,641	1.6	49,193	0	1.21—1.68	...	6" macadam with 1 and 2 course	Sand	Stone	0.55 to 0.58
Muscatine	14,073	8.91	177,365	0	1.20—1.90	...	6" macadam gravel, sand	Sand	.....	.....
Waterloo	12,580	5	96,922	0	1.20—2.10	...	2-course, macadam	Sand	Concrete Stone	0.36 0.50
Ft. Dodge	12,162	1.20	33,140	0	1.22—1.38	...	2-course on gravel or br. stone	Sand	Stone Concrete	0.83 0.56
Marshalltown	11,544	6.69	43,639	0	1.15—1.80	...	Sand & concr.	Sand or asphalt	.....	.....
Ft. Madison	9,278	1.9	45,200	0	1.26—1.65	...	2-course	Sand	.....	.....
Oskaloosa	9,212	9	166,455	0	1.39—1.60	...	2-course	Sand	Concrete	0.32
Boone	8,880	1.76	46,360	0	1.14—1.78	...	2-course concrete	Sand or Port. cem.	Concrete	0.45
Iowa City	7,987	1.82	57,476	0	1.04—1.33	...	Old macadam, concrete	Sand	Sandstone	0.33
Mason City	6,746	.91	16,700	23,000	1.65—1.96	1.89	5"—6" concr.	Sand or Port. cem.	Concrete	0.37
Charles City	4,227	.21	6,670	0	1.26	...	6" old macadam	Sand	Sandstone	0.62
Newton	3,682	0.7	15,600	0	1.45—1.53	...	6" concr.	Sand	Concrete	0.30
Albia	2,889	1.0	23,000	0	1.45	...	2-course	Sand	Stones	0.50
Adel	1,213	0.3	7,300	....	....	...	2-course	Sand	Concrete	.....
Totals	....	209.26	4,030,696	192,884						

The committee calls especial attention to the subject of foundations. At the present time, leaving out of account the brick paving successfully constructed upon macadam foundation at Clinton and elsewhere, there are two kinds of pavements from which selection would usually be made. These are the single course of brick on concrete foundation, and the two-course brick pavements. The two-course pavement was the form first adopted, and will still usually be cheaper to construct, than a pavement with a concrete base. The exact difference in cost will vary with local conditions, such as, for example, whether a cheap local brick can be obtained for the under course, and whether materials for concrete are abundant, cheap and of good quality. At Sioux City there was a difference of only 12 cents per square yard in favor of the two-course pavements. In Ottumwa the cost of recent two-course pavement was $1.40 per square yard, while in 1895 pavement with concrete base cost $1.58. In Boone the cost of two-course pavement in 1899 was given at $1.18, and of a pavement with a concrete base in 1901 at $1.78. Of course, the

cost of labor and materials was much higher in 1901 than in 1899. The opinion of engineers seems to be usually in favor of the pavement with the concrete base, but where the soil under the pavement furnishes a good, hard, dry foundation, and where the traffic is not too heavy, the two-course pavement has given good satisfaction. Concrete is required wherever there is any doubt as to the character of the soil foundations, and wherever the traffic is excessive. Concrete bases for brick pavements in this state seem universally to be constructed of natural cement in the proportion of 1:2:4, 1:2:5 or 1:2½:5. Mr. E. C. Blake, of Dubuque, raises the question as to whether it would not be better to use Portland cement concrete in a somewhat weaker mixture.

The question of filler is another important subject in connection with brick pavements. A large amount of sand filler is still in use. Most engineers express their preference for a Portland cement filler, but the additional cost is against it. In the few cases in which comparative figures were given, the additional cost of the Portland cement filler seems to range from 4 to 18 cents per square yard. Mr. C. E. Russell, of Boone, estimates that on recent work the actual cost of the Portland cement filler was about 12 cents per square yard. The general proportion for filler seems to be 1:1 or 2:3. Mr. C. P. Chase, of Clinton, expresses a preference for an elastic filler of asphalt composition. The advantages of the cement filler appear to be in providing a support for the edges of the brick, which prevents their chipping, and also in rendering the pavement impervious to water. Its disadvantage, aside from the cost, seems to be the rigidity given to the pavement.

Another important question is the matter of the curbs. The use of stone curb is still very extensive throughout the state. Trouble seems often to be experienced with limestone for curbs, but no complaint has been made of sandstone, such as Berea sandstone. However, the use of cement curb is also extensive and the cost appears to be materially less than that of the stone curb. The usual proportions for cement curbing are 1 part of cement to 3 parts of sand and gravel, although at Mason City, in 1901, the proportions of 1:2 were adopted, while at Boone, on the other hand, 1:4 was required in the specifications. The cost of the Mason City curb was 37 cents per foot, while that of Boone was 45 cents.

Another very important question in connection with brick pavements in Iowa is the extent and causes of failures. Although brick has been used very extensively for 10 or 12 years, very little has yet been done to the streets in the way of repairs. This is in spite of the fact that at the time the first pavements were put down the subject was not well understood and the materials used were not nearly so good as at present. No one can yet predict with certainty what will be the limit of life of brick pavements. Where failures have occurred they can usually be attributed to too soft brick or to poor foundations. In Iowa City one block with a macadam foundation failed through being disturbed in many places by trenches, which admitted water, and there are several cases of failure from settlement of the foundations and from digging trenches. In Clinton there was trouble due to poorly burnt bricks and to a lack of fineness of texture. A case was observed at Council Bluffs, where the pavement had been constructed 10 or 11 years ago, of very soft bricks, such as would not now be used, but which were of uniform quality. Although a considerable portion of the depth of these bricks had been worn away at the time the report was made, the pavement was still in good condition, thus illustrating the importance of uniformity of texture.

After all that can be said against brick pavements in Iowa, the fact remains that in very few cases has there been any expense for repairs large enough to attract attention except as the pavement has been badly treated in connection with the digging of trenches. This subject of the injury to pavement from the construction of trenches appears to be the one point with which all places have trouble. The remedy lies in strict control by the city of all excavations which affect the pavements. City ordinances should be passed, and enforced, strictly guarding the city in this respect. It is desirable not to have too cumbersome a method, and it might be well to have all such work done by the city's own employes and paid for by the parties interested.

Very extensive work has been done by Prof. Edw. J. Orton, Jr., of the University of Ohio, at Columbus, for the National Brick Manufacturers' Association in connection with the subject of paving brick tests. This association a few years ago recommended specifications for a standard test which has since been known as the N. B. M. A. test. This method of testing was afterwards subjected to considerable criticism, as it did not properly discriminate against the soft brick. Prof. A. N. Talbot, of the University of Illinois, developed and advocated a method of testing in which the charge was composed partially of brick and partially of cast-iron cubes and brick of different sizes and weights. This met the objection to the N. B. M. A. test and was provisionally adopted in preference to it. Still another form of rattler test was proposed about this time by Mr. Gomer Jones, of Geneva, N. Y., in which the bricks were to be fastened to the rattler and revolve with it, the charge of cast-iron remaining free in the center to fall upon and abrade the brick. All these forms of rattler tests were further thoroughly investigated by Professor Orton.

On August 1, 1901, a commission of engineers met the committee of the National Brick Makers' Association, having this matter in hand, to pass upon the results. The commission of engineers included the late Professor J. B. Johnson, of the University of Wisconsin; Professor A. N. Talbot, of the University of Illinois; Professor W. K. Hatt, of Purdue University; and Professor A. Marston, of the Iowa State College. As a result, the committee made, and the National Brick Manufacturers Committee adopted, a recommendation to the effect that the standard specifications for rattler tests of paving brick should be the so-called Talbot test, in which the charge is composed partially of paving brick and partially of cast iron. These specifications were given in full in The Engineering Record of March 17, 1900, and are not repeated here. The paving brick committee of the Iowa Engineering Society adopts these specifications, and recommends, regarding the allowable limits of rattler losses for good paving brick, that until more data are secured, a maximum allowable loss of 25 per cent. would be reasonable.

In connection with all rattler tests of paving brick, it should be understood that there is a great lack of uniformity of the results when several tests of brick, even from the same kiln, are made. This is the universal experience of all who have made many such tests, and results simply from the fact that the product of the kiln includes all grades, both hard and soft burned. On this account the acceptance or rejectance of paving brick, or the selection of one make in preference to another, should usually be based only upon the results of a large number of tests. No amount of testing can do away with the necessity for a close inspection of every load of brick used on the work. The whole investigation which the committee has made of the subject of brick paving and paving brick tests has impressed upon them the fact that the main requirement for a successful brick pavement is to have in responsible and unhampered control of every feature of the work an able and throughly informed engineer.

The Kansas City Flood.

The readers of The Engineering Record have, doubtless, already read much about the recent destructive flood at Kansas City, Mo.



Union Depots and Freight Yards, Kansas City, During Flood.

Some definite details furnished by Mr. F. G. Cudworth, engineer of Missouri River power house, under date of June 5, are given below.

Gentlemen:—The river reached its highest elevation at about noon of June 2; since that time it has been receding gradually. Of the seventeen bridges over the Kaw River, only one, the Missouri Pacific Railroad bridge, remains. Three of those carried out were owned by the Metropolitan Street Railway Company of Kansas City. The bridge carrying the main water supply line was also carried out and the Turkey Creek pumping plant forced to close down on Sunday afternoon, leaving the entire city without water from Sunday until Thursday night. Three-quarters of a mile of elevated railway was washed out, including the combined highway and elevated bridge crossing the

Kaw River. Both power houses of the Metropolitan Street Railway Company, located upon opposite sides of the Kaw, were rendered useless and will doubtless remain so for some weeks, as nearly all of the machinery was covered by the flood. A conservative estimate places the loss to this company at $1,000,000. The Missouri Pacific Railroad bridge was saved by the courage of the superintendent of terminals, who covered it with locomotives from end to end. The south approach to the Hannibal bridge was washed out, as well as that of the Milwaukee bridge some 6 or 8 miles farther down the river. Gas and electric lights were shut off for two nights. Elevations taken of the highest water show that at Union Depot the Kaw River was 10 feet higher than the Missouri one-half mile below the Hannibal bridge, showing that the waters of the Kaw were dammed back by the buildings and freight houses in the West Bottom nearly that much. At the date of writing the Kaw River had apparently changed its course some 1½ miles to the north of its old channel, and this may prove to be true of the Missouri, as a strong current is noticed some 2 miles to the north near the foot hills of Clay County.

Elevations of Missouri River, June, 1903, Taken at Missouri River Power House, First and Grand Avenues, Kansas City, Mo.

Date.	Time.	City elevation. Feet.	Government elevation. Feet.
June 1	10 A. M.	28.164	34.000
June 1	2.40 P. M.	28.402	34.302
June 2	7.30 A. M.	28.552	34.452
June 2	3.30 P. M	28.539	34.439
June 3	7.30 A. M.	28.055	33.955
June 3	4 P. M.	27.454	33.354
June 4	7.30 A. M.	26.467	32.367
June 4	4 P. M.	25.825	31.725
June 5	7.30 A. M.	24.572	30.472
June 5	5 P. M.	23.939	28.839
Kaw River.			
Highest water at Allen Ave. Viaduct (city entrance)		39.183	45.08

The Missouri River power house is about one mile below the Government bench on the Hannibal bridge.

Trade Publications.

Wainwright heaters and surface condensers are described in several pamphlets received from the Taunton Locomotive Mfg. Co., Taunton, Mass. In these appliances the use of corrugated copper tubing for the passage of the steam or water for condensing or heating purposes affords several advantages of both mechanical value and operating efficiency. The pamphlets state briefly the factors to be considered in the selection of a heater or condenser and give some results of tests of the comparative efficiency of straight and corrugated tubes for transmitting heat in such appliances. The Wainwright expansion joint for steam piping is also described.

The selection of competent assistants for engineering work is a subject of vital importance. In some of the important offices in large cities there is a rule that anyone applying for drafting or similar duties shall be given a trial, and if satisfactory and better than an older employe then he obtains the latter's place. Such a system of recruiting assistants is only possible in a few cases, however, and the services of a really good agency will be of value in obtaining the names of desirable men. Agencies are sometimes looked upon with suspicion, yet a good one does not deserve such a reputation. The Engineering Agency, Monadnock Block, Chicago, has prepared a little circular about its methods of business which will dispel many undeserved criticisms of the value of agency lists to those seeking either assistants or more desirable places.

The New Process Raw Hide Co., Syracuse, N. Y., has issued a small pamphlet giving a condensed statement of the advantages which its raw-hide pinions possess for a large variety of purposes. Strong claims are made for both durability and noiselessness.

A large variety of asbestos roofing felts are described in a catalogue prepared by the H. W. Johns-Manville Co., New York. The pamphlet is particularly useful because of the full directions for applying the felts for many different purposes, which architects and mill designers will find of assistance in preparing their specifications for such work.

The Hygienic Suburban Sewage Co., 1133 Broadway, New York, states in its new catalogue that its system of sewage disposal is carried on in three tanks through which the liquids pass consecutively. In the first tank the solids are broken down and dissolved, in the second the liquid undergoes the changes leading to purification, and in the third it is aerated.

The Dunn Mfg. Co., 307 Fifth Avenue, Pittsburg, Pa., has issued a folder giving dimensions and new prices of extensible trench braces or ditching jacks, both all-iron and with wood struts.

The Sprague Electric Co., 527 West 34th Street, New York, has issued its 1903 bulletin of Lundell fans, explaining their construction and giving the usual tables of sizes, voltages and finish. Desk, bracket, ceiling and window types are illustrated.

The Walker & Pratt Mfg. Co., 31 Union Street, Boston, Mass., placed the Crawford steam and hot-water heaters on the market so recently that a pamphlet of letters from users of the apparatus, which the company has just issued, will be of special interest to steam fitters. The past winter has been one in which the scarcity of coal made everyone watch his heating apparatus carefully, so that letters from satisfied users during such a period have special value.

The Russell Engine Co., Massillon, O., has lately issued new catalogues of its single-valve and four-valve automatic cut-off engines. The former type has a slide valve and is made in sizes from a 7x10-inch simple engine to a tandem compound with 14 and 22-inch cylinders and 20-inch stroke. The four-valve type, originally designed for large units only, is now regularly built in sizes ranging between a 13x18-inch simple engine and a compound with 24 and 48-inch cylinders and 30-inch stroke. In this type the main valve is a slide valve with a similar cut-off valve riding on it, while the exhaust valves are of the rotary pattern. Both catalogues contain detailed explanations of the construction of the engines and the reasons for the adoption of their special features.

The luxury of travel in some of the special trains running out of Chicago is probably unexcelled by the service in any part of the country. One of these, the Daylight Special of the Illinois Central system, is fully described in a pamphlet which can be obtained from A. H. Hanson, general passenger agent of the road at Chicago, and people interested in passenger traffic and cars to handle it will find it well worth writing for.

The cube concrete mixer made by Kaltenbach & Griess, Cleveland, has been employed on a number of important works where the plant of the contractors possessed features of special interest. The builders have accordingly prepared a small album of views of some of these installations, which is prefaced with a description of the mixer and the details of its construction.

Bollinger Bros., 129 First Avenue, Pittsburg, Pa., have issued a collection of views of car hauls, employed mainly in handling coal at the mouth of mines where it has to be elevated to the tipples. The cars are hauled up by chains with attachments designed for the purpose and are lowered to the mines by different chains with retarding devices to keep the emptles from running wild. The catalogue also illustrates coal crushers, belt and screw conveyors, screens and other conveying and handling apparatus.

The Morehead traps, both return and tank types, are described in a pamphlet from the American Blower Co., Detroit. The explanation of the purposes and advantages of such traps is unusually complete, and the same is true of the instructions for setting up both single and double trap systems.

The Marine Iron Works, Station A, Chicago, have issued a catalogue of modern marine steam machinery for vessels from 30 to 160 feet in length, covering paddle-wheel as well as propeller machinery, condensing or non-condensing. The line of boilers which they build includes the Roberts safety water tube, as also the better class of shell marine boilers, and for either hard coal, soft coal or wood fuel as desired.

The Bates Machine Co., Joliet, Ill., has prepared an exceptionally well-printed book describing its types of Corliss engines and air compressors. Tables are given showing the dimensions of the standard box-girder and heavy-duty types of engines, the special features are illustrated, and the general design of the engines is described. The compressors are not explained in equal detail, although there are illustrations of some of their parts to which the builders call particular attention. The book contains numerous illustrations of power plants, among them one of the boiler room of a compressor station in which gas is used for fuel.

The Westinghouse Electric & Mfg. Co. has lately issued three bulletins. No. 1017 describes the uses and capacities of potential regulators for single and polyphase circuits; No. 1053 is a revised edition of an earlier bulletin relating to the Westinghouse 69 railway motor for city and suburban equipments; No. 1062 describes the new type F induction motors for variable speed, the variations being produced by a change in resistance introduced across the collector rings of the secondary or revolving element. The last bulletin contains many speed-torque curves to assist in selecting the proper motor for any given purpose.

The Goheen Mfg. Co., Canton, O., has issued a pamphlet containing a discussion of paints for structural iron, penstocks, furnaces and like situations, which is marked by its conservative claims for "carbonizing coating," the company's product. Its composition is given as chemically pure linseed oil and well-known time-tried pigments, and nothing new is claimed for it. Excellent views of notable bridges and buildings where it was used are reproduced and there is a table of the covering capacity of various paints.

A number of months ago mention was made of the appearance of the first number of "American Art in Bronze and Iron," a publication giving excellent illustrations of bronze, brass and iron ornamental work executed by the John Williams Bronze Foundry, 556 West 27th Street, New York. A second number of this important publication has just been issued, devoted wholly to illustrations and descriptions of counter screens in banking houses. These screens are receiving the careful attention of architects owing to their decorative impor-

tance as well as utility, and the illustrations in this 56-page album will doubtless prove of permanent value. The text gives some interesting facts concerning the history of many of these banks, prepared by Mr. Wm. Donald Mitchell.

A concise but clear description of the Tonkin water-tube boilers is given in a new publication from the Oil Well Supply Co., Oswego, N. Y. A compact table enables the engineer to determine approximately the dimensions of a boiler of any capacity between 100 and 300 horse-power and the number of brick required for the setting, and there is a useful table of the capacity of lined and unlined steel stacks.

The Paxson-Warren sand blast machinery, including the sand blast machine, helmet for operator, system for cleaning used sand and sand-blast tumbling barrels, is described briefly in a folder prepared by the J. W. Paxson Co., 1021 N. Delaware Ave., Philadelphia.

Ten pages of useful information bound in stiff covers, pocket size, have been compiled for distribution at 25 cents, by George Cutter, maker of electric light specialties, Union and Fulton Sts., Chicago. It is a collection of those definitions, formulas and tables most needed in figuring the sizes of wire for lighting or power circuits.

The Allentown Rolling Mills, Allentown, Pa., have issued two pamphlets, giving sizes and capacities of two classes of Aldrich electric pumps, one of the vertical triplex type and the other of the horizontal quintuplex. The former is built to handle 50 to 2,240 gallons per minute under heads of 100 to 300 feet, and the latter 140 to 900 gallons per minute under heads as high as 1,400 feet.

Some interesting views of the Lower Roxborough filter work, Philadelphia, are given in a pamphlet printed by the Bonneville Portland Cement Co. Besides these and tables of tests of Star Portland cement, there is a valuable chart of tests of concrete cubes of the Star cement, in connection with its use in the construction of the filter beds.

The Norton Emery Wheel Co., Worcester, Mass., has reprinted an interesting article by Mr. Charles H. Norton on modern methods of grinding in machine shops. It is a subject which is attracting the closest attention from wide-awake superintendents, and is discussed in this brochure by a man who has spent many years in studying the capabilities of such methods of work.

The Dollar deep-well pump, described in a pamphlet from the Cannon Pump Mfg. Co., Waycross, Ga., differs from others in that its plunger is hollow and forms the pipe through which the water is forced to the surface. There is a valve opening upward in the bottom of the cylinder which forms the foot-piece of the down-pipe, and a similar valve opening upwards in the bottom of the hollow plunger rod, which enables this peculiar action of the apparatus to be obtained.

One of the best collections of instructive views to indicate the value of a product has been made in Catalog L of the Kinnear Manufacturing Company, Columbus, O. Besides showing the application of the Kinnear steel rolling doors and shutters to railway barns and shops, round houses, warehouses, office buildings, boilers and core ovens, it is a valuable album of types of construction of the various buildings in this country and in countries abroad. Numerous illustrations of details will be of interest, and will add very much to the usefulness of the pamphlet.

Henry Grant Morse.

The recent death of Henry G. Morse deprives the engineering profession of one of its representatives whose career was a constant source of pride to the wide circle of people who appreciate the value of a sure and steady hand at the helm of great enterprises. He was a typical civil engineer. Born in the little Ohio town of Poland, and receiving such education as the local schools afforded, he showed at an early age his strong inclination toward engineering works, and when little more than a lad he was so proficient as to be appointed assistant city engineer of Youngstown.

Technical education he recognized as an essential to any rapid progress in his chosen profession, and he accordingly abandoned his active work in 1868 to enter the Rensselaer Polytechnic Institute. After his graduation he was an assistant engineer on the Bennett's Branch extension of the Allegheny Valley Railroad and later the superintendent and engineer of the Keystone Land & Oil Company, of Parker, Pa. It was not until September, 1872, that he entered the special field with which his name will long be identified.



Henry Grant Morse.

On that date he became an assistant engineer of the Wrought Iron Bridge Company in charge of masonry and later was appointed engineer in charge of the design and construction of steel work. His broad grasp of bridge building was speedily demonstrated and the business aspect of the work proved as easy for him to master as its technical features. Under such circumstances it is not surprising that he aspired to control a business of this class of his own, and so in January, 1878, we find him a partner in the Morse Bridge Company, of Youngstown. Here he showed such capacity as a builder of large and small work, railway and highway bridges and blast furnaces, that a few years later, in 1887, he was chosen president of the Edge Moor Bridge Works. Here he remained until 1896, and under his supervision the company built the Liberal Arts Building at the Chicago Exposition and notable bridges over the Ohio at Steubenville, Wheeling, Kenova and Cincinnati.

About the close of this period his keen business foresight assured him of the important development in American shipbuilding, which was to begin shortly. An opportunity to test the truth of his belief came in 1896, when he was elected president of the Harlan & Hollingsworth Company, of Wilmington, Del. In this position he was able to acquire a familiarity with the situation which confirmed his opinion, and led him to undertake the crowning achievement of his active, useful life. This was the formation of the New York Shipbuilding Company, of Camden. He saw that the existing yards were cramped and poorly arranged for handling work with a minimum loss of time and money, and from July, 1898, until February, 1899, he was engaged on the general design of a plant for that corporation. When everything was planned and the business features of the project worked out, he began the task of securing capital for the undertaking. In spite of its magnitude, the company was financed in a month, and Mr. Morse was elected president. For four months he turned all his attention to the preparation of the detail plans for the works and by July, 1899, he was ready to begin construction.

Long before the entire plant was completed, contracts were signed for building eight vessels, of which seven have already been delivered. The smallest was an oil tank steamer 360 feet long, and the largest were a pair of twin-screw vessels 505 feet long for the Atlantic Transport Company. Among other contracts now in process of execution should be mentioned the twin-screw "Mongolia," 615 feet long, for the Pacific Mail Steamship Company.

The construction and management of this shipyard illustrates Mr. Morse's great ability. Himself a man able to attend to any detail in his great enterprises, he had the rare gift of selecting a staff of such ability that it was unnecessary for him to pay attention to details. He could throw all the force of his strong individuality into the pushing of each branch of the work so that all parts advanced rapidly, smoothly and harmoniously toward the achievement of the desired end. He not only accomplished large undertakings but he accomplished them rapidly; as soon as one part of his plant was ready for operation, he had something for it to do.

Personally, Mr. Morse was a man who won a host of friends, even among people to whom he answered "no" more often than "yes." He was never too much engaged to observe the amenities of a business career, and he was always appreciative of the work of others. His engineering attainments were great, and his interest in engineering work was never failing. He was a member of the national societies of civil, mechanical and mining engineers. The photograph reproduced in the accompanying engraving is an excellent likeness, and the strength of character it reveals will indicate in a slight measure some of those traits which make his death such a sad loss to a wide circle of friends and to the industrial life of the country.

The Consumption of Water from the Boston Metropolitan Water Works during the year 1902 was 123 gallons per inhabitant per day. The total quantity of water used or wasted to prevent freezing during the colder months of the year was equivalent to a daily average consumption of 4,500,000 gallons for the year.

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineeas. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal Notes.

Mr. O. C. Breed has resigned as city engineer of Fulton, N. Y.

Mr. T. Frank Quilty has resigned as assistant city engineer of Chicago.

Mr. M. P. Taylor has been elected city engineer of Johnson City, Tenn.

Mr. Andrew Rosewater has been reappointed city engineer of Omaha, Neb.

Mr. Douglas L. Le Fevre has been reappointed city engineer of Cumberland, Md.

Mr. H. J. Thompson has been appointed superintendent of the water-works of Hamilton, O.

Mr. Philip Minger has been appointed superintendent of the water-works of Middletown, O.

Mr. Lawrence Simpson has been elected general superintendent of the Water Commission of Memphis, Tenn.

Mr. C. E. Fuller and Mr. W. C. Hayes have been appointed assistant mechanical superintendents of the Erie Railroad.

Mr. Eugene A. McMurray's appointment as engineer of the lateral sewer system at Vailsburgh, N. J., has been ratified.

Messrs. Frank A. Nelson and George W. Jacoby have been awarded the McKim traveling fellowships in architecture at Columbia University.

Mr. D. B. Kinch, chief electrician of the Union Station, at Pittsburg, has resigned to become superintendent of the Frick Building in that city.

Mr. Charles H. Clark, chief engineer of the Utica & Mohawk Valley Railway Co., has been appointed engineer of the street railway lines of Cleveland, O.

Mr. Karl Kastberg, assistant city engineer of Des Moines, Ia., has been elected city engineer of Boone, Ia., where he will have charge of the water works improvement.

Capt. J. W. Craig has been appointed superintendent of construction for the Clark Construction Co., of Chicago, which is to erect some of the buildings at the Charleston, S. C., naval station.

Prof. W. E. Mott, of the College of Civil Engineering, Cornell University, is to sail for Europe early in July, where he will remain a year, studying hydraulics, particularly water-power plants.

Mr. J. C. Oliphant, for some years first assistant engineer to the city engineer of Toledo, O., has tendered his resignation and is to take charge of drainage and street improvements at Marshall, Mich.

Mr. Nisbet Wingfield, M. Am. Soc. C. E., Mr. George C. Whipple, Assoc. M. Am. Soc. C. E., and Prof. W. P. Mason, of Troy, N. Y., have been appointed a commission to investigate the water supply of Danville, Va.

Prof. William R. Ware, for 22 years professor of architecture at Columbia University, will retire from active service at the close of the present academic year and he has been appointed professor emeritus.

Mr. Theodore A. Leisen has tendered his resignation as engineer of the Park Board of Wilmington, Del., in order to accept a position as supervising engineer for the Water Department during the erection of the new plant.

Mr. J. G. Bloom has resigned as engineer of maintenance of way on the New Castle division of the Baltimore & Ohio Railroad to enter the service of the Chicago, Rock Island & Pacific Railway as assistant engineer at Topeka, Kan.

Mr. J. E. Hogue has been appointed superintendent of bridges of the Illinois Central and the Yazoo & Mississippi Valley railroads at Chicago, succeeding Mr. O. J. Travis. Mr. R. H. Keays has been appointed resident engineer of the Illinois Central Railroad at Cairo, Ill.

Mr. James L. Bernard, for nine years with the Atlas Portland Cement Co., representing that company in Mexico, Cuba and Porto Rico, has accepted a position in sales department of the Hudson Portland Cement Co., Hudson, N. Y., which expects to be in full operation by July 1, 1903.

Mr. George C. Clarke, assistant engineer of construction on the Pittsburg division of the Pennsylvania Railroad, has been appointed principal assistant engineer under Chief Engineer Alfred Noble, in the Pennsylvania tunnel construction at New York. He will be succeeded by Mr. N. F. Brown.

Mr. John Woodman, M. Can. Soc. C. E., has severed his connection with the Canadian Pacific Railway, as engineer of the Western Division of that road, and has taken up general engineering and architectural work, as civil and consulting engineer, at the Merchants' Bank Building, Winnipeg, Man.

Mr. Louis F. Massa, secretary of the A. D. Granger Co., contracting engineers, 95-97 Liberty Street, New York, sailed on the steamship "Minneapolis" Saturday, June 6, for an extended tour abroad. Mr. C. C. Tomkinson has been appointed assistant secretary and Mr. L. A. Camacho manager of the sales department.

Mr. E. H. McCullough tendered his resignation as city engineer of Greenville, S. C., some time ago to survey a railroad about 35 miles long from Greenville to a lumber center about 6 miles beyond Marietta. The work will include the development of a comparatively high-head water power on the middle branch of the Saluda River for working hard wood.

Prof. W. D. Taylor, M. Am. Soc. C. E., professor railway engineering in the University of Wisconsin, has been appointed engineering expert to the state tax commission of Wisconsin to assist the commission in the appraisement of the physical properties of the railways of the state in preparation for the change, in accordance with the new law, from the revenue to the ad valorem basis of taxation. His new duties do not require Prof. Taylor to give up his chair in the University.

The following changes in the Corps of Engineers, U. S. A., have been ordered: Maj. Joseph H. Willard is to assume charge of the work in hand at Los Angeles, Cal., by Capt. Edgar Jadwin, and his station at Chicago is to be taken by Capt. Charles S. Riche, who will be succeeded at Galveston by Capt. Jadwin. Capt. Joseph E. Kuhn is to be relieved from duty at the Military Academy by September 1 and is to have command of Company M, Third Battalion of Engineers at Washington, and proceed to the Philippine Islands.

Governor Odell of New York has appointed the following commission of five to investigate the threatened pollution of New York Bay by the trunk sewer planned to drain a large portion of northern New Jersey and emptying into the Kill von Kull. A similar commission is to be appointed in New Jersey to confer with the New York board: Daniel Lewis, State Health Commissioner; Prof. O. H. Landreth, consulting engineer, State Board of Health; Dr. George E. Soper; Louis L. Tribus, commissioner of public works, Borough of Richmond; Myron S. Falk.

Mr. De Courcy May, M. Am. Soc. M. E., M. Am. Soc. C. E., has been elected president of the New York Ship Building Company, at Camden, N. J., succeeding the late Henry G. Morse, with whom he was associated as general manager of the company. For several years he studied with various ship and engine builders abroad, was superintendent with the I. P. Morris Company for about ten years, and was engineer and general superintendent of the Cataract Construction Company during the installation of the wheel pit machinery at the plant of the Niagara Falls Power Company, Niagara Falls, N. Y. Mr. Charles L. Hall, formerly purchasing agent, has been appointed general manager.

Obituary Notes.

Charles A. F. Morris, of Excelsior, Minn., died June 2, aged 72 years. He was one of the pioneers of the state, having moved there before 1850, and he built many of the railroads in that and other western states.

Harold C. Grant, a graduate of Cornell University, and Melvin B. Smith, a graduate of the Massachusetts Institute of Technology, were drowned in a new sewer in Washington, D. C., June 2, where they intended to make some measurements for the Engineer Department of the District.

Oil Fuel has been used for some time under the steam boilers of the Houston Electric Company, which operates the street railway system of Houston, Tex. There are three Babcock & Wilcox boilers in the plant, of 154 horse-power capacity each, and the fuel oil circulating system of the National Supply Company, of Chicago, is installed. An evaporation of 10 pounds of water to one of oil is regularly obtained, with artesian well water received at 60 degrees and passed through an auxiliary feed water heater.

CONTRACTING NEWS

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CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 25, 26, 27, 28 and 31.

WATER.

Clayton, Ala.—See "Power Plants, Gas and Electricity."

Phoenix, Ariz.—The Geological Survey at Washington, D. C., is stated to have prepared a model of the dam to be constructed on Salt River, 65 miles above Phoenix. The dam will be 188 ft. thick at the base, 830 ft. long at the top and 250 ft. high. It will contain 11,600,000 cu. ft. of masonry. The reservoir to be constructed will drain over 6,000 sq. miles of territory and add 300,000 acres to the tillable area in the vicinity of Phoenix.

Hanford, Cal.—The Lake, Canal & Irrigation Co., of Hanford, has been incorporated; capital, $50,000. N. P. Duncan, R. E. Dixon, and others, of Hanford, are the directors.

Sacramento, Cal.—All bids opened May 18 for furnishing 1,134 tons 6 to 12-in. c. i. pipe were rejected by the Bd. of Trus. June 1st. New bids will be received. M. J. Desmond, City Clk.

Riverside, Cal.—The La Sierra Water Co., of Riverside, has been incorporated; capital, $250,000. Directors: W. E. Pedley, H. M. Bread and others, of Riverside.

The White's Addition Water Co. and the Hall's Addition Water Co. are reported to have consolidated as the Artesia Water Co.; capital, $100,000. S. H. Herrick, C. F. Marcy, and others, are the directors. White's addition will be repiped and supplied with filtered artesian water. It is also expected that the water systems of the Keyes tract and Cox's addition will be incorporated into the new company.

Bridgeport, Conn.—Rudolph Hering, of N. Y. City, N. Y., in his report on the water supply is stated to have recommended filtration.

Meriden, Conn.—Local press reports state that a 16-in. water main will be constructed through W. Main St. to the Reservoir Ave. main, to cost about $13,000.

Washington, D. C.—Bids are wanted June 20 for furnishing 8 and 12-in. c. i. water pipe, as advertised in The Engineering Record.

According to local press reports, Gen. Gillespie, Ch. of Engrs., on June 5 approved the recommendations of Col. Millier, Engr. in charge of Washington aqueduct, for the award of the following contracts for extra work in connection with the establishment of the filtration plant near the Soldiers' Home (bids opened May 22): For pumps and pumping engines and sand washer pumps, to Henry R. Worthington, of New York, N. Y., at $42,000 and $8,120 respectively; venturi meters, to the Builders' Iron Foundry, of Providence, R. I., at $11,030; sluice gates and gate valves, to the Coffin Valve Co., of Boston, Mass., at $18,910; boilers, mechanical stokers and economizers, to Babcock & Wilcox, of New York, N. Y., at $23,983, and special castings, to the Wilkinson Mfg. Co., of Bridgeport, Conn., at $21,619.

Monroe, Ga.—A petition has been presented to the Mayor and Council asking for an election to vote on issuing bonds to construct water works.

Terre Haute, Ind.—D. R. Gwinn, Pres. Terre Haute Water Co., writes that the company will probably lay about ½ mile of 8-in. c. i. pipe.

Maxwell, Ia.—Bids will be received June 24 by L. R. Shepherd, Village Recorder, for additions and repairs to the water works, including steel tower, pipe, hydrants, etc.

Sioux City, Ia.—Bids are wanted June 15 for 74,000 lin. ft. of 6 to 16-in. water pipe (21,000 tons), 40 hydrants and 100 gate valves; bids will also be received on July 1 for two 3,000,000-gal. pumps and two 120-H.-P. boilers, also the building of conduits and laying suction mains around present station; estimated cost of the above, including cost of construction, is $175,000. J. M. Lewis, City Engr.

Bids are wanted July 10 for the reconstruction of section main, conduit and well system at Main St. pumping station; also for laying c. i. water pipe, as advertised in The Engineering Record.

Cloverport, Ky.—The Council is stated to have granted Pate & Oelze a franchise for water works.

Wilton, Me.—The Tyngstown Water Co. is stated to have employed an engineer to prepare plans for water works.

Baltimore, Md.—An ordinance has been introduced in Council naming Mayor McLane, City Comptroller Heffner and Water Engr. Quick as a Comn. to acquire the mains, franchise rights, etc., of the Baltimore County Water & Electric Co. west of Gwynns Falls. The ordinance stipulates that the deal shall be consummated at a cost not exceeding $225,000.

Newburyport, Mass.—Press reports state that bids will be received June 16 by the City Treas. for $343,000 water bonds.

Springfield, Mass.—The Water Comn. is reported to have voted to purchase 2 meters, at a cost of $4,000.

Lawrence, Mass.—The Water Bd. has accepted the plans of Chapin & Knowles, of Pittsburg, Pa., for an additional filter, to cost $60,000. The proposed filter will be a sand gravity filter similar to the one now in use and will have an area of ¾ acres. M. F. Collins, Clk. of Water Bd.

Grand Rapids, Mich.—The Bd. of Pub. Wks. on May 30 awarded contracts as follows: To the American Car & Fdy. Co., of Detroit, for 6-in. pipe, at $30.40 per ton and 8 to 24-in. pipe, $29.90 per ton, and specials, $55.50 per ton, and to the R. D. Wood Co., of Philadelphia, Pa., for hydrants, at $36.60 ea.; total amount of contract, about $40,000.

Freeport, Minn.—G. Harren, Village Recorder, writes that the contract for constructing water works (bids opened June 6) has been awarded to W. D. Lovell, of Des Moines, Ia., for $7,824.

Omaha, Neb.—According to a recent law passed by Nebraska Legislature this city has been given power to purchase the property of the Omaha Water Co. John Alvord, of Chicago, Ill., has been appointed appraiser to represent the city, and Geo. H. Benzenberg, of Milwaukee, Wis., has been appointed by the company. They will select the third appraiser, and report on the valuation of the property. A. C. Koenig, of Omaha, will be Mgr. and Ch. Engr. of the water works when taken over by the city.

Hanover, N. H.—The Trus. of Dartmouth College are stated to have purchased the plant of the Hanover Water Co. for $40,000. The water will be brought in from the reservoir by a system of protected aqueducts.

Atlantic City, N. J.—It is stated that bids are wanted June 22 for $75,000 water bonds.

Laurel Springs, N. J.—Chas. S. King, 305 Market St., Camden, Secy. Laurel Springs Water Co., writes that the probable cost of proposed water works is from $30,000 to $50,000.

Avon-by-the-Sea, N. J.—See "Sewerage and Sewage Disposal."

Ft. Mott, N. J.—See "Government Work."

Fayetteville, N. C.—Press reports state that bids will be received July 1 by the City Clk. for $100,000 water works bonds.

Long Island City, L. I., N. Y.—Bids will be received June 18 by Robt. Grier Monroe, Comr. Water Supply, Gas and Electricity, N. Y. City, for furnishing material and installing new boilers and appurtenances at Bayside and Flushing pumping stations, Boro. Queens.

New Brighton, S. I., N. Y.—Bids will be received June 18 by Robt. Grier Monroe, Comr. Water Supply, Gas and Electricity, N. Y. City, for furnishing material and erecting a storehouse and boiler house at the Tottenville pumping station.

Horseheads, N. Y.—See "Power Plants, Gas and Electricity."

Keeseville, N. Y.—The Village Clk. writes that it was voted June 4 to increase the water supply.

Brooklyn, N. Y.—Bids will be received June 16 by Robt. Grier Monroe, Comr. Water Supply, Gas and Electricity, N. Y. City, for remodeling and extending the Watts Pond pumping station, near Valley Stream, L. I., including pumping plant, pump well and infiltration gallery system, with necessary appurtenances; also furnishing, delivering and laying a 48-in. trunk water main at Ridgewood reservoir in Cypress Hills, Myrtle Ave. and Bwsy.

Bids will be received June 18 by the Bd. of Park Comrs, N. Y. City, for furnishing and laying iron water pipes in Institute Park. Wm. R. Willcox, Chmn.

Ilion, N. Y.—Geo. Rasbach, Clk. Water Comrs., writes that the following bids were opened on June 9 for improving the water supply system: For the work complete, which includes pipe, pipe laying, reservoir and diverting dam and filters, there were 3 bidders, namely—Elory, Colby & Co., of Owego, $69,600; John Marsden, Utica, $59,600 (awarded contract), and H. B. Hooke & Son, $61,085. For pipe laying, reservoir and diverting dam and filters, 2 bidders—Thos. Kearney, Little Falls, $64,463, and C. R. Lewis, Ilion, $57,833. For pipe laying and reservoir diverting dam, Fred N. Lewis, of Herkimer, bid $41,438, and for furnishing pipe the U. S. Pipe & Fdy. Co. bid for 10 and 12-in. $30.40 per ton and for 6 and 8 in., $31.40, and Chas. Miller & Son Co., of Utica, bid $31.25 for all sizes.

Cohoes, N. Y.—C. C. Vermuele, 203 Bway., N. Y. City, is stated to have been selected by the Water Bd. to advise as to securing a better water supply.

Lockport, N. Y.—The Council is stated to have received 2 bids on June 1 for a supply of water for Lockport: The Western New York Water Co., of Buffalo, offered to furnish the city with water not to exceed 6,000,000 gals. daily at 8 cts. per M. The company agreed to supply the water to Lockport in a stand pipe from which it would be taken by the municipal system or to pump it directly into the city mains; the Horseshoe Lake Water Co., of Rochester, offered to supply 3,000,000 gals. daily at 10 cts. per M.

Yonkers, N. Y.—Tucker & Vinton, of N. Y. City, are stated to have secured the contract for building the filtration plant (bids opened May 21) for $45,895.

A. W. Kingsbury, Clk. Bd. Water Comrs., writes that the following contracts have been awarded (bids opened June 4): For pipes and castings to John Fox & Co., N. Y. City, $2,357; gates to Rensselaer Mfg. Co., Troy, $700, and sand washer to Townsend F. & M. Co., Albany, for $249.

New York, N. Y.—The following bids were opened by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, on June 2: For furnishing double and single nozzle hydrants, the Kennedy Valve Mfg. Co. bid $65.75 and $61.70 respectively, and for c. i. pipe and special castings, the John Fox & Co. bid $30.65 and $55 per ton respectively.

Bids will be received June 18 by Robt. Grier Monroe, Comr. Water Supply, Gas and Electricity, for furnishing and delivering stop cocks and hydrants; also furnishing, delivering and laying water mains in Lenox, Park and Vanderbilt Aves., 39th, 42d, 51st, Centre and Spruce Sts., also Bway. and Park Row.

Saranac Lake, N. Y.—Water bonds amounting to $45,000 are reported sold.

Springfield, O.—It is reported that the Cleveland, Cincinnati, Chicago & St. Louis Ry. proposes to install water works. W. C. Bayley, Div. Supt., Springfield.

Youngstown, O.—City Engr. F. M. Lillie is stated to have been authorized by the Bd. of Pub. Service to secure estimates for a filtration plant; it will probably be of 10,000,000 gals. capacity, and cost about $150,000.

Zanesville, O.—H. H. Kennedy, City Aud., writes the Bd. of Pub. Safety has been instructed by Council to secure plans and probable cost of a filtration plant.

Geary, Okla. Ter.—W. W. Cook & Sons, of Junction City, Kan., have secured the contract for furnishing material and constructing water works at $50,489. The American Light & Water Co., of Indianapolis, Ind., bid also for the work $51,890. J. W. Burton, City Engr.

Meadville, Pa.—Local press reports state that the time for receiving bids for constructing water works in this city has been extended from June 10 to June 16. Geo. S. Cullum, Supt. of Water Wks.

Pittsburg, Pa.—Bids are wanted June 22 for laying and relaying 34,871 ft. 10 and 12 in. pipe; also 13 single fire hydrants in portions of numerous streets. Edw. M. Bigelow, Dir. Dept. of Pub. Wks.

Clearfield, Pa.—A charter is stated to have been granted to the Winburne Water Co., of Clearfield County, with a capital of $5,000. Jas. Kerr, of Clearfield, is one of the incorporators.

Philadelphia, Pa.—Charters are stated to have been granted to the following companies: The Providence Water Co., of Providence Township, capital $5,000; the Coln Water Co., of Coln Township, capital $5,000; the Colerain Water Co., Colerain Township, capital $5,000; Conestoga Water Co., Conestoga Township, capital $5,000; the People's Water Co., of Sadlsbury Township, capital $5,000, and the Citizens' Water Co., of West Sadlsbury, capital $5,000. Ervin Lyndall, J. I. Kyle, H. E. Fauser, and others, all of Philadelphia, are the incorporators.

Sioux Falls, S. D.—At a mass meeting May 29 the citizens decided in favor of establishing municipal water works.

Waubay, S. D.—Press reports state that bids will be received June 30 by the Town Clk. for $7,000 water works bonds.

Memphis, Tenn.—Water bonds amounting to $1,250,000 were sold May 29, and the entire plant of the Artesian Water Co. has been transferred to the city. W. H. Bates, Chmn. Water Comn.

Dallas, Tex.—The members of the Water Comn., Mayor Cabell, City Engr. Raines, Water Wks. Engr. Bassett, Alderman Gill and others directly interested have been in conference with Consulting Engr. Chester B. Davis concerning plans for a pipe line from the reservoir at Bachman's branch to the pumping station at Turtle Creek.

Denton, Tex.—The City Council is stated to have instructed the Finance Com. to look into the cost of constructing another system of water works and lighting plant for the city.

San Saba, Tex.—The Dirs. of the Irrigation Co. are stated to have contracted with C. E. Coon & Co., of Houston, Tex., for the construction of dams, ditches and laterals for about $500,000.

Georgetown, Tex.—See "Power Plants, Gas and Electricity."

Salt Lake City, Utah.—L. C. Kelsey, City Engr., writes that the Council has under consideration the construction of a reservoir in Parley Canyon; probable cost of work is $235,000.

Ft. Douglas, Utah.—See "Government Work."

Springfield, Vt.—The citizens are reported to have voted June 2 to install a gravity system of water works, at a cost not to exceed $95,000. F. H. Dewart, of St. Albans, Vt., will prepare the plans.

Norfolk, Va.—The question of constructing a 30-in. water main is reported under consideration.

Olympia, Wash.—Articles of incorporation for the Pasco Irrigation Co. were filed with the Secy. of State at Olympia June 1, by Jas. A. Moore, Frank Dabney and H. K. Owens, with a capital of $3,500,000, for the purpose of irrigating 230,000 acres of land along both banks of Columbia River in Yakima and Franklin Counties, from the mouth of Snake River up stream, a distance of 40 miles. The lakes at the head of Yakima River, known as Kitchelos, Kachess, Cle Elum and Bumping, will be used for impounding reservoirs.

Port Angeles, Wash.—F. A. Lingenbrink and C. A. Cushing, are stated to have petitioned the Council for a franchise for water works.

Shinnston, W. Va.—See "Sewerage and Sewage Disposal."

Burnsville, W. Va.—See "Electric Railways."

St. Stephen, N. B.—J. Vroom, Town Clk., writes that the town may possibly buy the water works owned by a private company, or may decide to put in a gravity system if a better source of supply can be reached.

Warren, Ont.—See "Power Plants, Gas and Electricity."

Hamilton, Ont.—The citizens are reported to have voted to issue $100,000 bonds to build a high-level reservoir and improve the roadways.

Port Arthur, Ont.—Bids will be received June 25 by Jas. McTeigue, Esq., Town Clk., for furnishing steel water tower, c. i. pipes and specials, fire hydrants and valves, sewer pipes and junctions and electric power pump. Willis Chipman, Ch. Engr., 103 Bay St., Toronto.

Strathroy, Ont.—Harding & Leathorn, of London, Ont., are stated to have secured the contract for water works, for about $30,000.

Kingsville, Ont.—The Legislature is stated to have been petitioned for permission to issue $10,000 bonds to improve and extend pumping plant.

SEWERAGE AND SEWAGE DISPOSAL.

Colorado Springs, Colo.—E. W. Case, City Engr., writes that the Gilmore Plumbing Co., of Colorado Springs, bid $10,155 for extension of sewerage system (bids opened May 25). This work includes 18,707 ft. of 6, 8 and 10-in. pipe sewers, 52 manholes and 790 Ys. The trench is expected to average 9 ft. in depth and will be excavated in gravel and clay.

Hartford, Conn.—Bids will be received by the Bd. St. Comrs. June 17 for building the connecting Brook extension to intercepting sewer; estimated cost, $26,000. The extension consists of 5,330 ft. of tile and brick, and some iron pipe.

Naugatuck, Conn.—Boro. Engr. Ham is stated to have been authorized to prepare plans for sewers on 5 streets.

Wilmington, Del.—Local press reports state that the following bids were opened on June 6 by the St. and Water Bd. for constructing Price's Run sewer: Hoffman Engr. & Contr. Co., Philadelphia, Pa., $103,556; Christiana Constr. Co., Wilmington, $108,281; E. F. Fonder, Philadelphia, Pa., $128,386; Baltimore Constr. Co., Wilmington, $131,893, and J. D. Murray, New Brunswick, N. J., $135,227.

Gainesville, Ga.—Col. W. T. R. Wilson, of Atlanta, is stated to have completed plans for a sewerage system for Gainesville.

Sterling, Ill.—The Council is stated to have passed an ordinance providing for the construction of the E. Bway. sewerage system. M. E. Wilger, City Clk.

Galesburg, Ill.—Alderman Maley is reported to be Chmn. of Com. appointed to investigate the matter of supplying the city with a sewage disposal plant.

Paris, Ill.—Bids are wanted June 20 for constructing 860 ft. of 10-in. and 8,120 ft. of 8-in. sewer. D. H. Sawyer, City Engr.

Muncie, Ind.—Bids are wanted June 22 for constructing a 12-in. pipe sewer in a portion of Willard St. R. G. Hickok, City Clk.

Lafayette, Ind.—A charter is stated to have been granted to the Sanitary Sewer Co., of West Lafayette, to construct a sewerage system and engage in the building of sewers and drains; capital, $2,500. Directors: S. G. Snyder, T. M. Andrew, and others.

South Bend, Ind.—A. J. Hammond, City Engr., writes that contracts for sewers (bids opened June 3) have been awarded as follows: Napier and Lafayette Sts., to H. De Vos & Co., $5,138, and La Salle Ave., to Hoban & Roach, $2,317.

Wabash, Ind.—Bids are wanted July 13 for sanitary sewers in 6 streets; also for 9,000 yds. of asphalt paving on Market St. John Illity, City Engr.

Frankfort, Ind.—Bids are wanted June 18 for constructing sewer in certain streets. Chas. Cheney, City Engr.

New Bedford, Mass.—The Bd. of Aldermen is stated to have appropriated $12,200 to construct sewers.

Quincy, Mass.—The following bids were opened by the Metropolitan Water and Sewerage Bd. at Boston June 4 for portions of Section 44 High-Level Sewer, Quincy—*a*, C. G. Belden & Co., Quincy, total, $213,575; *b*, E. W. Everson & Co., Boston, $169,014; *c*, H. P. Nawn, Boston, $133,845; *d*, W. H. Ellis, Boston, $125,555 (awarded contract):

	570 lin. ft. earth exc. & refill. 60-in. pipe.	337 lin. ft. earth exc. & refill. screen chamber.	918 lin. ft. earth exc. & refill. 135"x150" sewer.	600 cu. yds. earth exc. & refill. foundations.	1,800 cu. yds. brick mas'ry, Amer.	1,800 cu. yds. brick mas'ry, Port.	2,500 cu. yds. concr. mas., Amer.	5,000 cu. yds. concr. mas., Port.	800 cu. yds. boulder conc., Port.	225 cu. yds. cut granite masonry.	570 lin. ft. laying 60-in. c. i. pipe.
a.....	$25.00	$75.00	$25.00	$2.00	$16.50	$17.00	$7.50	$8.00	$6.00	$70.00	$10.00
b.....	14.00	50.00	18.00	1.25	14.00	16.00	6.00	7.00	6.00	60.00	3.00
c.....	6.00	34.00	9.00	1.00	12.50	13.50	5.50	6.50	4.25	50.00	1.50
d.....	7.00	.30.00	7.20	.80	12.00	13.20	4.20	5.30	4.00	65.00	4.00

Roxbury, Mass.—The following bids were opened by the Metropolitan Water and Sewerage Bd. at Boston June 4 for laying force-mains and building connecting sewer. Section 76, High-Level Sewer, Roxbury—*a*, C. E. Trumbull Co., Boston; *b*, Patk. McGovern, Boston; *c*, Jas. Driscoll & Son, Brookline; *d*, H. P. Nawn, Boston (awarded contract):

	Lay 3,060 lin. ft. 48" pipe.	Earth exc. and refill. lump sum.	80 cu. yds. brk. mas., Port.	120 cu. yds. conc. mas., Port.	800 cu. yds. rock exc.	Totals.
a.....	$9.50	$400.	$15.00	$8.00	$6.00	$36,430
b.....	8.00	500.	18.00	10.00	7.00	33,220
c.....	7.50	200.	20.00	10.00	4.00	29,150
d.....	6.50	800.	18.00	7.50	4.00	26,230

Quincy, Mass.—The following bids were opened by the Metropolitan Water and Sewerage Bd. at Boston June 4 for Section 46 High-Level Sewer, Quincy—*a*, H. P. Nawn, Boston; *b*, C. G. Belden & Co., Quincy; *c*, W. H. Ellis, East Boston (awarded contract):

	702 lin. ft. earth exc. & refill. for 135" x150" sewer.	500 cu. yds. brk. mas'ry, Amer.	500 cu. yds. brk. mas'ry, Port.	3,500 cu. yds. concr. mas., Port.	10 M. ft. spruce lumb. in place.	Totals.
a.....	$7.20	$13.00	$14.50	$6.00	$35.	$40,802
b.....	9.00	13.50	14.00	5.50	20.	40,328
c.....	7.00	12.10	13.20	5.30	30.	37,044

Jackson, Mich.—Sewer bonds amounting to $100,000 have been sold.

Houghton, Mich.—Bids will be received June 18 by the Common Council for constructing sewers on portions of Shelden St. J. F. Jackson, Chmn. of St. Com.

Luverne, Minn.—Bids will be received June 16 by the Village Council for constructing a sewer in portions of Freeman St. E. S. Schwartz, Village Recorder.

Brainerd, Minn.—City Engr. Woolman is stated to have completed plans for a general sewerage system. He estimates the cost at about $23,000.

Omaha, Neb.—Plans for the proposed Saddle Creek Valley Sewer will be completed in about 6 weeks; it will have a disposal plant at its terminal. Andrew Rosewater is City Engr.

Vallabury, N. J.—Eugene A. McMurray is stated to have been appointed by the Council on June 3 as engineer of the lateral sewerage system. He will have Alex. Potter, 143 Liberty St., N. Y. City, N. Y., as Consulting Engr. The work proposed will cost between $40,000 and $60,000.

Summit, N. J.—Sewer bonds amounting to $125,000 are reported sold.

Ridgefield Park, N. J.—The following bids are reported to have been opened by the Bd. of Trus. June 1 for the construction of sewerage system No. 4: Callery & Murphy, $10,452 (awarded contract); Edwin C. Humphry, $14,415; Michael Henry, $22,207; P. Cavanagh, $23,335.

Avon-by-the-Sea, N. J.—Halsey & Logan, of Newark, are stated to have completed plans for water works, to cost $34,000, and a sewerage system, to cost $32,000. About 4½ miles of pipe will be laid for each system.

Brooklyn, N. Y.—Bids will be received June 18 by the Bd. of Park Comrs., N. Y. City, for furnishing and laying vitrified sewer pipe, also constructing catch basins, manholes and cesspools in Institute Park. Wm. R. Willcox, Chmn.

Whitesboro, N. Y.—It is stated that contracts will soon be let for the completion of the sewerage system at a cost of $5,000.

New York, N. Y.—Bids will be received June 16 by Jacob A. Cantor, Pres. Boro. Manhattan, for furnishing material and constructing 1,756 lin. ft. 3 ft. 6 in. by 2 ft. 4 in. brick sewer; also small quantity of salt glazed vitrified stone-ware pipe sewer on portions of several streets.

It is stated that the N. Y. Central & Hudson River R. R. Co. (H. Fernstrom, Ch. Engr.) will probably install a pumping system to handle the city sewage between 59th and 42d Sts. in connection with the lowering of its tracks between these points.

Depew, N. Y.—Bids will be received June 15 by the Bd. of Village Trus. for constructing a concrete retaining wall at the sewage disposal plant. J. C. Glade, Village Clk.

Cincinnati, O.—The City Engr. is reported to have been authorized to prepare plans for a sewer in Millcreek.

Delaware, O.—Bids will be received June 27 by F. D. King, City Clk., for constructing main sewers on portions of 2 streets.

Cleveland, O.—A. R. Callow, Secy. Dept. Pub. Service, writes that the contract for furnishing 20,000 lin. ft. 15-in. sewer pipe (bids opened June 5) has been awarded to the Central Builders' Supply Co., of Cleveland, at 37 4/5 cts. per ft.

Baker City, Ore.—The lowest bid opened by the City Council on June 2 for the construction of a sewerage system is stated to have been submitted by the Jacobsen-Bade Co., of Portland, for $49,542.

Eugene, Ore.—The citizens are stated to have voted May 29 to issue $15,000 bonds for a sewer in the western part of city.

Williamsport, Pa.—Bids are wanted June 26 for constructing sanitary sewers in Center, Mahoning and Front Sts., requiring about 1,814 ft. of 12-in. and 2,066 ft. of 10-in. pipe. W. C. Miller, Town Clk.

Indiana, Pa.—The Council is stated to have authorized the Fin. and Sewerage Com. to secure bids for the sale of bonds and to make arrangements for the purchase of material, the laying of pipe, and for preparation and construction of a sewerage system.

Harrisburg, Pa.—The lowest bid opened by the Bd. of Pub. Wks. June 5 for the construction of a sewer in Chestnut St. is stated to have been submitted by Fisher & Lynch, for $7,097.

Norristown, Pa.—Bids will be received June 24 by the Sewer Com. for constructing a sanitary sewer with necessary pipe, castings, laterals, flush tank and appurtenances in portions of Swede St. Wm. J. Wells, Chmn.; S. Cameron Corson, Boro. Engr.

Union, S. C.—According to press reports contracts will soon be let for a sewerage system.

Aberdeen, S. D.—Local press reports state that the following bids were opened on May 29 for the construction of sewer extensions: W. I. Gray & Co., $22,436; O'Neil & Son, $18,979; Jas. Kennedy, $16,967 (awarded contract); Symms-Powers Co., $18,700; Chris. Johnson, $19,992; C. M. Giddings and L. W. Kelley, $16,965.

Nashville, Tenn.—Local press reports state that bids are wanted by City Recorder Brown until July 1 for $200,000 sewer and street improvement bonds.

Austin, Tex.—City Engr. Lee is stated to have completed plans for storm water sewers on Congress Ave.; probable cost, $11,000.

Ft. Douglas, Utah.—See "Government Work."

Blaine, Wash.—It is stated that bids are wanted June 22 for constructing a 6-in. pipe sewer. R. J. Glen, City Clk.

Spokane, Wash.—The following bids for laying the 1st Ward sewer, Dist. No. 1, are reported to have been opened May 28 by Bd. of Pub. Wks.: Jas. C. Broad, $15,365; Peter Costello, $15,770; Aug. Ilse, $15,990.

Shinnston, W. Va.—Leslie Hawkes, Recorder, writes that the town is considering the construction of a sewerage system, but question is not decided yet. He further states that the town will put in water works the coming season.

Hudson, Wis.—It is reported that surveys are being made for a complete sewerage system.

Port Arthur, Ont.—See "Water."

BRIDGES.

Montgomery, Ala.—Local press reports state that the building of a foot and wagon bridge across Alabama River at Montgomery, to cost about $75,000, is being considered.

Bristol, Conn.—It is stated that a $3,500 bridge is to be built by the Bristol & Plainville Tramway Co. at Main St. E. C. Smith, Ch. Engr., Bristol.

Hartford, Conn.—Bids are wanted July 1 for building a stone bridge across Connecticut River, as advertised in The Engineering Record.

The Hartford St. Ity. Co. is to erect a high trestle over the tracks of the Highland Division of the New York, New Haven & Hartford Rd. in Main St., E. Hartford. The approaches will extend 200 ft. north and south of the tracks, and the span of the bridge will be 75 ft. in length, extending over the right of way of the steam road.

Derby, Conn.—See "Paving and Roadmaking."

Wilmington, Del.—It is stated that definite arrangements have been made by the officials of the Philadelphia, Baltimore & Washington R. R. Co. for the building of a bridge to replace present structure across Susquehanna River. The new bridge will be 3,300 ft. in length, and will be built about 75 ft. south of present structure. A. Feidpauche, Principal Asst. Engr., Philadelphia, Pa.

Washington, D. C.—Bids will be received until July 25 for constructing a highway bridge across Potomac River at Washington. Lieut.-Col. Chas. J. Allen, Corps Engrs. U. S. A.

Chicago, Ill.—Frank Murphy, Contract Clk., writes that the lowest bid received on June 5 for constructing the superstructure of Northwestern Ave. bridge over Chicago River, including machinery, locks, electrical equipment, etc., was submitted by C. H. Stroebel, Old Colony Bldg., for $208,275.

Martinton, Ill.—Reports state that the proposition to issue $10,000 bonds to build a bridge across Iroquis River at Rivards Ferry carried at the recent election.

Indianapolis, Ind.—Bids are wanted June 18 for constructing arch bridge and concrete culverts for county. Harry E. Smith, Co. Aud.

Anderson, Ind.—The Co. Comrs., according to press reports, will soon let a contract for building a bridge across White River at Delaware Ave., at a cost of about $35,000.

Wagoner, Ind. Ter.—According to reports, the high water has carried away the Arkansas Bridge on the Arkansas River.

Tracy, Ia.—It is stated that the Burlington bridge at Tracy, across Des Moines River, has been carried away by the recent flood.

Durham, Kan.—Reports state that bids will be received June 22 by J. H. Thrasher, Co. Clk. at Marion, for constructing a 100-ft. steel bridge over Cottonwood River at Durham.

Pikeville, Ky.—It is stated that bids are wanted June 30 for constructing the substructures, superstructures and approaches for steel Howe truss and stone arch bridges to be built across Stone, Coal, Toilets and Buckleys Creeks. W. O. B. Ratliff, Co. Judge.

New Orleans, La.—The American Creosoting Wks. has made an offer to the Com. on Sts. & Landings to build a bridge across Orleans Canal at Metairie Road.

Haverhill, Mass.—The House has passed a bill authorizing the building of a bridge across Merrimac River at Haverhill.

Westfield, Mass.—The building of a bridge across Elm St., at a cost of $3,500, is reported to be under consideration.

St. Joseph, Mich.—The Townships of Berrien and Oronoke are reported to have under consideration the building of a $20,000 steel bridge.

Grand Rapids, Mich.—The following bids for furnishing material and constructing a concrete or concrete-steel arch bridge at Bridge St. were opened by Bd. Pub. Wks. June 5—*a*, concrete arch; *b*, concrete-steel arch; *c*, alternate bid; *d*, foot bridge: Jas. McDermott & Son, Grand Rapids, *a*, $99,000; *b*, $108,000; *d*, $3,500. Joseph P. Rusche, Grand Rapids, *a*, $87,700 (awarded contract); *b*, $87,400; *d*, $1,500. The Ferro Concrete Constr. Co., Cincinnati, O., *b*, $107,900; *c*, $102,200; *d*, $2,000. Rudolph S. Blome, Chicago, Ill., *b*, $87,800; *d*, $1,850.

St. Paul, Minn.—The Bd. of Aldermen has authorized plans prepared for replacing the wooden approach of the east end of E. 6th St. bridge with a steel approach. There is $7,000 available for this work.

Kragness, Minn.—Bids will be received June 16 by the Town Bd. for constructing a bridge of 40 ft. span over Buffalo River. W. A. Brendemuehl, Clk.

Mankato, Minn.—Bids will be received June 22 by the Bd. of Co. Comrs. for constructing a steel bridge on stone piers, in Section 20, Ceresco Township. Edgar Weaver, Co. Aud.

Kansas City, Mo.—Press reports state that 5 railroad bridges across Missouri and Kaw Rivers have been washed away by the recent floods, and that the approaches to 2 other bridges have been carried away, making them useless for traffic.

It is stated that 16 substantial bridges across Kansas River have been washed away.

Havre, Mont.—The Co. Comrs. have decided to build a 1-span Howe truss bridge, 200 ft. long, across Milk River, at Bowes Ford, a few miles east of Havre.

Lodi, N. J.—Bids will be received by A. C. Demarest, of Hackensack, Clk. Bd. Chosen Freeholders, until June 20 for the construction of a bridge over Saddle River at Lodi; probable cost, $12,000.

Oneida, N. Y.—Bids will be received June 16 by the Bd. of Pub. Wks. for constructing a concrete abutment for bridge over Oneida Creek at Durhamville; also repairing abutment now in place, replacing bridge and grading highway. J. F. Connor, City Clk.

W. Seneca, N. Y.—The Town Bd. has decided to build an iron bridge across Smoke's Creek, between W. Seneca and Roland.

Cohoes, N. Y.—The stockholders of the Vichers Ferry bridge, which was damaged last spring by the freshets, are reported to be planning to repair said structure at once.

Canastota, N. Y.—Governor Odell has approved the bill appropriating $10,000 for a stone arch bridge across Canastota Creek.

Buffalo, N. Y.—The Grade Crossing Comn. is preparing plans for 5 foot bridges.

New York, N. Y.—A resolution has been adopted by the Bd. of Estimates appropriating $6,532,000 for building Bridge No. 3.

The R. H. Wood Co. has secured the contract to construct the steel underfooting for roadways on the Williamsburg Bridge, at $168,746.

Tonawanda, N. Y.—Press reports state that the State Engr. is preparing plans for a bridge to be built across the canal at Seymour St., cost not to exceed $17,000.

New York, N. Y.—See "Paving and Roadmaking."

Newark, O.—O. C. Larason, Co. Clk., writes that D. H. Pigg is Engr. in Charge of proposed bridge over Licking River at Orchard St.

Maumee, O.—The American Bridge Co. is reported to have secured the contract to construct, for the Toledo Urban & Interurban Ry. Co. a bridge, 1,430 ft. long, of steel, stone and concrete, across Maumee River, between Maumee and Perrysburg, at a cost of $280,000.

Cleveland, O.—Bids will be received July 1 by the Bd. of Co. Comrs. for completing the Adams Ave. arch over Nine Mile Creek in Nottingham Village. Julius C. Dorn, Clk.

Guthrie, Okla. Ter.—The citizens in the northwestern part of Logan Co. have petitioned the Co. Comrs. to build an iron bridge across Cimarron River.

Portland, Ore.—Press reports state that the proposition to issue $463,000 bonds for a new bridge at Morrison St. and for 2 free ferries, carried at the election held June 1.

The Oregon R. R. & Navigation Co., according to local press reports, has awarded the contracts for constructing the concrete masonry abutments and piers for 17 bridges on the western portion of the line, as follows: Deeks & Deeks, of St. Paul, Minn., will do the work on bridges between Walla Walla and Spokane, and Smyth & Howard, of Portland, the bridges between Umatilla and Huntington. The Pacific Coast Construction Co. is reported to have secured the contract for filling in about 30 trestles.

The building of a bridge across Sullivan's Gulch at Union Ave. is under consideration.

Ashley, Pa.—It is stated that bids are wanted June 22 for building a concrete bridge across Solomons Creek. D. E. Frederick, Boro. Secy.

Montrose, Pa.—Bids will be received June 16 by the Co. Comrs. for constructing masonry for bridges in Dimock, Jackson, Liberty and Oakland Townships. W. A. Titsworth, Clk.

Natrona, Pa.—The Bd. of Viewers on the building of a bridge across Allegheny River from Natrona to Burrell Township, Westmoreland Co., have reported in favor of constructing same, recommending a structure 1,269 ft. long.

Philadelphia, Pa.—The Comrs. of Philadelphia and Bucks Counties have reached an agreement whereby a $40,000 bridge is to be built across Poquessing Creek at Bristol Turnpike. It is stated that bids for constructing this bridge will soon be asked.

Royalton, Vt.—Press reports state that the citizens of the town of Royalton have voted in favor of replacing the present structure across White River at So. Royalton with a new bridge, which will probably be a double track steel structure, with a walk on one side.

Spokane, Wash.—L. B. Handley, Secy. Bd. Pub. Wks., writes that contracts for south approach to Monroe St. bridge (bids opened May 21) have been awarded as follows: Superstructure, to McCreery & Willard, of Spokane, at $12,500, and cement piers, to Aug. Ilse, of Spokane, at $13,456.

Seattle, Wash.—According to local press reports the Seattle & San Francisco Ry. & Navigation Co., which is owned by the Northern Pacific, has filed with Maj. John Millis, Corps Engrs., U. S. A., Seattle, plans for a permanent steel draw bridge with concrete piers and abutments to take the place of the present wooden structure now crossing the east waterway, Seattle Harbor.

Fond du Lac, Wis.—The Town Bd. has decided to replace wooden structure across Fond du Lac River, near Mihills' Corners, with an iron or steel bridge.

Montreal, Que.—It is stated that about $8,000 will be needed to repair the St. Catherine St. bridge.

PAVING AND ROADMAKING.

Denver, Colo.—The Colorado Paving Co. is stated to have secured the contract to pave with either Trinidad Lake or Bermudez asphalt on 14th St. at $1.40 per sq. yd.

Derby, Conn.—A bill has passed the Legislature authorizing Derby to issue $75,000 bonds for street improvements and a new bridge across Naugatuck River.

Augusta, Ga.—The following bids were opened by City Council June 1 for 49,000 yds. (*a*) asphalt and (*b*) bituminous macadam pavement on Broad St. (Nesbit Wingfield, City Engr.)—(1) Geo. W. Critchfield, N. Y. City, N. Y.; (2) Fleming & Twiggs, Augusta; (3) South Paving & Constr. Co., Chattanooga, Tenn.; (4) Green River Asphalt Co., N. Y. City, N. Y.; (5) Warren Bros. Co., Boston, Mass.

		Pavt., per sq. yd.	Brick drains, 9,000 ft.	Reset'g curb, 2,200 ft.	Old brick, 200 sq. yds.	Totals.
(1).....	*a*	$1.18	$0.48	$0.10	$0.60	$62,480
(2).....	*a*	1.27½	.52	.05	.20	67,305
(3).....	*a*	1.35	.50	.15	.25	71,030
(4).....	*a*	1.33⅓	.40	.12	.75	69,347
(5).....	*b*	1.48	.40	.10	.30	76,400

The following bids were opened at same time and place for (*a*) brick and (*b*) Belgian block pavement on Broad St. (52,000 yds.)—(1) Ga. Vitrified Brick & Constr. Co., Augusta; (2) South Paving & Constr. Co., Chattanooga, Tenn.; (3) W. F. Bowe, Augusta:

	(1)	(2)	(3)
Pavt., per sq. yd.....	*a* $1.27	*a* $1.64	*b* $1.69
Raising R. R. tracks.....	6,500	6,500	1,000
Reset. curb, 9,200 ft.....	.10	.15	.05
Old brick, 11,000 sq. yds.	.55	.55	.33
Old concrete, 350 yds....	.20	.50	.07
New concrete, 350 yds...	.48	.43	.47
Belgian blk., 150 s. y., relaid	.25	.25	.25
Totals	$79,785	$99,573	$94,658

Freeport, Ill.—An ordinance has been adopted on the recommendation of the Bd. of Local Improv. whereby Douglas Ave., West, Grove, Green, Cherry and Mechanic Sts. are to be graded, macadamized and curbed at a total cost of $20,500. According to the City Engr.'s estimate there will be required 14,800 lin. ft. of curbing, 24,700 sq. yds. of macadam, and 18,216 cu. yds. of excavating.

Moline, Ill.—Bids will be received June 20 by the Bd. of Local Improv. for grading, curbing, draining and paving with asphalt portions of 3 streets; also constructing gutter flag, repairing stone curb, and repairing storm water drains. C. P. Skinner, Pres.

Rock Island, Ill.—The City Engr. estimates the cost of paving 29th St. from 7th to 9th Aves. at $6,809.

Peoria, Ill.—The City Engr. has been directed to prepare estimates of the cost of paving with brick on portions of Reed, Fisher, Smith and Spencer Sts.

Rensselaer, Ind.—Bids will be received July 10 by the Bd. of Co. Comrs. for constructing the Hanging Grove gravel road, in all about 7 miles. Wm. C. Babcock, Co. Aud.

Warsaw, Ind.—Press reports state that all bids recently received for paving with brick and asphalt have been rejected.

Bloomington, Ind.—It is stated that bids are wanted June 16 for 4,900 sq. yds. of brick and 3,660 sq. yds. of macadam pavement. D. A. Rothrock, City Engr.

Terre Haute, Ind.—Bids will be received June 22 by the Bd. of Pub. Wks. for improving portions of 4th St. by paving with vitrified brick, curbing with limestone and paving the sidewalks with cement. S. C. Beach, Secy.

Wabash, Ind.—See "Sewerage and Sewage Disposal."

Paoli, Ind.—Geo. W. Tegarden, Co. Aud., writes that no bids were received on June 4 for constructing the W. Baden and Huron Roads, 18,700 ft. New bids will be called for.

Versailles, Ind.—John A. Spencer, Co. Aud., writes that bids are wanted July 7 for constructing 18 miles of macadam road. Engineer, Jas. E. Wright, of Versailles.

Hartford City, Ind.—Bids will be received June 23 by the Common Council for improving by paving with brick block portions of High St. Chas. A. Brown, City Clk.

Marshalltown, Ia.—Wm. Bremner, City Engr., writes that the Barber Asphalt Co., Equitable Bldg., Des Moines, has secured the contract (bids opened June 8) for 13,700 sq. yds. asphalt at $1.97 per sq. yd., and for 8,000 ft. combined curb and gutter, 65 cts. per ft.

Davenport, Ia.—Bids are wanted June 16 for paving with brick on portions of LeClaire and Perry Sts. Thos. Murray, City Engr.

Louisville, Ky.—Local press reports state that bids will be received until June 17 for paving about 38,500 sq. yds. on Bway., with asphalt. Probable cost, $95,000. J. B. F. Breed, City Engr.

Cumberland, Md.—John J. Stump, Chmn. St. & Alley Com., writes that the contract for grading and paving about 14,000 ft. of Green St. (bids opened May 23) has been awarded to Fred. Perry, of Cumberland, for about $12,000.

Frederick, Md.—Bids will be received June 22 by the Mayor and Aldermen for paving approximately 4,650 sq. yds. clay or shale block pavement; also furnishing and setting approximately 2,400 lin. ft. curb stone. T. Chalkley Hatton, Consulting Engr., Wilmington, Del.

Haverhill, Mass.—Albert L. Gillin, Clk. of Com., writes that Thos. Lahey, of Haverhill, secured the contract for furnishing 2,500 ft. of granite edgestones, at 47 cts. per lin. ft., and for 40,000 granite paving blocks at $57 per M. (bids opened June 4).

No. Adams, Mass.—H. C. Wood & Co. is reported to have secured the contract to pave with Porter brick on Union St. at $2.45 per sq. yd. About 4,000 sq. yds. will be required.

New Bedford, Mass.—The Bd. of Aldermen has appropriated $75,000 for street improvements.

Fitchburg, Mass.—It is stated that bids are wanted June 15 for furnishing granite block. D. A. Hartwell, Clk. Bd. Street Comrs.

Bay City, Mich.—The Bd. of Wks. estimates the cost of paving with vitrified brick on Cass Ave. at $25,440.

Grand Rapids, Mich.—Plans and specifications for macadamizing a portion of Charles St. have been approved by the Bd. of Pub. Wks.

Charlevoix, Mich.—Bids are wanted June 18 for furnishing material and laying about 2,600 ft. of combined curb and gutter and 6,500 sq. yds. of brick or bitulithic pavement. Geo. S. Pierson, Engr., Kalamazoo, Mich.

Traverse City, Mich.—Chas. M. Beers, City Clk., writes that the following 2 bids were received June 5 for paving 6th St. with brick—*a*, with 6-in. concrete foundation cement filler, and *b*, with 6-in. foundation of asphalt: John Scanlon, Saginaw, *a*, $2.17 per sq. yd., total $22,487 (awarded contract); *b*, $2.25, total $23,187; and J. J. Granville, *a*, $2.19, total $22,537; *b*, $2.28½, total $23,368. The work includes 8,745 sq. yds. of brick, 5,297 ft. of straight curb and 2,545 ft. circular curb. The successful bidder bid for cement circular curb 74 cts. per lin. ft. and for straight curb, 44 cts.

Detroit, Mich.—Engr. Robert McCormick, of Detroit, has been instructed to prepare estimates of the cost of paving Michigan Ave. in Springwells Township.

Local press reports state that the following bids were received by the Bd. of Pub. Wks. for furnishing the city 4,000,000 bricks: F. B. Stevens, $20 a thousand for Nelsonville brick, $20.50 for Metropolitan and $17.50 for Buckeye; F. B. Holmes & Co., $18 for Boien Brown and $18.20 for Union paver; C. H. Little, $16.50 for Porter; T. H. Kennedy, $18.10 for Harris paver, and H. Houghton, $18.40 for Harris paver. C. J. Deckman, of Cleveland, bid $18.25 without naming the brick; the Puritan Paving Brick Co., of Galesburg, Ill., several bids ranging from $17.20 to $21.90 for different brands.

The Cleveland Trinidad Paving Co. is stated to have secured the contract to resurface a portion of Woodward Ave. and Fort St., at $1.43 per sq. yd. Total cost reported to be $10,385.

St. Paul, Minn.—Local press reports state that the Barber Asphalt Paving Co. received the contract for curbing on Concord St., at $5,362, and Fielding & Shepley the contracts for paving with brick on Mississippi and E. 7th Sts., and with granite on E. 3d St. at $13,400, $42,200 and $12,260 respectively.

Duluth, Minn.—Co. Surv. Williams estimates the cost of grading and graveling the driveway on the west side of the river to Mill Creek at $6,000.

St. Joseph, Mo.—The Bd. of Pub. Wks. has decided to resurface Frederick Ave. from 8th to 26th Sts. and 6th St., from Patee to Atchison Sts., at a probable cost of $100,000.

Brookfield, Mo.—Local press reports state that bids are wanted by the City Council until June 16 for paving with brick on Main St., using brick as foundation. Chas. K. Hart, City Clk.

Omaha, Neb.—The City Council has passed a resolution requesting the Bd. of Pub. Wks. to prepare an estimate on the cost of a municipal asphalt repair plant.

Mt. Holly, N. J.—John E. Darnell, Dir. Bd. Co. Freeholders, writes that J. R. Shanley, 26 Exchange Pl., Jersey City, has secured the contract for constructing 7 miles of macadam road at $50,786 and the Delaware River Quarry & Constr. Co., Jersey City, for 6 miles of macadam road at $31,198 (bids opened June 8).

Elizabeth, N. J.—W. J. McCloud is stated to have submitted the lowest bids for paving on portions of Bond and First Sts. at $6,724 and $3,811 respectively, and B. M. Shanley & Co. the lowest on Pine St. at $21,158; J. J. Potts on Fifth St. at $10,054.

Bloomfield, N. J.—The Town Council has adopted a resolution to expend $10,000 for road improvements.

Trenton, N. J.—Bids will be received June 16 by the Common Council for paving with vitrified brick on 6-in. concrete base, portions of Dettmar Alley. C. Edw. Murray, City Clk.

Hoboken, N. J.—Bids are wanted June 24 for improving by grading, curbing, and paving with Belgian block portions of Harrison St. Jas. H. Londrigan, City Clk.

Brooklyn, N. Y.—Bids will be received June 18 by the Bd. of Park Comrs., N. Y. City, for furnishing and laying cement sidewalks around Bushwick and Institute Parks. Wm. R. Willcox, Chmn.

Port Chester, N. Y.—Bids will be received June 15 by the Bd. of Village Trus. for $5,264 Irving Ave. paving bonds; also $8,300 Irving Ave. macadamizing bonds. Jerome A. Peck, Village Clk.

Buffalo, N. Y.—The following are, according to local press reports, the lowest bids received June 2 for repaving: Vermont St., H. P. Burgard, at $3,100; Cleveland Ave., The German Rock Asphalt Co., at $9,172, and 16th St., The Eastern Construction Co., at $4,850.

Francis G. Ward, Comr. Pub. Wks., writes that the contract for repairing hard material sidewalks (bids opened June 9) has been awarded to E. D. Hofeller, of Buffalo, at 11 cts. per sq. ft.

Bids are wanted June 18 for repaving with asphalt portions of 11 streets; also paving with asphalt portions of Westo Alley. Francis G. Ward, Comr. Dept. of Pub. Wks.

Rochester, N. Y.—Local press reports state that the Rochester Vulcanite Co. has secured the contract to pave on Almira St., at $8,235.

Cohoes, N. Y.—The City Engr. has been instructed to prepare plans and specifications for Vliet St. extension.

New York, N. Y.—Local press reports state that Boro. Pres. Cantor will soon ask bids for constructing the second section of the extension of Riverside Drive, from 135th to 145th Sts., estimated to cost $1,500,000. The contract will call for a large amount of cut stone work, landscape gardening, tree planting, and at one point, near 136th and 137th Sts., there is to be a stone viaduct with masonry arches.

Bids will be received June 16 by Jacob A. Cantor, Boro. Pres., for regulating and paving with asphalt and granite block portions of several streets. Engineer's estimate, 2,770 sq. yds. asphalt, 2,000 sq. yds. granite block, 6,820 cu. yds. earth excavation, 11,133 cu. yds. rock excavation, 16,450 sq. ft. new flagstone furnished and laid, etc.

The United States Wood Preserving Co. has secured the contract to lay creoresinate wood block pavement for roadways on Williamsburg Bridge at $31,989.

Bids will be received June 23 by Jacob A. Cantor, Boro. Pres., for regulating, grading, paving with asphalt and repaving with asphalt block portions of numerous streets; Engineer's estimate, 5,500 sq. yds. asphalt pavement, including binder course; 58,500 sq. yds. asphalt block; 8,450 cu. yds. concrete, including mortar bed.

New Brighton, S. I., N. Y.—Jos. Johnson's Sons, of West New Brighton, have secured the contract for paving Jewett Ave., including 23,000 sq. yds. vitrified brick, 2,900 cu. yds. concrete and 10,300 lin. ft. of bluestone curb, and J. E. Donovon, of Port Richmond, the contract for paving roadway of Richmond Terrace, including 6,800 sq. yds. granite block, 1,250 cu. yds. concrete and 3,650 lin. ft. of new curb (bids opened June 5).

Long Island City, N. Y.—Bids will be received June 18 by Jos. Cassidy, Boro. Pres., for furnishing material and regulating, grading, curbing, paving with asphalt and repaving with asphalt block portions numerous streets. Engineer's estimate, 18,400 sq. yds. asphalt, including binder course, 14,360 sq. yds. asphalt block, 2,400 cu. yds. concrete, including mortar bed, 6,300 cu. yds. earth excavation, 14,600 sq. yds. old stone pavement relaid as foundation, 23,142 lin. ft. new bluestone curbstone furnished and set, 62,700 sq. ft. new bluestone flagstone furnished and laid, etc.; also for furnishing and delivering on Jackson Ave. 4,000 cu. yds. broken stone of trap rock, 3,700 cu. yds. screenings of trap rock.

Albany, N. Y.—The following bids were opened by State Engr. Edw. A. Bond on June 8 for the improvement of public highways as follows:

Catskill Road—Tompkins County—Length, 1.869 miles.—Chas. H. Quearean, Baldwinsville, N. Y., $16,364; John W. Cronin, Syracuse, N. Y., $19,000.

Town Line Extension Rd.—Broome Co.—1.97 mi.—Thomas & Brown, Glens Falls, N. Y., $16,800.

Aurora-Buffalo Rd.—Erie Co.—5.573 mi.—Mosier & Somers, Buffalo, N. Y., $62,000; Bd. Superv. Erie County, $50,400.

River Rd., Sec. 2-3—Erie Co.—3.015 mi.—Henry P. Burgard, Buffalo, N. Y., $25,000; German Rock & Asphalt Co., Buffalo, $23,443; Bd. Superv. Erie Co., $23,000.

Main St., Sec. 4—Erie Co.—5.625 mi.—Henry P. Burgard, Buffalo, N. Y., $32,000; Casey & Murray, Rochester, N. Y., $30,500; Bd. Superv. Erie Co., $34,500; Chambers & Grady, Rochester, N. Y., $33,934.

Main St., Sec. 5—Erie Co.—6.581 mi.—H. P. Burgard, Buffalo, N. Y., $36,750; Chambers & Grady, Rochester, N. Y., $40,826; Casey & Murray, Rochester, N. Y., $35,200; Bd. Superv. Erie Co., $40,000.

Genesee Turnpike—Onondaga Co.—1.13 mi.—John W. Cronin, Syracuse, N. Y., $8,629; R. M. Douglas, Syracuse, N. Y., $10,781.

Little Falls—Dolgeville Rd.—Herkimer Co.—2.29 mi.—F. N. Lewis, Herkimer, N. Y., $17,997; Thos. H. Karr, Troy, N. Y., $18,700; Casey & Murray, Rochester, N. Y., $18,000; Jos. Walker, Mariner's Harbor, N. Y., $16,490; McCaghney & Linihan, Little Falls, N. Y., $20,375; Hallinan Bros., Little Falls, N. Y., $17,744.

Fenton Rd.—Broome Co.—2.17 mi.—Thomas & Brown, Glens Falls, N. Y., $19,100.

Violet Ave.—Dutchess Co.—3.29 mi.—Thos. H. Karr, Troy, N. Y., $27,900; Bellew & Merritt, Tuckahoe, N. Y., $28,508; Jas. E. Martin, Utica, N. Y., $28,959; Harry L. Smith, N. Y. City, $35,000; Frank Pigeon, Saugerties, N. Y., $26,879.

Windsor Rd., Sec. 2—Clinton Co.—1.75 mi.—Bd. Superv., Clinton County, $13,300; Buckley Const. Co., Plattsburgh, N. Y., $12,687; Jas. T. Rogers, Plattsburgh, N. Y., $13,700.

Plattsburgh-Keesville Rd., Sec. 2—Clinton Co.—4.52 mi.—Bd. Superv. Clinton Co., $34,500; Buckley Const. Co., Plattsburgh, N. Y., $33,487; Thomas & Brown, Glens Falls, N. Y., $33,490; Bellew & Merritt Co., Tuckahoe, N. Y., $51,637; W. A. Burnham, Glens Falls, N. Y., $33,750; Jos. Walker, Mariner's Harbor, $32,290; Chambers & Grady, Rochester, N. Y., $34,151; Casey & Murray, Rochester, N. Y., $31,900.

Plattsburgh-Mooers Rd., Sec. 1—Clinton Co.—7.57 mi.—Bellew & Merritt Co., Tuckahoe, N. Y., $76,892; Bd. Superv. Clinton County, $58,300; Buckley Const. Co., Plattsburgh, N. Y., $57,450; Chambers & Grady, Rochester, N. Y., $54,416; Casey & Murray, Rochester, N. Y., $51,500; Jos. Walker, Mariner's Harbor, $53,390.

Hamilton Bridge Rd.—Oneida Co.—1.29 mi.—Harry L. Smith, N. Y. City, $9,750.

Seneca Turnpike—Oneida Co.—2.28 mi.—J. W. Cronin, Syracuse, N. Y., $16,500; Harry L. Smith, N. Y. City, $22,500.

Hamburg, N. Y.—Bids will ibe received by the Village Trus. for furnishing and constructing macadam roadway on portions of 3 streets; approximate quantities, 4,465 cu. yds. earth excavation, 3,420 broken stone; curb, 8,190 lin. ft., 1,195 sq. yds. Medina stone; also for 14,717 sq. yds. brick pavement on same streets. Elon G. Nott, Village Clk.

Cleveland, O.—The City Council has adopted resolutions to grade, curb and pave with brick on portions of several streets.

Bryan, O.—Bids will be received by the Common Council until July 2 for furnishing material and constructing approximately 47,167 sq. yds. of brick pavement, together with necessary curbing and drainage, on portions of 5 streets. J. W. Hoke, Village Clk.; Riggs & Sherman, Engrs., Toledo, O.

Findlay, O.—The paving with block on a portion of Front St. is reported to be under consideration.

The Council has adopted a resolution to issue $24,000 bonds for paving W. Sandusky St. and has authorized the sale of $12,000 bonds for paving E. Lima St.

Columbus, O.—It is stated that bids are wanted June 25 for paving and constructing sidewalks on Cleveland Ave. bridge. L. E. Jones, Co. Aud.

Harrisburg, Pa.—Local press reports state that the following bids were received June 2 for paving—*a*, Mulberry St. from east end of Bridge to Derry St.; *b*, Mulberry St. from Front to 3d St.; *c*, Forster St.; *d*, Herr St.; *e*, Verbeke St., prices given being per sq. yd.: Sheet asphalt, Warren-Quinlan Co., on all streets, $1.83 per sq. yd. Barber Asphalt Paving Co., *a*, $1.81; *b*, $1.94; *c*, *d*, and *e*, $1.79. Warren Bros., *c*, *d*, and *e*, $1.77. Bituminous macadam, Warren Bros., *c*, *d*, and *e*, $1.97. Vitrified brick, J. J. Connor, of Philadelphia, bid on all streets alike—$1.97 for Hickory Run, $2.12 for Clearfield and $1.96 for Vulcan. On curbing the bids were as follows: Barber Asphalt Paving Co., on Mulberry, east of the bridge, granite, $1.24; blue stone, 98 cts.; Medina, $1.10; resetting, 20 cts.; on Mulberry, from Front to Third, and on Herr, Forster and Verbeke Sts., granite, $1.15; blue, 99 cts.; Medina, 99 cts.; resetting, 21 cts. Warner-Quinlan bid on curbing as follows: All streets, granite, $1.19; blue, $1; Medina, $1.09; resetting, 20 cts. Warren Bros. bid as follows—on curbing for both kinds of paving they offer: On all streets, granite, $1.08; blue, 85 cts.; Medina, 95 cts.; resetting, 21 cts. John J. Connor bid as follows—on curbing for all kinds of paving they offer: Mulberry St., east of bridge, granite, $1.15; blue, 97 cts.; Medina, 99 cts.; resetting, 21 cts.; Mulberry, Front to Third, granite, $1.21; blue, 99 cts.; Medina, $1.12; resetting, 21 cts.; Forster, granite, $1.22; blue, 92 cts.; Medina, $1.12; resetting, 21 cts.; Herr, granite, $1.20; blue, 94 cts.; Medina, $1.10; resetting, 20 cts.; Verbeke, granite, $1.20; blue, 91 cts.; Medina, $1.05; resetting, 20 cts.

Bids are wanted June 19 for paving on portions of Washington, Chestnut, Pine, South and State Sts. with either sheet asphalt, asphalt block, vitrified brick, on a concrete base, Warren's Bituminous Macadam Waterproof pavement, or any other known and approved paving which has been in use upon a roadway for at least 1 year from previous to Jan. 24, 1903, and curbing with either granite, marble, bluestone, medina stone, or steel. Chas. B. McConkey, Highway Comr.

Edgewood, Pa.—Bids are wanted June 18 for approximately 2,900 cu. yds. grading, 1,280 lin. ft. curbing, 2,120 sq. yds. paving, Franklin St. R. L. Smith, Boro. Engr.

Pittsburg, Pa.—R. J. Cunningham, Controller, writes that the contract for 3 steam road rollers (bids opened June 6) has been awarded to Kelley Springfield Road Roller Co., of Springfield, O., for $6,825.

The officials of the city and the Pennsylvania R. R. Co. are reported to have under consideration the building of an asphalt paved boulevard on Stockton Ave. Cost reported to be about $100,000.

Clifton Heights, Pa.—At a recent Council meeting in the Boro. of Aldan, it was voted to borrow $17,000 for street and borough improvement.

Patrick Mahoney, of Oak Hill, is reported to have secured the contract to telford about 18,600 yds. on the streets of Aldan Boro.

Memphis, Tenn.—The Miller Paving Co. is stated to have secured from the Annesdale Park Co. the contract to construct 6 miles of granolithic sidewalks, including curbing and guttering, at a cost of about $40,000.

Carey Bros. are reported to have received the contract to grade 42 acres for said company, at a cost of about $25,000.

It is stated that the contract to macadamize about 6 miles of roadway is still to be let. Probable cost, $25,000.

Nashville, Tenn.—See "Sewerage and Sewage Disposal."

Sevierville, Tenn.—Local press reports state that bids will be received by the Co. Comrs. until June 20 for rebuilding the Sevierville pike from Shooks to this city, a distance of about 12 miles. There is $24,000 available for this work.

Stamford, Tex.—The City Council is reported to be contemplating the expenditure of about $30,000 for street improvements.

Houston, Tex.—Bids will be received by the Mayor, according to local press reports, until June 22 for constructing a gravel road on portions of several streets.

Ft. Douglas, Utah.—See "Government Work."

Roonoke, Va.—Bids will be received July 2 by W. E. Thomas, Clk. of Council, for grading, guttering and macadamizing portions of 6 streets. J. R. Wingate, City Engr.

Seattle, Wash.—J. W. Fitts & Co. are reported to have received the contract to improve Mercer St. Contract reported to be about $24,000.

The contract for constructing concrete sidewalks on 15th Ave. is stated to have been awarded to Frank & Brendon for $4,653.

Ft. Lawton, Wash.—It is stated that the Government will soon ask bids for grading and surfacing the roads in and leading to Ft. Lawton. Probable cost, $20,000.

Sheboygan, Wis.—The City Council is reported to be considering the repaving of Main St., at a cost of about $10,000. If this improvement is made, it is stated, that it will necessitate the laying of an iron water main in the street in place of present wooden main, at an additional cost of $7,000.

Superior, Wis.—The Bd. of Pub. Wks. is reported to be about to let contracts for macadamizing portions of Ogden and Hughitt Aves. and 12th St. Probable total cost, $40,000.

Oshkosh, Wis.—Local press reports state that bids will be received until July 2 for paving with asphalt on Algoma St. Estimated cost, $60,000. G. A. Randall, City Engr.

POWER PLANTS, GAS AND ELECTRICITY.

Huntsville, Ala.—The Huntsville Electric Ry. Light & Power Co. is stated to have secured the contract for lighting the streets for 5 yrs. at $75 per light per yr.

Blue Lake, Cal.—C. Deane, of Eureka, is reported to have been here, representing the Northern Power Co. This company proposes utilizing the waters of Smith River in Del Norte County for generating electric power; cost of proposed plant is estimated at $500,000.

Redlands, Cal.—It is reported that the Redlands Gas Co. will lay new mains and improve the lighting system.

Chico, Cal.—The Butte County Power, Light & Water Co. is reported incorporated, with principal office at Chico; capital, $300,000. W. P. Lynch, of Cherokee, and A. F. Jones, of Oroville, are among the directors.

Pueblo, Colo.—E. G. Middlekamp, Secy. Lunacy Comrs., writes that the contract for erecting and installing an electric light plant and wiring system for asylum buildings (bids opened June 2) has been awarded to Skinner & Sethman, of Denver, for $12,850.

Freeport, Ill.—O. T. Smith and associates are stated to have petitioned Council for a franchise for a heating plant.

Dixon, Ill.—Henry C. Higgins, Pres. Sterling, Dixon & Eastern Electric Ry. Co., is reported interested in the construction of an electric light and gas plant in Dixon.

Fairmount, Ind.—Jacob Briles, City Clk. and Treas., writes that there is a movement on foot here to put in an electric light plant by stock subscription.

Washington, Ind.—The Citizens' Light & Fuel Co. has been incorporated, to furnish gas and electricity for heating and lighting in Washington; capital, $100,000. Directors: Simeon Loudenback, Jas. C. Kecler and Geo. Lester Wilkins.

Michigan City, Ind.—The plant of the Michigan City Gas Light Co. has been transferred to the Michigan City & Northern Indiana Gas Co. Extensive improvements will be made, including the laying of 5 miles of new mains. Isaac C. Elston, Jr., Mgr., Michigan City.

Mason City, Ia.—It is reported that the Brice Electric Gas & Htg. Co. will install new machinery.

Moulton, Ia.—F. Moore, City Clk., writes that the La Plata Electric Light Co., of La Plata, Mo., will construct an electric light plant at Moulton.

Des Moines, Ia.—The controlling interest in the Des Moines Htg. Co. is stated to have been sold to the Iowa Light, Heat & Power Co. It is the purpose of the purchasers to immediately extend the service. The down-town conduits will be largely extended, and additional sub-stations established.

Gladstone, Ky.—R. S. Weltzell, Mgr. Gladstone Coal & Coke Co., writes that the company contemplates putting in an electric power plant to mine and haul coal, etc., and probably to light its office and store building.

New Orleans, La.—According to local press reports 2 propositions were received by City Council June 2 from the New Orleans Rys. Co. for lighting the city: The first for a 10-yr. contract from July 1, 1905, to furnish 2,600 alternating current series inclosed arc lamps, at a total cost of $208,705; the second proposition is to furnish 2,627 lamps at a cost of $134,200.

Baltimore, Md.—Bids are wanted June 17 for furnishing illuminating gas necessary to supply all street lamps within the city. Robt. J. McCuen, Supt. of Lamps and Lighting.

Baltimore, Md.—Gen. Supt. of Lighting McCuen in his annual report recommends the construction of a municipal electric light plant.

Detroit, Mich.—The Edison Illuminating Co. is stated to have purchased a site, 75x100 ft., for a substation.

Excelsior, Minn.—John Lind, of Minneapolis, is stated to have secured a franchise for an electric light plant. It will also be extended to Tonka Bay and Cottagewood.

St. Charles, Minn.—Bids will be received June 16 by H. C. Walker, City Recorder, for installing an electric light plant.

Winona, Minn.—The Winona Ry. & Light Co. is stated to have secured the contract for lighting the city for 10 yrs. with inclosed arc lights at $68 per lamp per yr.

Madison, Minn.—The City Council is reported to be considering improvements to the electric light plant.

Braymer, Mo.—The question of electric lights for Braymer is reported as being agitated.

Concord, N. H.—Holbrook, Cabot & Rollins, of Boston, Mass., have secured the contract to erect a granite dam at Garvin's Falls, on Merrimack River, in Concord. It will be about 400 ft. in length. The Manchester Traction Co. is the owner of the property.

Pleasantville, N. J.—The Bay Shore Gas Light & Fuel Co., of Pleasantville, N. J., has been incorporated to manufacture gas; capital, $50,000. Incorporators: Wm. F. McCully, Absecon, N. J.; Chas. V. O'Donnell, Pleasantville, N. J., and Martin Spiekerman, Absecon, N. J.

Ithaca, N. Y.—The Ithaca Electric Light & Power Co., of Ithaca, has been incorporated; capital, $500,000. Directors: E. C. Stewart, H. L. Hinckley and D. W. Burdick, of Ithaca.

Lyon Falls, N. Y.—The citizens voted June 1 to raise annually $500 for electric lights for the streets and avenues of Lyon Falls.

Buffalo, N. Y.—The Special Com. of the Bd. of Councilmen appointed to investigate the lighting of the streets has reported recommending the establishment of a municipal electric lighting plant.

New York, N. Y.—The following contracts have been awarded (bids opened June 8): For installing electric light wiring, fixtures and electric bell system, new Public School 24, Boro. of Manhattan, to Abr. L. Saruya, 1080 Lexington Ave., for $5,470, and for installing electric light wiring, fixtures, telephone and electric bell system in Richmond Boro. High School No. 1, Boro. of Richmond, to T. Fred. Jackson, 592 Columbus Ave., for $8,840.

Ridgewood, N. D.—The City Council is stated to have granted Ralph Maxwell, a franchise for an electric light plant.

Baker City, Ore.—The electric power plant of the Baker City Electric Light & Gas Co., of South Baker, is reported to have been destroyed by fire May 30.

Brownsville, Ore.—A. B. Kurtz, of Silverton, is reported interested in the construction of an electric light plant for Brownsville.

Sumpter, Ore.—Robt. E. Strahorn, of Spokane, Wash., is reported interested in the Sumpter Water Co., which proposes constructing a power plant a few miles above town on Cracker Creek for the purpose of operating electric lighting machinery. Water power will be utilized instead of steam.

Mifflinburg, Pa.—Local press reports state that bids will be received about July 7 by the Burgess and Pres. of Council for constructing an electric light plant. T. M. Getgen, Town Clk.

Lansdale, Pa.—The Montgomery Heat & Power Co. is stated to have petitioned the Council for permission to lay pipes and operate through the borough. The company proposes to construct a gas plant.

East Greenville, Pa.—E. E. Erb, Clk. of Council, writes that the authorities of East Greenville, Red Hill and Pennsburg are procuring estimates for electric light plants. No conclusion arrived at.

Greenville, S. C.—See "Railroads."

Geddes, S. D.—A mass meeting is reported to have voted in favor of granting a franchise for an electric light plant.

Marlin, Tex.—Press reports state that Capt. J. A. Martin and B. C. Nettles, of Marlin, have employed Prof. T. U. Taylor, Engr. in the Univ. Austin, to visit the falls of Brazos River, near Marlin, and make an examination and give an opinion on the practicability of developing the power and an estimate of the power that could be obtained. The object is to convert the power into electricity to be conveyed to Marlin and then utilized.

Georgetown, Tex.—It is stated that about $10,000 will be expended in improving the plant of the Georgetown Water & Electric Light Co.

Logan, Utah.—The contract for furnishing a generator for the city electric plant is stated to have been awarded the Westinghouse Electric & Mfg. Co. for $4,960.

Rutland, Vt.—The Rutland Power Co., of Rutland, has been incorporated; capital, $10,000. Incorporators: Wallace W. Nichols, Newman K. Chaffee, and others.

Ellensburg, Wash.—The Council proposes improving the city lighting plant, according to reports.

Burnsville, W. Va.—See "Electric Railways."

Grantsburg, Wis.—Bids are wanted June 23 for a complete electric light plant, boiler, engine, a 40-Kw. direct current dynamo and building. Oscar Claussen, Consulting Engr., St. Paul, Minn.; A. A. Anderson, Village Clk.

Berlin, Wis.—The Berlin Gas Co., of Berlin, has been incorporated; capital $35,000. Incorporators: Chas. W. Radford, John Challoner and Geo. Warnking.

Moosomin, Assa., N. W. Ter.—It is reported that this town invites correspondence and propositions for a lighting system for a town of 1,200. John Smithers, Secy.

Guelph, Ont.—Bids will be received June 27 by W. W. White, Chmn. Finance Com., for $155,000 bonds for purchasing gas and electric light plant. Richard Mitchell, City Clk.

Warren, Ont.—It is reported that bonds have been voted to establish a light and water plant.

ELECTRIC RAILWAYS.

Montgomery, Ala.—W. A. Henderson, Albert Wilson, and others, have secured a franchise to open a road to connect with the Mount Meigs line.

Ensley, Ala.—J. W. Minor and others have secured a franchise to construct railways in Ensley.

Los Angeles, Cal.—Alex. Culver has purchased a street railway franchise to enable the Los Angeles Ry. Co. to extend its Maple Ave. line about a mile to the southern limits of the city.

Santa Rosa, Cal.—Articles of incorporation of a new electric railway company will soon be filed. The company will be incorporated for $1,000,000, to build an electric railway from Santa Rosa to Sebastopol and Green Valley, and from Santa Rosa to Petaluma, and from that city on to a point on the bay, and thence by ferry steamers to San Francisco, and also to give Santa Rosa an electric street car system. Directors: Thos. Archer and Alfred D. Gowen, of San Francisco; and Frank A. Brush, of Santa Rosa.

Oroville, Cal.—The Butte & Plumas Ry., which is to extend 65 miles from Oroville to Quincy, with a 25-mile extension will be operated by electricity.

San Jose, Cal.—It is stated that H. F. Parkinson has applied for an electric railway franchise; bids for said franchise will be received until July 7.

Shelbyville, Ill.—The construction of a trolley line connecting Springfield and Effingham is the purpose of the Springfield & Southwestern Ry. Co., for which a charter has just been asked of the Secy. of State. Geo. D. Chaffee and Max Kleeman are reported interested.

Canton, Ill.—The Fulton County Electric R. R. Co., Canton, has been incorporated, with a capital of $10,000, to operate a street railway. Incorporators: J. W. Lawrence, H. H. Fuller and H. J. Shannon.

Moline, Ill.—A franchise has been granted by the Bd. of Superv. to the East Moline Interurban St. Ry. Co. to build an extension from East Moline to Rock River.

Decatur, Ill.—Articles of incorporation have been filed by the Decatur, Springfield & St. Louis Ry. Co., with a capital of $50,000, to build an electric railway from Decatur by way of Springfield and Carlinville, to East St. Louis.

Springfield, Ill.—The Jacksonville & Springfield Traction Co., of Springfield, has been incorporated, to construct a railway from Jacksonville to Springfield, and from Berlin to New Berlin; capital, $2,500. Incorporators: Y. Alexander, Lexington, Ky.; W. S. Kelly, Georgetown, Ky.; Jas. Y. Kelly, Jr., of Springfield, and others.

The Springfield & Northern Ry. Co., with principal office at Chicago, has been incorporated, to construct a road from Springfield through the counties of Sangamon, Menard, Mason, Tazewell and Peoria to Peoria County, Ill.; capital, $25,000. Incorporators: Gustave F. Fischer, Edwin J. Mosser, and others, all of Chicago.

Marion, Ind.—The Eastern Indiana Traction Co. has secured a new franchise, which provides for a right of way 40 ft. wide to be occupied for 50 years. The new line will enter the county 3 miles south of Lynn, and will extend to Ridgeville.

Seymour, Ind.—The Indiana Central Electric Ry. Co. has petitioned the City Council for a franchise through Seymour. The company will build a line from Columbus to French Lick.

Evansville, Ind.—The Council has granted franchises to the Evansville & Henderson Traction Co., and to the Evansville, Boonville & Rockport Traction Co.

Sullivan, Ind.—The City Council has granted franchises to the Western Indiana Traction Co. and the Coal Belt Traction Co.

Indianapolis, Ind.—The City Council has passed the ordinance granting the Consolidated Traction Co. a right of way and to enter the city over Holmes Ave., Haughville, in the construction of its line from Indianapolis to Crawfordsville.

Jeffersonville, Ind.—The Ohio Valley Electric Ry. Co. has been incorporated, with a capital of $10,000, by Louis Schneck, of Seymour; Geo. H. Holzbog, of Jeffersonville, and others, to construct an electric railway from Jeffersonville to Madison via Charlestown and New Washington, Ind., and another line from Jeffersonville to Henryville, Ind., and the State forest reservation, passing through Sellersburg and Memphis, Ind.

Brazil, Ind.—The Brazil Electric Co. has secured a franchise for an electric railway from Brazil to Diamond, touching Carbon, Cardonia and Sundown.

Columbus, Ind.—Articles of incorporation have been filed for the Southern Traction Co. of Indiana, with a capital of $20,000. It is proposed to build an electric railway from Columbus through Hanover to Madison. Incorporators: Henry C. Rominger, Edw. E. Goder and William T. Hubbard.

Mt. Pleasant, Ia.—Preliminary steps have been taken for the construction of an electric railway to Olds and Wayne. A. T. Forgy is interested.

Webster City, Ia.—An electric railway is projected from Des Moines to Webster City, with branches to Story City and to Ames. L. W. Reynolds, of Boone, Ia., is interested.

Davenport, Ia.—The Western Illinois Electric Ry. Co. has finished surveying the proposed route from Aledo to Moline over a route 47½ miles in length.

Des Moines, Ia.—Lyman Waterman, promoter, will survey the Des Moines, Mt. Ayr & Southern Electric Road early this month. The line between Des Moines and Mt. Ayr, a distance of 32 miles, will be built at once.

Huntington, Mass.—The Governor has signed the bill to incorporate the Huntington & Westfield River Ry. Co.

Camden, N. J.—Surveys are being made for the extension of the Camden & Suburban Ry. from Haddon Heights. It is proposed to go through Barrington, Lawnside, Magnolia, Somerdale, Stratford, Laurel Springs and possibly Clementon.

Lambertville, N. J.—The Common Council has granted the Delaware Valley Traction Co. the right to construct and operate an electric railway in Lambertville.

Fairport, N. Y.—The Village Bd. is stated to have granted a franchise to the Rochester & Eastern Ry. Co., on condition that the road shall be in operation one year from date. W. A. Comstock, Secy., Canandaigua.

Ithaca, N. Y.—It is reported that Thomas Craig, of Philadelphia, Pa., has secured the contract for constructing the electric railway between Ithaca and Auburn.

Amityville, N. Y.—The South Shore Traction Co. has secured a franchise to operate an electric railway through the village.

Lakewood, N. Y.—The Jamestown St. Ry. Co. has secured a franchise in Lakewood. Chas. Griffith, Ch. Engr., Jamestown.

Salamanca, N. Y.—The State Railroad Commissioners have granted the certificate of necessity to the Berney Traction Co., of Salamanca, to build an electric railway in Salamanca.

Guthrie, Okla. Ter.—The Oklahoma Traction Co. has secured a franchise in Guthrie.

Cincinnati, O.—The Ohio & Indiana St. R. R. Co. has been incorporated by J. D. DeWitt, Dr. Harvey Cook, and others to build an air-line electric railway from Cincinnati to Indianapolis; capital, $10,000.

Connellsville, Pa.—The Greensburg & Southern Electric Ry. Co. intends extending its line from Youngswood to Weaver's Old Stand, and thence to Mt. Pleasant.

Darby, Pa.—Burgess McGahey has signed the ordinance granting a franchise to the Philadelphia, Morton & Swarthmore St. Ry. Co.

Mt. Holly Springs, Pa.—The Carlisle & Mt. Holly Electric Ry. Co. is considering the building of a line from this place to Gettysburg via Bendersville and Biglerville.

Scranton, Pa.—The Scranton Ry. Co. contemplates an extension of the N. Main Ave. line to the site of the new shops of the Delaware, Lackawanna & Western R. R. in Kerper Valley.

Coatesville, Pa.—The Brandywine Electric St. Ry. Co., of Coatesville, has been incorporated, with a capital of $6,000, by Albert H. Swing, Coatesville; S. L. Hibbard, Jr., of Lansdowne, and others.

Burnsville, W. Va.—The Burnsville Progressive Co., of Burnsville, W. Va., has been incorporated to build, maintain and operate street car lines, water works and electric light plants; capital, $25,000. The incorporators are: Hugh Amos, D. C. Wellen, W. C. Heiner, and others, all of Burnsville.

Broadhead, Wis.—Surveys are to be made at once for the Rockford, Broadhead & Madison Electric Ry.

Fond du Lac, Wis.—Frank H. Sweet, and others, propose an electric interurban line to Manitowoc.

The Wisconsin Rapid Transit Co. proposes an electric line to Waverly Beach, with a branch to Chilton.

Owen Sound, Ont.—The application of the Huron, Bruce & Grey Electric Ry. Co. for extensions of charter from Dungannon to Walkerton and Wingham, and from the boundary line between Huron and Middlesex to Sarnia, has been granted.

RAILROADS.

Hayneville, Ala.—The Hayneville Ry. Co. has been incorporated, to build a railroad between Hayneville and Morganville. Incorporators: W. P. Russell, E. H. Pritchett, S. R. Merriwether, and others.

Linden, Ala.—The Tombigbee Ry. Co. has been incorporated, with a capital of $250,000, to construct and operate a railroad from Linden through the counties of Sumter, Greene and Pickens in Ala. to Noxubee and Lowndes in Miss. along and through the Tombigbee Valley, with the privilege of extending through Ala. to Mobile, Ala., and to Pensacola, Fla., with a branch from a point in Greene or Pickens County through Tuscaloosa, Fayette and Jefferson Counties to Birmingham. Northern terminus to be Columbus, Miss. Incorporators: Enos R. Stower, of Selma; Robt. R. Zell, of Birmingham; F. P. Jenkins, of Aberdeen, Miss., and others.

Dardanelle, Ark.—It is stated that the Central R. R. of Arkansas will soon be ready to let contracts for constructing the first 50 miles of its line south from Dardanelle. W. R. Abbott, Vice-Pres., Ft. Smith, Ark.

Ft. Smith, Ark.—It is stated that the Cherokee Construction Co. recently organized will soon place surveyors in the field to make the preliminary survey for a railroad line from Ft. Smith, Ark., along Arkansas River to Wichita, Kan. Willard Johnson and C. M. Cade, of Shawnee, Okla. Ter., are reported interested.

San Francisco, Cal.—The Salt Lake, Los Angeles & San Pedro R. R. Co. is reported to be considering the question of constructing a railroad into the mining district of Tonapah. T. E. Gibbon, of Los Angeles, is Attorney.

Tallahassee, Fla.—The Directors of the Georgia, Florida & Alabama Ry. Co. are stated to have decided to extend the road south from Tallahassee to Jacksonville, and north from Cuthbert, Ga., to Columbus, Ga. J. P. Williams, of Savannah, Pres.

Washburn, Me.—The Aroostook Valley R. R. Co. has petitioned the State R. R. Comrs. for permission to extend its road through Washburn, Wade Plantation and Perham Plantation; length of extension about 4 miles.

Kearney, Neb.—The Union Pacific Ry. Co. is stated to have awarded to Kilpatrick Bros. & Collins, of Denver, Colo., the contract for grading for double track 60 miles of roadbed between Kearney and Silver Creek, Neb.; contract involves $2,000,000.

Youngstown, O.—A press report states that the Steel Combine has decided to build a railroad from Youngstown to Lorain and Cleveland. This railroad will connect the various mills of the steel corporations, and will connect the Lorain mills with the furnaces in the valleys and also with the Sharon Steel Co.

Girard, O.—The Pittsburg, Cleveland & Toledo R. R. Co. is stated to have amended its articles of incorporation to authorize the construction of a branch from Girard, O., to make connection with the Pittsburg, Painesville & Fairport in Liberty Township.

Lawton, Okla. Ter.—A charter has been granted to the Lawton & Chickasaw Central Ry. Co. to construct a railroad from Lawton to Sulphur Springs, I. T., a distance of about 85 miles; capital, $2,000,000. Incorporators: J. W. Martin, H. T. Simms, Jas. H. Wolverton, and others, all of Lawton.

Curwensville, Pa.—McArthur Bros., of Chicago, Ill., are stated to have secured the contract for constructing the Curwensville & Bower R. R., a distance of 14 miles.

New Salem, Pa.—It is reported that the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) will construct about 12 miles of line from New Salem to Brownsville, as an extension of the Masonville & New Castle R. R.

Greenville, S. C.—E. H. McCullough, of Greenville, is surveying for railroad, 35 miles in length, from Greenville to a lumber center 6 or 7 miles beyond Marietta, where 60,000 acres has already been acquired. A water-power plant to furnish power for working hard wood is to be developed on the Middle Saluda River, requiring a masonry dam. R. E. Johnson, Seneca, S. C., Pres. of the R. R. Co. The road may take the route of the Carolina, Knoxville & Western R. R., the charter of which is said to have expired.

South Pittsburg, Tenn.—It is reported that a railroad will soon be constructed from South Pittsburg to Lancing, Tenn., a distance of 125 miles. J. H. McCord, of West Point, Miss., is reported interested.

Austin, Tex.—Engineers of the Missouri, Kansas & Texas R. R. are reported to be making a preliminary survey for a route into Austin from Georgetown. J. W. Petheran, Ch. Engr., Dallas.

Sinton, Tex.—The St. Louis, Brownsville & Mexico Ry. Co. is reported formed to construct and operate a railway from Sinton to Brownsville, Tex., with a branch line from a point near Brownsville n. w. to Rio Grande City, a total distance of about 200 miles; capital, $1,000,000.

Mannington, W. Va.—A press report states that a charter has been granted to the Pittsburg, Elk & Southern Ry. Co. to construct a line from a point on the Pennsylvania line north of Mannington via Mannington, Adamston and Clarksburg to Barbour County, making connection with the West Virginia Central Road.

Santiago De Chili, Chili.—A press report states that bids will be received by the Chilian Government on Dec. 15 for the construction of the Transandine R. R. The projected railroad will pass through the Capallata Pass and the Antuco Mountains. The bids will be received on the basis of a guarantee of 5 per cent. interest on the cost of the work. The Government is reported to be preparing to expend $25,000,000 on railroads and other public improvements.

Caimanera, Cuba.—According to the Washington "Star," U. S. Minister Squiers has informed the State Dept. that certain capitalists in Cuba are projecting the construction of a railroad 41 miles in length, connecting Caimanera with Cuatro Caminos in Mantanzas Province.

PUBLIC BUILDINGS.

Little Rock, Ark.—John H. Page, Secy. Bd. Charitable Institutions, writes that the contract for plans and specifications for 2 annexes at the Arkansas State Lunatic Asylum (bids opened May 12) has been awarded to F. W. Gibb, of Little Rock, Ark.; estimated cost, $135,000.

Norwich, Conn.—The following bids are stated to have been received for the erection of the State Hospital: A. Fales & Son, Boston, $94,201; Carpenter & Williams, Norwich, $93,360; Peck, McWilliams & Co., Norwich, $92,280.

Kewanee, Ill.—It is stated that a hospital will be erected at Elliott and Prospect Sts.; estimated cost, $35,000.

New Castle, Ind.—Rev. C. King, Pastor M. E. Church, writes that the Trus. have employed L. O. Miller to superintend the construction of a church, to cost about $26,000.

Booneville, Ind.—Press reports state that bids are wanted July 15 for erecting a court house, to cost about $50,000.

Waterloo, Ia.—This city is stated to have accepted the $30,000 gift of Andrew Carnegie for the erection of a library.

Clinton, Ia.—Cullen Bros., of Janesville, Wis., are stated to have received the contract for erecting the $45,000 library here.

Louisville, Ky.—Bids will be received June 20 by the Bldg. Com. Kentucky Exhibit Assoc. for erecting Kentucky Bldg. McDonald & J. F. Shebiessy, Archts., Main St. W. H. Newman, Chmn.

Paris, Ky.—Press reports state that bids are wanted June 23 for $150,000 court house bonds.

Ludlow, Ky.—Plans are stated to have been approved for the St. James Catholic Church to be erected at Oak and Davis Sts.; probable cost, $25,000. Rev. Father Kehoe, Pastor.

Baton Rouge, La.—It is stated that bids are wanted June 20 for erecting a 3-story brick building at the State Institute for the Blind. J. J. Gottlieb, Archt.

Sykesville, Md.—J. H. Fowblee is stated to have submitted the lowest bid for erecting the Epileptics Ward at the State Hospital, his bid being $26,430.

Corunna, Mich.—The plans of Clare Allen, of Jackson, are stated to have been accepted for the $75,000 Court House.

Ishpeming, Mich.—Plans are stated to have been completed for the Carnegie Library, and bids for erecting same will be received by Capt. W. H. Johnston; probable cost, $25,000.

Jackson, Mich.—B. L. Carlton, Secy. Library Bd., writes that the contract for erecting a Carnegie Library (bids opened June 5) has been awarded to Chas. A. Howind, of Jackson, for $65,593.

Stillwater, Minn.—It is stated that bids are wanted June 22 for erecting a public building.

Massena, N. Y.—Williams & Johnston, of Ogdensburg, are preparing plans for a building for Massena, to contain a town hall and opera house, to cost about $20,000. John Craper, Chmn. Bldg. Com.

Buffalo, N. Y.—Mosier & Summers, 1266 Seneca St., have secured the contract to construct the nurses' home at County Almshouse, to cost about $60,000.

Brooklyn, N. Y.—The Bd. of Estimate is stated to have appropriated $395,000 for the erection of a stable at Kent and Flushing Aves. for the Street Cleaning Dept.; also $100,000 for the 68th Precinct, $100,000 for the 70th Precinct, and $90,000 for the 71st Precinct Station Houses.

Bids will be received June 17 by Thos. Sturgis, Fire Comr., N. Y. City, for furnishing material and erecting 2 buildings for Engine Co. No. 146 and 145, Boro. Brooklyn.

Bids will be received June 18 by the Bd. of Park Comrs., N. Y. City, for furnishing material and erecting a shelter house in Saratoga Sq. Wm. R. Willcox, Chmn.

Rochester, N. Y.—Foote & Headley, Cutler Bldg., are stated to have prepared plans for a 222x105-ft. building for the Almshouse Hospital; estimated cost, $78,000.

New York, N. Y.—Bids will be received June 18 by the Bd. Park Comrs. for furnishing material for plumbing and interior finish of 2 shower-bath rooms in the pavilion to be erected in Wm. H. Seward Park. Wm. R. Willcox, Chmn.

Bids will be received June 19 by Francis V. Greene, Police Comr., for furnishing material for repairs and alterations to station house and prison of the 7th Precinct.

Blackwell's Island, N. Y.—The lowest bid opened on June 8 by the Dept. of Pub. Charities, N. Y. City (J. McKee Borden, Secy.) for completing dining pavilion for Tuberculosis Infirmary of the Metropolitan Hospital, Blackwell's Island, was submitted by Alfred Beinhauer, 289 4th Ave., for $13,309.

Asheville, N. C.—R. H. Hunt, of Chattanooga, Tenn., is reported to be preparing plans for an edifice for the Central Methodist Society; estimated cost, $50,000.

Xenia, O.—Bids will be received June 20 by the Trus. of the Ohio Soldiers' and Sailors' Orphans' Home for furnishing and installing hot water circulating pumps, condenser, expansion tank, vacuum pumps, pipe and fittings, pipe covering, etc. Orin C. Baker, Financial Officer.

Columbus, O.—Smith & Eastman Co., of St. Louis, Mo., are stated to have received the contract for erecting the Ohio Bldg. at the La. Purchase Expos., for about $32,000.

Philadelphia, Pa.—The Bd. of Mgrs. of the St. John's Orphan Asylum for Boys are stated to have decided to erect an addition, to cost $20,000.

Brookville, Pa.—Robinson & Winkler are stated to have prepared plans for an edifice for the Presbyterian Congregation, to cost $40,000.

Harrisburg, Pa.—The plans of Philip H. Johnston, of Philadelphia, are stated to have been approved for the Pennsylvania Building for the La. Purchase Expos., to cost $75,000

Woonsocket, R. I.—An ordinance is stated to have been passed providing an appropriation of $24,500 for erecting a station house and barn.

Charleston, S. C.—Frank P. Milburn, of Columbia, is stated to have prepared plans for the Charleston City Art Gallery; estimated cost, $100,000.

Yankton, S. D.—Bids will be received June 23 by the Bd. of Co. Comrs. for erecting a court house; separate bids will be received for heating and plumbing. C. L. Lawrence, Co. Aud.

National Home, Wis.—Bids are wanted June 16 for installing elevator in hospital. J. E. Armitage, Treas. Northwestern Branch, N. H. D. V. S.

St. John, N. B.—The contract for the erection of the public library is stated to have been awarded to Jas. Myles, Wentworth St., for $44,500.

Montreal, Que.—Martineau & Prenoveau are stated to have received the contract for erecting the addition to the Court House for $160,000.

BUSINESS BUILDINGS AND DWELLINGS.

Palm Beach, Fla.—The hotel, "The Breakers," is reported destroyed by fire June 9.

Peoria, Ill.—The Royal Neighbors of America are stated to be considering the erection of a building here to cost about $50,000.

The Barret Mfg. Co., of Chicago, is reported to have decided to erect a factory and office building in Peoria, to cost in all $125,000.

Chicago, Ill.—Julius H. Huber, 171 Washington St., is stated to have prepared plans for a 3-story hotel, to be erected at 1 N. Clark St., at a cost of $38,000.

It is stated that H. M. Lewis will erect a 3-story apartment house at Washington Boule. and Washtenaw Ave.; estimated cost, $45,000.

Ft. Wayne, Ind.—It is stated that the Loftus Realty Co. will erect a 6-story apartment house at Berry and Webster Sts., to cost $200,000. Geo. F. McCulloch and Hugh McGowan, of Indianapolis, are reported interested.

Indianapolis, Ind.—It is stated that the Knights and Ladies of Honor have decided to erect an office building here, to cost about $100,000.

Boston, Mass.—Plans have been filed for a 3-family dwelling at 888 Beacon St.; estimated cost, $40,000. Owner, Henry S. Dewey; Builder, W. A. & H. A. Root, 166 Devonshire St. Architect, Kilham & Hopkins, Boston.

Grand Haven, Mich.—W. H. Dupree, of Chicago, Ill., is reported to have purchased a site on Spring Lake for the erection of a residence, to cost $50,000.

Ishpeming, Mich.—M. J. McClure, of Chicago, Ill., has secured the contract for erecting the opera house, for $23,500.

New York, N. Y.—It is stated that John Daniells Sons & Sons have decided to add 4-story to the 8-story building at Bway. and 8th St.

Buffalo, N. Y.—It is stated that plans have been filed for an 8-story building to be erected at 219 Pearl St. by Adam, Meldrum & Anderson Co.; estimated cost, $117,000.

Toledo, O.—W. L. Milner & Co. are reported to have decided to erect a 6-story building at Summit and Jefferson Sts.

Toledo, O.—Local press reports state that bids for erecting the Masonic Temple will be received until July 1.

Columbus, O.—E. J. Smith and Cyrus Huling, of the Citizens Savings & Trust Co., are reported interested in the erection of an 8-story building at Long and High Sts.

John S. Woolcott is reported to be preparing plans for a hotel to be erected at E. Broad St. and Jefferson, for Dr. H. H. Barbour; estimated cost, $120,000.

Philadelphia, Pa.—Geo. F. Payne & Co., 401 S. Juniper St., are stated to have received the contract for erecting the 5-story brick warehouse at Race and Hicks Sts. for Griffin & Co.; estimated cost, $90,000.

Bryn Mawr, Pa.—The contract for erecting the 3-story residence for Francis L. Potts is stated to have been awarded to Wm. R. Dougherty; estimated cost, $120,000.

SCHOOLS.

Danbury, Conn.—The Senate is stated to have passed a bill providing for an appropriation of $100,000 for a State Normal School to be erected here.

Washington, D. C.—The contract for erecting the Dominican Building for the College of the Immaculate Conception is stated to have been awarded to the Brennan Constr. Co., Loan & Trust Bldg.; estimated cost, $250,000.

Local press reports state that the Commissioners D. C. will receive from architects in the District of Columbia, until July 15, competitive plans for the Business High School. Amount available for constructing the building is $168,000.

Atlanta, Ga.—The Trus. of the Goodwyn Institute are stated to have purchased a site at Madison and 3d Sts. for the erection of an 8 or 10-story building.

Boise, Idaho.—Press reports state that bids will be received June 27 by the School Authorities for $28,000 school bonds.

Chicago, Ill.—Bids are wanted June 19 for furnishing material for alterations, additions and repairs to steam heating apparatus in sundry school buildings. T. J. Waters, Ch. Engr. Bd. of Educ., 710 Tribune Bldg.

Webster, Ill.—Buerkin & Kaempen, of Quincy, is stated to have submitted the lowest bid for erecting the school here, for $44,321.

Marathon, Ia.—The citizens are stated to have voted to issue $20,000 for erecting a school here.

Waterville, Me.—The City Council has decided to erect a 12-room grammar school, at a cost of $25,000. C. W. Davis, Mayor.

Augusta, Me.—The Village School District of Augusta voted June 6 to erect the Lincoln St. School this year, at a cost not to exceed $12,000. Architect, A. G. Wing, of Augusta.

Orono, Me.—It is stated that bids are wanted June 20 for erecting the superstructure of the Engineering Building for the Univ. of Maine. Thomas & Crowell, Archts., 25 State St., Bangor.

Brockton, Mass.—It is stated that bids are wanted June 22 for erecting a High School. C. A. Brigham, Archt., 8 Exchange Pl., Boston.

Boston, Mass.—The Bd. of Trus. of Boston University are stated to have purchased a site for the Science building.

Saginaw, Mich.—The House is stated to have passed a bill providing for the erection of a Manual Training School for the Blind; estimated cost, $110,000.

Houghton, Mich.—It is stated that $45,000 will be expended in erecting a Metallurgical Laboratory for the Michigan College of Mines.

Pine City, Minn.—Bids will be received until June 20 by the School Bd. of the Independent School Dist. for erecting an addition to and altering the present High School. Henry J. Rath, Secy.

Fairbury, Neb.—The citizens are stated to have voted to issue $25,000 for erecting a school.

Lincoln, Neb.—Fisher & Lawrie, 212 Paxton Bldg., Omaha, have been retained as architects for a new physical laboratory for the Univ. of Nebraska. The building will be 3 stories high, of red pressed brick and cut stone. The Bd. of Regents of the Univ. has decided to build an office building on the campus at a cost of $40,000 and an academical building on the Univ. farm, at a cost of $60,000. Fisk & Diman, of Lincoln, are the architects for the former, and T. R. Kimball, of Omaha, for the latter.

Brooklyn, N. Y.—The following bids were opened by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, June 8, for general construction of addition to and alterations in School 7, Boro. of Brooklyn: John H. Goetschius, $68,970; Myron C. Rush, 327 Franklin Ave., $60,999 (awarded contract), and Geo. Hildebrand, $67,400.

Bids were also opened at same time and place for ventilating and heating apparatus in addition to and alterations in School 7, Boro. of Brooklyn: John Neal's Sons, $15,237; Williams & Gerstle, $14,989; Wm. N. Tobin, $13,522; Jas. Curran Mfg. Co., $14,500; United Htg. Co., 368 W. Bway., N. Y. City, $12,614 (awarded contract); E. Rutzler, $14,050; Fr. Dobson, $13,965.

New York, N. Y.—Bids will be received June 22 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary repairs, etc., to school No. 29.

Brooklyn, N. Y.—Bids will be received June 22 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring, fixtures and electric bell system in school No. 2.

New Brighton, S. I., N. Y.—Bids will be received June 22 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work at Richmond Boro. high school No. 1.

Thackery, O.—Bids are wanted June 27 for erecting a 2-story school. Address John E. Swearingen, Clk.

Mansfield, O.—Bids are wanted June 30 for furnishing material and erecting an addition to Bowman St. School. Vernon Redding, Archt., Bird Bldg. H. R. Cave, Clk. Bd. of Educ.

Springfield, O.—It is stated that bids are wanted July 2 for erecting a school. J. S. Bird, Clk. of School Bd.

Eugene, Ore.—Plans are stated to have been prepared for a high school to be erected at Willamette and 11th Sts.; probable cost, $25,000.

New Castle, Pa.—It is stated that a high school will be erected here, to cost $100,000.

Aberdeen, S. D.—The contract for erecting the high school is stated to have been awarded to J. H. Nickel, of St. Paul, Minn., for $26,964; contract for ventilating and heating to Symms Power Co., for $2,720.

Aberdeen, S. D.—Architects Dow & Son, of Sioux Falls, write that new bids will be received June 16 for erecting the brick Normal School in Aberdeen; cost reported to be $30,000.

Spokane, Wash.—It is stated that the contract will soon be let for the erection of the 5-story additiou to the Gonzaga College. Preusse & Zittel, Archts., Jameson Bldg.

Racine, Wis.—Jensen Bros. & Co. are stated to have received the contract for erecting the Garfield School for $26,815.

The contract for the erection of the Washington School is stated to have been awarded to H. R. Edwards, of Racine, for $26,859.

Winnipeg, Man.—Plans are stated to have been accepted for the 3-story 10-room Pinkham School to be erected here.

The School Bd. is stated to have awarded the contract for the general construction of the Carlton School to D. D. Wood for $34,316.

Guelph, Ont.—Bids will be received June 27 by W. W. White, Chmn. Finance Com., for $16,700 school bonds. Richard Mitchell, City Clk.

Toronto, Ont.—The University of Toronto is reported to be considering erecting a Convocation Hall; probable cost, $50,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Brooklyn, N. Y.—The Bd. of Estimate on June 6 approved the resolution giving St. Cleaning Commissioner John McG. Woodbury, of N. Y. City, $68,000 for improving the department in Boro. of Brooklyn.

Troy, N. Y.—Zeph F. Magill and Robt. Glass are reported to have submitted bids each for $9,000 per yr. for collecting and cremating garbage (bids opened May 26).

Albany, N. Y.—Bids will be received June 15 by the Bd. of Contract and Supply for furnishing 1 street sprinkler and 1 street sweeper. I. Wachsman, Clk. of Bd.

New York, N. Y.—The following bids were opened on June 4 by John McG. Woodbury, Comr. of St. Cleaning, for removal of snow and ice in Sections 1 to 11: Century Constr. Co., 13 Park Row (Sections 8, 10 and 11), 22 and 25 cts. per cu. yd., and Wm. Bradley (Sections 1 to 11), 13, 14, 15, 16, 17 and 18 cts., according to Sections.

Cleveland, O.—Local press reports state that Pres. Springborn, of the Bd. of Pub. Service, is now working on plans for the establishment of municipal reduction and cremation works, so that not only the garbage of the city will be destroyed under municipal supervision, but the solids in the city sewage will be cremated.

Charleroi, Pa.—The City Council is stated to have passed an ordinance authorizing the issue of bonds for the construction of a garbage furnace.

Seattle, Wash.—The City Council is stated to have accepted the report of the Com. recommending that the City Engr. and Bd. of Pub. Wks. be directed to investigate the probable cost, best method in use and general practicability of a municipal garbage plant.

GOVERNMENT WORK.

Montgomery, Ala.—The following bids were opened at Washington, D. C., June 1, for the construction (except heating apparatus) of the extension of the U. S. Court House, Post Office, etc., at Montgomery: Algernoo Blair, Montgomery, $64,790; Graves & Anderson, Montgomery, $53,513; Congress Constr. Co., Chicago, Ill., $62,983; Bailey Koerner, Henderson, Ky., $59,620; Miles & Bradt, Atlanta, Ga., $50,680; Gude & Walker, Atlanta, Ga., $51,500.

Ft. Huachuca, Ariz.—Bids are wanted June 15 (extension of date) for constructing gymnasium and post exchange building at this post. Lieut.-Col. J. W. Pope, Ch. Q. M., Denver, Colo.

Benicia, Cal.—Bids are wanted July 6 for furnishing iron, plumbers' supplies, etc., during year ending June 30, 1904. Lieut.-Col. John E. Greer, Ord. Dept., Comdg. Benicia Arsenal.

Norwich, Conn.—Bids are wanted July 6 for the construction (except heating apparatus and electric wiring and conduits) of U. S. Post Office at Norwich. Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Washington, D. C.—See "Bridges."

Washington, D. C.—Bids will be received June 23 at the Bureau of Supplies and Accounts, Navy Dept., for furnishing at the navy yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York; League Island, Pa.; Washington, D. C.; Norfolk, Va., and Pensacola, Fla., the following supplies: Cable, electrical supplies, cement, sand, stone paving blocks, iron, steel, castings, pipe, pipe fittings, boilers, tubes, valves, etc. A. S. Kenny, Paymaster-Gen., U. S. N.

Bids are wanted June 22 for furnishing and installing electric motors for freight elevator, lithographic presses and other machinery at the Geological Survey. E. A. Hitchcock, Secy. Dept. of Interior.

Ft. Leavenworth, Kan.—Maj. D. E. McCarthy, Constructing Q. M. at Ft. Leavenworth, is stated to have been authorized by the Army Improv. Bd. at Washington, D. C., to construct a soldiers' gymnasium at this post, to cost about $50,000.

National Military Home, Kan.—Bids are wanted July 20 for furnishing material and constructing a coal and ash conveyor at Western branch, N. H. D. V. S. Maj. W. W. Martin, Treas.

Springfield, Ill.—The following bids were opened at Washington, D. C., on June 3, for the construction (including plumbing, heating apparatus, electric wiring and conduits) of the U. S. Court House, Post Office, etc., extension at Springfield, Ill.: Culver Constr. Co., Springfield, $129,688; W. J. McAlpine, Dixon, $132,044, and Congress Constr. Co., Chicago, $138,721.

Sterling, Ill.—The Government Engrs. are stated to have completed survey and plans for the aqueduct to be constructed over Green River, through which the water of Hennepin canal will flow over river. The aqueduct will be 500 ft. in length, built on pillars in the water, being on the form of the bridge. The waterway will be of concrete, 80 ft. wide at top, 60 ft. at base, and in depth will be 9 ft.

Baltimore, Md.—The following are reported to be lowest bids opened on June 4 by the Light House Engr., Baltimore: For construction of light house, the Foundation & Constr. Co., of New York, N. Y., for $198,760, and for the metal work, the Atlanta Machine Wks., $27,973.

Detroit, Mich.—A press report states that Maj. W. H. Bixby, of Detroit, Engr. U. S. A., is completing plans for the construction of a ship canal for St. Clair flats: $300,000 is available for the work.

Ft. Brady, Mich.—Maj. W. H. Miller, Ch. Q. M., Chicago, Ill., writes that contracts have been awarded as follows for work at Ft. Brady, Mich.: To Michael J. Shirley and Louis J. Le Blanc, Sault Ste. Marie, Mich., for construction and gas piping of 2 double barrack buildings; to P. J. McGuire, Sault Ste. Marie, Mich., for plumbing; to Harris & Algor, Philadelphia, Pa., for heating, and to Cuthbert & Black, Chicago, Ill., for wiring for electric lighting.

Grand Rapids, Mich.—The following bids for construction of steel hull and cabin for a suction dredge, improving Grand River, Mich., were opened June 5 by Lieut.-Col. M. B. Adams, Corps Engrs., U. S. A.: Thos. Johnston, Ferrysburg, Mich., $21,000; Manitowoc Dry Dock Co., Manitowoc, Wis., $29,095; Geo. Warrington, Chicago, Ill., $46,450; The American Shipbuilding Co., Cleveland, O., $48,500.

Duluth, Minn.—The following bids were opened May 29 by Maj. Lansing H. Beach, Corps Engrs., U. S. A., for furnishing 43,000 cu. yds. of (*a*) broken stone or (*b*) pebbles (amount proposed to be expended on this work about $50,000), price given per cu. yd.: Duluth Crushed Stone Co., Duluth, *a*, $1.55. Kettle River Quarries Co., Minneapolis, *a*, $1.50 and $2. Geo. A. Wieland, Duluth, *b*, $1.03½ and $1.08½ (awarded contract to be delivered on stock pile at Superior Entry, Wis.). Whitney Bros., West Superior, Wis., *b*, $1.50 and $1.75.

Ft. Shaw, Mont.—The lowest bid opened by the Dept. of Interior at Washington, D. C., May 29, for water works and a sewerage system at Ft. Shaw, is stated to have been submitted by W. D. Lovell, of Des Moines, Ia., at $13,162.

Ft. Mott, N. J.—Bids are wanted June 16 for furnishing and installing 2 cisterns. Address Quartermaster, Ft. Mott.

Watervliet, N. Y.—Bids are wanted July 6 for furnishing iron, steel, etc., during year ending June 30, 1904. Lieut.-Col. Chas. Shaler, Comdg. Watervliet Arsenal.

Ellis Island, N. Y.—Bids are wanted June 18 for furnishing engineers, plumbers and electrical supplies, etc., required at the Ellis Island Immigration Station during the fiscal year commencing July 1, 1904. Wm. Williams, Comr. of Immigration.

Scranton, Pa.—The following bids were opened at Washington, D. C., June 4, for the construction (including plumbing and heating apparatus) of the U. S. Post Office, etc., extension at Scranton, Pa.: Matthew Stipp, $84,820; Conrad Schroeder, $78,434; M. J. Ruddy, $85,685; E. S. Wilkins, $88,178; Woelkins & Berham, $93,100; Congress Constr. Co., Chicago, Ill., $102,393. Bidders of Scranton, unless otherwise mentioned.

Philadelphia, Pa.—Bids will be received June 16 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing material and repairing buildings at naval hospital, Philadelphia. A. S. Kenny, Paymaster-Gen., U. S. N., Washington, D. C.

Newport, R. I.—Bids are wanted June 16 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for constructing retaining wall at naval training station, Newport. A. S. Kenny, Paymaster-Gen., U. S. N., Washington, D. C.

Ft. Greble, R. I.—Bids will be received by Constructing Q. M., including plumbing, heating and wiring 2 frame additions to barrack at Ft. Greble, as advertised in The Engineering Record.

Capt. Thos. H. Slavens, Q. M., U. S. A., Newport, writes that the contract for cutting off short leg and extending long leg of underground brick gathering canal at Ft. Greble, R. I. (bids opened June 3) has been awarded to Darling & Slade, 78 Bedford St., Fall River, Mass., for $2,195.

Ft. Clark, Tex.—Bids will be received June 19 by Ch. Quartermaster, San Antonio, for constructing post exchange building and gymnasium at this post.

Waco, Tex.—Bids are wanted July 8 for constructing (including plumbing, heating apparatus, electric wiring) the extension of the U. S. Court House, Post Office, etc., at Waco. Jas. Knox Taylor, Superv. Archt., Washington, D. C.

Ft. Douglas, Utah.—Bids are wanted July 17 for constructing water works, sewer system, roads and walks at this post. Address Constructing Quartermaster, 512 Dooly Bldg., Salt Lake City.

Ft. Myer, Va.—Wm. H. McCray, of Washington, D. C., is stated to have secured the contract to erect a gymnasium at Ft. Myer, for $39,888.

Norfolk, Va.—Bids are wanted July 25 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a concrete granite dry dock, exclusive of pumping plant and caisson, at the navy yard, Norfolk; cost of entire work not to exceed $1,200,000.

Ft. Casey, Wash.—Capt. Geo. H. Penrose, Q. M., U. S. A., writes that the contract for constructing and the plumbing, heating and electric wiring of buildings at this post (bids opened May 11) was awarded on June 1 to Alfred W. Burrell, of Oakland, Cal., for $70,862.

Vancouver Barracks, Wash.—According to press reports bids opened June 1 for the erection of a gymnasium and post exchange have been rejected, as all were in excess of the appropriation which is $40,000. New bids will be received. F. H. Hathaway, Ch. Q. M.

Milwaukee, Wis.—Maj. J. G. Warren, Corps Engrs., U. S. A., writes that the lowest bid opened on June 3 for building pile revetment at Two Rivers Harbor, was submitted by Frankman Bros. & Morris, of St. Paul, Minn., for $16,314.

Shoshone Agency, Wyo.—W. A. Jones, Comr. Indian Affairs, Washington, D. C., writes that all bids received May 18 for furnishing material for constructing power house and moving machinery at Shoshone School, have been rejected.

Ft. D. A. Russell, Wyo.—Bids will be received by Capt. W. S. Scott, Constructing Q. M., Cheyenne, until July 9 for constructing about 11,000 ft. of 12-in. irrigating conduit from Cheyenne city's gate house on Crow Creek, to the head of the irrigating system at Ft. D. A. Russell.

NEW INDUSTRIAL PLANTS.

The Weller Rolling Mill & Forge Co., Anniston, Ala., contemplates adding a forge plant to its rolling mill in the near future.

The Southern Sewer Pipe Co., Birmingham, Ala., has let contract to J. M. Morgan & Co., Birmingham, for a 3-story, 90x300-ft. building, to replace that recently burned. The new plant will be about one-third larger than the old. The company is in the market for pulleys, shafting, belting, boiler feed pump, power elevator, conveyors, etc.

The Ideal Cash Register Co., Bound Brook, N. J., contemplates erecting a new building in connection with its present plant. The present power plant is sufficient.

The Penn Facing Mills Co., Irwin, Pa., will rebuild its plant recently burned. The size of the building will be not less than 100x50 ft. If a new site is secured, a 150-H.-P. engine will be required.

Schofield, Mason & Co., Philadelphia, Pa., are erecting a 4-story and basement, 58x65-ft. building. Electric power will be used.

The Dillon-Griswold Wire Co., Sterling, Ill., contemplates using some of its water power on Rock River to generate electricity to be used as motive power in its works.

The Hartsville, S. C., Cotton Mill will increase its capital stock from $250,000 to $500,000, and build a 4-story, 140x130-ft. addition. The company will probably add 15,000 to 20,000 spindles and complement of looms. C. C. Twitty, Pres. & Treas.; J. E. Sirrine, Greenville, S. C., Engr. in Charge.

The Tipp Building & Mfg. Co., Tippecanoe City, O., intends to erect a 60x150-ft. and a 2-story, 60x100-ft. building to replace those recently burned. A 125-H.-P. engine and new woodworking machinery will be installed.

The directors of the Woodward, Ala., Iron Co. have authorized the building of a new furnace plant.

The Louisville, Ky., Tin & Stove Co. contemplates erecting a new plant.

E. W. Jackson, Harrisonburg, Va., writes that a stock company is being organized for the erection of a shale brick plant, including making paving block, fireproofing, electric conduit and building brick on the land of the Chesapeake Western Co. at Stokesville, Va.

The Walker Veneer & Panel Works, Alpena, Mich., will erect a 125x300-ft. plant at Grand Marais, Mich. Power plant has been ordered.

The Hays Mfg. Co., Erie, Pa., maker of water and gas specialties, is considering the erection of a new plant to include a 2-story and basement, 60x200-ft. machine shop, a 70x175-ft. foundry and a 40x60-ft. power house, of steel, concrete and brick. F. Felkel, Pittsburg, Archt.

The Mississippi Textile Novelty Co., Magnolia, Miss., will probably install electric motors for driving 25 looms, requiring about 20-H.-P.

The Franklin Brick Co., Columbus, O., expects to install a brick plant of not less than 100,000 daily capacity. An engine of not less than 250 H.-P. and two boilers of not less than 150 H.-P. each will be installed.

The Louisville, Ky., Portland Cement Co. will erect a plant near Louisville to have a daily capacity of 800 bbls. Peter Arlund & Co., Louisville, have charge of the enterprise.

The Leger, Okla. T., Mill Co. will erect mills at Leger, Chester, and Eldorado, Okla. T.

The Cleveland Automatic Stoker Co., Toledo, O., will probably double the size of its plant in the near future.

The Racine, Wis., Boat Mfg. Co. will build a larger plant to replace the plant recently destroyed by fire.

The American Frog & Mfg. Co., New England Bldg., Kansas City, Mo., will erect buildings to cover about 100,000 sq. ft., including a 100x180-ft. machinery and erecting department of steel and brick, equipped with a 10-ton electric overhead traveling crane; a 50x100-ft. brass foundry of 10 tons capacity, of steel and brick; a 100x200-ft. iron foundry of 50 tons capacity, of structural steel, equipped with a 10-ton electric overhead traveling crane; a forge shop of steel, 100 ft. square, 20x50-ft. engine room; 30x50-ft. boiler room; fuel storage of brick and steel, 50 ft. square; 40x50-ft. pattern shop of steel and brick; pattern storage of steel and brick, 60 ft. square; 2-story, 100x200-ft. store-room and office building of steel and brick. The equipment will include a 250-H.-P. high-speed automatic engine direct-connected to a 175-Kw. generator, two 150-H.-P. tubular boilers, iron-forming machinery, hammers, etc. All machine tools will be electrically driven.

The Anchor Duck Mills, Rome, Ga., will add another story to one of their buildings, which is 100x80 ft., and expect to install a power plant of about 300-H.-P. capacity.

MISCELLANEOUS.

Clayton, Ala.—It is stated that bids are wanted June 16 for constructing a water and electric light plant. J. S. Williams, Mayor.

Winder, Ga.—It is stated that bids are wanted until about July 10 for erecting an electric light plant, to be operated by steam and to have a capacity of 30 arc and 500 incandescent lights. Estimated cost, $10,000. A. A. Camp, Mayor.

Peoria, Ill.—Erza F. Parker and S. P. Hart, of Peoria, are reported to have been appointed as Comrs. by the Fond du Lac Comn. to investigate the matter of reclaiming land along Illinois River in Tazewell County, opposite Peoria.

Tipton, Ind.—Bids will be received June 16 by T. W. Longfellow, Co. Aud., for constructing ditch No. 298, known as John Funke et al. ditch.

Baltimore, Md.—A press report states that the Northern Central Ry. Co. is receiving bids for a new pier at Canton, Baltimore. The pier will have 4 tracks, will be 52 ft. wide and 800 ft. long, and cost about $70,000. H. W. Kapp, Div. Supt., Baltimore.

Boston, Mass.—Fred. N. Wales, Clk. Harbor & Land Comrs., writes that no bids were received on June 4 for dredging Bass River, approximately 15,000 cu. yds.

Brooklyn, N. Y.—Bids will be received June 18 by Wm. R. Willcox, Chmn. Bd. of Park Comrs., N. Y. City, for constructing rustic boundary wall at Sunset Park.

New York, N. Y.—Bids will be received June 18 by the Bd. of Park Comrs. for furnishing and delivering 5,000 cu. yds. broken stone of trap rock and 3,000 cu. yds. screenings of trap rock, in Bronx and Van Cortlandt Parks. Wm. R. Willcox, Chmn.

Bids will be received June 23 by Jacob A. Cantor, Boro. Pres., for installing gas and electric light fixtures; also combination gas and electric light fixtures, at the City Hall.

Horseheads, N. Y.—Bids are wanted by the Village Bd. of Trus. for furnishing the village with water and light. Address R. G. Eisenhart, Village Pres.

Cohoes, N. Y.—Bids will be received June 20 by Miller Hay, City Chamberlain, for $118,276 public improvement bonds.

Syracuse, N. Y.—Bids are wanted June 16 for $171,000 local improvement bonds. E. J. Mack, City Compt.

Pittsburg, Pa.—R. J. Cunningham, Controller, writes that the contract for furnishing about 3,000 bbls. cement (bids opened June 11 has been awarded to Murray Bros., of Allegheny, at $2.34 per bbl.

BUSINESS NOTES.

The general offices of the American Stoker Co. have been removed from New York to Erie, Pa.

The Ridgway, Pa., Machine Tool Co. is completing its plant, which has been under construction for the past year.

The Coffin Valve Co., Boston, has recently been awarded a contract for eight 5x10-ft. sluice gates for an irrigation plant operated by the Twin Falls Land & Water Company at Twin Falls, Idaho. The special feature worthy of mention in regard to this contract is that the gates are to be operated by one man under a head of 70 ft.

The Merrell Mfg. Co., Toledo, O., maker of pipe threading and cutting machinery, is building a 120x50-ft. foundry to be run from its present power plant. Machinery has been ordered.

The Pittsburg, Pa., Piping and Equipment Co. has been organized by Geo. H. Danner, Chas. R. Rall and Jos. K. Smith, who have severed their connection with the Best Mfg. Co. The new company will conduct a general pipe fitting, pipe bending and machine shop business and supply brass and bronze castings for blast furnaces, rolling mills, etc. The offices are at 1111-12 Westinghouse Bldg. and the works at 35th and Smallman Sts., Pittsburg.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Tawas Sugar Co., East Tawas, Mich., two 150-H.-P. self-oiling engines direct-connected to Crocker-Wheeler generators; Owosso, Mich., Sugar Co., two 150-H.-P. self-oiling engines direct-connected to Crocker-Wheeler generators.

The Ransome & Smith Co., 11 Broadway, New York, has been awarded contract for a 3-story and basement, 300x60-ft. factory building of reinforced concrete construction for the Kelly & Jones Co., Greensburg, Pa.

The Buffalo Steam Pump Co., whose works are at North Tonawanda, has been purchased by William F. and Henry W. Wendt, who are also owners of the Buffalo Forge Co. and the Geo. L. Squier Mfg. Co. The North Tonawanda works of the steam pump company are to be continued as heretofore, and the main offices will be in Buffalo.

A contract for furnishing seven 140,000-lb. smelting blowers for the Cerro de Pasco, Peru, Mining Company, has been awarded to the P. H. & F. M. Roots Co., 120 Liberty St., New York, whose home office is at Connersville, Ind. This is said to be the largest single order for smelting blowers, or any kind of pressure blowers, ever awarded, and was placed through the office of Frank Klepetko, consulting engineer, 8-10 Bridge St., New York.

The St. Mary's Portland Cement Co., Ltd., St. Mary's, Ont., which has been incorporated with J. J. Crabbe, Pres.; J. J. Main and Thos. Bryce, Vice-Presidents; T. H. Hamilton, Jos. Wright, all of Toronto; R. R. Hall, Peterboro; J. M. Staebler, Berlin; H. B. Harrison, Owen Sound; N. W. Tovell, Toronto, is distributing a prospectus obtainable from the Secretary-Treasurer, Ambrose Kent, 5 Richmond St. West, Toronto.

The Plunger Elevator Co. has sold, through its New York office, 156 Fifth Ave., three elevators to the Aetna Fire Insurance Co., of Hartford, Conn.

The Carolina Steel Bridge & Construction Co., Burlington, N. C., reports having closed the following contracts: Bridge over Haw River, Alamance Co., N. C., $12,000; bridge over Abbott's Creek, Davidson Co., N. C., $11,125; bridge over Smith River, Rockingham Co., N. C., $6,816; 2 bridges in Randolph Co., N. C., $7,400; 120-ft. span for Durham & Charlotte Ry. Co., $8,000; bridge at Pacolet, S. C., $3,287; bridge in Harris Co., Tex., $7,000; the Frisco system, $375,000 worth of work aggregating about 6,000 tons; steel work for the Fort Smith, Ark., post office building; roof trusses for the Southern R. R. Co.'s shop buildings at Atlanta, Ga.; three spans for Danville & Western R. R. Co.; steel draw bridge at Lake Charles, La., and a 150-ft. span for Lee County, S. C., besides several bridges for contractors in Texas.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Jun. 15.	Pipe, etc., Sioux City, Ia.	Jun. 13
Jun. 15.	Coopersburg, Pa., Adv. Jun. 6.	Jun. 6
Jun. 15.	South Deerfield, Mass. Adv. June 6, 13.	
Jun. 15.	Great Falls, Mont.	May 30
Jun. 15.	Tacoma, Wash.	May 30
Jun. 15.	North Tonawanda, N. Y. Adv. May 23 to Jun. 6.	May 23
Jun. 16.	Clayton, Ala.	Jun. 13
Jun. 16.	Meadville, Pa.	Jun. 13
Jun. 16.	Brooklyn, N. Y.	Jun. 13
Jun. 16.	Wantagh, L. I., N. Y.	Jun. 6
Jun. 18.	Mains, Brooklyn, N. Y.	May 30
Jun. 18.	Pipe, Brooklyn, N. Y.	Jun. 13
Jun. 18.	New Brighton, S. I., N. Y.	Jun. 13
Jun. 18.	Long Island City, L. I., N. Y.	Jun. 13
Jun. 18.	New York, N. Y.	Jun. 13
Jun. 18.	Brooklyn, N. Y.	May 30
Jun. 20.	Pipe, Washington, D. C., Adv. Jun. 13.	Jun. 13
Jun. 20.	Oakland City, Ind., Adv. May 30, Jun. 6.	May 30
Jun. 22.	Pittsburg, Pa.	Jun. 13
Jun. 23.	Gouverneur, N. Y., Adv. Jun. 6, 13.	Jun. 6
Jun. 24.	Maxwell, Ia.	Jun. 13
Jun. 25.	Port Arthur, Ont.	Jun. 13
Jun. 25.	Niagara Falls, Ont., Adv. Jun. 6, 13.	Jun. 6
Jun. 27.	Erie, Pa. (2 Prop.), Adv. Jun. 6, 13.	Jun. 6
Jun. —	Pump, Niagara Falls, Ont.	May 9
Jul. 1.	Pump, etc., Sioux City, Ia.	Jun. 13
Jul. 1.	West Point, Va.	May 23
Jul. 5.	Sacramento, Cal., Adv. Jun. 13.	Jun. 13
Jul. 7.	Reading, Pa., Adv., Jun. 6, 13.	Jun. 6
Jul. —	West Manchester, O.	May 30
Jul. 15.	Irrig. Work, Reno, Nev., Adv. Jun. 13.	Jun. 13
Jul. 15.	Halsted, Minn.	May 30
———	Horseheads, N. Y.	Jun. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Jun. 15.	Depew, N. Y.	Jun. 13
Jun. 15.	Johnstown, N. Y.	May 30
Jun. 15.	Burlington, Ia. (2 Prop.) Adv. May 30 to Jun. 13.	May 16
Jun. 16.	Luverne, Minn.	Jun. 13
Jun. 16.	New York, N. Y.	Jun. 13
Jun. 17.	Hartford, Conn.	Jun. 13
Jun. 17.	Brooklyn, N. Y.	Jun. 6
Jun. 18.	Houghton, Mich.	Jun. 13
Jun. 18.	Frankford, Ind.	Jun. 13
Jun. 18.	Brooklyn, N. Y.	Jun. 13
Jun. 18.	Cincinnati, O.	Jun. 6
Jun. 18.	Ingram, Pa.	Jun. 6
Jun. 20.	Paris, Ill.	Jun. 13
Jun. 20.	Washington, D. C. Adv. May 16, to Jun. 13.	May 16
Jun. 22.	Blaine, Wash.	Jun. 13
Jun. 22.	Muncie, Ind.	Jun. 13
Jun. 22.	Winona, Minn.	Jun. 6
Jun. 23.	Rockford, Ill., Adv. Jun. 13.	Jun. 13
Jun. 24.	Jersey Shore, Pa., Adv. Jun. 6, 13.	Jun. 6
Jun. 24.	Norristown, Pa.	Jun. 13
Jun. 25.	Port Arthur, Ont.	Jun. 13
Jun. 26.	Milton, Pa.	Jun. 13
Jun. 26.	Shreveport, La. Adv. May 30 to Jun. 13.	May 30
Jun. 27.	Delaware, O.	Jun. 13
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. —	Little Rock, Ark.	May 30
Jun. —	Ballard, Wash.	May 9
Jul. 1.	Geneva, O.	May 30
———	Greensboro, N. C.	May 30
Jul. 13.	Wabash, Ind.	Jun. 13
Jul. 20.	Atlanta, Ga., Adv. Jun. 13.	Jun. 13
	BRIDGES.	
Jun. 15.	Burlington, Ia. Adv. May 30 to Jun. 13.	May 16
Jun. 16.	Kragnes, Minn.	Jun. 13
Jun. 16.	Montrose, Pa.	Jun. 13
Jun. 16.	Oneida, N. Y.	Jun. 13
Jun. 17.	Wabash, Ind.	Jun. 6
Jun. 18.	Indianapolis, Ind.	Jun. 13
Jun. 18.	Shreveport, La.	May 30
Jun. 20.	Lodi, N. J.	Jun. 13
Jun. 20.	Marion, Ind.	May 30
Jun. 22.	Ashley, Pa.	Jun. 13
Jun. 22.	Mankato, Minn.	Jun. 13
Jun. 22.	Durham, Kan.	Jun. 13
Jun. 22.	Neport, Ky.	Jun. 6
Jun. 22.	Olivet, S. D.	May 16
Jun. 25.	Columbus, O.	Jun. 6
Jun. 27.	Grand Rapids, Mich., Adv. Jun. 6.	Jun. 6
Jun. 30.	Pikeville, Ky.	Jun. 13
Jul. 1.	Cleveland, O.	Jun. 13
Jul. 1.	Hartford, Conn., Adv. Jun. 13.	Jun. 13
Jul. 1.	Ottawa, O.	Jun. 6
Jul. 10.	Castlewood, S. D.	May 2
	PAVING AND ROADMAKING.	
Jun. 15.	Fitchburg, Mass.	Jun. 13
Jun. 15.	Oswego, N. Y.	Jun. 6
Jun. 15.	Ansonia, Conn.	Jun. 6
Jun. 15.	Freehold, N. J.	Jun. 6
Jun. 15.	Burlington, Ia. Adv. May 30 to Jun. 13.	May 16
Jun. 15.	Neptune, N. J.	May 30
Jun. 16.	Davenport, Ia.	Jun. 13
Jun. 16.	Bloomington, Ind.	Jun. 13
Jun. 16.	Brookfield, Mo.	Jun. 13
Jun. 16.	New York, N. Y.	Jun. 13
Jun. 16.	Trenton, N. J.	Jun. 13
Jun. 16.	Camden, N. J.	May 30
Jun. 16.	Rensselaer, N. Y. Adv. May 30 to Jun. 13.	May 30
Jun. 17.	Louisville, Ky.	Jun. 13
Jun. 17.	Providence, R. I.	May 30
Jun. 18.	Charlevoix, Mich., Adv. Jun. 13.	Jun. 13
Jun. 18.	Charlevoix, Mich.	Jun. 13
Jun. 18.	Long Island City, L. I., N. Y.	Jun. 13
Jun. 18.	Buffalo, N. Y.	Jun. 13
Jun. 18.	Brooklyn, N. Y.	Jun. 13
Jun. 18.	Terre Haute, Ind.	Jun. 13
Jun. 18.	Edgewood, Pa.	Jun. 13
Jun. 18.	Cincinnati, O.	Jun. 6
Jun. 19.	Harrisburg, Pa.	Jun. 13
Jun. 20.	Sevierville, Tenn.	Jun. 13
Jun. 20.	Moline, Ill.	Jun. 13
Jun. 20.	Washington, D. C., Adv. Jun. 13.	Jun. 13
Jun. 20.	Crownpoint, Ind.	Jun. 6
Jun. 20.	La Crosse, Wis.	Jun. 6
Jun. 20.	Mt. Holly, N. J.	Jun. 6
Jun. 22.	Frederick, Md.	Jun. 13
Jun. 22.	Houston, Tex.	Jun. 13
Jun. 22.	Jasper, Ind.	May 30
Jun. 22.	Bowling Green, O.	May 30
Jun. 23.	Columbus, O.	Jun. 13
Jun. 23.	New York, N. Y.	Jun. 13
Jun. 23.	Hartford City, Ind.	Jun. 13
Jun. 23.	La Crosse, Wis.	May 30
Jun. 24.	Hoboken, N. J.	Jun. 13
Jun. 24.	Cincinnati, O.	May 30
Jun. 25.	Anderson, S. C., Adv. Jun. 13.	Jun. 13
Jun. 26.	Indianapolis, Ind.	Jun. 6
Jun. 26.	Shreveport, La. Adv. May 30 to Jun. 13.	May 30
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. —	Charlevoix, Mich.	May 30
Jul. 1.	Cleveland, O.	Jun. 6
Jul. 2.	Oshkosh, Wis.	Jun. 13
Jul. 2.	Bryan, O.	Jun. 13
Jul. 2.	Roanoke, Va.	Jun. 13
Jul. 6.	Niagara Falls, Ont., Adv. Jun. 13.	Jun. 13
Jul. 7.	Versailles, Ind.	Jun. 13
Jul. 10.	Rensselaer, Ind.	Jun. 13
Jul. 13.	Wabash, Ind.	Jun. 13
———	Hamburg, N. Y.	Jun. 13
	POWER, GAS AND ELECTRICITY.	
Jun. 8.	Greene, N. Y.	May 30
Jun. 8.	New Orleans, La.	May 23
Jun. 10.	Ruston, La.	May 30
Jun. 15.	Vancouver, B. C.	Jun. 6
Jun. 15.	Fergus Falls, Minn.	Jun. 6
Jun. 15.	Vernal, Utah	May 16
Jun. 16.	Clayton, Ala.	Jun. 13
Jun. 16.	St. Charles, Minn.	Jun. 13
Jun. 16.	Buhl, Minn.	May 30
Jun. 17.	Baltimore, Md.	Jun. 13
Jun. 18.	Portland, Ore., Adv. Apr. 18 to May 2.	Apr. 18
Jun. 23.	New York, N. Y.	Jun. 13
Jun. 23.	Grantsburg, Wis.	Jun. 13
Jun. —	Napoleon, O.	May 16
Jun. —	North Yamkill, Ore.	Apr. 4
Jul. 6.	Salem, Ore.	Jun. 6
Jul. 7.	Mifflinburg, Pa.	Jun. 13
Jul. 10.	Winder, Ga.	Jun. 13
Sep. 1.	Corona, Cal.	May 16
———	Horseheads, N. Y.	Jun. 13
———	Toronto, Ont.	Jun. 6
———	Caledonia, Minn.	May 23
	GOVERNMENT WORK.	
Jun. 15.	Ft. Huachuca, Ariz.	Jun. 13
Jun. 15.	Ft. Riley, Kan., Adv. Jun. 6, 13.	Jun. 6
Jun. 15.	Washington, D. C. Adv. May 30, Jun. 6.	May 30
Jun. 15.	Norfolk, Va., Adv. May 23, Jun. 6.	May 23
Jun. 16.	Philadelphia, Pa.	Jun. 13
Jun. 16.	Ft. Mott, N. J.	Jun. 13
Jun. 16.	Newport, R. I.	Jun. 13
Jun. 16.	Washington, D. C.	May 30
Jun. 16.	Roads, Ft. Caswell, N. C. Adv. May 23, 30, Jun. 13.	May 23
Jun. 16.	Hospital, Ft. Caswell, N. C. Adv. May 30, Jun. 13.	May 30
Jun. 16.	Alexandria, Va., Adv. May 16, 30.	May 16
Jun. 17.	Washington, D. C.	Jun. 6
Jun. 17.	Saugatuck, Mich. Adv. May 23 to Jun. 13.	May 23
Jun. 18.	Ellis Island, N. Y.	Jun. 13
Jun. 18.	Boone, Ia.	May 23
Jun. 19.	Ft. Preble, Me., Adv. Jun. 13.	Jun. 13
Jun. 19.	Ft. Clark, Tex.	Jun. 13
Jun. 19.	Ft. Leavenworth, Kan. Adv. May 23 to Jun. 13.	May 23
Jun. 20.	Charleston, S. C.	May 30
Jun. 22.	Washington, D. C.	Jun. 13
Jun. 22.	Ft. Ethan Allen, Vt., Adv. Jun. 6, 13.	Jun. 6
Jun. 22.	Ashland, Wis.	Jun. 6
Jun. 22.	Stillwater, Minn., Adv. May 23, 30.	May 23
Jun. 22.	Baltimore, Md. Adv. May 23 to Jun. 13.	May 23
Jun. 22.	New Haven, Conn. Adv. May 23 to Jun. 13.	May 23
Jun. 23.	Washington, D. C.	Jun. 13
Jun. 23.	Chattanooga, Tenn., Adv. Jun. 13.	Jun. 13
Jun. 23.	Ft. D. A. Russell, Wyo.	May 23
Jun. 24.	Pctoskey, Mich. Adv. May 30 to Jun. 13.	May 30
Jun. 24.	Tompkinsville, N. Y. Adv. May 23 to Jun. 13.	May 23
Jun. 25.	Ft. Ethan Allen, Vt. Adv. May 30 to Jun. 13.	May 30
Jun. 25.	Leadville, Colo.	May 23
Jun. 26.	Philadelphia, Pa.	Jun. 6
Jun. 26.	Mobile, Ala.	May 30
Jun. 27.	Ft. Greble, R. I., Adv. Jun. 13.	Jun. 13
Jun. 27.	Chicago, Ill., Adv. Jun. 6, 13.	Jun. 6
Jun. 27.	New Orleans, La.	May 30
Jun. 30.	Philadelphia, Pa. Adv. May 16, 23, Jun. 13.	May 16
Jun. 30.	New Orleans, La., Adv. May 9, 16.	May 9
Jul. 1.	Memphis, Tenn., Adv. Jun. 6, 13.	Jun. 6
Jul. 1.	New Orleans, La.	Jun. 6
Jul. 6.	Norwich, Conn.	Jun. 13
Jul. 6.	Benicia, Cal.	Jun. 13
Jul. 6.	Watervliet, N. Y.	Jun. 13
Jul. 7.	Johnson City, Tenn., Adv. Jun. 13.	Jun. 13
Jul. 8.	Waco, Tex.	Jun. 13
Jul. 9.	Ft. McPherson, Ga., Adv. Jun. 13.	Jun. 13
Jul. 9.	Ft. D. A. Russell, Wyo.	Jun. 13
Jul. 10.	New York, N. Y., Adv. Jun. 13.	Jun. 13
Jul. 14.	Winston, N. C., Adv. Jun. 13.	Jun. 13
Sep. 14.	Providence, R. I.	May 30
Jul. 15	Ft. Bradford, R. I.	Jun. 13
Jul. 17.	Ft. Douglas, Utah.	Jun. 13
Jul. 20.	National Military Home, Kan.	Jun. 13
Jul. 25.	Washington, D. C.	Jun. 13
Jul. 25.	Norfolk, Va.	Jun. 13
	BUILDINGS.	
Jun. 15.	School, Brooklyn, N. Y.	Jun. 6
Jun. 15.	Htg. School, Richmond, S. I., N. Y.	Jun. 6
Jun. 15.	Library, Gloversville, N. Y.	Jun. 6
Jun. 16.	Hospital, National Home, Wis.	Jun. 13
Jun. 16.	School, Aberdeen, S. D.	Jun. 13
Jun. 16.	Church, Rockland, Mich.	Jun. 6
Jun. 16.	School, Hempstead, N. Y., Adv. May 30.	May 30
Jun. 16.	Jail, etc., Two Harbors, Minn.	May 30
Jun. 16.	School, Bayonne, N. J.	May 30
Jun. 16.	Hospital, Los Angeles, Cal.	May 23
Jun. 16.	School, Bedford, Ind.	May 2
Jun. 17.	Bldgs., Brooklyn, N. Y.	Jun. 13
Jun. 17.	Gymnasium, etc., Grand Forks, N. D.	Jun. 6
Jun. 18.	Shelter house, Brooklyn, N. Y.	Jun. 13
Jun. 18.	Pub. Bldg., New York, N. Y.	Jun. 13
Jun. 18.	School, Martins Ferry, O.	Jun. 6
Jun. 18.	City Hall, etc., Hot Springs, Ark.	Jun. 6
Jun. 18.	School, Dayton, O.	May 30
Jun. 18.	Pub. Bldg., Sandusky, O.	May 23
Jun. 19.	Station house, New York, N. Y.	Jun. 13
Jun. 19.	School, Chicago, Ill.	Jun. 13
Jun. 20.	School, Pine City, Minn.	Jun. 13
Jun. 20.	Bldg., Louisville, Ky.	Jun. 13
Jun. 20.	Pub. Bldg., Baton Rouge, La.	Jun. 13
Jun. 20.	School, Orono, Me.	Jun. 13
Jun. 20.	Pub. Bldg., Xenia, O.	Jun. 13
Jun. 20.	Hotel, Baton Rouge, La.	Jun. 6
Jun. 20.	School, St. Charles, Ill.	Jun. 6
Jun. 20.	Pub. Bldg., Providence, R. I.	Jun. 6
Jun. 22.	School, Brockton, Mass.	Jun. 13
Jun. 22.	Pub. Bldg., Stillwater, Minn.	Jun. 13
Jun. 22.	School, New York, N. Y.	Jun. 13
Jun. 22.	School, Brooklyn, N. Y.	Jun. 13
Jun. 22.	School, New Brighton, S. I., N. Y.	Jun. 13
Jun. 22.	School, Cleveland, O.	Jun. 6
Jun. 22.	Hospital, New York, N. Y.	Jun. 6
Jun. 22.	Church, Topeka, Kan.	May 30
Jun. 22.	Fire Station, Houston, Tex.	May 16
Jun. 23.	Court house, Yankton, S. D.	Jun. 13
Jun. 24.	Infirmary, Dayton, O.	Jun. 6
Jun. 25.	Hosp. Boiler Plant, Indianapolis, Ind. Adv. Jun. 6, 13.	Jun. 6
Jun. 25.	Church, Granville, N. Y.	Jun. 6
Jun. 27.	School, Thackery, O.	Jun. 13
Jun. 29.	School, Glenville, O.	Jun. 6
Jun. 30.	School, Mansfield, O.	Jun. 13
Jun. 30.	School, Plainview, Minn.	Jun. 6
Jun. —	Hotel, La Crosse, Wis.	May 23
Jul. 1.	Police Station, Newark, N. J.	Jun. 13
Jul. 1.	Bus. Bldg., Toledo, O.	Jun. 13
Jul. 1.	Library, Binghamton, N. Y. Adv. Jun. 6, 13.	Jun. 6
Jul. 1.	Court house, Boonville, Ind.	May 30
Jul. 1.	Court house, Carnesville, Ga.	May 30
Jul. 2.	School, Springfield, O.	Jun. 13
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jul. 13.	Court House, La Grange, Ga.	May 9
Jul. 15.	Court house, Booneville, Ind.	Jun. 13
Jul. 15.	School plans, Washington, D. C.	Jun. 13
Jul. —	Jail, Jackson, Miss.	Jun. 6
	MISCELLANEOUS.	
Jun. 15.	St. Sprinkler, etc., Albany, N. Y.	Jun. 13
Jun. 15.	Dredging, etc., New York, N. Y.	Jun. 6
Jun. 16.	Ditch, Tipton, Ind.	Jun. 13
Jun. 16.	Dredging, etc., New York, N. Y.	Jun. 6
Jun. 18.	Cement, Boston, Mass.	Jun. 13
Jun. 18.	Broken stone, etc., New York, N. Y.	Jun. 13
Jun. 18.	Wall, Brooklyn, N. Y.	Jun. 13
Jun. 22.	St. Ry., Sidney, O.	Jun. 6
Jun. 23.	Piles, New York, N. Y.	Jun. 13
Jun. 29.	Ditch, Jefferson, Ia.	Jun. 6
Jun. 30.	R. R., Denver, Colo.	Jun. 6
Jul. 7.	El. Ry., San Jose, Cal.	Jun. 13
Jul. —	Levee, West Memphis, Ark.	Jun. 6
Jul. —	Removal of earth, Camden, N. J.	May 30
———	El. Ry. work, Columbia, Mo.	May 30
Dec. 15.	R. R. work, Santiago De Chili, Chili.	Jun. 13
May 2, '04.	R. R., Oodnadatta, So. Australia.	Feb. 21

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The American Water-Works Association.

The convention of the American Water-Works Association at Detroit next week is a meeting which should be attended by all interested in the water supplies of our cities. There is no one branch of municipal service which needs such careful attention to-day as that charged with water supply. The growth of our urban population has been so rapid that the quantity of water to be supplied now exceeds the capacity of the works in many places, and every time a fire occurs there is a justifiable complaint by the fire department of a deficient supply. The quality of the supply for most communities has also deteriorated because of the increase in both the number of residents on the water-sheds and the quantity of sewage discharged into streams by upper riparian communities. The loss and waste of the water have reached such proportions that the works are furnishing at times a supply half again as large as there is any reason whatever for providing. These are some of the problems that the members of the American Water-Works Association must solve.

One of the amusing features in the recent history of the Association has been the ill-advised attempts to turn it into an engineering organization. It is nothing of the kind and should not be so considered. Its scope covers in a broad way general features of engineering, but not the technical details of the specialist. Such details ought to be left for discussion at meetings of purely engineering societies. The investigations of the water analyst are likewise of deep moment to the water-works superintendent, but the methods of chemical and biological research do not concern him. The design of pumping machinery is not in his province except as it results in an economical engine when finished. In a word, the superintendent and the commissioner, the men for whom the American Water Works Association was founded and has been conducted, are executive officials, whose desire for technical information stops with broad results and does not extend to details. The management of pumping stations, the prevention of water waste, the financial administration of a business having thousands of open accounts with people who are ever ready with criticism, are subjects just as important to these officers as the design of the works. It is ridiculous to criticize an association with such a broad scope because it does not confine its attention to one part of its field, and it is unjust for members who do nothing toward making its proceedings of the greatest value to complain that the papers are of little value. In such an organization everyone should contribute, and nobody has a license to shirk his duty and become a mere spectator.

If the members of the Association will permit the suggestion, The Engineering Record desires to advise them to consider the utility of some investigations by committees, similar to those undertaken by various organizations of railway officials. The reports of such committees are often of the greatest value, bringing together in concise form the experience of many men and sometimes suggesting standard designs or methods of work which prove widely useful.

Among the subjects on which committees might gather valuable data and make useful suggestions are the following: The management of pumping stations, including precautions to be taken against accident, the maintenance of machinery, the organization of the staff and the keeping of records; the management of mechanical and sand filter plants, the equipment of construction and repair gangs, the protection of hydrants and pipes during the winter, methods of book-keeping, and specifications for supplies. Careful committee work on these topics during the next year should bring together a body of information from all parts of the country that will make the 1904 convention a memorable one among those who attend it and a valuable one to every water-works official.

Water Analyses of National Scope.

Except in the West the amount of water available for industrial and domestic purposes in any district is already pretty well known, thanks very largely to the work of the hydrographic division of the United States Geological Survey. In fact, with the exception of underground supplies, there is comparatively little to be learned about the general distribution of water in this country, speaking in a broad way; and the Survey is extending the scope of its investigations so rapidly that before long it is probable that even the main underground supplies of the country will be fairly well indicated by the results of the field work which it has lately inaugurated. The quantity of the water in the vicinity of a proposed industry or village needing a supply is often a much less important subject than the quality of the yield of various sources that are available. Up to the present time an analytical determination of the character of a supply has been a matter of so much expense and frequently of serious delay that the work of the chemist has not been appreciated.

The analysis of water is a matter of various manipulations concerning which there is no standard practice. The American Public Health Association has a committee which has been doing excellent work in bringing order out of the chaos of manifold schemes of analytical work, and the committee's recommendations are meeting with general approval. They refer mainly, however, to the careful work done by skilled men in well-equipped laboratories, and it is just as well that this process of standardization has begun with the full analytical methods. But there is a great need of analytical methods which will be far more expeditious, so that a qualitative as well as a quantitative survey of a watershed will be a matter of a comparatively short time. This is the more desirable because the actual results of an analysis itself are of trifling value except when interpreted in the light of a full knowledge of the surroundings from which the samples were taken. No chemist will care to explain the significance of his analytical results on the basis of the figures alone, for he knows that he cannot do so safely, and many amusing stories are told of the ridiculous assertions sometimes made by analysts who have ventured to report on the character of the water they examined from the knowledge given by their laboratory work without confirmation by information concerning the source of the samples.

For these reasons the Geological Survey has endeavored to enlist eminent analysts throughout the country in a discussion of this matter. A widespread correspondence has been conducted to ascertain the most useful determinations and the best means for obtaining quick and approximately accurate results. When these reports are all collated, a scheme will be proposed by which large watersheds can be surveyed chemically and biologically at a reasonable expense. The inquiries cover both organic and inorganic determinations so that the work will be as valuable to communities seeking information about possible sources of domestic water supplies as to industrial establishments and similar business corporations, who are vitally interested in obtaining water which will be useful for boiler purposes or for various uses in their manufacturing operations. When the amount of money is considered that is lost annually by railways, to mention but a single interest, through the use of water which is hard on the boilers of the locomotives, it is evident that this new line of investigation of the Survey may be confidently expected to yield results of great practical value. Moreover, if the analytical methods which are finally adopted are as simple and reliable as it seems probable they will be, the engineer will be able to do much of his preliminary analytical work himself, at the spot where the samples are taken. This is particularly desirable in connection with waters which contain much organic matter and is almost essential in sewage analysis for some purposes, as Dr. Rideal has pointed out in his well-known treatise on the subject of sewage disposal. These short and approximate analytical methods will not take the place of the more refined work of the chemist, but there is the same useful place for them that there is for the rough fireside assay of the mining prospector. His assay is an indication of value, but by no means a final criterion.

The Detroit Water Works.

A Short History Compiled and Written by Clarence W. Hubbell, Assoc. M. Am. Soc. C. E., and Civil Engineer to the Board of Water Commissioners.

The soil underlying the city is an impervious blue clay containing occasional striated granite boulders and enclosing isolated pockets of sand, sometimes of considerable extent. Close-grained limestone is found at a depth of 70 to 120 feet below the river surface. In this soil there are no springs, and the small streams which originally flowed through the site of the city were never suitable for water supply. Shallow wells fill with surface water during the wet season and go dry in summer, making them not only satisfactory but also unsanitary; while deep wells, reaching to or penetrating rock, are either dry or furnish an unpalatable water. These unfavorable conditions forced the settlers led by Le Mothe Cadillac in 1701, and the early French "habitans" as well as their successors down to the present generation, to turn to the Detroit River, which has ever proved an unfailing and satisfactory source of supply. In pioneer days, every man, with water cart or shoulder yoke, supplied his domestic need; and it is safe to say that, under this system, domestic waste, that ever fruitful source of debate, was at a minimum. An early ordinance provided for fire protection by compelling each citizen to keep on his premises a cask of given size, filled with water and furnished with pole handles, ready for immediate use in case of need.

Founded in 1701, the settlement at Detroit remained under French rule for nearly sixty years. Fort Pontchartrain, located on the then river bank near the present intersection of Jefferson Avenue and Shelby Street, was surrendered to the English on November 29, 1760. During the Revolutionary War, the English condemned the old fort as indefensible, and built a new one which was named Fort Lernoult. The site was on higher ground farther back from the river, and is marked by the present postoffice building, which stands at the northwest corner of the old fort. This fort was first occupied by American soldiers in 1796. It was ignominiously surrendered to the English by General Hull, August 16, 1812, and re-occupied by the American forces under General McArthur, September 29, 1813, nineteen days after Perry "met the enemy" on Lake Erie. The name was changed at this time from Lernoult to Fort Shelby. Although an important post, the population was unstable, and fluctuated between a few thousand and a few hundred during more than a century of international jealousy and savage intrigue. However, dating from the restoration of confidence after the War of 1812, the growth and prosperity of the city has been uninterrupted.

The inception of the system of water supply dates back as far as 1820, when the Trustees of the city invited proposals for the exclusive privilege of erecting works. Nothing came of the invitation, however, only one proposal being received, and that not satisfactory. Detroit's need became well known, and in 1824 Bethuel Farrand and Rufus Wells, of Aurelius, Cayuga County, New York, determined to obtain the right to furnish the city with water. Mr. Farrand obtained the desired privilege from the Common Council February 21, 1825. He was certainly deserving of success, for, in order to meet the Council, he made the trip from his home to Detroit on foot and in the midst of winter, coming by way of the south shore of Lake Erie and returning through Canada. The plant erected under this grant consisted of two pumps of 5-inch bore, driven by horse power. The pumps were located at the foot of Randolph Street, and lifted water into a 40-gallon cask, from which it flowed by gravity through 4½-inch bore tamarack logs into a white-oak reservoir 16 feet square and 6 feet deep, which was located where the water office now stands. The distribution system consisted of a few lines of tamarack logs which Mr. Farrand and Mr. Wells cut on the Clinton River and rafted to Detroit. At this time the population had reached about 1,500.

From this primitive beginning, the works have passed through many transformations. The first steam pump was installed in 1830, and was of the rotary type driven by a 10-horse-power engine, the delivery main being 3-inch iron pipe. The original horse power pump used by Mr. Wells in 1827 and a section of the 3-inch pipe laid in 1830 are now in the possession of the Board and may be seen at the pumping station. The works were purchased by the city June 1, 1836, at a cost of $20,500, the population being between 5,000 and 6,000. In 1840, contracts were made for the completion of the new works which were under way at the foot of Orleans Street. The contract included the laying of 9 miles of tamarack logs and 4½ miles of cast-iron pipe.

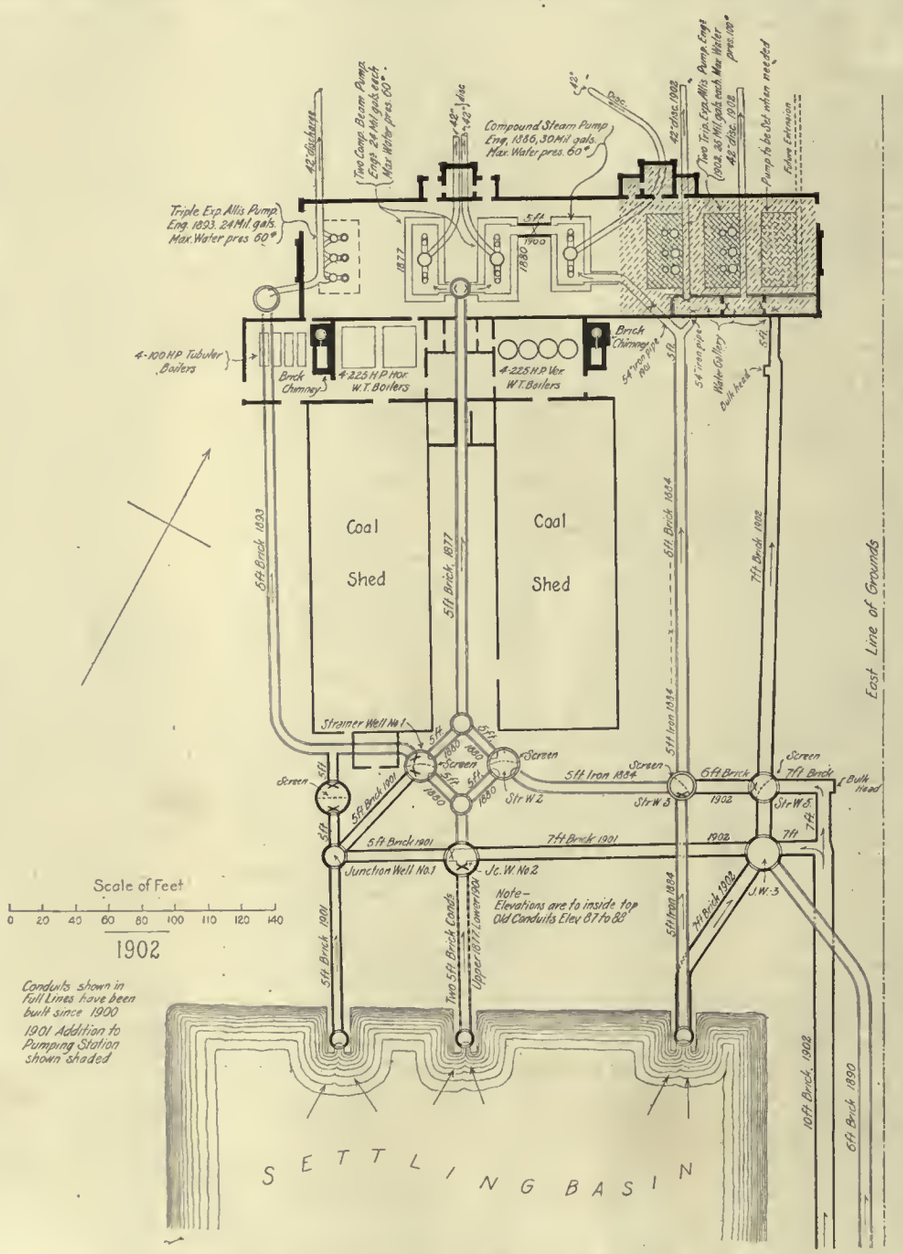


Diagram Showing Location of Pumping Station, Conduits and Settling Basin.

The present management rests in the Board of Water Commissioners, created by special act of the state legislature on February 14, 1853. The Board consists of five men who serve without salary. The term of office is five years, one man being appointed each year by the Mayor and approved by the Council. A better system could scarcely be devised for securing an uncorruptible public service, and the results have been uniformly good. In 1857, a reservoir, having a capacity of 10,000,000 U. S. gallons, was completed at a total cost of about $116,000. The surface of the water in the reservoir when filled was about 77 feet above the river level. The cast-iron supply main was 24 inches in diameter.

The present pumping plant, and we may also say the present system, dates only from 1874, when the site now occupied was purchased. In 1886 the use of the reservoir, which was completed in 1857, was dispensed with, and in 1895; a stand-pipe, which still ornaments the grounds, was disconnected from the mains, since which time the city has been supplied through a direct pressure system, absolutely without reservoir, stand-pipe, or other reserve, and is dependent for its pressure upon the continuous action of the pumps. Taking this fact into consideration, together with the size of the plant, which supplies at the present time 325,000 persons, the management is proud to say that, for a period of nearly twenty-five years the supply has never once been entirely cut off, although accidents to force mains and difficulties with anchor ice have occasionally caused pressures to be somewhat reduced for periods of a few hours. It is believed that few cities can make so good a showing, although

protected from accidents by large reserves in the form of reservoirs. The entire system is supplied by one station, which so far as known has the largest capacity of any single station in the world. It contains six large pumping engines, and has foundations laid for a seventh.

Engine No. 1 is a 24,000,000-gallon compound condensing beam engine, built by the Detroit Locomotive Works in 1874, having steam cylinders of 42 and 84 inches in diameter, with 72-inch stroke, the pumps being the double-acting piston type, directly connected, and 40¼ inches in diameter. Engine No. 2 was built in 1880 by Samuel F. Hodge & Company's Riverside Iron Works, of Detroit, and is similar in type, construction and capacity, but has a high-pressure cylinder 46 inches, and pump cylinders 41 inches, in diameter. Engine No. 3 was built by the Riverside Iron Works in 1884, and is of the same general type. It is one of the largest pressure pumping engines in America, and although rated at 30,000,000 gallons, is frequently speeded to 35,000,000 gallons per 24 hours. In 1897 its high-pressure cylinder was reduced from 46 inches to 35 inches in order to admit of the use of higher-pressure steam and improve its duty, which was thereby raised from about 96,000,000 foot-pounds to 107,000,000 per 100 pounds of coal or 1,000 pounds of dry steam.

Engine No. 4 is of the well-known Reynolds-Corliss triple-expansion type, built by the Edward P. Allis Company, of Milwaukee, in 1893. Its rated capacity is 24,000,000 gallons per 24 hours, and the duty developed upon official trial was 142,000,000 foot-pounds per 1,000 pounds of steam. Engines Nos. 5 and 6 are in duplicate, and are vertical, triple-expansion, crank and fly-wheel, three-plunger, condensing, self-contained engines, having a rated capacity of 25,000,000 U. S. gallons per 24 hours, and a guaranteed duty of 140,000,000 foot-pounds per 1,000,000 heat units consumed. The length of stroke is 72 inches, and the pumps are designed for a water pressure of 80 pounds, with steam at 135 pounds. These engines weigh 900 tons each, and will be ready for service within a few weeks. The Allis-Chalmers Company, of Milwaukee, have the contract to build both engines for $276,000.

The pumping station, exclusive of boiler house and coal sheds, is 314 feet long by about 70 feet wide, and is provided with a 20-ton hand crane which travels the entire length of the building. The boiler plant consists of four 100-horse-power tubular boilers, four 225-horse-power horizontal water-tube boilers, and four 225-horse-power vertical water-tube boilers. The best quality of mine-run bituminous coal is used, and it is brought by boat, costing on an average about $3.25 per ton laid down. The brick coal sheds, in the rear of the boiler house, have a storage capacity of 10,000 tons. The total pumping expenses, including fuel, maintenance and operation, but exclusive of fixed charges, such as interest on investment, was $51,505.43 for the year ending June 30, 1902, or an average of $2.80 per million gallons pumped against a mean head of 50.32 pounds.

For many years cordwood was cheap, costing about 75 cents per cord for soft wood and $1.25 for hard. It was used exclusively in early years, coal being purchased for the first time in 1860. The wood was still used in a diminishing ratio for nearly twenty years, the last entry being a small purchase made in 1879 at $2.58 per cord. The excessive cost of hard coal, which was used to avoid smoke nuisance, led the Board to experiment with natural gas, which was first used for fuel December 8, 1890; but, although satisfactory, it was discontinued in September, 1892, on account of failing supply, crude oil being substituted therefor. This fuel likewise gave good satisfaction; but, owing to the ever-increasing cost of oil it was discontinued in April, 1896, when the use of anthracite coal was resumed, followed by the introduction of bituminous coal in October of the same year. The latter change, accompanied by the equipment of the boilers with mechanical stokers to abate the smoke nuisance, reduced the bills for fuel about 50 per cent.; and no changes have been made since.

Views Showing Development of Detroit Water Works in a Quarter Century.



The Detroit Water-Works, 1848-1858.



The Detroit Water-Works, 1858-1874.



The Detroit Water-Works, 1874.

The water supply is taken from the American channel of the Detroit River opposite the head of Belle Isle. The three intake cribs lie in about 28 feet of water, are of the submerged type, and have vertical white-oak strainer bars, between which the clear opening is about 1¾ inches. The average depth over the tops of the cribs is 20 feet, and water is taken in through side openings only. Water flows by gravity from the intake cribs to a receiving basin 365 feet wide, 775 feet long by about 16 feet deep, through three boiler-plate intake pipes, two of which are 6 feet in diameter and one 5 feet, having lengths of 1,030, 1,505 and 1,505 feet, respectively. The intake cribs are frequently blocked up by anchor ice in winter, and several mechanically operated emergency devices are employed to overcome the difficulty. The receiving basin, originally designed for a settling basin, serves as storage for a reserve supply for the pumps sufficient to carry the works safely through several hours of ice stoppage. The settling basin is connected to the pump wells by a system of brick conduits in which strainer wells are interposed.

To improve the intake system, which is in some ways unsatisfactory, a 4-ring brick tunnel, having an inside diameter of 10 feet, is now under construction, being completed to the bottom of the shore shaft which is at the river bank about 1,360 feet from the pumping station. From the shore shaft, the tunnel will extend under the bed of the river a distance of 3,160 feet, and will terminate in a surface crib of timber, concrete and cut-stone construction.

The population, consumption, and number of miles of pipe in the distribution system and valuation of works are given in an accompanying table by decades.

Bonds outstanding at the present time aggregate $1,029,000. Water rates are very low, as shown in the following schedule, adopted July

Meter Rates—Payable Quarterly.

	Quarterly.
First 30,000 gals	$1.75
All in excess of 30,000 gals	2¼ cts. per M.
Minimum rate	1.75

Assessment Rates.

	Per annum.
For family, household purposes	$2.60
Additional families to first, in same house supplied through same faucet, each family	1.40
Greenhouses—Special rates.	
Private stable, for each horse	1.20
Livery stables, for each horse	1.20
Dray and team horses, each	.60
Cows, each	.60
Stores and offices, from	$1.00 to 12.00
Bakeries, average daily use for each barrel of flour	2.00
Groceries and provision stores, from	$3.00 to 50.00
Saloons, from	6.00 to 50.00
Bar, with faucet, from	8.00 to 50.00
Fish houses, from	6.00 to 50.00
Beer Pump	2.00
Barber shops, each chair	2.00
Slaughter houses—Special rates.	
Hotels and Taverns, in addition to family rate, each room	.60
Boarding schools, from	$4.00 to 50.00
Printing offices—Special rates.	
Butcher stalls, each not less than	3.00
Workshops, for 10 persons or under	3.00
Workshops, for each additional 10 persons	1.00
Boarding Houses, in addition to family rate, each boarder or roomer	.40
Estimated quantities of water each 1,000 gals.	.07
Building purposes, each 1 M. brick	.03
Building purposes, each 100 yards plastering	.05
Building purposes, each perch stone	.01
Building purposes, minimum	.50

Fixtures.

Bath tub, for families, 1st tub	$1.00
Bath tub, each additional tub	.60
Bath tub, public, each tub	4.00
Automatic water closets, for family, 1st closet	1.60
Automatic water closets, each additional	.60
Automatic water closets, for hotels, stores, factories, etc., for 10 persons	2.00
Automatic water closets, each additional person	.20
Rod water closets, not less than	6.00
Urinals, not less than	2.00



The Detroit Water-Works Park, 1903.



The Detroit Water-Works Pumping Station, 1903.

Wash hand basins, for family, each	.50
Wash hand basins, for other purposes, each person	.15
Hose bibb or connection, premises 30 feet front or less	.60
Hose bibb or connection, premises 30 feet to 60 feet	.80
Hose bibb or connection, premises, 60 feet to 100 feet	1.60
Special rates for larger grounds.	
Fountains	$5.00 to 20.00
Street sprinklers, each wagon	50.00

Where there is a waste of water an increase of rates will be made.

The distribution system, at the close of the year ending June 30, 1902, comprised 581 miles of cast-iron pipe in sizes from 3 to 42 inches in diameter, as follows:

Size of pipe, inches.	Total length in feet, to July, 1902.
42	73,379
36	3,602
30	54,494
24	84,587
20	393
18	87
16	53,829
12	37,562
10	163,655
8	324,716
6	1,395,798
4	810,633
3	63,221

The pumping station is not centrally located with reference to the distribution system, lying at the extreme easterly side of the city; and as the supply mains extend nearly 12 miles north and west, the friction losses to the points most distant from the station is considerable. The ground rises gradually, reaching an elevation of about 70 feet above the surface of the river at the extreme north end of the city, in which portion the available pressure for use is very low, not more than 14 to 18 pounds after deducting friction and elevation. For many years, residents in this portion of the city were able to draw water only on the first floor, and in some instances even this was not possible except at certain hours of the night. About 1890 it was the custom to throttle gates in order

to restrict the area supplied and thus reduce the velocity in the mains supplying the upper district, thereby gaining a few feet head, due to the reduced frictional loss, the maximum pressure available at the pumps being 60 pounds only. The system of throttling gates to prevent the flow of water from high to lower territory was elaborated by Mr. Gardner S. Williams, M. Am. Soc. C. E., civil engineer to the Board from 1893 to 1898.

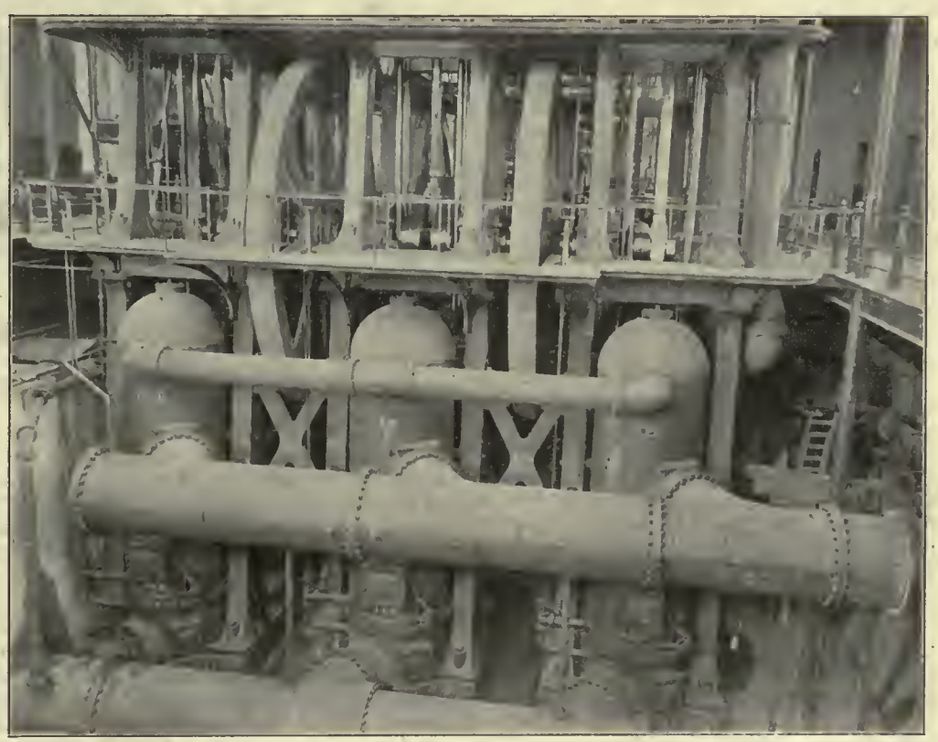


Interior of Detroit Pumping Station Showing Some of the Large Engines.

In 1898 it was decided to divide the city into two systems, each to be supplied by its own pumps and mains. The division was made on a contour line approximately 50 feet above the river level. A new line of 42-inch pipe was laid to supply the upper district; and the two 25,000,000-gallon pumps now nearing completion, belong to the upper or high-pressure system. The lower system, along the river front, is supplied through three 42-inch cast-iron force mains, and the pressure of 60 pounds obtainable from the old pumps is sufficient for all purposes except fire. All buildings above five stories have their own pumping plants.

In order to determine the frictional loss at various points in the system, thirty Crosby pressure gauges are located in the various fire department engine houses throughout the city, and are read hourly by the watchmen in charge, throughout the entire twenty-four hours. The records of these gauges are reported weekly to the civil engineer and furnish data upon which to base the extensions required from time to time. They prove very useful, also, in showing, as they do, the maximum and minimum pressures to be expected during the year in the case of proposed high buildings or use of power for pumps, elevators, and small turbines. Self-recording gauges have been used to some extent, but on the whole have proven of little benefit, partially on account of the constant pulsation which is felt to the farthest extremity of the system at every stroke of the pump. No one thing adds more to the efficiency of the engineering department than the records obtained from the pressure gauges, which are carefully tested from time to time, and their readings averaged and kept ready for immediate use.

The pressure maintained by the engineers at the pumps is regulated by a gauge 4 miles away, in the water office near the center of the city, where a constant pressure of 27 to 28 pounds is maintained. The pressure at the pumps varies according to the amount of water used and the consequent intervening friction in the mains, the range being from 40 to 60 pounds, according to the time of day and the season of the year. The maximum hours occur in the summer when lawn-sprinkling is done, at which time the friction is greatest; but the maximum days usually occur in winter when many taps are left running full to prevent freezing during the entire twenty-four hours.



Water End of One of the Allis Triple-Expansion Pumping Engines.

The Detroit system furnishes an unusually good opportunity to study the phenomena of consumption, there being no reservoir to complicate results, and only one station supplying the entire system. The pumps being of the piston and plunger type, give an accurate record of the amount of water used, and this is recorded for each hour of the twenty-four. The hourly records extend over a period of about ten years, previous to which time daily records only were kept. The consumption recorded at the minimum hour, between 2:00 and 3:00 A. M., during the periods of minimum consumption, which occur twice a year, in the spring and fall show a consumption rate of 88 to 90 gallons per person supplied. Careful experiments, made in districts where the pipe was new and tested before covering so that it was known to be absolutely tight, indicate that the necessary consumption at this hour, both in resident and manufacturing districts, is at the rate of 13 to 16 gallons per capita daily. These results are also substantiated by Deacon meter readings taken some years ago in an old portion of the city. Making allowances for all legitimate use of water, it is safe to say that at least 70 gallons daily per person serves no useful purpose; and, as the present average consumption is 162 gallons per person, the waste amounts to 43 per cent. of the total quantity of water pumped. The rate of consumption during maximum hours occasionally reaches 300 gallons per person, for which the works must be designed. The 70 gallons wasted therefore necessitates an excess capacity in the works of about 23 per cent.

This question of waste is no new problem, neither in Detroit nor other cities. As far back as 1836 bitter complaint was made that the pumps were required to deliver 19 gallons daily per person, most of which, it is alleged, escaped through the leaky joints in the lines of wooden pipe.

A few meters were introduced in 1854 and 1857. It was not, however, until 1888, when the consumption had reached an average of 215 gallons per person supplied that the subject of meters received any serious consideration. At that time a crusade was established to reduce

STATISTICS OF DETROIT WATER WORKS.

Year.	Population.	Miles of pipe.	Million gallons pumped.	Million gallons metered.	Total rates collected.	Value of works.
1810	770	.....	....	....	.....	.....
1820	1,442	.....	....	....	.....	.....
1830	2,222	Few logs	....	....	.....	.....
1840	9,192	No record	....	....	.....	‡$20,500
1850	21,019	No record	....	....	.....	.....
1860	45,619	Wood 27 Iron 39	870	....	49,434.90	690,000
1870	79,577	Wood 67 Iron 52	1,866	....	127,143.61	1,030,372
1880	116,342	Wood 84 Iron 125	5,553	*40	227,452.73	2,751,000
1890	205,876	Wood 10 Iron 351	12,121	626	387,877.73	3,712,000
1900	292,462	571	17,077	3,283	†309,385.22	6,221,000
1903*	330,000	620	....	....	.....	7,000,000

* Estimated. †Rates reduced in 1896 and 1898. ‡ Purchase price in 1836.

the consumption, in which Mr. Leverette N. Case, then secretary of the Board, now manager of the water and gas works at Duluth, took an active part. A corps of inspectors was organized, excessive waste at the pumps was cut off, and the installation of meters begun. The waste at the pumps was considerable, owing to the fact that they were allowed to run full capacity even during hours of minimum consumption, the excess being returned through waste gates into the pump wells. The reduction in per capita consumption from 215 gallons, 1888, to an average of about 130 gallons, 1898, can be credited approximately as follows:

	Per consumer daily.
Saving due to meters, about	45 gal.
Economy at the pumps, about	30 gal.
Work of inspectors, about	10 gal.
Total reduction	85 gal.

The meter system was gradually extended to cover all manufacturing and business consumption; and, in 1894, about 1,000 private houses were metered. They demonstrated that a considerable saving could be effected; but the extension of the meter system to cover all domestic consumption, could not be defended upon financial grounds, owing to the exceedingly low cost of furnishing the water—in fact, it would be difficult to find a city where the financial benefit of the meter system would be less than in Detroit, owing to the unlimited supply, comparatively low pressure, and economical pumping machinery. The policy of metering all manufacturing, business, and public supplies, is still continued, and all villages lying outside the corporation limits are supplied by meter, paying double rates for water consumed. The increase in per capita consumption from 130 gallons in 1898 to 162 in 1902 is not believed to be due to retrenchment in the setting of meters, as the percentage of metered water within the city has constantly increased; but may be in part accounted for by the reduction in rates made in 1897-8 and in part by corrected population returns based on the U. S. Census of 1900. A 42-inch Venturi meter has been placed in the force main supplying the upper district. The village of Highland Park is supplied through a 12-inch Venturi meter; and the villages of Hamtramck, Woodmere, Delray and River Rouge are supplied through batteries of 4-inch and 6-inch Thomson meters. On June 30, 1902, there were 59,225 service connections in use, of which 5,738 were metered. About 2,200 services are added yearly. The total water pumped last year was 18,333,104,700 U. S. gallons, distributed in the following manner:

	Per cent.
Unmetered city consumption	76.14
Metered city consumption	23.02
Supplied to villages by meter	.83

The present valuation of the works is approximately $7,000,000; the pumping station and real estate, $2,600,000; distribution system, $4,280,000; meters, $100,000; tools and materials on hand, $120,000.

Although unfiltered, the quality of water supplied is the very best, and the typhoid death-rate lower than in most cities which have purification works. The death-rate from this disease averages only 16 per 100,000, while the death-rates in Chicago and Cleveland are about 80 per 100,000. The following table shows maximum and minimum results of chemical and bacterial examinations extending over a period of one year:

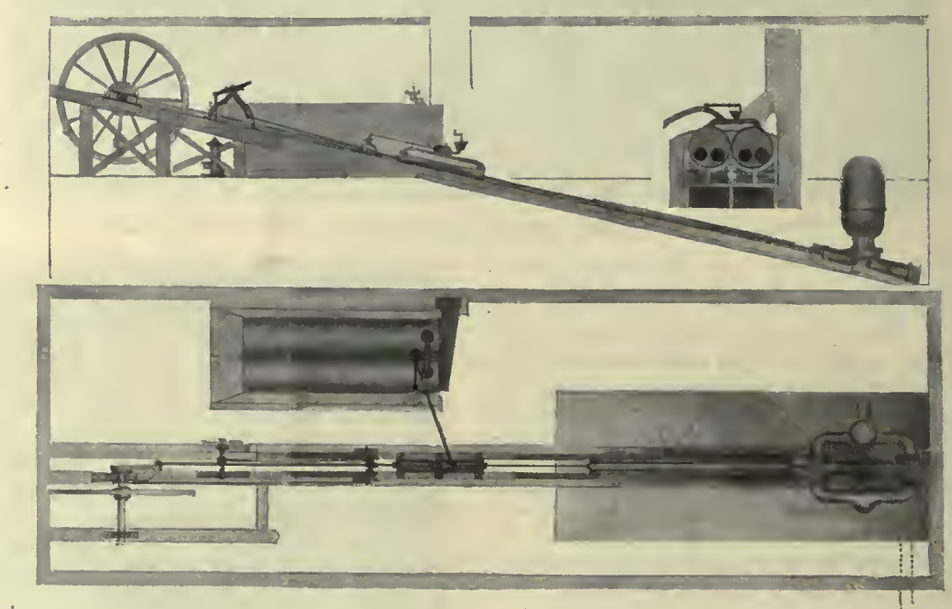
Description.	Parts per million. Minimum.	Maximum.
Appearance	Clear	Slightly turbid
Total solids	103.0	118.2
Volatile matter	34.8	44.4
Non-volatile matter	58.6	79.6
Free ammonia	.006	.028
Albuminoid ammonia	.074	.126
Nitrogen as nitrates	.082	.230
Nitrogen as nitrites	.000	.000
Chlorine	2.50	3.15
Oxygen absorbed in 15 min.	.28	.48
Oxygen absorbed in 4 hours.	.72	.96
Bacteria per cubic centimeter	26.	398.
Growth in .2 per cent. carbolic-acid gelatin	None	None

Notwithstanding the purity of supply, Detroit has not been entirely free from epidemics of those diseases which are considered as water-born. In 1832, cholera broke out among soldiers en route to Chicago for the Black Hawk War. The vessel containing them was anchored for a time at Belle Isle, and many diseased soldiers finally landed at Mt. Clemens, 25 miles from the city, some of them finding their way to Detroit. In addition to the soldiers who died, the epidemic resulted in the death of ninety-six citizens. Two years later, cholera again broke out and seven per cent. of the population died within a month. There were also outbreaks in 1849 and 1854, during the heights of which there were thirty-five to forty deaths per day. It is doubtful whether these epidemics could be traced directly to the water supply. There has never been a serious epidemic of typhoid fever, although certain cases have been clearly traced to pollution coming from cities above Detroit, and especially to the dredging out of Black River at Port Huron, 60 miles away.

The water is suitable for industrial purposes, causing slight though not excessive scale. The following table gives the mineral analysis in grains per U. S. gallon:

Sodium chloride (NaCl)	0.288
Sodium carbonate (Na_2CO_3)	0.069
Potassium chloride (KCl)	Trace
Calcium sulphate ($CaSO_4$)	0.639
Calcium carbonate ($CaCO_3$)	3.122
Magnesium carbonate ($MgCO_3$)	1.506
Silica (SiO_2)	0.093
Alumina (Al_2O_3)	0.198
Ferrous carbonate ($FeCO_3$)	Trace
Total mineral matter	5.906
Organic and volatile matter	2.123

The structural records of the Board are kept by the engineering department organized by Mr. Gardner S. Williams in 1893, prior to which time much reliance was placed in the memory of certain foremen who, unfortunately, had a habit of dying at inopportune times; the records could not, therefore, be said to be of a permanent nature. There is now a detailed drawing of every street intersection, some 5,000 in all, showing the location of the water mains and all other construction, such as conduits, sewers, drains, gas pipes and works of private companies. Sketches are made of all underground work exposed from time to time, and the information posted on the drawings as rapidly as possible. These records are therefore becoming more complete and valuable year by year, it being the policy of the department to record only such construction as is absolutely known to exist—on the principle that it is better not to know so much than to know so much that isn't so. The system of records is supplemented by a complete card index; and it is believed that few systems, outside of the Metropolitan Water Board, are so well organized in their engineering departments.



Reproduction of Old Drawing of Pump and Boiler Used in 1831.

The fire department of the city is managed by a separate board; but although it has an auxiliary supply consisting of a system of steel pipe lines to which powerful fire boats may be attached at various points along the river front, its main supply is obtained from the water-works system. At the close of the last fiscal year there were in service 3,613 fire hydrants and 561 reservoirs. Fire engines are used and a record is kept of the quantity of water used at each fire; although considerable, amounting to about 16,000,000 gallons per year, it is a small amount compared with the normal consumption. All the water used to put out fires in a year is less than one-tenth of one per cent. and could be pumped in sixteen hours by our smallest pump.

This sketch would not be complete without some mention of the water-works park. The

grounds, some 70 acres in extent, surrounding the pumping station, are maintained as a public park, the finest in the city. The handsome and much used Hurlbut Branch of the public library, which forms an attractive feature of the park, is remodeled from the old oil tank formerly used for the storage of fuel oil. There is a pear tree in the park which measures 9 feet 4 inches in circumference 3 feet above the ground. Tradition says that the Jesuit priests who visited the Indians some 200 years ago brought pear seeds from France, which they planted along the shores of Detroit River, always placing eleven in a cluster and one by itself a little to one side to represent Judas; when the grounds were purchased it was necessary to remove all that remained of the cluster, and now "Old Judas" keeps his lonely watch, the last of the twelve.

In the history and development of the works, no one man has exercised so great an influence as Chauncey Hurlbut. He was connected with the business interests of Detroit when it was a mere village, having a population not exceeding 3,000; and it was his privilege to witness the development from small beginnings to a city of 170,000. Having sustained loss by fire in 1831, he was active in the formation of the first fire department, and organized the Hurlbut Hose Company No. 1, June 6, 1837. He was chief engineer of the fire department from 1837 to 1842, at a salary of $100 per year. A letter written by him at that time well illustrates the public spirit and high ideals of the man:

"Detroit, March 3, 1841.

"Jno. Owen, Esq., Pres. Fire Department of the City of Detroit.

Dear Sir:—Enclosed you will find a warrant on the City Treasurer for $100 which I received for services as Chief Engineer. Being a believer in Franklin's doctrine that no man should grow rich by emoluments of office, I remit the warrant to you for the benefit of the Fire Department.

"Very respectfully yours, CHAUNCEY HURLBUT."

He served as president of the fire department in 1843. He was secretary of the Detroit Mechanics' Society in 1835, and the library of the Society was still given a place over his store on Woodward Avenue in 1873. He was one of the first directors of the Merchants' Exchange and Board of Trade organized in 1847, also of the Second National Bank opened in 1863. He served several terms as alderman from the second ward of the city, and was appointed on the Detroit Sewer Commission in 1857 for one year. His greatest public service, however, was connected with the development of the water works. His connection with that enterprise, although not continuous, dates from March 1, 1840, when he was appointed to serve on a committee on "new hydraulic works." He was a member of the Board of Water Commissioners from 1861 to 1863, was again appointed in 1868, and was made president in 1873, which position he retained until his death in 1885 at the age of eighty-two years. He was especially interested in the plans for enlargement when that ever-recurring subject came up for consideration in 1870; and it was largely due to his energy and foresight that the present location of the pumping station was selected, and that the plans adopted at that time were laid out on a scale which admitted of extension to meet the requirements of a growing city. His confidence in the prosperity of Detroit was absolute, and his policy accordingly broad in its conception. Having acquired a comfortable fortune, he practically gave up his own business, and devoted his entire time and the experience of his ripest years to the development of what he considered Detroit's greatest need. In the face of bitter opposition, he carried his plans to successful issue by sheer force of will; and in later years the correctness of his judgment was acknowledged even by his enemies. A man of large ideas, he did not forget details, and applied to the management of the works those principles which had made his own business a success, reducing the operating expenses to the lowest possible amount. His fortune was left in trust for the permanent maintenance of the water-works park and a public library in connection therewith. The Hurlbut memorial gateway was erected by the Board at a cost of $30,000 in appreciation of his services.



The Hurlbut Memorial Gate of the Detroit Water Works.

Management of Pumping Stations.

By Kenneth Torrance, M. Am. Soc. M. E., Chief Engineer, Ridgewood Pumping Station, Brooklyn.

In the management of pumping stations on which the supply of water for large or small communities depends, the principal object to be sought must be the uninterrupted supply of water. When one stops to think of the consequences which would follow to a city of any size should the water supply suddenly fail, it is readily seen that water is the most essential of all the various articles required for daily life. In some fortunate cities they always have considerable water supply in reserve by being supplied from large storage reservoirs, but most of our largest cities have to depend on the continuous operation of pumping stations.

Large bodies move slowly, and this is especially so in regard to large water works plants. Usually, no matter how large the plant is when planned and work started, it is just about equal to the demand when completed and it must then be operated to its maximum capacity while new and larger plants are designed and built.

In keeping up a continuous supply, the most important thing is eternal vigilance, and second to that is system. Every detail should be watched, and, as far as possible, the spare engines or boilers must be in such condition that should an accident occur to those in operation, others can be started at once. If the plant contains spare machinery, it is best to run the engines and boilers in turn for certain periods at a time, all the most important repairs, etc., being done at once on shutting down, so as to be prepared for emergency.

In this way a smaller force can be used, the work being done to the best advantage. If we could only plan out the work ahead, shutting down each engine or boiler at certain intervals, sweeping tubes, washing, cleaning and testing boilers, examining feed and air pumps, overhauling water plungers and valves, packing, etc., all these and other matters being taken up on regular days in turn, it would simplify matters immensely, but it is the unexpected that always happens and no sooner does the system get in fair order than something is sure to occur and several cogs are slipped before things are moving smoothly again. Most pumping stations, save in very small cities, run continuously day and night. The most satisfactory system is where there are storage reservoirs large enough so that the pumps can be operated at constant speed and not be dependent on the consumption, for in the latter case engines must be shut down and boilers banked during the small hours of the night and then started up again when the large consumption of early morning comes. The present trend of the times is certainly toward an eight-hour working day, and this division works very nicely in the continuous running of stations as it gives three watches in each day. This usually divides as follows: The morning watch, 6:00 A. M. to 2:00 P. M.; the afternoon watch, from 2:00 P. M. to 10:00 P. M.; and the night watch, from 10:00 P. M. to 6:00 A. M. These three watches are devoted to those who are immediately connected with the running of the machinery, engineers, oilers, firemen, etc. Then there is the regular day watch of from 8:00 A. M. to 5:00 P. M. for those about the station engaged in repairs, cleaning, etc., and duties which can only be done effectively in the day.

Anyone who has had much night work to do will appreciate how unpleasant and wearisome the turning of night into day becomes, and, in the Brooklyn Water-Works, our watches are arranged so as to have each set of men one

week on each watch, the change being made on Sunday. To do this we utilize a fourth watch, called the repair watch, working it out as follows: The regular watch starts in Sunday morning and continues on that watch until the following Sunday, when it comes in on the afternoon watch; it keeps the afternoon watch all that week and on the next Sunday comes in on the night, remaining on that watch until Sunday morning, when it goes off and does not come back until 8:00 A. M. Monday, on what is known as the repair watch. After one week on repairs they start in again on the regular run Sunday morning.

This system has proved most satisfactory, for, although all the men are not equally good on repair work, yet we have found that the men realize that if they slight any of the work of overhauling or repairs, that the trouble will be apt to come when they are running the machinery and it consequently makes them very careful to do good and faithful work. As stated above, all the men are not equally efficient on all kinds of work, and it therefore becomes necessary to so plan the work ahead that such work will be taken up each week as that particular set of men are best qualified to perform. As far as possible it is best to divide the regular work up so that each man or set of men will have stated and definite duties to perform and who can therefore be held responsible for the satisfactory performance of their work.

It is not possible for the chief engineer to be present all the time, and as there should be a responsible head, the most capable engineer on each watch should be put in charge and held responsible. Of course the engineer must have charge of all the machinery, including boilers, but in a large plant it is always well to have a head fireman or water tender, who has a general charge of the fire-rooms, watching the feed water and seeing that the fires are properly handled, so that the best results can be obtained. Next in importance to continuous operation, is high economy and efficiency. We all know that it is possible, by careful training, to get marvelous speed from a horse or man for a short distance, but such speed cannot be maintained continuously. So, also, it is possible to get the highest results from engines and boilers when tuned up for official tests, but almost impossible to keep up to the high work in regular monthly runs.

The engines should not fall off to any extent in efficiency, but there are so many small connecting links between the energy in the coal and that transmitted to the water, that the failure in any one will materially affect the whole. It is astonishing how much steam can be wasted in small leaks from joints, stuffing boxes or defective valves. When a badly packed stuffing box once begins to leak, it is impossible to stop it by tightening up the gland, even when putting on an excessive strain, and it is often impracticable to repack without shutting down some machine which at the time cannot be spared.

These small leaks are wasteful and most annoying, and when any steam piping, no matter how small, is to be put up, the greatest care should be taken to see that it is properly drained, for any water pocket will sooner or later cause a leak. Much steam is often lost through leaky valves, and it is safe to say that any valve which is used as a throttle valve on high steam pressures, is bound to cut out in short order. It is therefore our custom to use two valves, one which is either full open or tight shut, and the other used as a regulating valve. This may be expensive in valves, but pays in the end, especially when the labor of replacing a defective valve is figured in.

It is much easier to detect a large than small loss and efficiency is usually lost by many of these small leaks. Of course every one realizes that the hotter the feed is returned to the boiler the less coal it will take to evaporate it into steam, and yet we often notice exhaust steam blowing out into the atmosphere while the feed water is not more than 150 degrees.

The number of fuel saving devices is legion and if any one should try every device offered him by plausible salesmen that agree to put in their fuel savers without cost unless a saving of from 10 to 50 per cent. is accomplished, would spend his time in doing nothing except making hair splitting tests and changing his plant every few weeks. Many of these fuel saving schemes have merit and give most satisfactory results, but there are also many that it is far cheaper to let some other man experiment with. The greatest care should be taken in looking thoroughly into any device that is offered, especially if the guarantee or claim appears to be excessive, and in any case it is always best to see the scheme in actual operation in a similar plant. As a rule, when a test is being made on one of these devices, the contractor will prove his claim by the aid of an expert fireman, who could in any case save 10 or 15 per cent. of the fuel by careful firing. It is therefore always best in these cases to insist that the tests be made by the regular working force, allowing the contractor to have a representative on the ground.

When all is said and done, however, the real test of efficiency is the cost of pumping a given quantity of water a definite height, usually 1,000,000 gallons one foot high, and this is largely dependent on the cost of the fuel. Other things being equal, the fuel costing the least per ton will be the cheapest, providing, of course, that it can be burned. This does not mean that of two coals of nearly the same price the better grade is not the cheaper, but when one can manage to burn with fair success a really cheap fuel, it is usually found to cost less per unit of work turned out. Usually the cheap coal leaves a large percentage of refuse, ash and unconsumed coal, and where it is expensive to remove this refuse this expense must be figured in. It sometimes occurs, too, that with a good grade of coal one or two firemen could do the work, whereas with the poor grade two or three would be required, and this must also be taken into consideration. It is usually possible to save money by using a bituminous or semi-bituminous coal, but the smoke question enters into this consideration, and if the plant is owned by the city, any smoke, no matter how little, is cause for complaint. In the Brooklyn Water-Works, during the year 1895, we succeeded, by the substitution of cheap buckwheat and pea coal for the larger-size anthracite, in cutting the cost of pumping from over 2 cents to under 1½ cents per million gallons one foot high. Of course we used more coal in doing this and the duty fell off considerably, but the true test is the cost in dollars and cents and the saving was large. The coal strike of last year has changed all the coal prices and at the present time it is very difficult to get a low-priced coal that is not of the most inferior quality. There is also a chance for economy in the use of oils, and it is often possible to obtain a good and satisfactory oil which, although slightly more is used, yet the excess will not make up the difference in price. In oils, however, one must be very careful, for a poor oil may cause great loss by cutting cylinder and valves or gumming the piston rings, and therefore largely increasing the friction of the engine. The question of necessary labor to care properly for the machinery is a most important one, and requires much thought. When everything is working smoothly and there is no hitch or trouble, the needed attendance is small, but it is the unexpected that must be guarded against and the regular force should, in important stations, be large enough to keep things going and at the same time attend to any sudden accident or difficulty. It is curious how one small trouble will lead to more and larger ones. It seems that just as soon as the regular order of things is changed, everything goes amiss and a strong and prompt hand is required at once to straighten matters out.

The fire-room is where most of the money in running a pumping plant is spent and should receive the closest attention. The personal equation enters into the case here more than anywhere else and a good man, who can and will work the fires intelligently, is worth his salary many times over. The great trouble with the ordinary firemen is that they follow each other like a flock of sheep. One man will start to cover or slice his fires and immediately all the rest will jump up and do the same thing. This is true in cleaning the fires and unless there is a good head fireman in charge the steam is almost sure to drop several pounds when the cleaning of the fires is started. Firemen are also fond of shoveling into a furnace all the coal they can possibly get in and then sitting down to watch it burn. Then, too, some firemen will open the fire door and then look around for the shovel or slice bar, regardless of the fact that cold air is rushing in over the fires and cooling everything off. The boilers should be kept as clean as possible outside as well as in, and should be blown, tubes swept and cleaned at regular intervals, the frequency depending on the quality of feed water and other local conditions. Great care should be taken to examine carefully the surface and main blow off cocks, as these are very apt to leak and the loss of this water after having been heated up is certainly expensive. Our practice in this matter is to use a heavy gate as well as a plug cock and we think the expense justified.

The proper keeping of the records is a most important part of the work of any pumping station, for if we do not know exactly what we are doing and what is the cost, we will be unable to tell whether the work is being done cheaply and how it compares with other plants.

The basis of computations in the Brooklyn Water-Works is, as previously stated, the cost of pumping one million gallons one foot high. This is figured on the coal consumed, the labor, supplies and repairs, and the interest and sinking fund, and the records are so kept that these charges can be readily determined.

To arrive at these results the first thing to be determined is the work of the engines. Small log books are therefore kept by the running engineer, in which are entered hourly the engine counter, the strokes made, the steam pressure, the water pressure, depth of suction, vacuum and temperature of feed, etc. At the end of each watch the coal as weighed in by the coal passer and consumed during the eight hours' run is entered as well as the refuse from the furnaces. The oil and waste used during this time are also noted. These items are daily transferred to the large regular log books which are kept in the office. From these data the total work of the engines is figured up at the end of each month and at the same time the duty or total foot-pounds of work per 100 pounds of coal. The total cost of the coal, the total salaries and the cost of supplies

and repairs per month are also kept accurately and used to figure the cost per million gallons. The labor account is kept by means of time cards for each man and the supplies are charged up by the storekeeper when issued. The interest and sinking fund charges are made up by the chief engineer of the department and reduced to a monthly basis. These figures are worked out for each engine, copied on large record sheets together with the daily records and sent down to the main office of the department, the original copy with the work and figures being filed at the station.

In a large station containing many pumping engines these records take considerable time and trouble to keep up, but when the work is well and carefully done the results obtained should be of value.

The general supplies required for pumping stations are varied in the extreme and great care is needed in selecting the kind and quality best suited for the purpose. Many articles deteriorate by age, especially rubber goods and it is not easy to keep the stock up and yet not have too large a supply on hand. This is especially true in municipal stations, where it is apt to take several weeks before the goods ordered are received and the tendency is therefore to keep a large stock ahead.

In providing supplies for engines and boilers, it is the best economy to get the very best, and also, once having determined the best, to stick to that. This is true because the labor of putting in a poor valve or fitting is often more than the article itself is worth, and in any case is just as costly for a poor as for a good one. It is also the best practice to standardize everything as much as possible so that the different sizes and kinds required in stock shall be as few as possible. Then, too, in substituting a new for an old article there is less trouble. Any one who has to attend to the ordering of supplies has to keep careful watch for the "just as good" and "equal to" substitutes that are offered and delivered. This is difficult, for it is not always easy to prove the inferiority of an article without a trial, and a poor article once used causes much trouble.

The cities are continually growing and consequently pumping stations have to be enlarged. In making these additions future enlargements should always be figured on. If proper consideration is given to this, much money would be saved, for if we simply add an engine or a boiler to those already in operation, it is often possible to run with the same force or with a very slight increase, whereas if we place the machinery in separate rooms or buildings, practically a complete new force will be required. There is also often much time and fuel lost in changing from one battery of boilers to another, which could have been avoided by a little forethought.

One of the most difficult parts of managing a pumping station is the handling of the men, to be just and neither too easy nor too severe. It is certainly very annoying to have a man fail to report for duty, causing the man he should relieve to do double duty, or else causing another man to be brought in when his services were required at other work. Some men seem much more liable to sickness than others, and it is often difficult to determine whether the sickness is legitimate or not. We have found that having a regular physician who will call on anyone who is absent on account of sickness and report the facts in the case to those in authority, has a very beneficial effect. These cases are the exception and not the rule, and it certainly pays to be as considerate as possible, for the work is then done cheerfully and well.

A Very Tall Steel Water Tower.

A general description of the very complete plant of the New York Shipbuilding Company, at Camden, N. J., was printed in The Engineering Record of January 3, 1903. These works are supplied with water under about 200 feet head for automatic sprinkler and other purposes from a steel tank on a tall tower built by the Chicago Bridge & Iron Company, Chicago, Ill. This company has for some years made a specialty of the design and erection of elevated water tanks with hemispherical bottoms, supported on towers consisting usually of four posts with very simple connections to the tank at the top and suitable sys-



New York Shipbuilding Company's Water Tower.

tems of bracing. An abstract is given below of the company's standard specifications.

Excepting a few details, principally the connections of the columns to the tank, the structure at Camden is of the standard design of the Chicago Bridge & Iron Company, but is noteworthy for its great height, which it is claimed exceeds that of any other structure of this class. The tank is a cylinder 33 feet 6 inches high with a hemispherical bottom of 13 feet radius, the lowest point of the bottom being 200 feet above the ground. It is surmounted by a conical roof 9 feet 10 inches high, above which there is a flagpole 48 feet high, so that the total height of the structure above the ground is 300 feet. The general appearance of the tank and tower is shown by the accompanying view and one of the diagrams gives its principal dimensions.

The capacity of the tank is 150,000 gallons. It is 26 feet in diameter, and made of five courses of four steel plates each, the bottom course being 6 feet 10 inches high and the others 6 feet 8 inches. The lowest course and the hemispherical bottom are 5/16-inch thick. Four courses are ¼-inch thick, and the roof is of plates weighing 7½ pounds per square foot. The horizontal seams in the tank, and the seams in the roof are single riveted. The vertical seams in the first two courses are triple riveted, in the third course double riveted and in the fourth and fifth courses single riveted, the rivets being ¾-inch diameter in the lowest seam and ⅝-inch in the others. All joints are lapped and the corner of one plate is scarfed where three plates meet.

The roof is composed of 26 plates and overhangs the side of the tank about 2½ feet, being finished with a fascia plate and an eaves angle. It is connected with the top of the tank by means of 1½x2½x3/16-inch bent plates and 460 5/16-inch rivets. There is a 20-inch square opening in the roof about 1 foot from the side of the tank, covered by a door. The plates are reinforced on the under side around the opening by three 1½x1½x⅛-inch angles. In line with the door is an opening through the overhang of the roof over a ladder on the side of the tank.

The flagpole has a total length of 58 feet and projects 48 feet above the apex of the roof. It consists of four sections of gas-pipe respectively 4½, 4, 3½ and 3 inches in size, spliced by sleeves 1 foot 9 inches long, is pierced by 13/16-inch holes 1 foot apart for ladder rungs and surmounted by a 10-inch hollow cast-iron ball. At the apex of the roof the pole passes through a ⅜-inch bent plate collar riveted to the roof. There is a lead joint between the column and the pipe, and two ¾-inch bolts pass through both, at right angles. At its base, which is at the level of the top of the tank, the pole is fastened in a similar manner to two 3/16-inch plates 39 inches in diameter, as shown. Between the outer edges of these plates are inserted the ends of 48 ¾-inch rods which radiate to the side of the tank. These rods are bolted to the plates and to the tank and support the pole.

The hemispherical bottom is composed of one circular dished steel head, at its very lowest part, 115 inches in diameter, 5/16-inch thick, and twelve 5/16-inch curved special plates with double riveted seams. There is only one row of rivets in the dished head. All rivets are ¾-inch diameter. The bottom is attached to the tank by one row of ⅞-inch rivets 2 feet 4 inches below the seam between the lowest and the second course of tank plates. By means of this same row of rivets a ring of 3½x6x½-inch angles, with the 6-inch leg horizontal, is attached to the side of the tank. The plates of the lowest course thus extend 4 feet 6 inches below the junction of the bottom with the tank and, having two 3x4x⅜-inch flange angles on their lower edges, form a circular plate girder for the support of the tank. To this girder are riveted on the outside 24 pairs of vertical 4x3x5/16-inch angles 4 feet 4 inches long fitted to bear between the horizontal legs of the top and bottom flange angles. These pairs of angles are spaced 3 feet 4⅞ inches center to center, in alternate pairs, being placed back to back and 6 inches apart, the former coming at the twelve points of connection for the three-pronged tops of the four posts of the tower, as shown in the plan of the balcony girder. Back of these angles, on the inner side of the vertical girder, are pairs of 4x3x⅜-inch

angles 2 feet 3 inches long, as shown in the section.

To the horizontal legs of the bottom flange angles of this circular girder are riveted horizontal 5/16-inch plates forming the floor of the balcony around the bottom of the tank and at the same time doing duty as the web of the horizontal circular girder, to which are attached, by means of connection plates and angles, the tops of the tower posts, as shown by the detail drawings. These plates are about 2½ feet wide, and to their outer edges is riveted a railing about 3 feet 4 inches high, of 3½x2½x¼-inch angles spaced about 8 feet apart and latticed with 1½x¼-inch bars. The floor plates are pierced by numerous 1-inch holes for drainage.

The tower consists of four battered posts with three-pronged tops and six sets of horizontal struts dividing the tower into five stories below the level at which the posts begin to branch. The stories decrease in height from 42 feet 9 inches at the bottom to 34 feet 9 inches at the top and each story is X-braced with pairs of diagonal tie rods. The posts rest on four stepped concrete blocks containing about 65 cubic yards each, 13 feet deep, 11 feet 10 inches by 14 feet 7 inches on the bottom, having caps made of equal parts of sand and cement, 5 feet square and 2 feet thick. The tops of these foundations are about 48 feet apart on centers. In the bottom of each footing is embedded a cast-iron washer 30x12½ inches and 1 inch thick with a longitudinal rib 6 inches deep and 1 inch thick, on its under side. Cylindrical nut seats 17½ inches apart are formed in the rib so that the two 2¼-inch anchor bolts take bearing at the bottom of the rib and extend through it. One pair of diagonally opposite posts are made with sliding seats to allow for temperature movements, while the other posts are bolted rigidly to the foundations.

Each post is made of two 15-inch channels, of the weights shown on the diagram, latticed on one side and having 17¼-inch wide cover-plates on the other side. The horizontal struts consist of two pairs of angles back to back, latticed, and are connected to the posts by bent jaw plates. At the top of the fifth story each post is divided into three prongs so as to give twelve points of support. This construction differs from the standard design of the Chicago Bridge & Iron Company, in which there are only four points of support, the top of each post being connected by vertical connection angles to the side of the tank.

Access to the tank is had by climbing one of the latticed posts of the tower to a point about 20 feet below the balcony, from which point a ladder extends to and through the balcony floor. From the balcony a second ladder riveted to the tank rises to the hole in the roof, through which a man can get on the roof or enter, through the door, into the tank.

The inlet and outlet pipe to the tank is a 12-inch cast-iron pipe, with bell and spigot joints, rising from a cast-iron foot elbow with a flat base plate resting on a concrete block 4½ feet in diameter and 1 foot thick. The lower part of the pipe and the elbow are enclosed by a hollow concrete pier 3 feet 6 inches in diameter outside with walls 1 foot thick rising 1 foot 6 inches above the surface of the ground. This pier serves as the foundation for the frost jacket which encloses the vertical pipe. The pipe is connected to the lowest part of the hemispherical bottom of the tank by means of a standard expansion joint, as shown in the detail. The frost case is 2 feet 6 inches in diameter and formed of 3/16-inch steel plates reinforced at intervals of about 10 feet by 1¼x1¼x3/16-inch angles riveted to each edge of each plate so as to form horizontal flanges by means of which the successive courses of plates are riveted together. In the plane of each set of horizontal tower struts, excepting the bottom one, the pipe is braced by means of 2½x⅜-inch pipe straps and four ⅞-inch tie rods extending from the pipe to each post of the tower. Besides the connection for the inlet and outlet pipe the bottom of the tank is tapped as shown for a 1-inch and a 4-inch pipe. These pipes are used for steam to prevent freezing and for blow-off, respectively.

The estimated weight of the tank full of water is 1,330,000 pounds. The load on the circular girder is assumed to be 16,220 pounds per linear foot, and the span between supports is reduced to 6.8 feet by pronging the tops of the posts. The Chicago Bridge & Iron Company's

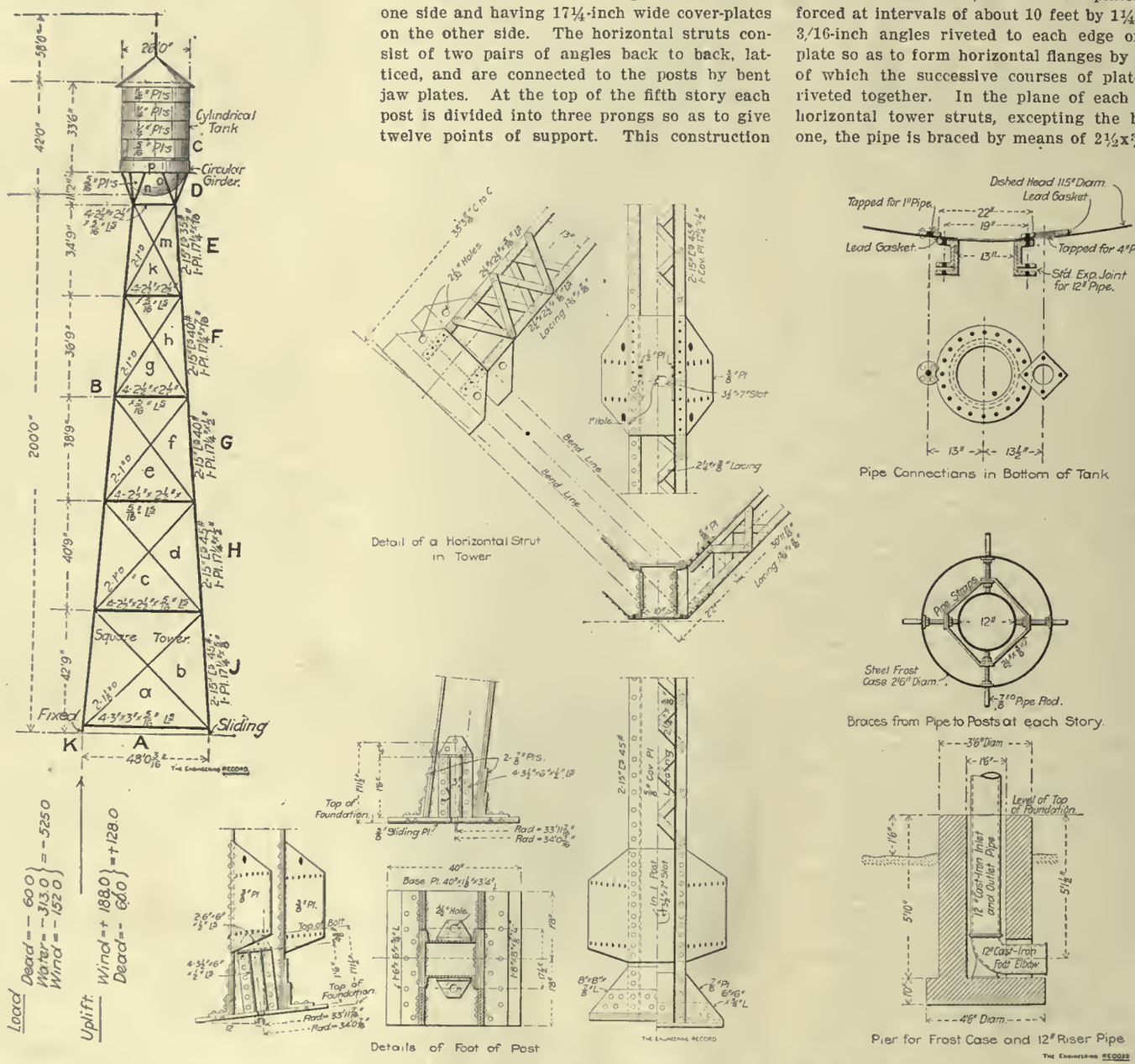
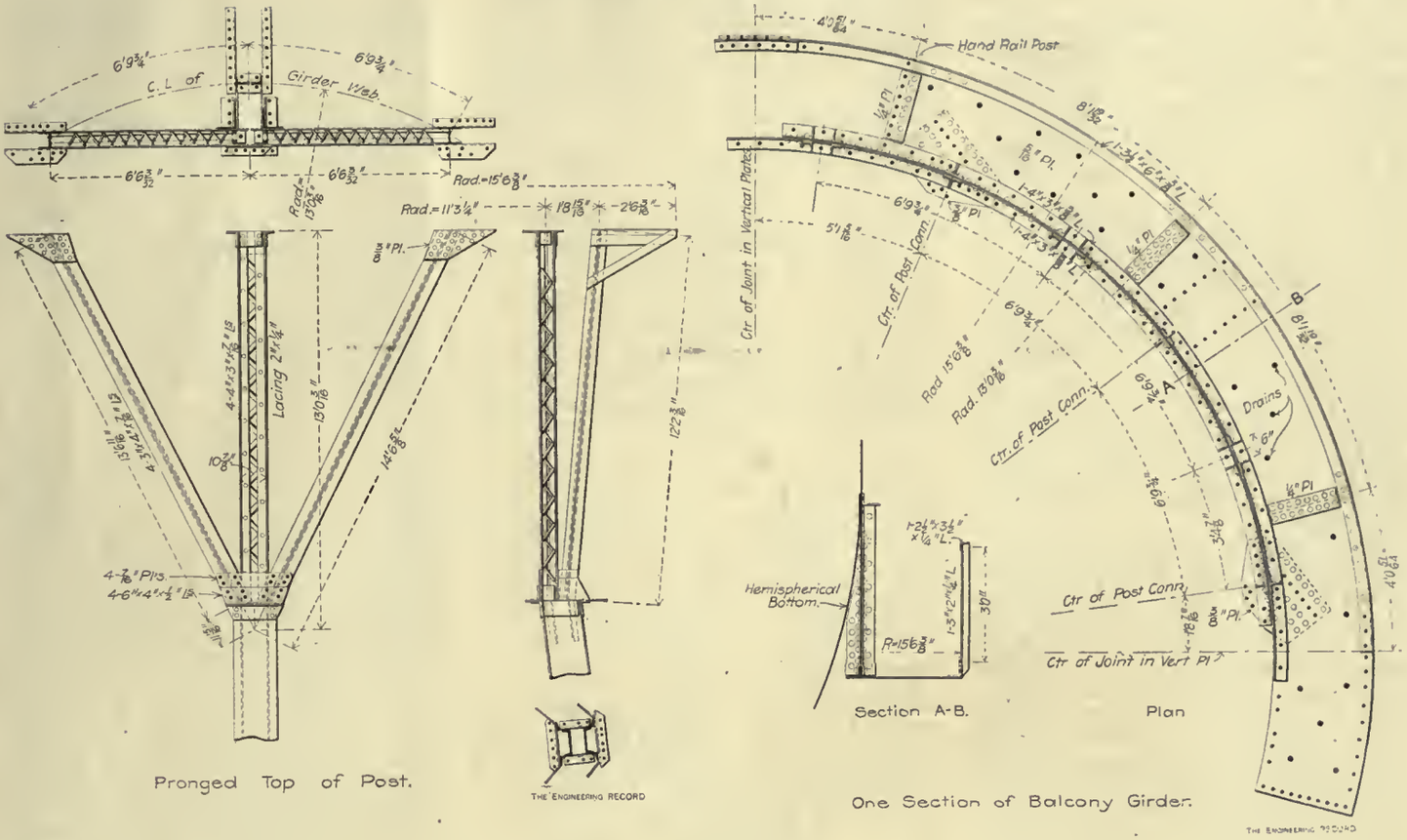
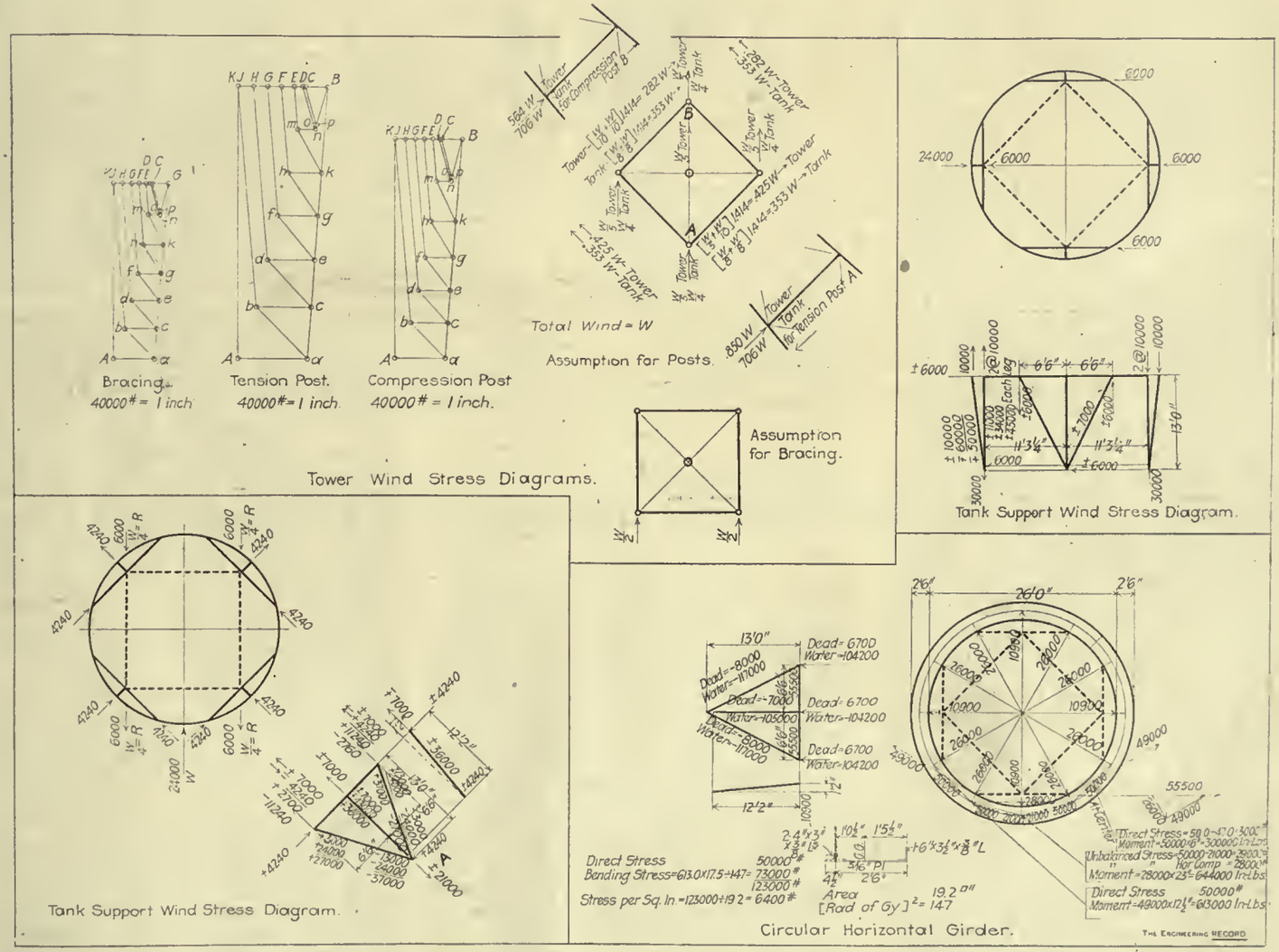


Diagram and Details of the New York Shipbuilding Company's Water Tower, at Camden, N. J.





Stress Diagrams and Details of Supports, New York Shipbuilding Company's Water Tower, at Camden, N. J.

Designed and Built by the Chicago Bridge and Iron Company.

engineers do not believe that the pronging out of the posts makes as substantial a piece of work as carrying the posts up to connect directly to the tank, being convinced that it is practically impossible to secure uniform loading over the twelve points of support. Extracts from the standard specifications according to which the tank and tower were constructed follow.

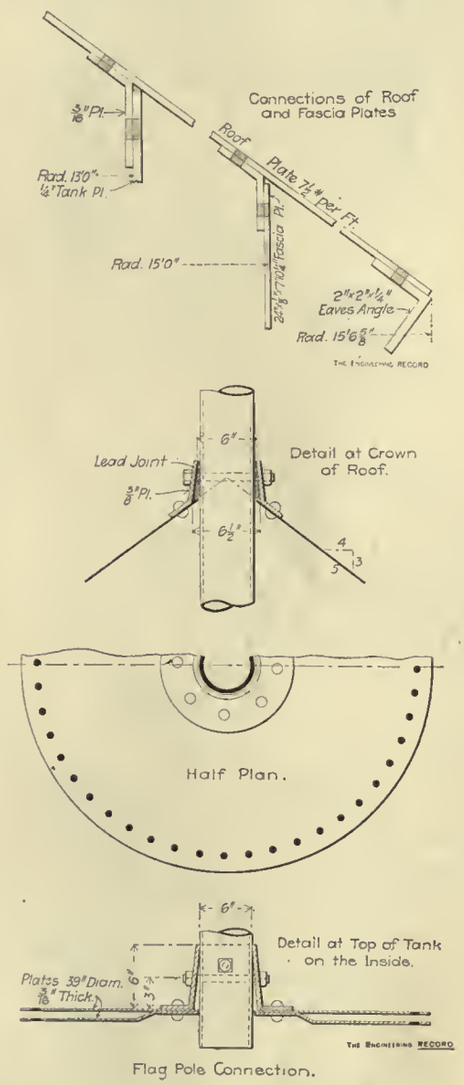
"All metal, except rods, which require welding or forging, will be soft steel. All tank plates and principal parts of main posts shall be made by the open-hearth process. Other steel may be either open-hearth or Bessemer. Rivet steel shall show an ultimate strength of from 48,000 to 58,000 pounds per square inch; elastic limit not less than half the ultimate strength; elongation, 26 per cent.; soft steel, ultimate strength 52,000 to 62,000 pounds, and elongation 25 per cent. In open-hearth steel made by the acid process, the phosphorous limit shall be .08 per cent.; by the basic process, .04 per cent.

"The structure shall be proportioned for its own weight, the weight of water in the tank and a wind pressure of not less than 30 pounds per square foot over half the diametral plane of the tank and 200 pounds for each vertical foot of tower. Wind forces will be assumed in any direction, and members must be proportioned for the maximum stresses. For members not exceeding 90 radii of gyration between supports 14,000 pounds per square inch compression is allowed, and for greater lengths the allowed unit stress equals 20,300 minus 70 times the length divided by the least radius of gyration, both in inches, no main post will exceed 100 radii of gyration in length, and no other strut exceed 150 radii, or such length that the fiber stress due to bending from its own weight exceeds 4,000 pounds per square inch." Other unit loads conform to good modern practice.

"Anchor bolts shall always be provided. No plates less than ¼ inch thick and no shape weighing less than 4 pounds per linear foot shall be used, except in roofs and ornamental features. All joints in main posts shall be made above, and as near as practicable to a horizontal strut. Splices are to be made with plates on all sides of the columns. Where the main posts connect to the tank the posts shall be reinforced so that the area of section for a distance of 3 feet below this point shall be equal to 1½ times the area of post." The requirements for riveting and other details not mentioned are up to the standards of practice for first-class structural work.

"The tank is to be made absolutely watertight by calking only. No foreign substance of any description is to be put into the joints between the plates. All bends in steel, except as noted below, must be made cold. *This particularly applies to the formation of tank plates, both the sides and the bottom.* Detail pieces, if necessary, may be bent hot without annealing. If a steel piece in which the full strength is required has been partially heated the whole must be subsequently annealed. All work shall be covered before leaving the shop with one coat of graphite paint thoroughly mixed with pure boiled linseed oil, and a small amount of Japan dryer, except the contiguous surfaces of the plates forming the tank. This portion shall not be painted."

The stress diagrams of the tower, reproduced herewith, show the assumed wind pressure and the method of calculating the stresses without need for comment. These diagrams were made by the engineers of the New York Shipbuilding Company. The structure is a handsome piece of work of its kind and the Chicago Bridge & Iron Company is naturally proud of it. Mr. W. F. Gronan was the chief engineer of the shipbuilding company and Mr. Edwin H. Sapp his principal assistant when the tower was designed. Mr. Sapp is now the civil engineer of the works. Mr. George T. Horton was the engineer in charge of the work for the Chicago Bridge & Iron Company, of which Mr. Horace E. Horton, M. Am. Soc. C. E., is proprietor.



Details of Flag Pole and Roof of Water Tower.

Past and Present Pumping Methods in the Metropolitan Water District of Massachusetts.

By A. O. Doane, Division Engineer, Metropolitan Water Works.

Before the introduction of the Metropolitan water supply, the pumping in this district, which includes the city of Boston and seventeen neighboring cities and towns, was done at seventeen stations, nearly all of small size, and, with the exception of the Boston stations, equipped with low duty pumping machinery. Each municipality had its own plant and almost all had independent sources of supply. As the main pipe lines of the Metropolitan system were completed and connected with the distribution systems of the cities and towns in the district, it was possible to dispense with the Mystic pumping station of the city of Boston and several of the smaller plants, the work being transferred to the large station at Chestnut Hill reservoir, formerly belonging to the city of Boston.

At the beginning of the year 1899 the main pipe system for the supply of the higher portion of the northern part of the district, known as the northern high service district, was nearly completed; but the pumping station on the shore of Spot Pond, which was to supply this district, was not ready for service. Pending the completion of this plant arrangements were made with the water departments of several cities having pumping stations which were available for this work to operate them under the direction of the distribution department of the Metropolitan Water Works, the board to pay all running expenses and keep the machinery in repair. Under this arrangement the water supplied to the northern high service district was pumped at the stations mentioned in the accompanying table, which gives the location of the station and number and capacity of the pumps:

Location.	No. of pumps.	Nominal capacity of each, gallons.
Somerville	1	2,000,000
Medford	2	1,500,000
Malden	2	2,000,000
Everett	1	700,000
Chelsea	2	1,500,000
Revere Water Co., Saugus	1	1,250,000
Total	9	8,950,000

All these stations were equipped with compound duplex direct-acting pumps and nearly all were run condensing. With the exception of the Saugus station of the Revere Water Company, which pumped from driven wells, all the water pumped was taken from the low service pipes of the city in which the station was located, these mains being connected with the Metropolitan low service pipes, and delivered into the local high service pipes which were connected to the Metropolitan main pipe supplying the northern high service district. The pumping stations at Somerville and Chelsea were the first put in operation, and later on the others were put in service as the consumption increased. Owing to the cold weather at the beginning of the year, a large quantity of water was run to waste in order to prevent the freezing of water pipes in houses; later in the year the weather was very hot and dry and a large amount of water was used to sprinkle lawns and streets. Under these unfavorable conditions the consumption of water was unusually large and at times the capacity of all the stations was taxed to the utmost to meet the demand.

Five stand-pipes and three small reservoirs were connected to this system, but owing to the difference in elevations, which varied from 195 to 254 feet above Boston city base, some of the stand-pipes had to be shut off and held in reserve. The reservoirs at Chelsea and Revere, which were much lower than any of the others, were kept in service by regulating the pressure in the main line by means of an ordinary 24-inch gate valve situated a short distance above the branch pipes leading to these basins. The pressure below the valve was that due to the elevation of the water in these reservoirs.

This regulation by means of an ordinary valve was somewhat troublesome when the rate of consumption changed rapidly, as was the case when the infrequent showers fell, stopping the hose and watering carts, but in ordinary running the gate was not touched for days and sometimes weeks at a time.

The stations were operated by the same employes as were in service at the time the plants came under the control of the Metropolitan Water Board. They were untrained in working in connection with other stations, but soon became accustomed to the new order of pumping, and the system worked very smoothly considering the circumstances under which it operated. The telephone was of the greatest assistance in this work, as the pumping had to be done in accordance with schedules, and these

had to be modified frequently and sometimes very quickly in order to meet sudden changes in consumption. The operation of the regulating gate was also directed by telephone. This method of pumping continued until the pumping engine at the Spot Pond station was started in regular service in the latter part of March, 1900, when all the small plants then in service were permanently shut down.

The cost of pumping at the small stations was somewhat high, ranging from $8.68 to $25.74 per million gallons pumped. In most cases the cost of labor was a little less than half of the total expense, the remainder covering cost of fuel, supplies and repairs. The large variation in the cost of pumping at the different stations was due to various causes, such as the size, type and efficiency of the pumps, the difference in the dynamic head pumped against and the method of operation, whether continuous or intermittent. The personal factor was also important, careful attention to methods of firing, use of oil, keeping boiler tubes clean, etc., had a marked effect on the cost of pumping. The duty obtained from the pumping engines at the small stations varied from 25,000,000 to 55,000,000 foot-pounds per 100 pounds of coal, on the basis of plunger displacement with allowance for slip. The dynamic head varied from 76 to 265 feet. The average daily pumpage for 1899 was 6,922,000 gallons with a minimum of 5,707,000 gallons average daily consumption for January and maximum of 8,416,000 in July. On several occasions considerably more than 9,000,000 gallons were pumped in twenty-four hours.

On the completion of the three 35,000,000-gallon Holly pumping engines at the new low service pumping station at Chestnut Hill in October, 1900, the water for the low service district of Boston, which had previously been supplied by gravity from Chestnut Hill reservoir, as well as the supply for the northern low service district formerly handled by some of the pumps at the high service station at Chestnut Hill, was pumped at the low service station. Part of this water was again pumped at the Spot Pond station for the northern high service district. Two small pumping stations, one at Arlington and the other at West Roxbury, pumped small amounts of water for limited areas too high to be effectively served by the large stations. The five stations of the Metropolitan water works mentioned in the second table pump all the water supplied to the district from the Metropolitan works. This table also gives capacities, quantities and costs of pumping for 1902.

Location of stations.	Capacity of pumps, million gals.	Average daily amount pumped, mil. gals.	Cost per million gallons raised to reservoir.
Chestnut Hill, low service.	105.0	76.553	$1.356
Chestnut Hill, high service	66.0	29.852	4.064
Spot Pond	30.0	7.997	4.509
Arlington	1.5	.315	40.769
West Roxbury	2.0	.352	40.554
Total	204.5	115.069	....

The pumping engines in the three large stations are all of the high duty flywheel type. The larger ones are of the vertical triple expansion self contained pattern. The duty obtained from these engines in regular service in 1902 varied from 120,000,000 to 136,000,000 foot-pounds on the coal and plunger displacement basis. By the concentration of the pumping at these stations, the cost of the work has been greatly reduced as compared with the record for the year 1897, when the pumping was done at seventeen independent stations. The third table gives the figures for the years 1897 and 1902.

	Cost of pumping.	Million gallons pumped.	Cost per million gallons.
1897	$122,400.00	12,700	$9.64
1902	105,226.76	42,000.4	2.50

On account of the coal situation the cost per ton of fuel was much greater in 1902 than in 1897. The installation of two new boilers to replace old ones at the Chestnut Hill high service station, the cost of which was charged to maintenance, also increased the cost of pumping for the year. The figures in the table show very clearly the marked reduction in pumping expenses made possible by the introduction of the Metropolitan supply.

The Suez Canal Company's total revenue for 1902 was $20,622,000, an increase over that for 1901 of nearly $772,000. The total expenditure during the past year for operating expenses and for interest and redemption of the Consolidated Coupon Debt and of the capital, according to "The Engineer," of London, amounted to $8,140,600, leaving a profit of $12,481,400.



Locations of Pumping Stations and Reservoirs, Boston Metropolitan District.

The Cement Industry in 1902 is briefly summarized as follows by the Division of Mining and Mineral Resources of the United States Geological Survey: The production of Portland cement amounted to 16,875,506 barrels; that of natural-rock cement to 9,083,759 barrels; that of slag, or Pozzuolana cement to 478,555 barrels, making a total for the year of 26,437,820 barrels. The production for 1901 was 20,068,737 barrels, of which 12,711,225 barrels were Portland, 7,084,823 barrels were natural-rock, and 272,689 barrels were slag or Pozzuolana cement. The total gain of 1901 over 1900 was 2,837,587 barrels; that of 1902 over 1901 was 6,369,083 barrels. It may be of interest to note that in 1892, ten years ago, the total production of cement in the United States was 8,758,621 barrels, of which 8,211,181 barrels were natural-rock and 547,440 barrels were Portland. It will be observed that the gain of 1902 over 1901 is within 2,500,000 barrels of the total production of 1892. Even this phenomenal increase of production has scarcely kept pace with the continually growing demand.

Progress of the Construction of the New Croton Dam.

The new Croton dam across the valley of the Croton River, about 3 miles from the Hudson, is the tallest masonry dam in the world and will impound an additional supply of about 30,000,000,000 gallons of water for the Boroughs of Manhattan and the Bronx, New York City. The work on it was commenced eleven years ago, and it would probably have been completed but for the changes which have been ordered in its design since it has been under construction. It was originally intended to have a main masonry dam about 600 feet long, with a long curved masonry spillway and overfall at the north end, and a long and high earth dam extension at the south end. Alternate designs were under consideration when proposals were invited for one of them, and soon after the contracts were awarded the original dimensions were changed so as to extend the masonry dam about 110 feet further south, and thus reduce the maximum height of the earth dam to about 50 feet above the original surface of the ground. Construction was commenced on these lines and was carried forward, as fully described and illustrated in The Engineering Record of June 11, 1898.

A wide pit was excavated to a maximum depth of 130 feet below the bed of the river, and the foundations of the masonry dam were carried down in it from 10 to 50 feet below the original surface of the rock until sound and satisfactory strata were exposed. At the south end the excavation was carried down to a depth of 125 feet below the original surface and extended transversely on the down-stream side so as to provide rock foundations for the footings of the wing wall to retain the slope of the earth embankment. This wall and the rubble granite core-wall for the earth dam were thoroughly bonded into the masonry of the main dam, and the core-wall trench was back-filled with selected material thoroughly rammed in thin layers up to the surface of the ground.

The proposed construction of the earth dam is shown in the accompanying cross-section. It consisted of a wide embankment, with flat slopes, thoroughly bonded into a deep trench cut into the hardpan of the hillside. The hardpan had a depth of 60 feet above the rock. The core-wall was carried down through the hardpan so as to have a rock foundation beyond suspicion, although it was considered that the hardpan itself would have been entirely safe to carry this wall without danger of leakage under the footing. The core-wall was founded on hard limestone, but at one point this stratum was intersected by a vein of granulated limestone which could be removed, without blasting, by hard picking. As this vein was thoroughly protected by the deep stratum of hardpan and was dense and compact, it was considered satisfactory for carrying the wall which might well have been supported on a bed of dense confined sand. The trench was therefore excavated from 4 to 12 feet below the bottom of the hardpan, and the core-wall was built.

After Chief Engineer Alphonse Fteley, who designed the dam and supervised the first portion of its construction, had been succeeded by Chief Engineer W. R. Hill, a question was raised concerning the desirability of retaining the earth dam construction. A commission of engineers was appointed to report on the designs and conditions, and advised that the main dam should be made of uniform construction throughout. This report was published in The Engineering Record of November 30, 1901, and in accordance with it new plans were prepared. The contractors were instructed to remove most

of the work already built between the end of the masonry dam and the gate-house, and to extend the masonry construction to correspond with that already built. This involved the removal of about 7,600 cubic yards of granite masonry contained in the core-wall, about 215 feet long and 106 feet in maximum height, and of part of the wing wall which is about 130 feet long, 120 feet high and 50 feet thick, maximum; the excavation of about 275,000 cubic yards of hardpan and gravel and the construction of 70,000 cubic yards or more of granite masonry which, at the unit prices, represents a total cost of about $580,000.

It should be especially noted that the surface of the granulated limestone is covered by an impervious stratum of hardpan 60 feet thick, and that at the point where it intersects the center line of the dam it is at least 450 feet horizontally from the nearest point in the sides or bottom of the reservoir above the dam, so that whatever its permeability no water could reach it without penetrating for a great distance through the hardpan, covered by 20 feet of gravel and sand. It is thus evident that the location for the earth dam and core-wall was properly independent of the vein of limestone, and that the conditions and foundations were entirely safe and satisfactory for it. The radical change in the character of the superstructure and, still more, the removal of so many thousand yards of dense hardpan, which formed an ample and massive foundation above it and protected all the underlying strata, have completely changed the foundation requirements and conditions, and it is evident that very different treatment is desirable for the footings of the massive masonry which will of course be carried down to a sound stratum in the usual manner and by the careful methods previously adopted where a depth probably much greater was attained under more difficulties than are likely to obtain here.

The demolition and excavation was accomplished with difficulty on account of the excellent character of the masonry and back-fill, and of the awkward position for removing the spoil from the pit. The masonry was drilled and blasted as in a quarry, and the blocks were thrown out in large masses which required additional blasting before they could be handled. No cavities whatever were found in the masonry and all of the concrete and mortar was hard and dense. The work was continually inspected by the staff of the resident engineer, and the stones were found to have been properly bedded and the joints suitably made. The cement developed satisfactory strength and the lines of cleavage split through the stones as well as the joints. Below the water line the back-fill was found thoroughly compacted against the masonry, and there were no evidences of leakage through the masonry or of any collection of water on the faces or underneath it, and no indications of deterioration or unsatisfactory conditions in the rock at the foundations. The portion of the core-wall adjacent to the main dam was left and racked off to provide bond for the new masonry, and some of the wing wall below the surface of the ground was also left in position to form part of the new masonry.

The new foundation pit has been dug to the bottom of the wing wall and around the remainder of the core-wall to the upper side of the dam, where it is extended northwards parallel to the up-stream face to allow for a buttress which will be built there so as to enclose the end of the old masonry. This will enable the new masonry to be joined to the old without injuring the latter by cutting into it for bonds. A vertical well will be left in the masonry, as shown in the accompanying sketch plan, and filled with puddled clay to cut off any flow of water between the old and new work. This foundation pit is being carried down through very stiff hardpan to a depth of 180 feet below the highest point of the excavation, on the side of the hill; it will have a bottom width of about 190 feet and a top width of about 550 feet. The material is so hard that much of it is drilled and blasted. It is loaded by hand into skips and buckets hoisted by two cableways previously installed, parallel to the axis of the dam, and by boom derricks located on the edges of the pit. Inclines are also sloped down into the pit and allow the materials to be excavated by steam shovels. All of the spoil is loaded on berms at two different heights and is hauled by locomotives a long distance up and down the valley to the spoil banks. This change of plan has necessitated the removal of a great mass of hardpan which formed the flank of the hill and protected the surface of the rock.

The faces of the hardpan slopes have stood the weather very well and 1 horizontal to 2 vertical slopes that were established and properly protected from accumulated wash stood for more than two years with comparatively little sloughing off. At certain points in the course of the original excavation for the main dam pit, these slopes were 150 feet in height including the sand and gravel at the top. When subjected to heavy rains, the steep slopes wear very well unless exposed to accumulated wash. If it were possible to saturate the hardpan, and if this produced a tendency for it to move, the integrity of the earth dam with flat slopes of mixed gravel, might be threatened. The commission of engineers considered the earth dam seriously menaced, and the plans were changed.

In order to loosen the hardpan for excavation, horizontal "wash" holes were driven in the face of the bank by means of hydraulic jets, as described in The Engineering Record of August 16, 1902. These holes were charged with dynamite and shattered the hardpan so that the shovels could handle it. When the pit had been excavated to the surface of the rock, the stratum of granulated limestone, before mentioned, was again exposed and was found to have a width of from 50 to 60 feet parallel with the axis of the dam, and to lie about 25 feet horizontally from the face of the gate house walls. Its surface is at about elevation 100, that is 116 feet below the crest of the dam. It extends to an unknown distance east and west of the axis of the dam, and is wider at the west side, where it splits into two branches enclosing the point of a large mass of hard limestone. From the appearance of the exposed upper surface and the excavation which has been made in it, it is thought that further explorations may show it to have a V-shaped cross-section in the vertical plane through the axis of the dam. It has been excavated to a depth of about 20 feet, and soundings made 18 feet deeper indicate an improvement in the character of the rock.

Where the soft rock is undisturbed, its appearance resembles ordinary limestone rock with irregular cleavage. It is very dense and dry with no open cracks or seams, and can be excavated with pick and shovel. As fast as loosened, it is loaded by hand and by the steam shovels, but crumbles to pieces by the time it is deposited in the dump cars. Small pieces of it resemble lumps of brown sugar and are easily crushed in the fingers to a fine sharp sand. This stratum contains many dykes of hard limestone and seems to grow rather harder deeper down. It will be excavated under the dam so as to carry the foundations down to satisfactory rock below.



Croton Dam, Core Wall and Spillway, Looking North.

The foundations of the gate-house a few feet south of this stratum are on hard and satisfactory rock, but the distance is so small that explorations were made to determine whether there is any danger that the soft material extends laterally through the hard rock underneath the gate-house. A horizontal drift was blasted about 24 feet into the hillside about 30 feet below the gate-house foundation and the limestone was found to be so hard that it will probably be considered satisfactory and the excavation be sealed with concrete and rubble masonry and the construction of the new portion of the dam continued as fast as satisfactory rock is prepared for its foundations. It is

proposed to make test borings along the up-stream toe of the main dam to see if there are any indications of granular seams in the rock under the foundations of the nearly completed structure.

The cross-section at Z-Z which corresponds to one at A-A on the sketch plan, printed on the next page, is accurately drawn to scale and shows the core wall as constructed and back-filled up to the top of the hardpan. The proposed earth bank shown enclosing the upper part of the wall was never constructed, and before the changes were commenced the upper part of the core wall was exposed above the hardpan, and the excavation in the sand and gravel was not back-filled. After the plans were changed, this excavation was carried down through the hardpan, as shown in the views looking north and northeast. In the former view the sides of the excavation shown are of selected back-fill, which stands at a steep angle. The excavation in this picture has not been carried to the full depth or the full width.

Complete final drawings have not yet been made of the masonry extension at the south end of the dam, but the general character of the construction has been determined and it will conform approximately to the heavy broken outlines in the sketch plan. The dimensions of



Face of the Croton Dam, Looking Northeast.

the core wall left in position, the size and shape of the buttress enclosing the puddle well and the details at the junction of the old and new masonry are not yet accurately determined and their lines in the sketch plan, together with the heel and toe of the new masonry, are assumed in order to show the probable character and relative position of the new work. The limits of the excavation are also conjectural and are assumed for the purpose of indicating its magnitude. The position of the granulated limestone and the general dimensions of the new and old masonry are accurately given.

The view of the down-stream face of the dam shows the advanced condition of the work and the completed section of its crest. Its magnitude is apparent from the height of the structure, which rises 150 feet above the ground at the left. At the right a portion of the pit is seen which is now being excavated through the back-fill and hardpan for the foundations of the new masonry. At the extreme right is shown the character of the masonry where the upper part of the old wing wall has been blasted off. The view looking north includes part of the south end of the main dam together with a very much fore-shortened view of its up-stream face, and, at the right, the nearly completed spillway half-way up the hill, on the opposite side of the valley. At the left of the foreground a small portion of the wing wall is visible with the masonry in the main dam which had been concealed and is now exposed by the unexpected removal of the back-fill. The appearance of this masonry is excellent, equaling that in the upper part of the dam and demonstrating that the work was well done in places that it was supposed would be forever inaccessible.

The view looking south shows the gate-house foundations in the center of the upper part of the picture, and at the left of this a portion of the core wall, which was built in a trench quarried out of the rocky hillside. On both sides there is a steep bank of hardpan with a flatter slope of earth and gravel on top and a protecting masonry wall above, on both sides, to shield the old Croton aqueduct, which passes through the gate-house. At the right there is a berm on which the spoil cars are removed, and the steam shovel operates. At the left of the derrick base the vein of granulated limestone which crosses the axis of the dam is so light colored that it gives the snowy appearance to the central part of the picture. At its left, its junction with the dark harder stone is well defined. Just at the left of the derrick mast and about midway between its base and the foot of the gate-house wall, a small dark spot represents the entrance of the exploration drift in the hard rock, which was made to test the security of the gate-house foundations. The disintegrated limestone is so soft that it can, under favorable conditions, be excavated by the steam shovel seen at the extreme right.

About 650 men are employed at the dam, and work is being pushed with two eight-hour shifts daily. The main dam is substantially finished and the ornamental arches in the upper part of the face are completed for a length of about 400 feet. The masonry is being carried up to the required height at both ends of the dam, and work is in progress on the spillway and overfall. Mr. W. R. Hill is chief engineer for the Aqueduct Commissioners; Mr. Chas. S. Gowan, resident engineer, and Messrs. Coleman, Breuchaud & Coleman are the contractors, to whom acknowledgment is made for data.

On the Design and Construction of Slow Sand Filters.

By John H. Gregory, Assoc. M. Am. Soc. C. E.

The installation of slow sand filters for purifying water supplies in the United States has passed the experimental stage, and it is gratifying to note that many of the large cities are now either building or have under consideration the construction of such plants. In the following article it is the purpose to discuss certain of the elements which enter into the design and construction of filters, as viewed from the standpoint of American practice. In reproducing certain details which have been published in The Engineering Record and various other engineering periodicals the writer wishes to acknowledge his indebtedness to those who have designed and built the works considered.

Location.—In general filters have been and will continue to be installed in connection with systems of water-works already in operation. Under such circumstances the engineer will endeavor to use as much as possible of the existing works, and as the arrangement of these varies so widely, the question of location must be largely determined by the local conditions. A few of the points bearing on the subject will, however, be touched upon.

It is safe to say that in nearly all cases where it is proposed to install filters, better results will be accomplished if the raw water is allowed to pass through a period of sedimentation, the length of which depends upon the quality of the raw water, before being filtered. With a system of works in operation, to which the filters are added, if there is no sedimentation basin or if an existing reservoir cannot be made to serve this purpose, a sedimentation basin should be built. In constructing a new system of works of which filters are a part, a sedimentation basin should be included in the design.

With a gravity supply from an impounding reservoir, it will generally be found that the reservoir is of sufficient size to serve as a sedimentation basin, but if the volume of water passing through it during periods of flood is relatively large, it may be necessary to build a small auxiliary sedimentation basin or to so reconstruct the reservoir that in a portion of it a satisfactory period of sedimentation may be obtained.

With a supply which is pumped from a river to a distributing reservoir, this reservoir can sometimes be used as a sedimentation basin, but if the conditions are such that it cannot be so used, it will be necessary to build a sedimentation basin either at the river or above the distributing reservoir.

Considering now a gravity supply from an impounding reservoir, the natural place to locate the filters, if suitable ground can be obtained, is directly below the reservoir. The water line on the filters should be at a slightly lower elevation than low water in the reservoir, so that all the required storage is still available. A filtered water basin must be built below the filters for distributing the filtered water unless a distributing reservoir exists, in which case this reservoir can be made to serve the purpose of the filtered water basin. A certain amount of head is lost in passing the filters, which need not exceed 5 to 7 feet depending on conditions, which will be discussed later, and with the arrangement last mentioned it might be necessary to lay an additional conduit or to enlarge a portion of the existing one in order that the filtered water might still be delivered at high water elevation in the distributing reservoir.

If no distributing reservoir exists, a filtered water basin must be built, thereby introducing

in addition to the loss of head in passing through the filters, another loss in the basin due to the fluctuation in water level caused by the variation in draft, the amount depending on the size and depth of the basin. If there is ample pressure in the distribution system the total loss caused by the filters and filtered water basin, say about 8 pounds under ordinary conditions, will not be a serious matter, but if the pressure in the system is low, enlarged or additional conduit capacity to the distribution system will be necessary in order that the existing pressure may be maintained.

The modern tendency is to carry higher pressure in distribution systems than formerly, and when filters are added to works already in operation, their effect on the pressure in the system, if they have any, should be carefully considered. This point is mentioned because it is one which has sometimes been overlooked.

It should be remarked here that the reason for building a filtered water basin if no distributing reservoir exists is so that the filters will not be connected direct to the distribution system, an arrangement which will cause a variation in rate of filtration. Filters, in order that they may maintain their maximum efficiency should run at practically a constant rate. In order that this may be accomplished it is readily seen that the high water elevation in the filtered water basin must be several feet below the water line on the filters, the exact amount depending on the maximum allowable loss of head on the filters so that fluctuations of the water line in the filtered water basin will not affect the operation of the apparatus for regulating the rate of filtration. Slight variations or a very gradual change in the rate of filtration will not materially alter the quality of the filtered water, but sudden changes should be avoided. It is possible, however, to locate the water level of the filtered water basin at a higher elevation so that the filters may respond slightly to a variation in draft, but this is an arrangement which should be used only under certain local conditions.

If suitable ground cannot be obtained below the impounding reservoir at a proper elevation it may be necessary to build a pumping station with low lift pumps which will deliver the settled water to filters at a higher elevation. The construction of a filtered water basin in addition will depend on whether or not there is a distributing reservoir below. Before deciding, however, on the above arrangement a careful study should be made of all possible filter sites below. A level or gently sloping tract of land would preferably be chosen for the location of the filters, but it does not necessarily follow that because the topography of a piece of land is more or less irregular or has considerable differences of elevation that a satisfactory layout cannot be made. With irregular ground, the high points can be leveled off and the depressions filled, the first of the filters being built on the natural ground, the others being deferred for a year or so until the filled ground has had a chance to settle and come to a firm bearing. With sloping ground no especial difficulty is encountered as the filters can be arranged in a series of steps conforming very closely to the topography.

If the supply is from a river and is pumped to a distributing reservoir at a higher elevation, more latitude is generally offered in deciding on the location of the filters. Assuming that the distributing reservoir is to be used as a filtered water basin for distributing the filtered water and thereby causing no reduction in pressure over that existing in the distribution system, several locations for the filters suggest themselves.

An economical arrangement would be that in which the sedimentation basin would be built adjacent to the river and the pumping station and at a low enough level so that raw water from the river would pass into it by gravity. The pumps which formerly delivered into the distributing reservoir would now deliver settled water to the filters at a slightly higher elevation than the distributing reservoir so that the water after being filtered would enter the distributing reservoir by gravity.

With the sedimentation basin at the level of the river, as in the case just cited, it might be possible to locate the filters adjacent to the basin so that settled water would pass on to them by gravity, the filtered water then being delivered by the pumps to the distributing reservoir. In considering such a location for the filters, although it is one seldom likely to arise, the possibility of trouble from ground water should not be overlooked.

If either of the above arrangements is not feasible, the sedimentation basin may be built at a higher elevation than the distributing reservoir, the pumps delivering raw water into it instead of into the distributing reservoir. Settled water would then be delivered to the filters by gravity, the filtered water being discharged into the distributing reservoir.

Or if suitable ground for the sedimentation basin cannot be found at a higher elevation than the distributing reservoir, this reservoir may be made to serve as a sedimentation basin, delivering settled water by gravity to the filters which would be located at a lower elevation. With this arrangement it will, however, for reasons previously mentioned, be necessary to build a filtered water basin below the filters and introducing thereby a loss of pressure in the distribution system unless enlarged or additional conduit capacity be provided.

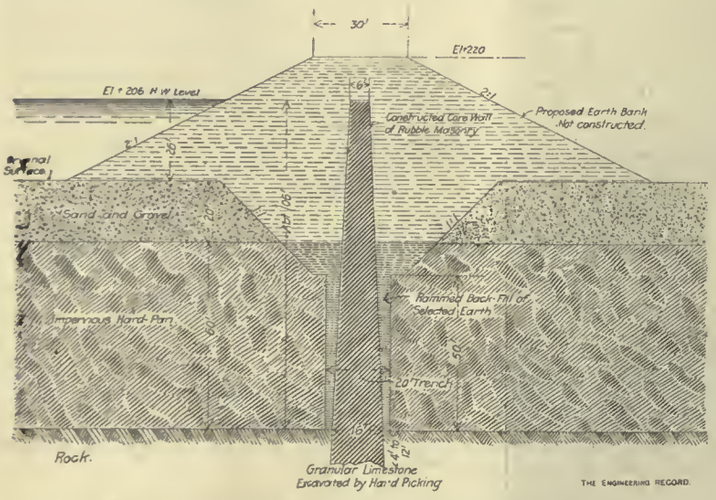
All of the above arrangements are economical in that the first cost of construction is low, and also in that the increase in the cost of pumping is but slight, being practically only the cost of the additional coal required to pump against the few additional feet of head.

If suitable ground cannot be found for making a layout in accordance with one of these arrangements, it will be necessary to build an additional low lift pumping station at the river.

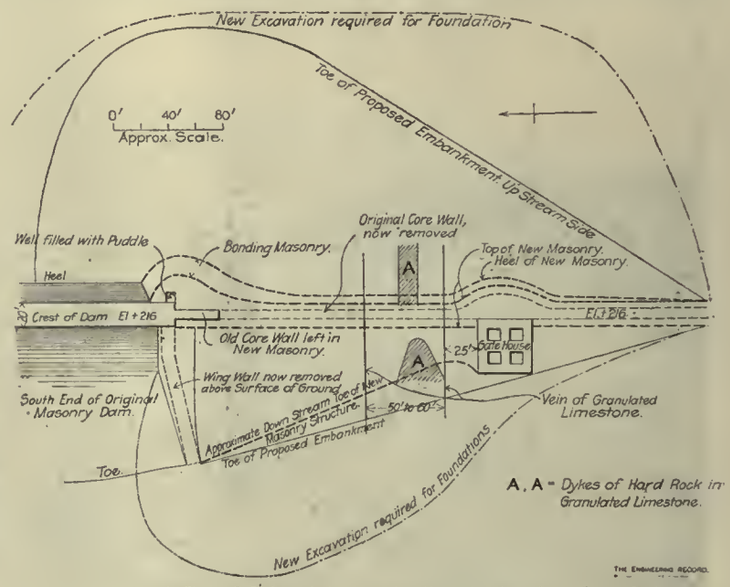
Such being the case, the raw water may pass into the sedimentation basin by gravity from which settled water would be pumped by the new pumping station to the filters located on higher ground. Or the raw water may be pumped by the new station to the sedimentation basin which would now also be on the higher ground, and from which the settled water would pass onto the filters by gravity. In both cases it would be necessary to build a small filtered water basin from which suction pipes would lead to the old pumping station, and thence the filtered water would be pumped into the distributing reservoir.

If suitable ground for locating the filters adjacent to the old pumping station cannot be found, they may be located at a higher elevation than the distributing reservoir. In this case the new pumping station would pump the raw water into the sedimentation basin from which settled water would pass to the old pumping station. From here it would be delivered to the filters, the filtered water passing by gravity into the distributing reservoir.

In considering possible locations for the sedimentation basin and filters, it should be borne in mind, other things being equal, that it is more desirable to pump filtered water than settled or raw water, and settled water than raw water. Also it will be found more advantageous in operation to have the settled water delivered to the filters by gravity from the sedimentation basin, where the difference in eleva-



Cross-Section Z-Z of Original Design for South End of Dam at Point where Soft Rock Occurs



Sketch Plan of Old and New Construction showing Approximate Position of New Masonry and of Disintegrated Rock.

Cross-Section of Superseded Earth Embankment and Sketch Plan of Proposed Changes at the Croton Dam.

tion between the water level in the sedimentation basin and in the filters is generally small, rather than by pumping, especially if the lift is comparatively high.

Capacity of Plant.—The capacity of the plant, or the amount of water which the filters are to furnish, must be decided on before the amount of filtering area required can be determined. This capacity will depend on the maximum average rate of consumption. The filtered water basin or distributing reservoir should be sufficiently large to compensate for the variation in rate of consumption during the day or possibly during a period of several days so that the filters may run at a constant rate of filtration.

Assuming then that the filters are designed for the maximum average rate of consumption, it is seen that at some periods of the year when the average rate of consumption is less, there is more filtering area than is required. At such times instead of putting some of the beds out of service and holding the established rate of filtration on the others, the rate should be reduced on all the beds except of course on those



Croton Dam: Gate-House and End of Core-Wall, Looking South.

which were out of service in the process of cleaning or refilling.

It might be argued that the filters need be designed only for the average rate of consumption and not for the maximum average, increasing the rate of filtration at times when the maximum average rate of consumption occurs. At certain seasons the character of the raw water might be such that the rate of filtration could be increased, but one could never be sure that this would occur at the same time that the maximum average rate of consumption occurs. If a period of bad water should come when the filters were running under these conditions at the higher rate of filtration, serious results might follow, especially if the bad water should continue for any length of time.

While it costs more to build filters which are designed to yield the maximum average rate of consumption than the average rate of consumption, it should be considered better policy to incur the additional expenditure in building the slightly larger plant if possible, so that when filtered water is first furnished there will be no scarcity. It is time enough after the introduction of filtered water to impress on the consumers the fact that by the addition of filters, the operating expenses have been increased and that every possible means should be taken to restrict waste.

Covered or Open Filters.—In climates where the winter is cold and severe, that is, where the temperature remains below freezing for long periods of time, there seems to be no question but that covers are necessary. Where, however, the average temperature of the coldest winter month is about freezing, opinion is divided as to whether filters should be covered or not.

If periods of freezing weather are of comparatively short duration and are not of frequent occurrence, but little trouble will be experienced with ice which may form on open filters. Should, however, these periods be of longer duration, in addition to the greater trouble from ice, will be experienced the impossibility of cleaning the filters during the freezing weather. To tide over such times until warmer weather occurs when the filters can be cleaned, reserve area, in addition to that ordinarily required, must be provided.

A careful study should be made of the temperature records of the winter months to determine how much, if any, additional reserve area will be required. It should not be overlooked, however, that the cost of this additional reserve area, should it be needed, may be equal to or more than that needed to provide covers for the rest of the plant.

The cost of removing ice from open filters adds materially to the operating expenses, and it may easily amount to more than the interest on the cost of providing covers for the filters.

As to the bacterial efficiency, during warm weather open filters give practically the same as covered ones, but during cold weather they give slightly less efficiency.

It has been claimed that open filters are more easily cleaned than covered ones, but with the more efficient methods which are now in use it is practically as easy to clean one as the other.

With waters which have algae growths in summer, covered filters are of decided advantage in that there is no tendency for the algae to grow in the dark, and by preventing these growths the period of service between scrapings is increased.

With open filters, when cleaning in summer, the heat sometimes bakes the upper surface of the sand so that a deeper scraping is required. Again in winter if a fall of snow occurs during cleaning a deeper scraping generally results. In both cases the extra sand not only must be scraped up, but must be washed and handled, thereby increasing the cost of operation. If a rain takes place during cleaning, the sand may become compacted and require re-raking. With covered filters these troubles are removed, and in addition they have the advantage that cleaning can go on in any kind of weather.

With covered filters it is sometimes argued that as the surface of the sand is broken in many places by the piers more opportunity is offered for raw water to pass down and get into the underdrains. While it is true that this possibility exists, provision can be made in the design to reduce it to a minimum. Experience, however, indicates that no trouble is caused by this piercing of the sand surface.

Covered filters require a slightly larger total area on account of the space occupied by the piers, but this is small and need not exceed 1.5 per cent. of the total sand area needed.

The greatest objection to covered filters, in fact practically the only objection, is their increased cost, which under ordinary conditions is from 40 to 50 per cent. more than open filters. They have, however, many advantages, some of which have been noted above, and these advantages should receive serious consideration in deciding the question of whether to use open or covered filters. Should open filters be decided on, it would be a wise policy and not an expensive one to so build them that if covers were found necessary at a later day they could be added with but little inconvenience or trouble.

Rate of Filtration.—It would of course be desirable to have the results of a carefully conducted series of tests on experimental filters, supplied with water which it is proposed to filter, from which to determine the proper rate of filtration, but, while desirable, it is not absolutely essential. In the last few years several experimental stations have been in operation for longer or shorter periods where extensive tests have been made on the filtration of water, and these, together with the various filter plants which are in operation, have fortunately been so geographically distributed over that portion of the country where slow sand filters are most applicable for the purification of water that the character of the various river waters is fairly well known. From the results of the tests conducted at these points, it is possible to predict with a large degree of certainty what results may be accomplished from the filtration of a given water.

The rate of filtration which has been adopted in designing some of the most recent and largest plants is 3,000,000 gallons per acre per 24 hours, and with the size of filter sand which would probably be used, this is considered a safe figure. This rate is for a raw water which is more or less polluted. With a water which contains only algae or certain microscopical organisms a higher rate can be used. It should be noted, however, that the present tendency is towards higher rates of filtration, the raw water being subjected to preliminary treatment of some kind, either by being treated with a coagulant in the sedimentation basin, or by passing through a preliminary filter, before being applied to the slow sand filter. Experiments in-

dicate that there are long periods during the year when certain raw waters may be filtered at higher rates, even as high as 6,000,000 gallons per acre per 24 hours, with satisfactory results, and if the raw water can be subjected to a satisfactory preliminary treatment so that the turbidity may be sufficiently reduced during periods of bad water, these higher rates can be maintained during the entire year.

It is considered conservative practice, however, at present to design the filtering area for a rate of filtration of 3,000,000 gallons per acre per 24 hours, with of course a proper area in reserve for use during cleaning and refilling, but to design the piping system and apparatus for indicating and regulating the rate of filtration for a higher rate, say 6,000,000 gallons per acre per 24 hours, so that should a higher rate be found possible no additions to or changes in the plant would be required.

In making computations in which the unit rate of filtration often occurs, or so many million gallons per acre per 24 hours, the writer has found the abbreviation $\overline{M}$gad a convenient one, meaning million gallons acre daily. Thus, instead of writing 3,500,000 gallons per acre per 24 hours, write 3.5 Mgad, and similarly instead of writing 24,600,000 gallons per 24 hours, write 24.6 $\overline{M}$gd.

Area and Number of Filters.—Having decided now on the capacity of the plant and the rate of filtration, a sufficient area in reserve, in addition to that needed to yield the required amount of water, must be provided for use while some of the filters are out of service being cleaned or refilled. The number and size of the filters depends not only on the capacity of the plant but on the number of days a filter is in service between cleanings and on the number of days required for cleaning.

With small plants the filters will of necessity be small and their number and size is more a matter of judgment than computation. With large plants, however, more latitude is offered in the choice of the number and size of the filters. From the standpoint of economy of construction large filters are desirable, but for convenience in operation, especially in handling sand, they should not be too large. With large filters the question of maintaining a practically uniform rate of filtration over the whole area of the filter also enters in, but with a proper arrangement of underdrains this need not be a serious matter. The most economical size of filters in a large plant is still a matter of question. An area of one acre seems to be the maximum yet proposed in some of the most recently designed plants.

In the following table are given the number and approximate areas of the filters in some of the plants, which are either in operation, under construction or proposed.

Location.	No. of filters.	Approx. net area of each filter, acres.
Albany	8	0.703
Philadelphia—		
Lower Roxborough	5	0.537
Upper Roxborough	8	0.698
Belmont	18	0.735
Torresdale	55	0.751
Pittsburg	25	1.00
Washington	29	1.00

Let

Q = total quantity of water to be filtered in Mgd.

r = normal rate of filtration in $\overline{M}$gad.

r_1 = rate of filtration in $\overline{M}$gad with turbid water.

n = number of filters ordinarily in service.

n_r = number of filters ordinarily in reserve.

n_1 = number of filters in service with turbid water.

n_o = number of filters out of service with turbid water.

N = total number of filters.

a = area of one filter in acres.

A = total area of all filters in acres.

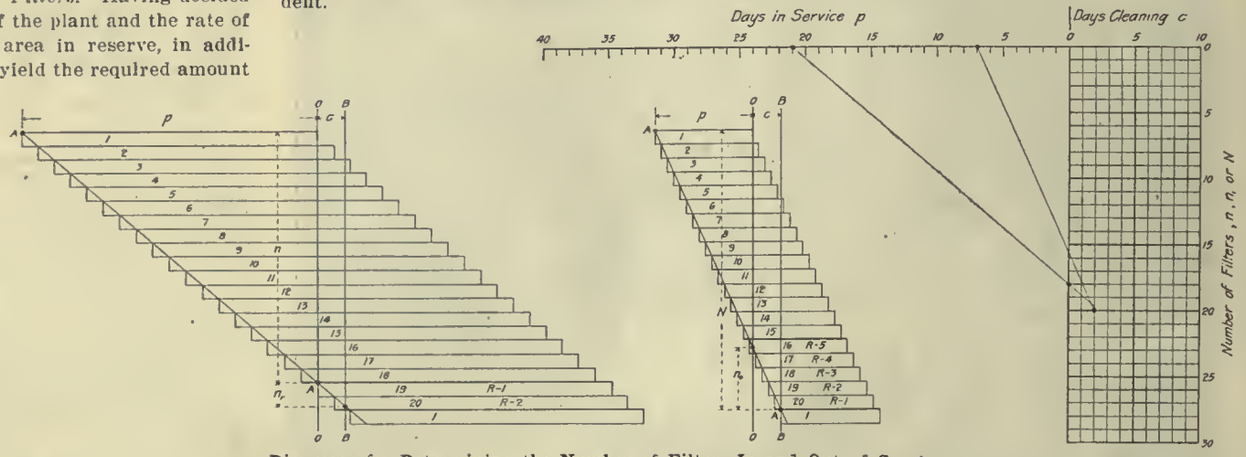
p = ordinary number of days of service between cleanings.

c = number of days out of service for draining, cleaning and refilling.

The number of filters ordinarily required in reserve may be found either graphically or analytically. The graphical method will be best described by means of an example.

Let n = 18, p = 21, c = 2, Q = 45 and r = 3.

A diagram is constructed as shown on the left in one of the accompanying figures, so that the filters are started successively with such a time interval that the first filter in reserve, R—1, starts when filter No. 1 goes out of service, the second filter in reserve, R—2, when filter No. 2 goes out, and so on. The construction necessary for obtaining this result is evident.



Diagrams for Determining the Number of Filters In and Out of Service.

The inclined line A—A and the vertical line B—B through c = 2, are now drawn. The point at which these lines intersect will fall in the last filter in reserve which is needed before No. 1 will be ready to start again; in this case 2.

Expressed algebraically, it is evident from the construction that

$$n = \frac{c}{p} n$$

The value of n_r will generally come out fractional, but as it is impossible to have a fractional part of a filter in reserve, the next highest integer must be taken. Using the numerical values above,

$$n_r = 1.7 + ; \text{ take } n_r = 2.$$

It follows of course that

$$N = n + n_r = 20,$$

that

$$a = \frac{Q}{r\,n} = 0.833 \text{ acre},$$

and that

$$A = N\,a = \frac{Q\,N}{r\,n} = 16.67 \text{ acres}.$$

It is not sufficient, however, to consider the problem settled at this point. A time of bad water may come on when the period of service p will be reduced from 21 days to say 7 days. With this condition of affairs more filters than 2 will be out of service at one time, and in order to yield the required amount of water, those in service

filtration. In ...es of ...inch Pipes at the ...ecoville, Mass.

are out of ser... ...engineer, Metropolitan ... seco...

structed shown ... the rig... ously described, ... that th... will be started a... ...n 2 d... ...out of operation. ... ...ntyard, in 1897. ...is diagram is al... ...self-evident. ...across the ...ection of the vertical line O—O, wi... ...nd Medf...clined line A—A, will fall in the last ...se pi... total number of filters which are out ...ach ...ervice, counting from the bottom up, i... ...ampi... ...ase 5.

Expressed algebrai... ...ributi... ...-inch ...

$$n_o = \frac{\quad}{\quad + c} N$$

Here, again, ...generally come out fractional, and, as f... ...the next highest integer must be taken. ... ...n N = 20, c = 2 and the new value of p = 7 ...

$$n_o = 4 \frac{\quad}{\quad} \text{; take } n_o = 5.$$

The number of f... ...rs in service will then be

$$n_1 = N - n_o = 15$$

and the correspond...g rate of filtration on them ...

$$r_1 = \frac{\text{sta...}}{n_1} r = 3.6 \text{ Mgad.}$$

This rate of filtration is not sufficiently above the normal to cause any anxiety as to the quality of the effluent.

It does not ...sarily follow, however, that the value of n = 18 chosen in the example cited is the best. Having determined the ordinary value of p, varying generally from 20 to 30, which it is considered proper to use, a study should be made, using various values of n in connection with the minimum value of p. It will be sufficient to use the value of c as 2 or 3. Formerly c would have been taken as 3, but with more efficient methods of cleaning it can be taken as 2. It will generally be found that the most economical design will result when the number of filters as well as the total area is a minimum, subject to the condition, however, that the maximum allowable rate of filtration shall not be exceeded when the period of service between cleanings is a minimum.

In making this study which is most conveniently done graphically, it is not necessary to go through the process of constructing separate diagrams, similar to those just described, for each set of values taken. One extremely simple diagram, suggested by the others, can be very quickly made on cross-section paper, which will solve all the problems involving the number of beds in and out of service. This diagram is shown at the right of the cut. Its construction is seen at a glance.

Having assumed n, c, and the ordinary value of p, the intersection of a line through n = 0, p, and p = 0, n, with the vertical through c, will give the value of N. Taking the values cited

= 18, p = 21, c = 2, obtain the needed [illegible] angle diagram, it is seen description of the [illegible] fall between N = 19 and given in the "Jou[illegible] N = 2[illegible] necessarily being Engineering Societ[illegible]

" Saville, M. Am[illegible] N, [illegible] and the minimum value legislature, [illegible] of a line through n = 0, [illegible] of a ne[illegible] with the v[illegible]tical through c = 0, wi[illegible]e Metrop[illegible]e value of n_1. With p = 7. c = 2, and [illegible]old W[illegible]as just found, this intersection falls bet[illegible]on e[illegible] = 15 and n_1 = 16, the value n_1 = 15 b[illegible]tropoli[illegible] course taken for the reason previously [illegible]vious[illegible]ned.

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Hydraulic Diagram[illegible]tabl[illegible]nd Further Notes Upon the Hazen-with[illegible]ia[illegible]s Slide Rule.

By Leonard Metcalf, [illegible] the [illegible] Am. Soc. C. E.

On March 28, 1903, T[illegible] Engineering Record published an interesting [illegible]icle upon the Hazen-Williams hydraulic slide [illegible]le, thus calling the attention of engineers [illegible] this new and very useful instrument. Somew[illegible]hat over a year ago, the writer was preparin[illegible] some hydraulic dia-

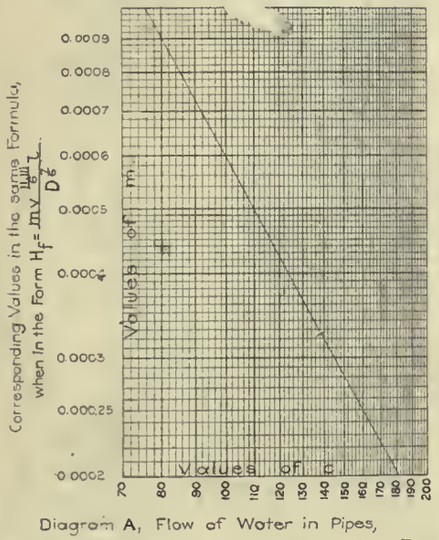


Diagram A, Flow of Water in Pipes, Corresponding Values of c and m in Hazen-Williams Formula. THE ENGINEERING RECORD.

grams for use in his office when Mr. Allen Hazen called to his atte[illegible] his new (or modified Chezy) formula, upon which he and Prof. Gardner S. Williams had been at work, and kindly gave to him a blue print of the slide rule diagram based upon it that he had prepared for trial. This blue-printed scale was mounted upon the slide of an old slide rule, and proved so serviceable and convenient that the writer gave some study to the new formula, and finally concluded, with the courteous consent of Messrs. Hazen and Williams, to base his diagrams and tables upon it. The accompanying diagrams and tables, with the data already published by the Record, may perhaps be of interest to other engineers and serve to show the relations existing between the new formula and the better-known Chezy formula.

Unnecessary descriptions are here avoided, as the diagrams are generally self-explanatory. The reader is referred, however, to the previous article upon the Hazen-Williams hydraulic slide rule; to an interesting article entitled "Notes on Lost Head in Water Supply Systems," by Prof. A. Prescott Folwell ("Engineering News," April 17, 1902), and an article upon the "Flow of Water in Pipes and Channels," by Mr. William E. Foss ("Journal" of the Association of Engineering Societies June, 1894).

Chezy formula, $V = C\sqrt{RS} = C R^{0.5} S^{0.5}$ .....(1)

Hazen-Williams formula, $V = c S^{0.54} R^{0.63} (0.001)^{-0.04}$ .....(2)

In the latter the following values are suggested:

For new pipe and favorable conditions, c = 140
For new pipe and general use, c = 130
For riveted steel pipe, c = 110
For old and tuberculated coated pipe, c = 100

(See also data published in The Engineering Record, March 28, 1903.)

Formula (2) reduces to the following forms:

When c = 100 $V = 131.8\ R^{0.63} S^{0.54} = 55.0\ D^{0.63} S^{0.54}$ .....(3)

When c = 110 $V = 145.0\ R^{0.63} S^{0.54} = 60.5\ D^{0.63} S^{0.54}$ .....(4)

When c = 120 $V = 158.2\ R^{0.63} S^{0.54} = 66.0\ D^{0.63} S^{0.54}$ .....(5)

When c = 130 $V = 171.4\ R^{0.63} S^{0.54} = 71.6\ D^{0.63} S^{0.54}$ .....(6)

When c = 140 $V = 184.6\ R^{0.63} S^{0.54} = 77.1\ D^{0.63} S^{0.54}$ .....(7)

V = velocity in feet per second;
C and c = coefficients of roughness, which are not identical in formulas (1) and (2);
R = hydraulic mean radius;
S = slope, or ratio of head to length;
D = diameter in feet;
H_f = friction head in feet per foot of pipe;

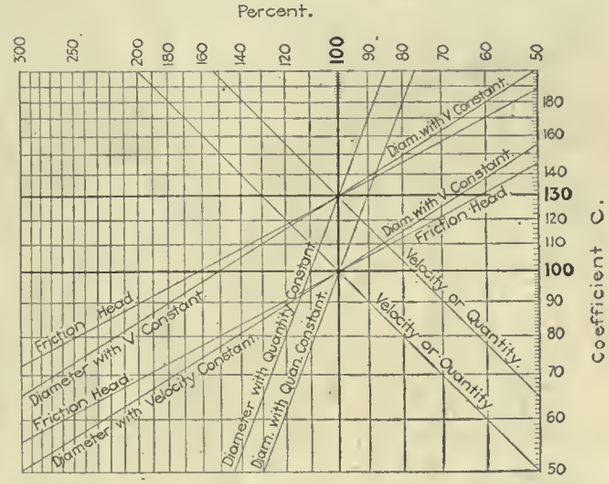


Diagram I. Rate of Variation of Certain Factors in Hazen-Williams Formula. $V = c R^{0.63} S^{0.54} (0.001)^{-0.04}$ THE ENGINEERING RECORD.

Diagrams Giving Corresponding Values and Rate of Variation of Certain Hydraulic Factors.

q = discharge in gallons per minute;
Q = discharge in gallons per 24 hours.

For convenience in use in certain computations, formula (2) may be transposed and written in the exponential form, which reduces to the following:

$$H = \frac{3.02121\ V^{\frac{11.1111}{9}}}{c^{\frac{11.1111}{9}} D^{\frac{5}{9}}} = \frac{3.02121\ V^{1.85185}}{c^{1.85185} D^{1.16666}} \quad (8) \text{ and } (9)$$

And when

c = 100 H_f = 0.000,598 $L V^{\frac{11.1111}{9}} \div D^{\frac{5}{9}}$ .....(10)
c = 110 H_f = 0.000,501 (") .....(11)
c = 120 H = 0.000,426 (") .....(12)
c = 130 H_f = 0.000,368 (") .....(13)
c = 140 H_f = 0.000,321 (") .....(14)

Or, if stated in general terms,

$$H_f = \frac{m\ L\ V^{\frac{11.1111}{9}}}{D^{\frac{5}{9}}} \quad \ldots\ldots\ldots\ldots (15)$$

The relation between the value of c in formula (2) and m in the exponential form of the formula (15) is shown in Diagram A, upon logarithmic cross-section paper. If it be desired to compute the friction head in terms of the discharge, q, in gallons per minute, we have:

$$H_f = \frac{0.000,0579691\ L\ q^{\frac{11.1111}{9}}}{c^{\frac{11.1111}{9}} D^{4.9703}}; \quad \ldots\ldots\ldots (16)$$

and when

c = 100 H_f = 0.000,000,011,468 $L q^{1.85185} \div D^{4.87037}$ (17)
c = 110 H_f = 0.000,000,009,613 (") (18)
c = 120 H_f = 0.000,000,008,182 (") (19)
c = 130 H_f = 0.000,000,007,055 (") (20)
c = 140 H_f = 0.000,000,006,150 (") (21)

If it be desired to compute the friction head in terms of the discharge Q, in gallons per 24 hours, we have:

$$H_f = 0.000,000,000,008,211 \left(\frac{L\ Q^{\frac{11.1111}{9}}}{c^{\frac{11.1111}{9}} D^{4.87037}} \right) \quad (22)$$

and when c = 100.

$$H_f = 0.000,000,000,000,01624 \left(\frac{L\ Q^{\frac{11.1111}{9}}}{D^{4.87037}} \right) \quad (23)$$

and when c = 110.

H = 0.000,000,000,000,01362 (") ..(24)

and when c = 120.

H = 0.000,000,000,000,01159 (") ..(25)

and when c = 130.

H = 0.000,000,000,000,009992 (") ..(26)

and when c = 140.

H = 0.000,000,000,000,008711 (") ..(27)

Table B gives for 3-inch up to 60-inch pipe the pipe areas; contents in cubic feet and gallons per linear foot; the discharge in gallons per minute and per twenty-four hours, under velocities of flow of 1 and 3 feet per second; and the friction loss in feet of head per 1,000 feet of pipe, under velocities of flow of from 1 to 6 feet per second, based upon a coefficient of roughness c = 130. The logarithms for these values are also given in this table. In commenting upon this table, it might be said that the variation in the coefficient of roughness is such as to make it unnecessary to carry the computations out to as many significant figures as are given. However, in order to check the computations very thoroughly, even more places of figures were used than are published. (See inset).

Diagram D, upon logarithmic cross-section paper, shows the discharge and corresponding velocities for 3-inch to 36-inch pipe, together with the velocity and the entry heads. In making this diagram and those that follow, the value of c was assumed as 130, in the Hazen-Williams formula (2), which under these circumstances reduces to the form:

$$V = 71.5559\ D^{0.63} S^{0.54} \quad \ldots\ldots\ldots\ldots (28)$$

Diagram E, upon logarithmic paper, gives a comparison of the Hazen-Williams formula with the Edmund B. Weston tables (based upon Darcy's experiments); the formulae of Williams, Hubbell and Fenkell (based upon their recent Detroit experiments); and the formula suggested by Mr. Hazen in his discussion of Mr. Fenkell's paper on "A Hydraulic Study," published in the "Journal of the Association of Engineering Societies," March, 1901.

Diagram F gives a comparison of the Hazen-Williams formula with the experimental results of various experimenters, as plotted by Mr. Hazen in his above-mentioned discussion of Mr. Fenkell's paper.

The relation between the value of c in the Hazen-Williams formula and the C of the Chezy formula may be found by equating the values of S shown in formulae (1) and (2), which will be found to reduce to the form,

$$C\ (\text{Chezy}) = 0.2090\ c^{0.9259} V^{0.0741} D^{0.0833} \quad \ldots\ldots (29)$$

In the assumed case, where c = 130, this equation reduces to the form,

$$C = 104.3\ V^{0.0741} D^{0.0833} \quad \ldots\ldots\ldots\ldots (30)$$

a relation which is shown graphically in Diagram G.

In order to bring out more clearly the effect of variation of the coefficient c in the discharge

of pipes as determined by the Hazen and Williams formula, and for convenience in use in the case of tuberculated cast iron pipes, Diagram H was prepared, giving the discharge of tuberculated cast-iron pipes, with corresponding velocities for 3-inch to 36-inch pipes when the coefficient of roughness, *c*, is 100.

In this case the Hazen and Williams formula (2) reduces to the form,

$$V = 55.0\ D^{0.63}\ S^{0.54} \quad \ldots\ldots\ldots\

obtain the needed change of direction. A description of the laying of these pipes was given in the "Journal" of the Association of Engineering Societies, March, 1901, by Mr. C. M. Saville, M. Am. Soc. C. E.

The legislature of 1901 authorized the construction of a new bridge under the direction of the Metropolitan Park Commission in place of the old Wellington bridge, to connect the boulevards on either shore of the river built by the Metropolitan Park Commission several years previous. After studying the location of the new bridge, a new pier and bulkhead line were established on the Somerville side of the river with the approval of the Secretary of War and the Harbor and Land Commission. This brought the Somerville abutment some 250 feet beyond the original shore line of the river, and after the completion of the filling of the proposed boulevard connection, these pipe lines would have been covered with 8 to 17 feet of earth. It was not thought best to permit this to be done, and plans and specifications were prepared for raising the pipe lines. It was essential that one of the lines should be in service at all times, as it was the only line of supply from Chestnut Hill to cities and towns of the North Metropolitan District.

The method adopted employed slings of chain and wire rope around the pipes and vertical lifting screws supported on a pile trestle. The cutting, raising and connecting of the pipes was done by the maintenance force of the Distribution Department; all the remaining work was done under a contract with Lawler Brothers, of Charlestown, Mass. This contract included the excavation of the material around the pipes, furnishing and driving piles and spur-shores, furnishing and placing temporary and permanent caps, and building and maintaining coffer dam, including all pumping, etc., The general arrangement and some details of the pipe lines and trestles are shown in the accompanying illustrations.

The material was first removed from over the pipes by means of a dredge operating an hydraulic orange-peel bucket. The earth was removed on the outside of the pipes to a point about 1 foot below the bottom of the pipe, but between the pipes only to a depth a few inches below the top of the pipe. After the dredging was finished, pile driving was started from a scow as near the shore end as possible, the six bents nearest the shore end being driven from a land machine. The piles were of spruce or Norway pine, not less than 12 inches in diameter at the butt and 6 inches in diameter at tip, driven in bents, about 6 feet apart. Each alternate bent was a high bent consisting of three piles 6 feet on centers with a spur-shore to each outer pile, and the shorter bents of three piles only, without spur-shores. The high bents were capped temporarily with two 4x10-inch girder caps, fastened together and to each pile with one 1-inch screw bolt. These caps were mortised into each pile at least 3 inches, leaving about 6 inches between caps for lifting screws to pass. The lifting screws were of 2½-inch steel, threaded 7 feet, two threads per inch and worked through washers 16 inches square resting on the temporary caps. The cables used were second hand ⅝-inch wire cables and cost, together with the clips, $58.30. Where cables were used to connect the lifting screws with the cables around the pipes, the cables were fastened to each other by means of clamps. At

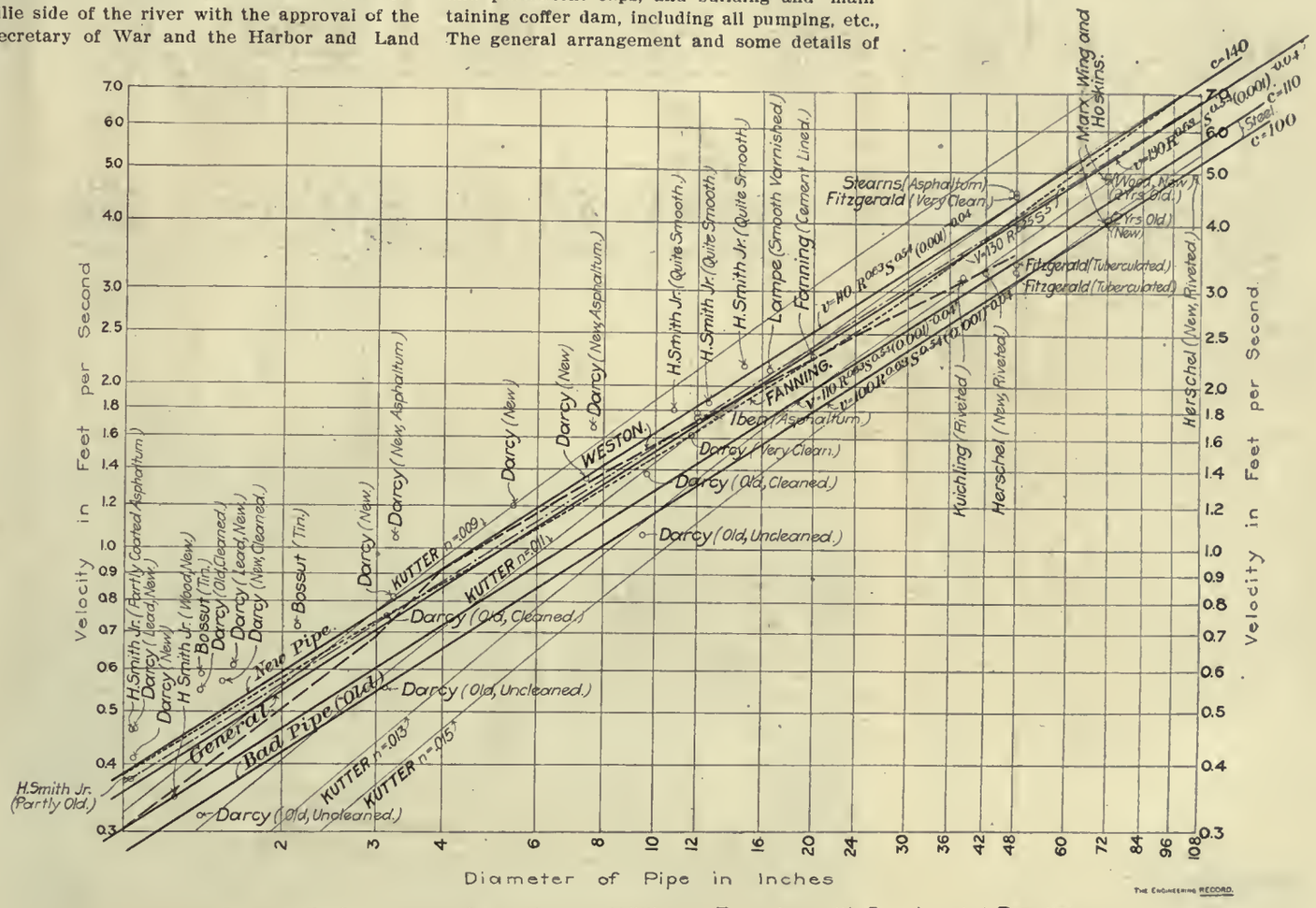


Diagram F, Comparison of the Hazen – Williams Formula, with Experimental Results.

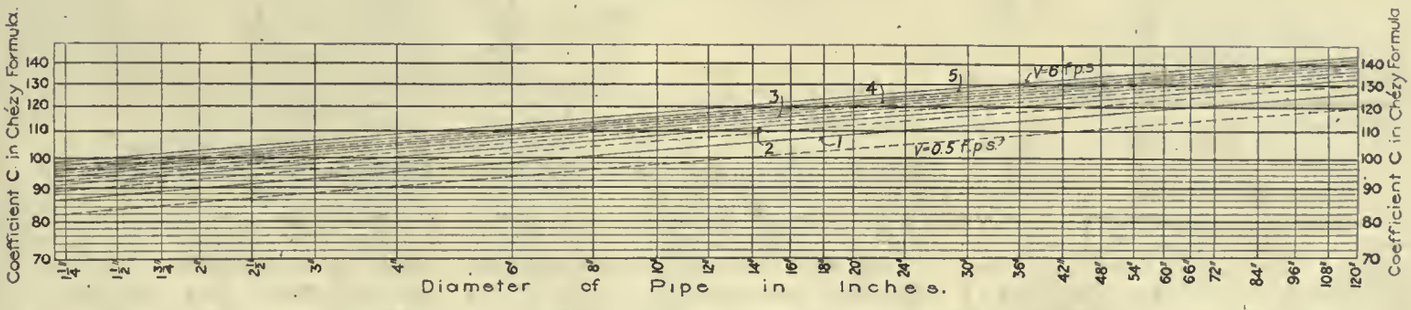


Diagram G, Values of Coefficient C in Chézy Formula, Corresponding to Values of Velocity of Flow in Different Sizes of Pipes, as Computed by the Hazen – Williams Formula.

the outer end of the trestle a coffer dam of 4-inch tongued and grooved sheeting was built to elevation 4 above Boston city base. Where the pipes passed through the southerly end of the coffer dam a temporary bulkhead was built of sand bags and earth, and after each pipe line was raised, a line of sheeting was driven across the end, making the coffer dam tight so that the lower vertical curve could be set.

Below low water a diver was employed to place chains or cables around the pipes. A needle of ¾-inch iron was used, bent nearly to the radius of the pipe with an eye at one end, to which was fastened a small manila rope. The diver forced this needle from the outside underneath the pipe until he could reach the other end between the pipes. The wire cable was then fastened to the manila rope and two turns of the wire rope were drawn around the pipe, the two ends fastened together and tied to a piece of wood as a float, so that they could be easily picked up when ready to be connected with the lifting screws. Where the pipes were above low water the operation was performed by laborers from the maintenance force at low tide.

As soon as the piles were driven, the temporary 4x10-inch double-girder caps were bolted in place; the cables around the pipes connected with the lifting screws by means of either cables or chains, as was the more convenient, and after the pipe was cut at both ends and the southerly end of the coffer dam over the pipe line was removed, the work of raising the west line of pipe was started. About 23 men were employed, one man to each screw, and where the screws were moved with difficulty, two men to a screw. After about an hour's work three of the cables around the pipes broke and work had to be suspended until new cables could be placed around the pipes. While the piles were being driven the contractor for the filling of the approach to the new bridge had started work on the west side of the bridge about 75 feet away from the pipe trestle. The material was dredged from the bottom of the river, and after the filling had reached a depth of about 8 feet it was found one morning that the wet filling had slid from the west side of the bridge where it had been deposited by the dredge, underneath the bridge and across the two lines of pipe, covering the pipes to a depth of 2 or 3 feet for 5 pipe lengths, a distance of about 60 feet.

All of the cables that broke were at the point where the pipes had been covered by this wet filling and the additional weight and suction from the filling was undoubtedly the cause of the breaking of the cables. The pipes were raised 14 feet at the outer end and about 4 feet at the shore end, and 12x12-inch caps 6 feet long were then slipped under the pipes and fastened to the tops of the piles with 1-inch oak treenails 18 inches long.

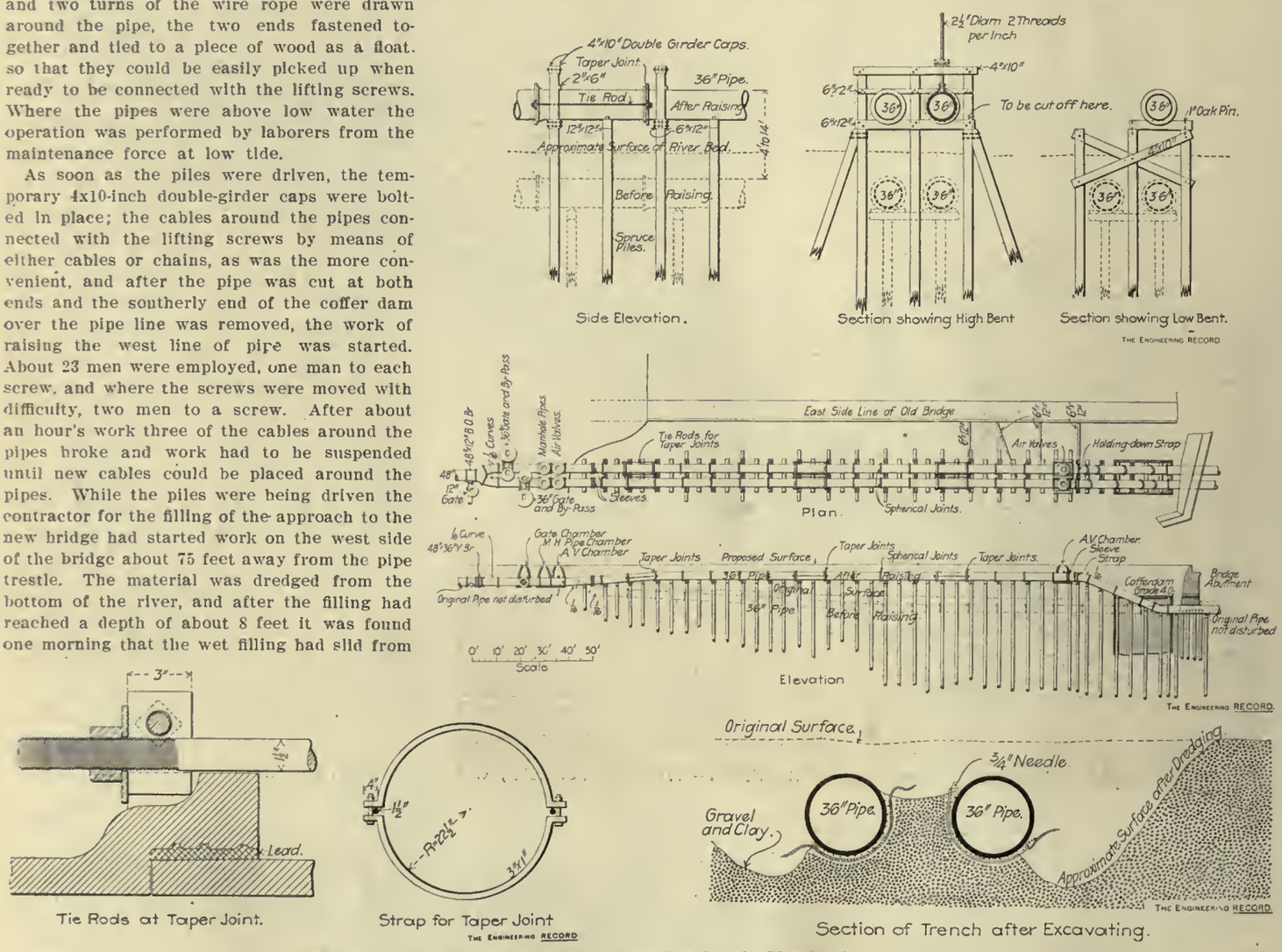
After this line had been raised, and while the pipe was still suspended from the lifting screws, a severe easterly storm arose and the action of the waves striking against the whole length of the broadside of the pipe, a distance of about 250 feet, caused it to vibrate quite freely. At the outer end, where preparations had been made for forcing off the last two lengths of pipe beyond the taper joint by means of jacks, the oscillations were sufficient to shake the pipe almost entirely free from its neighbor, so that the spigot was just barely caught on the adjoining bell, showing a movement of about 5 inches. While this was exactly what it was desired to accomplish at this time, nevertheless, in order to prevent a repetition of the occurrence after the pipe had been connected and put into service again, four 6x12-inch hard pine sticks about 30 feet long were bolted at one end to piles under the bridge and at the other end to two of the piles in the bent carrying the pipes, and no further movement was noticeable.

It was evident, after the pipe had been raised, that each of the taper joints had pulled out more or less, varying from ½ inch to 1⅛ inches. In order to prevent any further movement, two tie rods 1½ inches in diameter were placed between 3x1-inch iron bands encircling the pipes just in front of and behind the bells adjacent to each taper joint and tightened by nuts at one end. After the pipe was raised, the end of the coffer dam was replaced, the coffer dam pumped out and the lower vertical curve set. At the next low tide the two lengths that had been pushed off from the taper joint were laid on the incline and the upper vertical curve was set and the closure made.

After the westerly line was raised and connections made at each end, the work of raising the easterly line was started. This line was raised in much less time and no trouble was caused by any of the cables breaking. From the time the pipe was cut on the westerly line to the time the connections were completed was 14 actual working days, deducting stormy days, holidays and Sundays. On the easterly line, doing the same work, only 8 days were required.

At the shore end the joints were burnt out while the pipe was suspended by chains or cables from the lifting screw and the piles and cap were covered with sheet iron. This sheet iron around the piles was in sections about 26 inches long, having a flange ½ inch wide on each side. The flanges were fastened together with ⅛ inch stove bolts. A space of 2 inches between the pile and its covering was filled with gravel and protected the pile perfectly from any damage by the fire. After being used while burning out the joint on the westerly line, the covering of the outer pile was moved over to the outside pile during the burning out of the joints on the easterly line. At the outer end a temporary platform was built about 18 inches below the bottom of the pipe and covered with 8 or 10 inches of earth, upon which the fire was placed, and the piles and caps were protected in the same manner as at the shore end.

The pressure on these pipes at the 36-inch valve was 62 pounds per square inch, and when the easterly line was cut at the shore end there was only 14 feet of pipe in advance of the 36-inch valve to prevent its being forced



Tie Rods at Taper Joint.

Strap for Taper Joint

THE ENGINEERING RECORD

Section of Trench after Excavating.

Method of Raising Two Large Pipe Lines Crossing the Mystic River near Boston.

off. On the westerly line there was 22 feet beyond the valve to hold it in place, but no sign of any movement was noticed on either line.

The length of the pipe as laid after being raised was 257 feet on the easterly line and 256 feet on the westerly line, a total of 513 feet of 36-inch pipe. The cost of the contract work, including extra work on braces and additional pumping, was $3,694.39. The cost of placing cables around the pipes, cutting and raising pipes and making new connections, furnishing and placing straps, wedges, bolts, etc., by the maintenance force, was $1,970, making the total cost per linear foot, $11.04.

Mr. Dexter Brackett, as engineer of the Distribution Department of the Metropolitan Water Works, had general supervision of the work described. Mr. Frederic P. Stearns is chief engineer of the Metropolitan Water and Sewerage Board.

The Planting of Forests is urged by the National Nut Growers' Association which is pointing out that many kinds of nut trees are especially suitable for this purpose, since they yield profitable crops during the waiting period.

A New Lead-Melting Pot.

It has often been remarked that improvements are introduced most slowly in those callings where the work is of a routine character requiring but moderate skill. It seems so easy to calk pipe, for example, and the usual tools for the purpose are so few and simple that any marked improvement in the outfit or methods of work has not appeared possible. In these days of strong competition, however, every little saving counts, particularly when the contract for pipe laying is a large one, and some shrewd contractors have recently designed an appliance which will enable a saving to be made that is by no means to be despised.

The device is a lead-melting pot intended to supersede the coke-burning furnace familiar to everybody. That furnace has to be kept on the bank and the melted lead brought in ladles to the joint to be poured, so that the lead is often too cool for satisfactory pouring. On large pipes or in deep trenches an appreciable amount of time is lost at each joint owing to these conditions. The new apparatus sits directly on top of the pipe and has a spigot projecting over the top of the bell. Consequently the lead can be run just as soon as the clay roll or jointer is in place. It is only necessary to raise the operating lever and let the molten lead flow into the joint until it is full.

The apparatus consists of the melting pot proper and a gasoline tank with an air pump to keep up a pressure on the gasoline. This air pressure forces the gasoline into pipes about the pot; the pipes are drilled with small holes which act as jet burners and can be made to furnish a steady intense heat applied just where it is needed. The lead pot and gate are so arranged that there is no waste of lead in pouring the joints, as is often the case where hand ladles are used by careless workmen, and the lead is delivered in a steady stream of high temperature which renders improbable the occurrence of seams and hollow places in the joint.

The apparatus is made in two sizes by the Contractors Plant Company, of Boston. Size 1 is for pipe up to 36 inches diameter and No. 2 is for larger pipe. The makers state that on several occasions, two men with a No. 1 melter and a jointer have done all the work on 100 joints of 36-inch pipe in ten hours. One hundred pounds of lead per joint was employed as a rule and the day's work required four gallons of gasoline.



Operating the Screws to Raise a Large Pipe Line near Boston.

The Oil Fuel Situation in the Gulf States, where many steam plants are fitted up for burning crude oil, installed for the most part soon after the discovery of the gushers at Beaumont, Tex., is assuming a serious aspect. Prices recently had advanced to 70 cents a barrel at the wells, so that by the time the oil is hauled to the point of use, its economy, as against the burning of coal, is questionable and in many places absolutely negative. It is believed by some users that the interests controlling the marketable wells have forced the prices in order to discourage the consumption of the crude product for steaming purposes, as there is more profit in refining, so that those who will must pay for the privilege. The return to coal will not cause much trouble in most cases, as it was long since found out that a deeper fire box is not absolutely necessary and in a great many plants the only change to the boilers is a checkered arrangement of bricks laid on the grate bars to deflect the jet and the insertion of the burners in the front walls of the setting. Many plants have only a part of the boilers equipped for oil burning.

The Philadelphia Rapid Transit Power Equipment.

The power plant for the Philadelphia Rapid Transit Company is designed for an ultimate capacity of 50,000 kilowatts. The first installation will include three 5,000-kilowatt steam turbines of the type now being built by the Westinghouse Machine Company for large powers, and forms part of a contract recently closed with Messrs. Westinghouse, Church, Kerr & Company, covering also 50,000 kilowatts capacity of electrical generating and converting machinery for equipping the subway and elevated system now under construction in that city. The turbines will be direct-connected to Westinghouse three-phase, 25-cycle generators, and the units will run at 750 revolutions per minute with 175 pounds of steam, 27½ inches vacuum and possibly 100 to 150 degrees of superheat. The three units will operate in multiple upon a common bus bar, and power will be distributed directly at a nominal potential of 13,000 volts from the station without the use of any intermediate transformers; for this purpose the generators are wound for high potential.

The new power station will be located upon the Delaware River, near the foot of Green Street, and it is the idea of its designers to concentrate at this point the entire power generating equipment at present distributed among a number of smaller stations. The location of the new station upon the river bank secures excellent coaling facilities and an inexhaustible supply of water for condensing purposes. The present equipment will furnish power for the subway and some reserve power for the surface traction system, pending the execution of proposed plans for centralizing the entire power system.

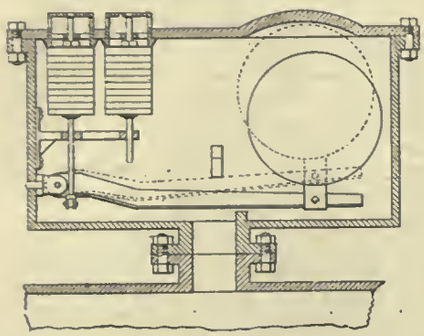
The contract also includes a large amount of transforming and converting machinery, to be installed in several sub-stations, which will be built in the district covered by the transit system. This machinery will be used for converting the high-tension alternating-current power received from the power station into low-potential direct current for use directly upon the third rail of the traction system. The rapid transit system will cover the entire business district of Philadelphia, and includes a two and four-track subway about 1¼ miles in length, extending from the Delaware River along Market Street, to a point near Twenty-third Street, a short distance from the Schuylkill River. At Broad Street an appropriate central terminal station will be erected.

A New Air Valve.

A few years ago a 72-inch steel pipe storm water sewer was laid in Jersey City, discharging under pressure. This pipe was practically level for 2,100 feet, with its invert about 5 feet below mean low water; it received the drainage from the "Heights" partly through a 40-inch cast-iron pipe 1,500 feet long and partly through a 48-inch cast-iron pipe 1,600 feet long. The speedy and certain removal of air from these mains during storms occurring when the mouth of the sewer would be sealed by the tide was absolutely essential. For this purpose Mr. Arthur S. Tuttle, M. Am. Soc. C. E., in 1900, designed an air valve which has given such good satisfaction that he decided to place it upon the market. The general design of the

valve is shown by the accompanying line cut. It is automatic in action both for discharging air or other gases collecting at the high points of pipes carrying water or other liquids and for admitting air to the pipe in the event of the rapid removal of the liquid tending to form a partial vacuum.

The apparatus consists essentially of a closed



A New Air Valve.

chamber to be connected to the pipe by a flanged nozzle, containing one or more buoyant poppet valves on vertical spindles and a float attached to a lever. Over each poppet valve is a small turret with openings to the atmosphere. The cover is flange-bolted to the chamber so as to be readily removable for inspection, cleaning or repairs. The action of the valve is very simple. Assuming first the case of a pipe being filled, the chamber contains only air and the poppet valves rest upon the bracket seats shown so as to leave the air passages to the atmosphere open. When the water nearly fills the chamber, the buoyancy of each valve causes it to close promptly. The chamber will remain sealed so long as there is liquid enough to keep the valves seated. If, however, air or gas accumulates in the chamber, the water will gradually be forced from it, and the buoyant weight at the end of the lever will finally drop, under the action of gravity, and cause the lever to bear upon a pin extending from the side of the valve spindle, thus opening the valve and permitting the escape of the air. If the relative proportions of the valve have been properly made to suit the pressure in the pipe, equilibrium can only be restored by carrying the poppet valve down and holding it open until disengaged by the rising of the float arm, as the water rises in the chamber. The travel of the arm and float are limited by a stop, as indicated. The spindle of the valve is held in a vertical position by guides so that it will always come to an even seating. The float being wholly contained within the air-chamber is caused to rise and fall solely by reason of its buoyancy and weight without regard to the pressure within the chamber. The several parts are so constructed and arranged that the buoyant weight has a very limited movement and only operates to open the buoyant valve after the air-chamber has become approximately full of air. As the air escapes from the chamber and the water rises in the same, the buoyant weight will be given its maximum elevation by flotation long before the water rises sufficiently in the air-chamber to close the buoyant valves by flotation. A considerable period is thus permitted to elapse between successive operations of the apparatus, as the valve is not opened until the chamber is approximately full of air and is not closed until the chamber is approximately full of water.

It is claimed that this new air valve is very positive and reliable in action and does not permit the escape of water, although promptly discharging any accumulated air or admitting air so promptly as to prevent collapse in the event of a sudden emptying of the pipe caused by breakage or otherwise. The importance of these properties and the convenience of the wholly automatic action of this valve will be recognized by those who have had experience with air valves. This valve is being placed upon the market by the Eddy Valve Company, of Waterford, N. Y.

The Crane at the Detroit Pumping Station.

In the valuable paper on pumping station management by Mr. Kenneth Torrance, printed elsewhere in this issue, stress is laid on the importance of being ever ready to attend to any accident in such a plant. While a breakdown in the power station of an industrial plant is a troublesome matter, the failure of the pumping machinery in a station furnishing the water supply of a city is infinitely more serious. Among the precautions to be taken to assist repairs in such a case, as well as to aid in erection and maintenance, none is more serviceable



Traveling Crane in Detroit Pumping Station.

than the installation of a traveling crane. That in use in the Detroit station, described by Mr. Hubbell elsewhere in this issue, is shown in the accompanying illustration.

It has a span of 45 feet and a lift of 44 feet. Its rated capacity is 20 tons, but it lifted 25 tons during tests. There are two operating platforms, one on each side of the main bridge, with the hoisting gearing on the main trolley. Both the bridge and trolley traversing are managed by hand cranks operated from the side platforms, which are carried by auxiliary girders that also serve as guard rails. The entire structure is of steel and the least factor of safety in any of its parts is five. Cut gears are used throughout, the most important being steel. The wheels of the trucks and trolley are also steel. The gearing was designed so that electric motors can be added for operation whenever desired. The crane was furnished by the Northern Engineering Works, of Detroit, and has proved most serviceable in erecting the two Allis pumps now nearly completed.

Book Notes.

Treatise on Hydraulics. By Mansfield Merriman. New York: John Wiley & Sons. Eighth edition. 593 pages, illustrated. Price, $5.

This new edition of this very widely known American text book on hydraulics conforms in general arrangement to the plan pursued in the preceding editions, but has been thoroughly rewritten and revised, and two new chapters have been added, one on Hydraulic Instruments and Observations and the other on Pumps and Pumping. Among numerous new topics introduced in other chapters may be mentioned new coefficients for dams and pipes, loss of head in pipes due to curvature, branched circuits in pipe systems, canals for water power, discharge curves for rivers and water hammer in pipes. The most important metric data, coefficients and formulas are given at the end of each chapter. The hydraulic tables have been collected at the end of the volume, instead of being scattered through the text, and the most important are given in both English and metric units.

Some time ago a useful series of articles on the management of gas engines appeared in "The Gas Engine," and it is probable that their recent publication in book form under the title, "Gas Engine Troubles and Remedies," will be of service to many persons placed in charge of such machinery, who are without previous experience in these duties. Mr. Albert Stritmatter, the author, seems to enjoy the confidence of many engine builders, who have supplied him with information concerning unusual cases of accidents or troubles they have had to remedy. He explains the methods of regulating the feed, ignition, timing and lubrication, and explains what may be expected to happen from the neglect of any of the proper duties of maintenance. A particularly useful chapter tells the meaning of the various improper sounds given forth by an ill-kept engine. (Cincinnati, The Gas Engine Publishing Co.; 7x5 inches, 110 pp., $1).

Alphonse Fteley.

The members of the American Society of Civil Engineers have heard with deep sorrow of the death on June 11 of Alphonse Fteley, one of the most eminent of their number, upon whom they conferred in 1898 one of the highest honors they can offer, the presidency of the association. Although born in France, in 1837, educated in the Ecole Polytechnique at Paris, and for six years in general practice abroad, Mr. Fteley's career was subsequently wholly American and he was a strong believer in the ideals of his adopted country.

He came to the United States in 1865 and at once found work as a mechanical draftsman with a New York machine works. The next year, however, saw him engaged as assistant to the late William Worthen, under whom he worked on various hydraulic power and water supply undertakings. From 1870 to 1873 he was in private practice concerned with bridges, highways and water-works.

Mr. Fteley was called from New York to Boston in the spring of 1873, to take charge, under Mr. Joseph P. Davis, who was then city engineer, of the new works for supplying Boston with water from the Sudbury River. A contract for the longest tunnel on the line of the new aqueduct was let without delay, but soon after the letting the city government, instead of authorizing the construction of the remainder of the works, passed orders for various investigations of other sources of supply, which continued for nearly two years. During this time Mr. Fteley was engaged upon the final location and designs for the Sudbury works, and also organized the accurate gaugings of the Sudbury aqueduct which have since become classic. For the five years from 1875 to 1880, he was engaged upon the construction of the Sudbury aqueduct, reservoirs and other works connected with the new water supply. During this time, also, in connection with his assistant, Mr. F. P. Stearns, he carried out many hydraulic experiments, the results of which were contained in a paper presented to the American Society of Civil Engineers in 1882, for which the Norman medal was awarded in 1883. In the spring of 1880, Mr. Davis resigned as city engineer and his place was filled by the promotion of the chief assistant, making a vacancy in the position of chief assistant which was filled by Mr. Fteley until January, 1884. While in this position he was engaged upon the design of various municipal works, including important parts of the main drainage, water supply and park systems. What his standing was in Boston is best indicated by the following extracts from a letter by one who knew him long and well:

"He made a host of friends both in and out of the engineering profession and established firmly in this vicinity his reputation as an eminent engineer. It was characteristic of the man that those in his employ not only had the highest respect for his attainments, but they became deeply attached to him as a friend. He was thoroughly liked even by the contractors from whom he required first-class work.

"That an absence of twenty years has not diminished the attachment of those who knew him well is evidenced by the eagerness with which news regarding his health has been received in recent years. Further evidence of the cordial feeling toward him in this vicinity and of appreciation of his high standing was furnished last autumn by the hearty and favorable response to the suggestion that he be made an honorary member of the New England Water Works Association.

"The important works designed and built under Mr. Fteley's direction in this vicinity were all successful and testify to his great skill as an engineer. These and the still more important works completed under his direction in New York lead to the full belief that had his health permitted him to finish the uncompleted portions of the New York water-works, the results would have been equally satisfactory."

In 1884, he was called to New York as principal assistant engineer to the Croton Aqueduct Commission, a position he resigned two years later to enter private practice, although retaining a connection with the Commission as consulting engineer. In 1888 he was appointed chief engineer of the Commission and held this responsible office until the close of 1899, when he was forced to resign on account of the precarious condition of his health. The facts concerning the difficulties of his work have never been fully published, and this is no place in which to discuss them. It is sufficient to say that not infrequently his recommendations were overruled by the Commission for reasons of public policy, the force of which he recognized. The great dam now approaching completion is erected on a site which Mr. Fteley never approved, and other less striking but very important instances might be mentioned. The Commission received his loyal support at all times, however, even when it ordered work conducted on lines not the most desirable from an engineering standpoint. So many articles have been published in The Engineering Record concerning the great Croton works designed and built under his direction that even a list of them is unnecessary here.



Alphonse Fteley.

After his resignation he lived in retirement, obliged by a complication of diseases to shun all possible sources of excitement or exertion. For some time his death had been expected by his friends, yet the private announcement of it at the Asheville convention of the American Society of Civil Engineers was a deep shock to the members, such was the great respect in which he was held by all engineers.

His consulting practice during the last twenty years was very large. He was a member of the technical advisory committee of the New Panama Canal Company, consulting engineer to the Metropolitan Water and Sewerage Board of Boston, consulting engineer to Newark during the construction of the East Jersey Water Company's works, consulting engineer to the Rapid Transit Commission of Boston and the Rapid Transit Railroad Commission of New York, to mention only a few of such engagements. The number of small works on which he gave advice was legion, and there are many young engineers who will bear testimony to his patience in hearing their troubles, his skill in solving them and his frequent generous refusal to accept any fee for his valuable advice. A man of deep and broad intellectual attainments, a keen judge of character, gifted with a charming manner, and possessed by a sterling honesty against which suspicion never even pointed, his death is a great loss to the community he served so faithfully.

The Convention of the American Society of Civil Engineers.

The convention of the American Society of Civil Engineers at Asheville last week bore out in every way the promises made by Mr. J. L. Ludlow at the Washington meeting last summer. It may be recalled that when the place of the convention was under discussion and the members were listening to strong arguments by advocates of two cities, Mr. Ludlow recommended the selection of Asheville as a means of avoiding an action unpleasant to the representatives of either city. He told the members that Asheville's picturesque surroundings, its excellent hotel accommodations and its reputation for gracious hospitality warranted holding the convention there, and it is the unanimous sentiment of those present that last week's functions more than justified his statements.

The trip to the convention city of the members and their guests who assemble at New York is always one of the interesting features of the convention. The journey this year was by way of the Pennsylvania road to Washington, and afforded an opportunity of seeing hastily some of the great improvements on its line which that company now has in hand, particularly the constructon of heavy masonry arch bridges. From Washington to Asheville, the journey was made in a well-appointed special train provided by the Southern Railway, and the schedule enabled the party to observe the double-tracking between Alexandria and Orange, Va., and the reduction of curves and grades between Hickory and Old Fort, N. C. The improvements in question are badly needed, for the traffic on the main line is so heavy that practically every siding on the main line was held by freight trains waiting for the Society's special to pass. On the line to Old Fort, the original location was manifestly made with the sole purpose of obtaining a line of minimum first cost, and the grade reductions and curve eliminations which are now necessary were an interesting study to the engineers on the train.

The meetings were opened Tuesday afternoon by Mr. Ludlow, who welcomed the Society in behalf of the local committee, and by Gen. T. F. Davidson, who spoke for the city. After President Noble's brief reply, the discussion of the time and place of the next convention was begun. It had already been practically determined at Washington to meet in 1904 at St. Louis, and the members present at last week's meeting were of the same mind. Secretary Hunt announced that the time for the session should be the last of September, as that will be

most satisfactory to the Institution of Civil Engineers, who will be the Society's guests next year. Various letters were read offering special facilities at St. Louis for the meetings or the members in attendance, and the entire subject was finally referred to the Board of Direction with power to act. The proposed amendments to the constitution relating to the grading and election of applicants for admission to the Society were somewhat modified and then advanced to letter ballot.

PROPOSED UNION BUILDING.

Secretary Hunt then presented a report from the Board of Direction on the relation of the American Society of Civil Engineers to the project for a union building for the four national engineering societies and the Engineers' Club of New York. It was explained that the Board of Direction had considered it unadvisable to take any official action concerning a subject of such importance, in the absence of definite action by the members of the Society. The Board had nevertheless appointed a committee to attend conferences with similar committees from the other parties to the project, and to take part in the deliberations of such conferences. The committee's part was wholly complimentary to the other organizations, as it was impossible for them to have any official character or to act for the Board of Direction or the Society. This committee had approved as to form the resolutions adopted at one of these conferences and printed in The Engineering Record of May 23. This approval was one of form only, in order to bring the subject properly before the Board, and did not extend to the spirit of the resolutions. On the contrary the Board recommended their rejection in the following resolution:

"Whereas the resolutions submitted by the Joint Conference Committee in the matter of the proposed union engineering building are not in suitable form, in the opinion of the Board of Direction of the American Society of Civil Engineers, to be submitted to the Society:

"Resolved, that it is the sense of this Board that the proposition, when submitted to the Society, should make definite provision for the accommodations necessary for the present and future needs of the several organizations, and that the proportion of the total expense to be borne by each of the organizations concerned should be definitely stated, and be it further

"Resolved, that the Board of Direction recommends to the Business Meeting to be held at the Annual Convention the adoption of the following resolutions:

"(1.) Resolved, that the Board of Direction be authorized to ascertain whether suitable accommodations can be obtained for the Society in the proposed new building, with provisions for future needs.

"(2.) Resolved, that the Board of Direction be authorized to co-operate to this end with the other organizations concerned.

"(3.) Resolved, that the Board of Direction be requested, provided it is satisfied that suitable accommodations can be obtained, to send to the members of the Society a letter-ballot by means of which a direct expression of the wishes of the Society in the matter may be secured, and to accompany such ballot by a statement of reasons for and against uniting in the scheme with the other organizations.

"(4.) Resolved, that the Board of Direction, in case a majority of the members, as shown by letter-ballot, are in favor of uniting with the other organizations, is authorized to proceed in behalf of the Society in carrying out the project."

The discussion of the report was opened by Past-President John F. Wallace, general manager of the Illinois Central Railroad, who pointed out that the refusal to pass resolutions of this nature, which committed the Society to no policy, would be discourteous to Mr. Carnegie and to the other societies mentioned in his letter offering funds for a union building. It was important to notice, however, that the acceptance of the gift involved the assumption of obligations which should be carefully weighed before final action was taken in a matter of such serious importance to all concerned. The consideration of the subject should be approached from two standpoints, one of professional dignity and one of expediency.

The American Society of Civil Engineers was not a technical society, in his opinion, so much as a professional organization. The great achievements of its past were not discussions of technical papers so much as a steady, consistent struggle for the recognition of engineering as a profession and not a trade or calling. It was the first society to insist on a strict compliance with severe rules as to qualifications for membership in the higher grades. It fought alone for years to impress on a sceptical public the idea that a man who achieved success as a designer and builder of railways, or ships, or power plants, or municipal works was a professional man. The younger members of the Society could not appreciate, the speaker said, what a hard battle the Society fought for engineering of every class. It had always stood for the interests of entire profession in everything except the discussion of technical details, and any action tending to cause an impression that the Society is an organization composed of the remnant of engineers left after the subtraction of those devoted to electrical, mechanical and mining subjects should be opposed as vigorously as possible.

The expediency of entering upon a project involving the abandonment of the present Society building was considered by Mr. Wallace to be a matter of grave doubt. The organization is on a sound financial basis, with a small debt so easily taken care of that in a few years it may be possible to reduce the annual dues without affecting the net revenue. The location of the house is as good as that proposed for the new building on Thirty-ninth Street for the four societies. Moreover, the association, as joint tenants or in any other manner, of the national societies and a local social club was not desirable for reasons stated at some length.

On the other hand Mr. Wallace believed that the Society should aid in every way in helping the other organizations secure the home they desired. It should co-operate with them on all lines which did not involve a sacrifice of its record as the only broadly professional body of engineers, as distinct from special technical associations. This co-operation might properly extend to a sufficient contribution to the project to enable the Society to have the use of the proposed large auditorium and other accommodations desirable for the annual meeting held each winter.

Mr. George H. Pegram, chief engineer of the Manhattan Railway Company, the next speaker, was one of the three representatives of the Board of Direction at the joint conferences of committees of the organizations interested in the union building. He pointed out that the project contemplated no affiliation of these bodies but simply their joint ownership of property and possibly a joint management of their libraries. Each would be as entirely independent as now, and their individuality would be as distinct. If the acceptance of the gift by the Society were contingent upon an immediate vote, without careful consideration of all the advantages and disadvantages involved by its acceptance, he was in favor of its rejection. But were time allowed for a careful study of the problem, as the resolutions of the Board permitted, he saw no reason to doubt that the gift of Mr. Carnegie could be accepted by the Society without detriment to itself and with advantage to the engineering profession.

A letter was read by Mr. Pegram from Prof. George F. Swain endorsing this view and referring to the vote of the members of the Society in the Boston district, which was summarized in The Engineering Record of June 6. He also read a telegram from a number of members asking to have ballots on the acceptance of Mr. Carnegie's offer sent out without delay. Mr. Bernard R. Green, one of the members whose name was signed to the telegram, was present at the convention, and announced that he was not entirely in sympathy with the request and had permitted the use of his name through a misunderstanding of the terms of the proposed message.

Secretary Hunt then read a letter from Past-President Alphonse Fteley advising the Society to take ample time for a careful consideration of the proposed association in a union building, before voting on the matter. This letter was read just before Mr. Fteley's sudden death, and it was a sad reflection subsequently to many of those present that the exertions made by the eminent and respected writer in endeavoring to prevent the unconsidered acceptance of Mr. Carnegie's offer by the Society may have hastened his lamented end.

Mr. E. L. Corthell sent a letter, read by the secretary, in which he strongly advised the Society not to join in any project for a joint building. The effect of such an action, in his opinion, would be to reduce the Society, in the eyes of many people, to the position of a specialists' association. While its technical field was somewhat special, it was true, nevertheless the Society was broadly professional in the true sense, and had always stood for the highest aims and the widest recognition of the engineer as distinct from the specialist. Its position, in his opinion, was admirably stated in the presidential address made in 1895 by Mr. George S. Morison, who said:

"The relations which our Society should bear to the other national engineering societies are established by the definition of civil engineering. Our Society should include the choicest minds in every branch of engineering; it must have among its members the leading members of every society which represents an engineering specialty. No other society can have our general range; on the other hand, no other national society can make the same restrictions as to individual requirements. Each of the other societies is devoted to some specific branch of engineering, but the individual qualifications should be comparatively light; it receives into its ranks every engineer working in its specialty, as we receive engineers of every specialty but not every engineer.

"The differences between our Society and the several other classes of engineering societies are of so radical a nature that it would be a dangerous thing to try in any way to consolidate or unite them. We cannot unite without entirely changing the qualifications for membership. No idea of uniting with the other national societies has ever been suggested. We cannot unite with the various local societies without either so widening the qualifications of our membership that we shall cease to be a society of civil engineers, or so restricting the qualifications of their membership that the ranks of many of them would be destroyed."

In conclusion Mr. Corthell gave a somewhat amusing summary of the results of his well-

known attempt to establish an international society of engineers and architects. That project came to an end because it was impossible to form an international society embracing all specialists without lowering the standard of admission. It was his belief that the best results would be attained by societies of specialists with a single broadly professional association with requirements so high that membership in it would be a hall-mark of competency which no one could question. The American Society of Civil Engineers was a professional organization of this class, and he deplored any action which would tend to restrict it to a limited technical branch of engineering.

Past-President J. J. R. Croes, who next spoke, was armed for the debate with letters from all eight survivors of the little group which reorganized the Society after its quiescent period some forty years ago, and from other leading members. Thos. F. Rowland, a distinguished member of the mechanical as well as the civil engineers' society, was strongly opposed to any kind of an association of the American Society of Civil Engineers with specialized organizations. Past-President Charles H. Paine believed that the Society should remain independent, and that the suggestion for a union of the kind proposed could only come from people unfamiliar with the broad professional character of the organization, which was responsible for its pre-eminent position. He saw nothing to gain in the project. Past-President Mendes Cohen, always a strong advocate of a union building for the engineering societies, opposed vigorously any alliance whatever with a local social club, as something inconsistent with national professional bodies, and this opinion was also expressed in a letter from Mr. A. P. Boller. Messrs. George S. Greene, Jr., and Henry G. Morris expressed ideas similar to those of Mr. Paine. Mr. Edward P. North, one of the earliest members of the Engineers' Club, was opposed to its location in free communication with the rooms of the national societies, as he believed that their junior members should not be exposed to the temptations of a private bar. Moreover, he considered that the only proper course for all parties concerned was to get a legal form of joint partnership agreement and a careful estimate of the expense of running a union building, before taking definite action on the acceptance of Mr. Carnegie's offer. Past-President Thos. C. Keefer wrote that he always preferred life in a private home to existence in an apartment house, and the joint occupation of a large building by several societies had no greater attraction. Past-President Robert Moore wrote that his observation had invariably shown a lack of harmony where several large families were housed beneath one roof. Mr. Joseph P. Davis, whom the Society has long desired in vain to persuade to act as its president, wrote that it would be a fatal mistake to enter into a joint ownership proposition. Mr. Samuel M. Gray could see nothing to gain and much to lose in the proposed measure. Mr. Robert Cartwright, also a member of the mechanical engineers' society, was opposed to any union except under carefully considered safeguards, a view also held by all Rochester members. Mr. Charles Macdonald was convinced that there should be some delay in order to consider the matter carefully. He hoped some sound basis of joint ownership could be devised, which would be free from all serious objections. The development of engineering had been through specialization, first of mining engineers, then of mechanical engineers, and recently of electrical engineers, all performing needed and difficult professional work. He believed in close association of the civil engineers with them, so that each could gain strength from the others. One was not any better than the others, in his view, and he deplored any contrary statement as tending to arouse unnecessary feeling. Mr. Francis Collingwood wrote that detailed information was needed before taking definite action. Mr. Rudolph Hering believed a union building for the engineering societies to be desirable and could see no insuperable obstacle to such a project; he was opposed, however, to any association with the Engineers' Club.

After presenting the letters mentioned, Mr. Croes stated his own views, already expressed in The Engineering Record of May 16. His conclusion was that the Society should send to Mr. Carnegie a letter of thanks for the portion of the gift that would be its share but declining it owing to the obligations and conditions its acceptance would involve.

Mr. Oberlin Smith, a member of all four national engineering societies as well as the Engineers' Club, protested strongly against the tone of superiority adopted by some of the members of the American Society of Civil Engineers in referring to other organizations. He failed to see in what respect the members of all were not of an equally high standing, and he could discover no reason for hesitation in joint partnership between equals. He had been a member of the Engineers' Club for many years and was not conscious of a deterioration of his moral nature in consequence; in fact he considered that the proposed location of the club would be a great convenience not only to him but to many other members of the various engineering societies.

At this point in the discussion the convention adjourned until the following morning, the evening session being devoted to Mr. Noble's presidential address, of which a review was printed last week.

On Wednesday morning, Col. Henry. S. Haines spoke strongly concerning what he considered unwarranted and unjust attacks on the character of the Engineers' Club and the personnel of its membership. He regarded the club as an admirable organization, affording the same opportunities and standards for social intercourse that the engineering societies afforded for technical discussions. The club supplemented the societies and deserved their cooperation so far as advisable for the good of all. He pointed out that the American Society of Civil Engineers could take any action it pleased without preventing the acceptance and immediate use of Mr. Carnegie's gift by the other beneficiaries, who had expressed their intention of proceeding immediately without regard to the Society's action. As the Society would therefore be the only organization liable to suffer by the delay necessary for mature deliberation, he held that it was justified in taking whatever time was necessary for an investigation of the advisability of the proposed use of a joint building. It was the most important decision the organization had been called upon to make, and it was particularly important because of the possibility that a decision against the project might lead to a secession from the parent body of one set of members after another to form smaller organizations of a special character, finding ample accommodations in the union building. The hearty affiliation of the Society with the other bodies might prevent this slow withering away.

Mr. Frederick Brooks presented briefly the views of the majority of the Boston members, which were favorable to a union building. Mr. George W. Catt, president of the Atlantic, Gulf & Pacific Company, spoke in favor of the project. He believed the Engineers' Club occupied a useful and honorable position which would not be prejudicial to any technical organizations associated with it. The association of the four technical societies, when considered on a broad professional basis, was highly desirable. The more intimate the relations of the organizations, the greater would be the interchange of technical information between them, the closer the bonds of professional esteem, and the more useful to the others the knowledge each had acquired in its special field.

Mr. Robert W. Lesley, president of the American Cement Company, expressed the opinion that the financial details of a union building could be readily arranged, if it were advisable to construct one. The trustees might be chosen on some such basis as the United States Congress, part representing the number of members in each body and having a voting weight in accordance with the numbers represented, and part chosen on the basis of the financial interest of each organization in the house. Such a governing board could be selected on various other lines which would give an equitable representation to all concerned.

Mr. Henry B. Seaman read some correspondence showing in a striking manner the unpleasant personal criticism which has been received by those who have openly counseled the Society to avoid any hasty acceptance of this project. Mr. George S. Davison said that delay in acceptance of his gifts never disturbed Mr. Carnegie, who was a business man able to appreciate the folly of a hasty scramble to secure a gift without a careful consideration of the obligations its acceptance entailed. In the Pittsburg district, there was often several years' delay in accepting such gifts, and events had proved that the acceptance of some of them had been unfortunate.

On motion of Past-President B. M. Harrod, the resolutions proposed by the Board of Direction were slightly modified and then unanimously adopted. The first resolution was amended by adding at the end, after the word "needs," the following, "and also to make such investigations and hold such conferences as bear upon the advisability of the acceptance of Mr. Carnegie's proposition by this Society." In the third resolution, after the word "obtained," there was added the clause, "and that the acceptance of the proposition is otherwise practicable."

On motion of Colonel Haines, with an amendment by Major Harrod, the following resolution was then passed with slight opposition: "Resolved, that it is the sense of this meeting that the letter-ballot called for in the resolutions should be presented to the Society with the usual sixty days' notice and opportunity for discussion at the next annual meeting."

These resolutions mean, in effect, that the investigation of the subject will be undertaken by the Board of Direction, which will issue a report on the subject when its examination is finished. This report will be discussed at the annual meeting and then voted upon by letter-ballot, which will enable the final result to be announced in March.

TIMBER TESTS.

The first professional discussion was on timber tests and was opened by Prof. W. K. Hatt of Purdue University, temporarily on the staff of the Bureau of Forestry. A general statement of the character of the elaborate investigations undertaken by the Bureau, written by Mr. Gifford Pinchot, was printed in the Society's "Proceedings" for April, and Mr. Hatt's remarks were intended to supplement that statement and a similar circular distributed widely throughout the country.

The replies to the circular sent out by Mr. Pinchot indicate that there is a lively appreciation of the importance of a continuous study of methods of economizing the use of timber,

lengthening its life and developing the supply by proper forestation. The determination of the strength of various species of wood is but a minor detail in the work. As soon as the replies to the Bureau's circular have been received and considered and a plan of investigation prepared, it will be submitted for criticism to experts in such work before its final adoption. The proposed scheme will be so drawn up that parts of the investigation can be carried out and their results made public without being delayed by other portions of the work.

In a general way, Professor Hatt summed up the present knowledge of the mechanical properties of different species of structural timber as fairly exact, so far as such values may be based on small sticks. The reduction which must be made for large merchantable timber and the effect of forest conditions on these values was largely unknown. The future work should not duplicate any that had already been performed in a reasonably satisfactory manner, and tests should be confined to species giving promise of being on the market for some time. Among the subjects which still required investigation, Professor Hatt mentioned the effect of kiln-drying and the methods of seasoning in general, the influence of fire retardants on the properties of timber, and the efficiency of preservatives, particularly those employed with so-called inferior woods.

It was a common belief that tests on small pieces did not yield unit values applicable to large sticks. Former tests made by the Government showed that while timber in small sizes was usually more free from defects than timber of large sizes, nevertheless a comparison of results of tests on a large stick with a number of tests on small pieces from the same large stick showed there was no significant difference in the unit values. What the designer wished to know, however, was the probable strength of the different sizes and grades of timber in the market, and this knowledge could only be obtained, in the speaker's opinion, by a test of timber actually cut for the market by the saw mill. Logs sawed under the direction of the engineer making the tests were less likely to yield results comparable with those of commercial sticks.

The sticks subjected to test will be photographed, and the reader of the report will not only have a reproduction of the photograph to assist him in judging any test stick, but will also be furnished with a memorandum of the market grade of the piece and other information bearing on its quality. It is further proposed to present some analysis to determine in a quantitative way the reduction of the moduli due to knots, shakes and crooked grain.

An examination of the effect of forest conditions on the quality of timber is also included in the investigations proposed by the Bureau, although it may not be undertaken until a late period. In connection with this study the examination of the mechanical properties of inferior woods may furnish information of great commercial importance. At present only the more valuable species on a tract are cut, leaving the inferior species standing, resulting in the future forest becoming mainly a growth of inferior trees. If the latter can be largely cut and a small proportion of the valuable species left standing, the chances are better for the new growth to contain a large percentage of valuable woods.

Variations in testing processes and their effect on the results will also receive the attention of the Bureau, while the study of the influence of different degrees of moisture will be particularly thorough. For the latter purpose it is proposed to test sticks of the same size and grade, both green and seasoned, and to ascertain the degree of moisture to be expected in market timber. With this information, and a series of experimentally determined constants showing the ratio of strength of timber with any percentage of moisture to that of a well-dried stick, the designer will be equipped for all necessary computations.

The species of woods to be tested will include not only western red fir, hemlock and spruce; eastern spruce, hemlock and fir; southern pine, and other species already in extensive use, but also woods which have yet to come upon the market in large quantities. Among the latter may be mentioned southern red gum, catalpa, tamarack and eucalyptus. The methods of conducting the tests were referred to but briefly, as this subject is to be discussed at length at the meetings of the American Society for Testing Materials.

The organization of the work of timber tests presupposes a central laboratory at Washington, D. C., directed by the Bureau of Forestry, and other testing stations at such points as the Pacific coast, the Mississippi Valley hardwood centers, and the North Atlantic region. These stations will be under the direction of the central laboratory to which copies of all data taken will be sent. All tests will be made by uniform methods prescribed in advance. The timber for tests will be selected by the resident engineer of the station, acting in conjunction with a dendrologist and an experienced inspector.

In the discussion following Mr. Hatt's paper, Mr. A. L. Johnson gave a brief review of the previous work done by the Bureau of Forestry along the lines of the proposed work. The early investigations were hampered by a serious lack of funds, which prevented any comprehensive work. Before anything was undertaken, however, a general scheme for a study of the timber resources of the country was worked out, which was explained to the convention by means of a diagram. Some such scheme was essential, for otherwise the work would not be properly connected together and some of it would have to be duplicated. Mr. Johnson criticised the Bureau's plan for permitting such a duplication through the use of test sticks bought in the market. Tests of such sticks would furnish information of use to the designer of timber structures, but would have to be duplicated when it came time to test sticks cut under an inspector's eye and seasoned by methods which would give a knowledge of the degree and character of the drying. In his opinion, it would be more desirable to omit the test of sticks bought in the market, at least very largely, because the sticks procured by the Bureau in the forests could easily be graded by a timber inspector and serve every purpose.

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Annual convention at Saratoga Springs, N. Y., June 23 to 26. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Convention at Detroit, Mich., June 23 to 26. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal Notes.

Mr. Albert E. Chandler has recently been appointed state engineer of Nevada, with headquarters in Carson City.

Mr. A. S. McClenahen has been appointed superintendent of water works and electric lighting of Wyandotte, Mich.

Mr. Charles P. Baldwin has removed his architectural offices to the Exchange Building, 45 Clinton Street, Newark, N. Y.

Mr. George F. Deakin has resigned as superintendent of the Waukesha, Wis., Water Co., and Mr. H. E. Wolbert has been appointed to succeed him.

Mr. George W. Drumheller has resigned as city engineer of Mount Vernon, N. Y., and Mr. Charles M. Hick, formerly assistant city engineer, is now in charge.

Mr. A. W. Martin has been appointed assistant general superintendent of the system, and Mr. William Daniels, superintendent of the New Haven terminal of the New York, New Haven & Hartford Railroad.

Captain William V. Judson, Corps of Engineers, U. S. A., has been relieved from duty at the Engineer School of Application at the Washington barracks to take charge of work in the office of the Chief of Engineers, in that city.

Mr. Joseph Hyde Pratt, of the Engineering Company of America, 74 Broadway, New York City, has started on a trip through South Dakota, Nevada and Arizona to make examinations of mining properties and to supervise work for which the company is consulting engineer.

Obituary Notes.

Alfred G. Ferguson, a prominent civil engineer of Vancouver, B. C., died June 2 in a sanitarium in San Francisco, aged 59 years. He was engaged mostly in railroad construction, including tunnels on the Canadian Pacific Railway.

Charles Frederick Dunham, a widely known mining engineer, died June 14 at the home of his brother-in-law, Mr. James Owen, of Montclair, N. J., after an illness of several weeks from heart disease. Since 1894 he had been in charge of mines at Sierra Mojada, Mex., this engagement terminating a period of about 23 years spent almost wholly in mine engineering and ownership, including some ten years of private practice. He was born in Brooklyn, N. Y., in 1853.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 33, 34, 35, 39 and 44.

WATER.

Clayton, Ala.—See "Power Plants, Gas and Electricity."

Salacauga, Ala.—G. P. McDonnld, Town Clk., writes that the town has accepted a proposition from T. L. Yoder, of Pittsburg, Pa., for water works.

Alexander City, Ala.—It is stated that bids will be received about July 1 for constructing proposed water works. The work will include about 2 miles of mains to be laid, the building of a stand tower and 50,000 gal. tank, also pumping station. A. P. Ferquay, Mayor.

Santa Rosa, Cal.—It is stated that bids are wanted July 7 for furnishing the city a 2,500,000 gal. pumping engine. C. D. Clawson, City Clk.

Redding, Cal.—City Engr. D. M. Burson will have charge of the construction of the proposed new water works.

San Jose, Cal.—The lowest bid opened June 10 by the Bd. of Mgrs. for a steel water tower for Agnews Hospital is stated to have been submitted by S. Kuehenbeiser & Son, of San Jose, for $7,680.

San Rafael, Cal.—The Marin County Water Co., of which Wm. Barr is Pres., is stated to have decided to increase its water supply.

Idaho Springs, Colo.—See "Power Plants, Gas and Electricity."

Walsenburg, Colo.—Press reports state that Engr. T. L. Darby, of Denver, estimates the cost of constructing water works here, at $48,000. The proposed works will be a gravity system, and will include a complete new set of pipes and a storage reservoir. The supply will be taken from the underflow in Cuchara River bed by means of water cribs.

Bridgeport, Conn.—Mayor Mulvihill is stated to have appointed Aldermen Morrisey, Carroll, Doty, King and Enos as a special committee to devise a plan for the fulfilment of the suggestions regarding the purification of city water embodied in the report of Rudolph Hering, of New York, N. Y.

New Haven, Conn.—The New Haven Water Co. is stated to have awarded to Eglie & Bunting, of Boston, Mass., the contract for the erection of a sand filter plant at Lake Whitney; the contract involves an expenditure of about $275,000.

Washington, D. C.—Bids will be received by the Comrs. D. C. until Aug. 8 for furnishing 300 high-pressure fire hydrants. John Biddle, Comr., D. C.

Hawkinsville, Ga.—J. Holder, City Clk., writes that surveys are being made for the proposed water works and sewerage system, to cost $35,000. Engineer, Arthur Pew.

Augusta, Ga.—Bids will be received July 8 by T. I. Hickmann, Intendant, for $25,000 bonds to be used for extending water works and sewerage system, also for street improvements.

Battle Creek, Ia.—Bids will be received July 1 by M. H. Storck, City Recorder, for constructing 60 ft. steel tower with 60,000 gal. steel or wood tank, complete with foundation, and to re-erect old tank now on 50-ft. wood tower on 8-ft. wood tower.

Shellsburg, Ia.—A press report states that H. Dickinson and Wm. De Fol are on the committee to investigate the question of constructing water works.

Exira, Ia.—V. B. Hillyer, City Clk., writes that bids are wanted July 10 for the construction of water works, to cost $2,500.

Lawrenburg, Ky.—See "Power Plants, Gas and Electricity."

New Roads, La.—See "Power Plants, Gas and Electricity."

Ruston, La.—See "Power Plants, Gas and Electricity."

Lowell, Mass.—R. J. Thomas, Supt. Water Wks., writes that the city has been authorized by the State Legislature to extend its water system to Dracut, but it is probable that nothing will be done in the matter this year.

Battle Creek, Mich.—The Special Com. on Water Supply is reported to be in favor of a filtration plant.

Essexville, Mich.—J. H. Blomshield, of Bay City, is preparing plans for water works.

Onaway, Mich.—The citizens are stated to have voted to issue $18,000 bonds for water works.

Ford, Mich.—See "Power Plants, Gas and Electricity."

Marine City, Mich.—The Bd. of Pub. Wks. is stated to have been authorized to secure bids for placing boiler in water works and removing east wall of water works.

Eveleth, Minn.—Pastoret & Martin, of Two Harbors, is stated to have secured the contract for improving and extending the water works, for $11,078.

Millville, Minn.—The citizens are reported to have voted to construct water works.

Wood Lake, Minn.—W. I. Gray & Co., of Minneapolis, is stated to have secured the contract for water works, for $6,750.

Hanley Falls, Minn.—Bids are wanted June 30 for water works, including steel tower with wood tank, brick building, gasoline engine, deep well pump and pipe line. Oscar Claussen, Consulting Engr., St. Paul.

Yazoo City, Miss.—Bids will be received by the Mayor and Bd. of Aldermen until July 13 for furnishing material and constructing approximately 12 miles of 4 to 12-in. c. i. pipe, hydrants and valves, pumping basin, lined and covered reservoir, steam pumps, condenser and feed water heater. Kirkpatrick & Johnson, Engrs., Jackson, Miss.; E. J. Poursine, City Clk.

Columbus, Miss.—The Council is stated to have authorized A. Frederickson to purchase an additional pump for the water works.

Pickens, Miss.—Bids are being received by Engineers Kirkpatrick & Johnson, of Jackson, for steel tank and tower tank to hold 30,000 gals. on tank 100 ft. high from base of columns to bottom of cylindrical part of tank to be erected at Pickens, Miss. Bidders' design to accompany proposal.

Biloxi, Miss.—The contract for an artesian well (bids opened June 5) has been awarded to A. B. Blakemore, of New Orleans, La. Bid per ft. depth, 8-in. well, $2.95 including pipe. At same time a contract was let to Means & Fulton Iron Wks., Birmingham, Ala., for steel tank and tower for $9,900, not including foundations. Engineers, Kirkpatrick & Johnson, Jackson.

St. Louis, Mo.—Jas. L. Blair, representing eastern capitalists, has presented a proposal for building a new water works for the city to the Bd. of Pub. Improv.

Cameron, Mo.—The citizens are stated to have voted to issue $59,000 bonds for water works, to be constructed under supervision of Hiram Phillips, of St. Louis.

Dillon, Mont.—Engineer F. C. Kelsey, of Salt Lake City, Utah, writes that the date of opening bids for the construction of water works has been extended to June 29.

Camden, N. J.—Geo. J. Phillips has secured the contract for removing Pavonia reservoir (bids opened June 9) at 32½ cts. per cu. yd.; amount available, $10,000.

Contracts for water supplies (bids opened June 10) have been awarded as follows: Meters, Hersey Co., of Boston, Mass.; pipes, specials, valves, boxes and hydrants, to R. D. Wood & Co., of Camden, and valves to Rensselaer Valve Co., of Troy, N. Y.

Perth Amboy, N. J.—Press reports state that bids will be received June 26 by the City Treas. for $80,000 water bonds.

Glenridge, N. J.—A press report states that the Eagle Rock Water Co. has executed a contract with a New York engineering concern to sink 4 wells on its property in Glenridge. This work is preliminary to the erection of a power-house and pumping station with a capacity of 2,500,000 gals. per day. The plans will call for a duplex high-duty system.

Buffalo, N. Y.—The Com. on Water of the Bd. of Aldermen is stated to have decided to report in favor of appropriating $2,000 to engage experts to examine the water supply and report as to the necessity of a filtration plant.

Schenectady, N. Y.—The following bids were opened by the Water Comrs. (John H. Amo, Secy.) June 8 for (*a*) 36-in. steel riveted force water main, (*b*) standpipe, (*c*) collecting gallery, (*d*) engine house at the Rotterdam pumping station: T. A. Gillespie Co., 71 Bway., N. Y. City, *a*, $152,780 (awarded contract); *b*, $27,000; *c*, $25,500 (awarded contract); *d*, $14,000 (awarded contract). Clinton Beckwith, Herkimer, *a*, $211,080. Riter-Conley Mfg. Co., 55 Water St., Pittsburg, Pa., *a*, $152,640; *b*, $32,700; *b* and *c*, $49,097. Chicago Bridge & Iron Co., Chicago, Ill., *b*, $29,950 (awarded contract). R. D. Wood, Philadelphia, Pa., *b*, $28,000. Ellery-Colby Co., Owego, *b*, $39,000. Thos. Kearney, Little Falls, *c*, $15,986. John N. Nolan, Schenectady, *c*, $15,359. John M. Van Duzee, Schenectady, *c*, $13,858.

Saranac Lake, N. Y.—Bids will be received by the Bd. of Water & Sewer Comrs. until June 26 for constructing a water main and dam. The work will comprise about 13,550 ft. of 14-in. c. i. water main and appurtenances; also a masonry dam of about 80 cu. yds. Seaver A. Miller, Village Clk.

New York, N. Y.—Bids were received June 16 by the Dept. of Water Supply, Gas and Electricity from (*a*) N. Y.-Continental-Jewell Filtration Co., and (*b*) Jas. McFerran, for remodeling the Watts Pond pumping station near Valley Stream, L. I., the following being the principal items: Engine and boiler superstructure, *a*, $3,000; *b*, $11,969. Coal shed, trestle, etc., *a*, $4,400; *b*, $5,500. Pumping plant furnished by contr. for 1 yr., *a*, $10,000; *b*, $12,000. Pump well, *a*, $2,000; *b*, $3,700. 36-in. vitrified pipe infiltration galleries, 6,000 lin. ft., *a*, $7.50; *b*, $5.50. 3,200 lin. ft. 33-in. pipe, *a*, $7.50; *b*, $5.20. 2,150 ft. 30-in. pipe, *a*, $7; *b*, $4.90. 1,075 ft. 27-in. pipe, *a*, $6; *b*, $4.60. 1,075 ft. 24-in. pipe, *a*, $5; *b*, $4.20. 1,075 ft. 20-in. pipe, *a*, $4; *b*, $3.70. 450 ft. 30-in. c. i. pipe, *a*, $12; *b*, $7.50. 55 sump boxes, *a*, $90; *b*, $140. Two 30-in. foot valves, *a*, $500; *b*, $448.

Bids were received at the same time for remodeling the Wantagh, L. I., Station: For the engine and boiler superstructure, coal shed, pumping plant, pump well, 2,550 ft. 36-in. vit. pipe, 1,070 ft. 33-in. vit. pipe, 2,700 ft. 30-in. vit. pipe, 1,070 ft. 27-in. vit. pipe, 1,600 ft. 24-in. vit. pipe, 1,600 ft. 20-in. pipe, and 1,800 ft. 30-in. c. i. pipe. N. Y.-Continental-Jewell Filtration Co. bid $3,500, $3,500, $10,000, $2,000, $9, $9, $8, $6.50, $5, $4 and $12.50 respectively, and John J. Cashman bid $3,500, $3,000, $5,000, $3,600, $13, $12, $10.50, $9.50, $8, $7 and $15.

Brooklyn, N. Y.—The lowest bid opened by Robt. Grier Monroe, Comr. of Water Supply, N. Y. City, on June 11 for furnishing, delivering and laying a main on Atlantic Ave., Boro. of Brooklyn, was submitted by John J. Cashman, of Brooklyn, as follows: For c. i. pipe, $30 per ton; special castings, $60 per ton, and for laying 48 in., 36 in., 30 in. and 6 in. pipe, $7, $2.75, $2.25 and 30 cts. per lin. ft. respectively.

Mt. Airy, N. C.—See "Power Plants, Gas and Electricity."

Cincinnati, O.—Bids are wanted June 25 for furnishing and delivering water pipe, water pipe specials and loam castings. Robt. Allison, Pres. Bd. of Pub. Service.

Tiffin, O.—The City Council will shortly ask for bids for a water works franchise. C. J. Peters, City Engr.

New Bremen, O.—Bids are wanted June 30 for constructing water works. John P. Force, Consulting Engr., Columbus; G. A. Klenning, Clk. Bd. Pub. Affairs.

Berlin, Pa.—It is stated that bids will be received until June 27 by Chapin & Knowles, Engrs., Frick Bldg., Pittsburg, for constructing a plant for the Berlin Water Co., which is to supply the town of Berlin.

Weissport, Pa.—Bids will be received by A. P. Andrews, Treas. of the Blue Ridge Water Supply Co., Walnutport, until July 7 for furnishing material and constructing a gravity system of water works for the Blue Ridge Water Supply Co., embracing approximately 15,000 ft. of 6-in. and 4,000 ft. of 4-in. pipe, 5 double nozzle hydrants, 15 6 and 4-in. valves and boxes, 800,000 gal. storage reservoir, and 600,000 gal. receiving basin. Warren F. Cressman, Engr., Sellersville; H. J. Hongen, Pres., Weissport.

Lebanon, Pa.—The question of issuing bonds to the amount of $500,000 for water, sewerage and paving purposes was defeated at the election June 16.

Lancaster, Pa.—The following bids were opened by the Special Water Comn. June 8:

12,000,000 gal. pump—Marine Eng. & Mchy. Co., N. Y. City (2 bids); $38,500 and $37,000; Camden Iron Wks., Camden, N. J., $36,800 (compound high duty); Henry R. Worthington, N. Y. City, N. Y. (3 bids), $58,000 (triple high duty), $45,000 (compound high duty), $37,000 (triple low duty).

Stand pipe—Lippett & Wood, Philipsburg, N. J., $29,800; E. Keelert Co., Williamsport, $19,437; J. U. Fritchey, Lancaster, $23,700; Chicago Bridge & Iron Co., Chicago, Ill. (2 bids), $21,974 (granite foundations), $19,974 (Clearfield stone).

1,312 net tons c. i. pipe and special castings—U. S. Cast Iron Pipe & Fdry. Co., Philadelphia, $39,577; Dimmick Pipe Co., Birmingham, Ala., $39,399; Camden Iron Wks., Camden, N. J., $38,921; Reading Fdry. Co., Philadelphia, $37,018.

Pittsburg, Pa.—The question of constructing a filtration system is under consideration by the new city administration. Wm. B. Hays, Mayor.

Reading, Pa.—The Water Bd. has purchased property in Mt. Penn Boro. as a site for the plant to filter the water of Antietam reservoir.

Columbia, S. C.—An ordinance is stated to have been introduced in Council providing for the appointment of a Water Works Comn., to take steps to construct water works.

Col. J. Q. Marshall is stated to have made a proposition to Council to furnish the city with a water supply.

Pukwana, S. D.—The citizens are stated to have voted June 9 to issue $5,000 bonds for water works.

Sioux Falls, S. D.—Water bonds amounting to $73,000 are reported sold.

Harriman, Tenn.—The contract for water works improvements is stated to have been awarded to Van D. Hite-Smith for $14,089.

Paris, Tex.—The citizens are stated to have voted June 4 to issue $75,000 bonds for improving and maintaining the water works, including the construction of a new pipe line to the lake 6 miles west of town.

Dallas, Tex.—I. A. Moore, City Secy., writes that it is proposed to lay mains from reservoir to city, at a cost of $100,000. Engineer, Chester B. Davis.

Mineola, Tex.—The Council is reported to be considering the granting of a water works franchise to R. J. Smith.

Waco, Tex.—The Water Comn. has reported to City Council recommending that the city make a contract with the Bell Water Co., and if this contract cannot be made, that the city at once construct municipal water works.

San Antonio, Tex.—Bids will be received by the City Secy. until July 15 for supplying material and doing the following work: For constructing 26,000 ft. of 42-in. conduits, to operate under pressure 2 steel surg tanks, 15x35 ft., concrete foundations for 2 surg tanks, delivering sluice and gate valves, valve standards and extension valve boxes, 100 tons of 24 and 30-in. c. i. pipe and certain specials, castings, and laying c. i. pipe and setting valves and valve boxes. Chester B. Davis, Consulting Engr., 10 Wall St., N. Y. City. Complete set of plans and specifications may be obtained from the Engr. upon receipt of $15.

Floresville, Tex.—H. C. Thompson, City Clk., writes that it was voted June 12 to issue $14,000 bonds for water works.

Richmond, Va.—Bids will be received by the Com. on Water until July 1 for constructing subsiding and coagulating basins. Approximate estimated cost of the work to be done is placed at $300,000. C. E. Bolling, Supt.

Spokane, Wash.—The Bd. of Pub. Wks. is stated to have decided to secure bids for a standpipe for Cook's addition. It will be 70 ft. high, 30 ft. in diameter, and have a capacity of 366,000 gals.

Martinsburg, W. Va.—The following contracts are stated to have been awarded (bids opened May 21): For pumps, to McGowan & Co., of Cincinnati, O., $5,331, and for boilers, to H. A. Hammann, of Martinsville, for $3,136.

Clarksburg, W. Va.—W. H. Cole, City Clk., writes that it is proposed to erect new water tanks, at a cost of $1,700.

Winnipeg, Man.—H. W. Ruttan, City Engr., writes that contracts for 1,000 meters (bids opened June 8) have been awarded to the National Meter Co. and the Hersey Mfg. Co., en. 500.

Whitby, Ont.—See "Power Plants, Gas and Electricity."

Toronto, Ont.—Thos. McQueen, Secy. Water Bd., writes that the John Inglis Co., of Toronto, has secured the contract for a pumping engine (bids opened May 12) for $150,000, allowing $5,000 for engine No. 3.

SEWERAGE AND SEWAGE DISPOSAL.

San Francisco, Cal.—City Engr. C. E. Grunsky is now preparing plans for the following public improvements which will soon be submitted to the vote of the citizens: Sewers, $7,000,000; school buildings, $2,000,000; public library, $1,000,000; hospital, $1,000,000; repaving streets, $1,000,000. In addition to these the matter of opening and extending parks will be considered, as well as the matter of providing for the equipment and operation of a modern street railroad. $68,000 has been provided in the budget for the fiscal year 1903-04, passed by the Supervisors June 12, for the construction of new sewers and pavements.

Pueblo, Colo.—E. W. Hathaway, City Engr., writes that the contract for 4,000 lin. ft. of 8 and 12-in. sewers in Sewer Dist. No. 12 (bids opened May 25) has been awarded to Minnequa Constr. Co., Central Blk., at 58 and 75 cts. per lin. ft.; total, $2,722.

Wilmington, Del.—The Dirs. of the St. & Sewer Dept. are stated to have decided to again reject all bids recently received for the Price's Run sewer, as all were in excess of the amount available, which is $90,000. The Bd. will construct the sewer itself, under supervision of its engineer, T. Chalkley Hatton.

Washington, D. C.—Local press reports state the sewer on the site of the new union station will be rebuilt. It is estimated that between 1,200 and 1,500 lateral ft. of sewer, 10 ft. in diameter, will have to be constructed, and the cost will be between $60,000 and $75,000.

Hawkinsville, Ga.—See "Water."

Chicago, Ill.—Bids will be received June 24 by the Bd. of Local Improv. for constructing house drains in portions of numerous streets. Andrew M. Lynch, Pres.

Danville, Ill.—W. H. Martin, City Engr., writes that $20,000 has been appropriated for a sewer in the 7th Ward.

Chatsworth, Ill.—The Comrs. of Oliver Drainage Dist. contemplate repairs and extensions on the drainage system in Livingston County, amounting to $15,000. Surveys now in progress. John W. Walsh, Chatsworth, Ill., Pres. of Bd. J. G. Melluish, of Bloomington, Engr.

Chicago, Ill.—The ordinance for the Jackson Park Ave. system of sewers, estimated to cost $800,000, has been submitted by the Bd. of Local Improv. and ordered published.

Ardmore, Ind. Ter.—The American Light & Water Co. is stated to have secured the contract for constructing a sewerage system here, for $7,500.

Rockwell City, Ia.—The Bd. of Superv. is stated to have ordered the construction of the Purgatory drain; it will be 16 miles in length, from 16 to 20 ft. wide and about 8 ft. deep; probable cost, $40,000. B. E. Stonebroker, Co. Aud.

Council Bluffs, Ia.—The Bd. of Superv. is stated to have authorized R. V. Innes, Co. Aud., to secure bids for the construction of the Harrison-Pottawattamie County drainage Canal and the Pigeon Creek ditch; probable cost of both is $60,000.

Central Covington, Ky.—The Town Trus. are stated to have contracted with Carl Bros. for the construction of a stone trunk sewer from Ward St. to connect with Willow Run sewer at Covington; cost about $18,000. Thos. J. Ellis, Supt. of Constr.

Boston, Mass.—Bids will be received June 23 by Geo. U. Crocker, City Treas., for $1,000,000 sewerage works bonds.

Worcester, Mass.—Mayor Edw. F. Fletcher has approved the order authorizing the construction of filter beds at the sewage purification works, at a cost of $25,000.

Milton, Mass.—Bids will be received June 27 by the Bd. of Sewer Comrs. for constructing about 9,000 ft. of pipe sewer. Wm. B. Thurber, Chmn.

Coldwater, Mich.—C. W. McKinney, of Toledo, O., is stated to have secured the contract for building a sewerage system, for $6,584.

Battle Creek, Mich.—A press report states that it was voted June 15 to issue $15,000 bonds for sewers and $10,000 for paving.

Hillsdale, Mich.—The Bd. of Pub. Wks. is stated to have let a contract for building the west side main sewer to the Elkhart Constr. Co., of Elkhart, Ind. The sewer will be about 1½ miles in length.

Albert Lea, Minn.—The citizens are stated to have voted to authorize the Council to construct a section of the main sewer, at an estimated cost of $16,000.

Fergus Falls, Minn.—It is stated that bids are about to be received by the Co. Comrs. for the construction of a drainage ditch to drain Inman and Henning.

Brookhaven, Miss.—The Mayor and Bd. of Aldermen are reported to be considering the construction of a sewerage system, to cost $30,000.

Yazoo City, Miss.—Bids will be received by the Mayor and Bd. of Aldermen until July 13 for constructing approximately 11 miles of 6 to 18-in. pipe sewers, with accessories, and centrifugal pumps and engines. Kirkpatrick & Johnson, Engrs., Jackson, Miss.; E. J. Poursine, City Clk.

West Orange, N. J.—The Town Council is reported to be considering the beginning of work on building the town's trunk sewer to connect with joint sewer; probable cost of work, $35,000. Engineer, Alex. Potter, 143 Liberty St., N. Y. City, N. Y.

Phillipsburg, N. J.—This city is considering the building of 2,000 ft. of storm sewer, 5 ft. 6 in. in diameter, and 2,600 ft. of 24-in. pipe sewer, to connect with the private system of the Ingersoll-Sergeant Drill Co.

Hoboken, N. J.—Sewer bonds amounting to $35,000 were sold on June 10.

New York, N. Y.—Bids will be received June 30 by Jacob A. Cantor, Boro. Pres., for furnishing material and constructing brick sewer in portions of numerous streets. Engineer's estimate, 2,768 lin. ft. 3 ft. 6 in. by 2 ft. 4 in., and 135 lin. ft. 4 ft. by 2 ft. 8 in. brick sewer.

Saratoga Springs, N. Y.—Bids will be received June 26 by the Sewer, Water and Street Com. for constructing a 6 and 8-in. sewer in portions in Diamond alley and Walworth St.

Johnstown, N. Y.—J. W. Miller, City Engr., writes that new bids will be received July 6 for trunk sewer work, to cost $10,000.

Brooklyn, N. Y.—Bids will be received June 24 by J. Edw. Swanstrom, Boro. Pres., for furnishing material and constructing sewers, outlet sewers and sewer basins, in portions of numerous streets. Engineer's estimate, 5,528 lin. ft. 120-in. brick and concrete steel sewer, 3,302 lin. ft. 60, 66 and 72-in. brick sewer, 2,585 lin. ft. 12, 15 and 18-in. vitrified stoneware pipe laid in concrete, 4,300 lin. ft. 12-in. vitrified pipe sub-drain, 14 receiving basins, 28 sewer basins, 25,000 lin. ft. piles, etc.

Brooklyn, N. Y.—Douglass Co. submitted the following bid on June 10 to J. Edw. Swanstrom, Boro. Pres., for sewer work in Columbia St., Boro. of Brooklyn: For 760 lin. ft. 30-in. brick sewer, $7.17 per ft.; 7 manholes, ea. $51.55; 8 rec. basins, ea. $159.75; 16,000 B. M. foundation, planking and pile coping, $35 per M., and 100 lin. ft. piles driven in place, 35c. per ft.

Ithaca, N. Y.—John Miller, City Clk., writes that the citizens have voted to appropriate $10,000 for sanitary work.

North Tonawanda, N. Y.—The Bd. of Pub. Wks. is stated to have instructed City Engr. Smith to submit specifications for the construction of sewers, under the $60,000 sewer appropriation.

Norwood, N. Y.—E. J. Holt, Village Clk., writes that it was voted June 12 to issue $15,000 bonds for extending the sewerage system.

New Brighton, S. I., N. Y.—Bids will be received June 26 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing material for completing a system of pipe sewers in the 5th Ward.

Cincinnati, O.—The Bd. Pub. Service is stated to have authorized City Engr. Stanley to prepare plans for sewers in Avondale.

Cleveland, O.—Bids are wanted July 2 for constructing sewers in portions of 3 streets. A. R. Callow, Secy. Bd. Pub. Wks.

Geneva, O.—Bids will be received by the Village Council until July 2 for furnishing material and constructing a sewage disposal works. C. I. Crowther, Clk. of Council.

Oklahoma, Okla. Ter.—The Council is reported to be considering the construction of new sewers.

Eugene, Ore.—B. F. Dorris, City Recorder, writes that it was voted May 29 to issue $15,000 bonds for constructing the Jefferson St. sewer.

Warren, Pa.—Bids will be received June 24 by the Sewer Com. Town Council, for furnishing material and constructing sewers in Warren; bids for material and for constructing sewers to be made separately. U. G. Lyons, Chmn.

Milton, Pa.—Bids will be received June 26 by the Town Council for constructing sanitary sewers in portions of 3 streets, requiring in all about 3,880 ft. 10 and 12-in. pipe. W. J. Caldwell, Ch. Sewer Com.

Lancaster, Pa.—The Sewer Comn. has approved the plans of Saml. M. Gray, of Providence, R. I., for the proposed sewerage improvements, and recommended the adoption of these plans to City Council. Israel Carpenter, City Engr.

Lebanon, Pa.—See "Water."

Sharon, Pa.—M. Ewing, City Secy., writes that it was voted June 16 to issue $30,000 bonds for sewerage extension and $46,500 for paving, etc.

Corry, Pa.—Bids are wanted June 22 for 1,940 ft. of 36-in. sewer, including manholes, etc. Nevin R. Dickson, City Engr.

Woonsocket, R. I.—Two bids were opened by the Bd. of Sewer Comrs. on June 1st for 8 and 10-in. pipe sewers in 4 streets: Cenedella Bros., of Milford, Mass., bid $1.25 per ft. for sewers on all streets, and F. E. Shaw, of Providence, bid $1.50, $2, $2.25 and $2.60 per ft. for sewers according to streets. F. H. Mills, City Engr.

Marion, S. C.—The City Clk. & Treas. writes that it is proposed to construct a sewerage system, at a cost of $22,000.

Aberdeen, S. D.—Press reports state that bids are wanted June 30 for $25,000 sewer bonds.

Austin, Tex.—The City Council on June 8 is stated to have decided to construct a storm sewer on Congress Ave., at a cost of $21,217.

Big Stone Gap, Va.—See "Power Plants, Gas and Electricity."

Spokane, Wash.—J. C. Broad, 106 Port St., is stated to have secured the contract for constructing Sewer District No. 1, of the 1st Ward, for $15,365.

Janesville, Wis.—The City Council has adopted the plans of City Engr. C. V. Kerch for a sewerage system.

BRIDGES.

Hot Springs, Ark.—A correspondent writes that bids are being received by the Co. Judge for a bridge across Ouachiti River; it will have 2 spans, 16-ft. roadway and be 450 ft. in length.

Riverside, Cal.—The Co. Surv. has been instructed to co-operate with the City Engr. and estimate the cost of constructing a new W. Riverside bridge.

Oakland, Cal.—The E. B. & A. L. Stone Co., of Oakland, is reported to have secured the contract to construct a concrete bridge across San Leandro Creek in Eden Township, for $6,821.

Palatka, Fla.—The Co. Comrs. are reported to be considering the building of a bridge across St. Johns River, between Palatka and E. Palatka.

Sterling, Ill.—It is reported that the building of a $40,000 bridge connecting Sterling and Rock Falls is under consideration.

Ustick, Ill.—The citizens have voted in favor of building 2 iron bridges in this town.

Chicago, Ill.—Frank Murphy, Contract Clk., writes that the following are the bids for erecting superstructure of N. Western Ave. bridge over Chicago River, which were received by Comr. of Pub. Wks. June 5; J. J. O'Heron, 45 River St., $224,800; American Bridge Co., The Rookery, $215,200; Jackson & Corbett Co., 70 La Salle St., $219,000; C. L. Strobel, Old Colony Bldg., $208,000; Roendheld & Gallery, Chamber of Commerce, $211,825.

Terre Haute, Ind.—Local press reports state that the lowest bid received June 10 for constructing a bridge across Wabash River, in this city, was from the Lafayette Engineering Co., at $234,000 for a 36-ft. bridge with buckle plates, and $231,000 with concrete steel construction, or for a 50-ft. bridge at $271,200 and $267,500 as above. The appropriation is $175,000.

Bluffton, Ind.—Bids are wanted June 24 for constructing a 70-ft. span iron bridge over Rock Creek ditch; also a stone arch on Studabaker gravel road. Wm. A. Marsh, Co. Aud.

Mishawaka, Ind.—John M. Brown, Co. Aud., South Bend, writes that bids received on June 11 for a bridge over St. Joseph River, and a 375-ft. plate girder bridge at Mishawaka, have been rejected.

Anderson, Ind.—Bids will be received July 7 by the Co. Comrs. for constructing masonry substructure and steel superstructure of bridge, 685 ft. long, over White River at Delaware St. Otis P. Crim, Co. Aud.

Hagerstown, Md.—The Co. Court has granted permission to the Western Maryland R. R. Co. to file an application with the Bd. of Pub. Wks. for permission to build 7 bridges across Chesapeake & Ohio Canal, between Bigpool and Cumberland.

Providence, Md.—The Co. Comrs. have decided to build an iron bridge near this city. (Elkton, C. H.)

Salem, Mass.—The Co. Comrs. will expend $90,000 for a bridge from Salem to Beverley, and $25,000 for a bridge at Waters River, Danvers, Mass. Wallace E. Bates, Chmn. Engr., Guy W. Ricker.

Taunton, Mass.—An appropriation of $23,000 has been made by city for a draw bridge over Taunton River. Luther Dean, City Engr.

Lowell, Mass.—City Engr. Geo. Bowers has prepared estimates for a bridge over Beaver Brook at New York St., and also for one at Pawtucket St.

Boston, Mass.—Bids will be received June 23 by Geo. U. Crocker, City Treas., for $200,000 Cambridge bridge bonds.

Fall River, Mass.—A bill has passed the House authorizing the building of a bridge across Taunton River in the vicinity of Slades Ferry bridge.

Lansing, Mich.—It is stated that the proposition to issue $20,000 bridge bonds, carried at the recent election.

Bay City, Mich.—J. H. Bloomshield, of Bay City, is preparing plans for bridges over Burgor Creek and Railroad Creek, Bay County.

Deerfield, Mich.—It is stated that bids will be received by the Township Bd. until July 3 for constructing a 270-ft. bridge across River Raisin. Nathan Manley, Clk.

Anoka, Minn.—Bids will be received June 26 by the Bd. of Co. Comrs. for repairing north wing of west abutment of bridge over Rum River; also for furnishing material and constructing a steel and a combination steel and wood bridge over Rum River in Oak Grove Township. W. F. Chase, Chmn.

Duluth, Minn.—Bids will be received July 2 by the Bd. of Co. Comrs. for repairing the steel bridge over St. Louis River on the Miller trunk road, 8 miles south of Eveleth; also for constructing a bridge over St. Louis River on the Vermilion Road. O. Halden, Co. Aud.

St. Paul, Minn.—City Bridge Engr. Edmunstone is reported to be preparing plans for a steel bridge to take the place of the present structure at Mendota Road. Probable cost, $12,000.

Natchez, Miss.—Bids are wanted July 6 for $4,000 bridge bonds. Jas. S. Fleming, Pres. of Bd.

Kansas City, Mo.—Local press reports state that there is a movement on foot to have the two Kansas Citys and the Metropolitan St. Ry. Co. unite in the building of a bridge across Kaw River, near James St.

The Chicago Great Western R. R. is reported to be contemplating the construction of a bridge across Kaw River, in this city. F. R. Coates, Ch. Engr., St. Paul, Minn.

Carthage, Mo.—The Missouri Pacific R. R. is reported to be contemplating the building of a bridge at High St., this city. H. Rohwer, Ch. Engr., St. Louis, Mo.

Galatin, Mo.—The Diidine Bridge & Construction Co., of Cameron, Mo., is stated to have secured the contract to construct a bridge across Grand River at Grantford, for $5,995.

Nashua, N. H.—Old wooden bridge over Nashua River is badly decayed. New one talked of, but no definite action taken. E. J. Johnson is City Engr.

Buffalo, N. Y.—The item appearing in the issue of June 6 stating that Frank J. Reap secured the contract for constructing the substructure for the Perry St. viaduct across the L. S. & M. S. R. R. was an error, the contract was awarded to McKeown & Johnson at $106,893.

Brooklyn, N. Y.—President Swanstrom has been granted $22,000 by the Bd. of Aldermen for constructing a bridge at Prospect Ave. and Seeley St.

New York, N. Y.—William J. Kelly, Counsel for the Long Island R. R. Co., presented to the Bd. Rapid Transit Comrs. an application of the N. Y. Connecting R. R. for a franchise for a road to connect the Long Island R. R. with the N. Y., New Haven and Hartford R. R. by means of a bridge across the East River and Ward's and Randall's Islands.

Bids will be received July 2 by Gustav Lindenthal, Comr. of Bridges, for furnishing material and plant necessary for wash borings along the line of the Queens approach of Blackwell's Island Bridge (No. 4), over East River, between Queens and Manhattan Boroughs.

Binghamton, N. Y.—City Engr. Monroe estimates the cost of replacing itockbottom bridge at $58,000.

Youngstown, O.—The Pittsburg & Lake Erie R. R. Co. is stated to have awarded to the American Bridge Co. the contract to construct a bridge across its tracks at E. Youngstown.

Watonga, Okla. Ter.—The building of a steel bridge across North Canadian River is being considered.

Vale, Ore.—It is stated that bids are wanted July 8 for constructing a 120-ft. span steel bridge across Malheur River. W. G. Thompson, Co. Clk.

McKeesport, Pa.—Bids are wanted July 8 for constructing a steel viaduct over White's Hollow, at the intersection of Versailles Ave. and Irvin St. C. E. Soles, City Compt.

Natrona, Pa.—The Viewers appointed to report on the building of a bridge across Allegheny River, between Natrona and Westmoreland Co., have recommended the building of a structure 1,269 ft. long, extending from Federal St., Natrona, to Burrell Township, Westmoreland Co.

Reading, Pa.—Local press reports state that the bridge at 5th St. has been closed to traffic, and the Bd. of Pub. Wks. has decided to engage a bridge-building company to make an examination of the structure and have steel girders replace the wooden ones. City Engr. Beard has the matter in charge.

Pittsburg, Pa.—Jos. W. Craig, of Pittsburg, is reported to be interested in the incorporating of 3 bridge companies, for the purpose of building 3 bridges across the Ohio River. It reported that they are to be iron structures, and will cost about $250,000 each.

Sharon, Pa.—Local press reports state that the Canton Bridge Co., Canton, O., submitted the lowest bid for constructing the superstructure of the Budd Ave. viaduct, at $44,500 for a structure capable of carrying street cars, or $45,000 for one capable of carrying 12 tons. Wm. McIntyre & Sons are reported to have submitted the lowest bid for constructing the substructure at $16,197.

Philadelphia, Pa.—Local press reports state that the Baltimore & Ohio R. R. Co. has been requested to replace the present wooden bridges in the 40th Ward, with more substantial structures. J. M. Graham, Ch. Engr., Baltimore, Md.

Pittsburg, Pa.—See "Railroads."

Pawtucket, R. I.—City Engr. Carpenter is making soundings for the Cross St. bridge. Bids will soon be called for.

Spartanburg, S. C.—The 350-ft. steel bridge across Lawson's Fork on the Pacolet River, near Spartanburg, is reported to have been washed away by the floods; also the 142-ft. 3-span bridge across Middle Tiger River, between Wellford and Duncan, N. C.

McMinnville, Tenn.—The Co. Comrs. have authorized the building of 3 bridges in Warren Co., at a total cost of $10,000.

Memphis, Tenn.—Plans and specifications have been prepared for a bridge over 55-ft. subway under Bway. Several railroads and the city are interested; cost to be about $27,000. Thos. Bernard, Engr. M. of W. Southern Ry., Chattanooga, may be addressed.

Gainesville, Tex.—It is stated that plans and specifications are being prepared for a wagon bridge to be built across Red River, near this city.

Hamilton, Ont.—An appropriation of $8,000 has been made for the building of a bridge at Wellington and Ferrie Sts.

PAVING AND ROADMAKING.

San Francisco, Cal.—See Sewerage and Sewage Disposal."

Bridgeport, Conn.—The contract for furnishing and laying about 4,100 sq. yds. of brick pavement, for which bids were received by Street Com. of Council, June 12, has been awarded to J. J. Connor, of Philadelphia, Pa., at $2.73 per sq. yd. for Mack block; total, $11,193.

Wilmington, Del.—Local press reports state that the State Highway Comn. will soon ask for bids for constructing a roadway on the Hare's Corners road, between the Philadelphia & Reading Ry. tracks crossing the causeway and the Delaware R. R. bridge at Farnhurst. The distance is between 2 and 3 miles, and the estimated cost is $14,700.

Chicago, Ill.—Local press reports state that the Lincoln Park Comrs. are about to sell bonds and let contracts for building the Lake Shore drive from Fullerton Ave. to Cornelia St., a distance of about ½ mile, and of such lawns and other improvements as the drive may necessitate. There has been voted $1,000,000 by the residents of Lake View for this improvement.

The Bd. of Local Improv., according to local press reports, has awarded contracts for asphalting La Salle and Sherman Sts., from Van Buren to Harrison Sts., to the Barber Asphalt Paving Co., Stock Ex. Bldg., at $11,499 and $14,569 respectively.

Elgin, Ill.—Bids are wanted. June 22 for grading and paving with asphalt on Grove Ave. A. H. Hubbard, Mayor, Pres. Bd. of Local Improv.

Kewanee, Ill.—The City Engr. estimates the cost of paving with asphalt on Main St. at $41,621.

Chicago, Ill.—Bids will be received June 24 by the Bd. of Local Improv. for grading, curbing and paving with repressed vitrified brick and asphalt on portions of numerous streets. Andrew M. Lynch, Pres.

Freeport, Ill.—Petitions are in circulation for the paving of Stephenson St. with either asphalt or brick. G. W. Graham, City Engr.

Elgin, Ill.—The property owners of Douglas Ave. have decided to pave 11 blocks with macadam.

Centralia, Ill.—It is reported that the Council has appropriated $12,000 for street work.

Evanston, Ill.—Bids will be received June 25 by the Bd. of Local Improvements for granite top macadam pavements on portions of Foster and Noyes Sts. J. H. Moore, Comr. Pub. Wks.

Bloomington, Ill.—Contracts for asphalt paving (bids opened June 11) have been awarded as follows: To the Western Constr. Co., of Lafayette, Ind., for paving Fell Ave., about 1,861 sq. yds., at $2.27 per sq. yd., 1,403 ft. curb, 71 cts. per lin. ft.—total, $4,750; and to the Barber Asphalt Paving Co., Chicago, for 13,235 sq. yds. resurfacing on E. Grove St., $1.35 per sq. yd.—total, $17,867; and for paving E. Jefferson St., 1,541 sq. yds., $1.80 per sq. yd., 1,025 ft. curb, 60 cts. per lin. ft.—total, $3,389. Elmer Folsom, City Engr.

Terre Haute, Ind.—The property owners have petitioned the Bd. of Pub. Wks. to pave with brick, curb with stone and construct concrete sidewalks, on Locust St. from 13th to 25th Sts.

Bids are wanted June 22 for paving S. 4th St. with brick, about 20,000 sq. yds. Ralph H. Sparks, City Engr.

New Albany, Ind.—The City Council has adopted a resolution to pave with asphalt on a portion of Market St. and with brick on portions of several alleys.

Bluffton, Ind.—The Hoosier Construction Co., Indianapolis, Ind., is reported to have secured the contract for paving 10 streets with bituminous macadam at $1.91 per sq. yd., and Kemp & Son the contract for paving 10 other streets with brick at $2.03 per sq. yd.

Elkhart, Ind.—It is reported that the paving with brick on E. Franklin St. is being considered.

Columbus, Ind.—Bids will be received July 6 by the Bd. of Co. Comrs. for constructing 6 miles of gravel road and 2 miles stone and gravel in Flatrock Township; also for constructing macadam on Guinn and Rainey Roads in Rockcreek Township, gravel on Robertson Road in Rockcreek Township, on Pierce Road in Columbus Township, and on Lohr Road between Columbus and Wayne Townships, in all about 6 miles. Wm. A. Morris, Co. Aud.

Michigan City, Ind.—Bids are wanted July 6 for constructing cement walks on several streets. Edw. J. Heise, City Clk.

Paoli, Ind.—Bids will be received July 7 by the Bd. of Co. Comrs. for constructing 29,762 ft. of Paoli and Leavenworth Road in South East Township. Geo. W. Tegarden, Co. Aud.

Ottumwa, Ia.—W. R. Warren, City Clk., writes that the contract for asphalt paving (bids opened June 1) has been awarded to the Barber Asphalt Paving Co., of Des Moines, for about $30,000. The work includes 15,000 yds. of new paving and some repairing.

Paducah, Ky.—The City Council is considering the paving of Jefferson St. at a cost of about $20,000.

Alexandria, La.—Bids will be received by the Mayor and Bd. of Aldermen until July 7 for paving with either brick or asphalt, about 8,500 sq. yds., on Elliott St., and with brick, about 10,500 sq. yds., on Jackson St. Thos. Crawly, Mayor.

New Orleans, La.—Local press reports state that the following bids were received June 8 for paving on Canal St., from Liberty to Metairie Road with asphalt (there are about 121,000 sq. yds. of pavement to be laid—the bids include the concrete foundation): Union Development Co., $1.69½ per sq. yd.—total, $329,251; Sicilian Asphalt Paving Co., N. Y. City, $2.20 per sq. yd.—total, $419,093; La. Improvement Co., New Orleans, $1.93½ per sq. yd.—total, $360,383.

Cumberland, Md.—An ordinance has been passed by the City Council to repave a portion of Washington St. with fire brick.

Athol, Mass.—This town has decided to construct the Phillipston Road, for which $9,500 has been appropriated by the State.

Worcester, Mass.—See "Electric Railways."

Taunton, Mass.—An order for $40,000 for street improvements is under consideration by City Council. It is for macadam, granite and bitulithic pavements. Luther Dean is City Engr.

Salem, Mass.—The City Council has voted $32,000 for Warren's bituminous macadam for Lafayette St.

Boston, Mass.—Bids will be received June 23 by Geo. U. Crocker, City Treas., for $500,000 highway bonds.

Pittsfield, Mass.—The Barber Asphalt Paving Co. is reported to have secured the contract to pave with Trinidad land asphalt, on North, South, East and Waconah Sts. and Bank Row, in all about 26,500 sq. yds., at $1.91 per sq. yd.

Sunderland, Mass.—At the special town meeting it was voted to have the Selectmen contract with the State Highway Comrs. to build the State Road in this town, for which $5,500 has been appropriated.

Marquette, Mich.—Mitchell & Sherman are reported to have submitted the lowest bid for building the Lakeshore Boule. at $9,867.

St. Clair, Mich.—H. W. Brown, City Clk., writes that the Port Huron Eng. & Thresher Co. has secured the contract to construct a plain macadam road in this city. He further states that bids are wanted for the purchase of $27,500 bonds.

Lansing, Mich.—It is proposed to pave Capitol Ave. for 2 blocks and Allegan St. for 4 blocks with brick. H. A. Collar, City Engr.

Grosse Point, Mich.—The Village of Fairview is reported to be contemplating the expenditure of $80,000 for the paving of Jefferson Ave.

Essexville, Mich.—J. H. Bloomshield, of Bay City, is preparing plans and estimates for street improvements.

St. Johns, Mich.—J. H. Bloomshield, of Bay City, is preparing specifications for paving Clinton Ave. and Walker St.

Battle Creek, Mich.—See "Sewerage and Sewage Disposal."

Bay City, Mich.—City Engr. Thompson estimates the cost of paving Washington St. from So. Union to the Viaduct as follows: With brick, $6,909; asphalt, $8,024.

The Bd. of Pub. Wks. estimates the cost of paving a portion of Adams St. at $8,165.

Grand Rapids, Mich.—The Business Men of this city are reported to be interested in the extending of Turner St. and the building of a road to Mill Creek. Probable cost, $6,000.

Saginaw, Mich.—The Good Roads bill has passed the House providing for an appropriation of $10,000 and the appointing of a State Highway Comr.

Duluth, Minn.—The City Engr. has submitted to the City Council estimates for paving with macadam a portion of Grand Ave. at $23,191, and grading, gravelling and placing stone gutters in 6th St., Cascade, to 10th St. east, at $35,283.

The City Engr. has been requested to submit estimates of the cost of placing creosoted blocks on Lake Ave. viaduct.

The Bd. of Pub. Wks. has been authorized to receive new bids for paving Michigan Ave., from Lake to 2d Aves.

St. Paul, Minn.—The Bd. of Pub. Wks. has ordered the paving of Maria Ave. from 7th to Cherry Sts. with asphalt. Estimated cost, $21,304.

Neptune, N. J.—W. H. De Nyse, Co. Engr., Long Branch, writes that the contract for constructing about 4½ miles gravel road in Neptune (bids opened June 15) has been awarded to Frank C. Byram, of Red Bank, N. J., for $15,407.

Paterson, N. J.—Bids will be received June 29 by the Road Com. of Co. Bd. Chosen Freeholders for repairing portions of numerous streets in Passaic County. Jacob Geroe, Chmn.

New Brunswick, N. J.—Bids will be received July 1 by the Co. Bd. of Chosen Freeholders for constructing stone roads in Middlesex Co., in all about 6 miles. Asbury Fountain, Dir.

Harrison, N. J.—The Common Council contemplates paving with brick on a concrete foundation, a portion of Cleveland Ave.

Newark, N. J.—The following bids for grading and paving with Telford pavement were received by Bd. of Chosen Freeholders June 11—*a*, excav. per cu. yd.; *b*, Telford paving per sq. yd.; *c*, totals:

Grove St., in East Orange, Vailsburgh, Irvington—P. H. Kernan & Smith, Orange, *a*, 30 cts.; *b*, 85 cts.; *c*, $20,459. Geo. Spottiswoode & Co., Orange, *a*, 35 cts.; *b*, 79 cts.; *c*, $20,082 (awarded contract).

Hobarts Gap, in Livingston and Milburn—Lighthipe & Son, Milburn, *a*, 40 cts.; *b*, 65 cts.; *c*, $34,405 (awarded contract).

Swamp Road, in Caldwell and Livingston—J. D. Murray, New Brunswick, *a*, 45 cts.; *b*, 55 cts.; *c*, $44,424. Wright & Lindsley, Orange, *a*, 35 cts.; *b*, 55 cts.; *c*, $40,424 (awarded contract. P. A. Matthews, Caldwell, *a*, 35 cts.; *b*, 57 cts.; *c*, $41,385.

Dutch Lane, in Caldwell—J. D. Murray, New Brunswick, *a*, 37 cts.; *b*, 57 cts.; *c*, $23,518. Francisco Bros., Little Falls, *a*, 35 cts.; *b*, 55 cts.; *c*, $22,517 (awarded contract).

Ridgewood Ave., in Glen Ridge—Wright & Lindsley, Orange, *a*, 32 cts.; *b*, 60 cts.; *c*, $9,216. Francisco Bros., Little Falls, *a*, 35 cts.; *b*, 56 cts.; *c*, $9,064. Osborn & Marcellis Co., Montclair, *a* 35 cts.; *b*, 55 cts.; *c*, $8,958 (awarded contract).

Local press reports state that contracts for paving have been awarded as follows: To the Newark Paving Co., 800 Broad St., 3 streets—Avenue C with granite, $11,373; Dawson St. with granite, $10.227, and Montclair Ave. with brick. $14,667. To Jas. Seme, 800 Broad St., Jay St. with granite, $6,851. To J. Roosevelt Shanley, Jersey City, for 17th Ave. with granite, $19,128.

New Brighton, N. Y.—Bids will be received June 26 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing material for regulating, grading and repaving with asphalt block on concrete foundation portions of Richmond Terrace and New York Ave. Engineer's estimate, 10,200 sq. yds. asphalt block pavement, 1,680 cu. yds. concrete, including mortar bed, 5,450 lin. ft. bluestone curbstone, furnished and set, etc.

Albany, N. Y.—State Engr. Bond announces that he has awarded the following contracts for Highway Improvement work (bids opened June 8th and 10th): Catskill Turnpike Rd., to Chas. H. Quereau, Baldwinsville, $16,364; Little Falls-Dolgeville Rd., Jos. Walker, Mariners Harbor, $16,490; Violet Ave. Rd., F. Pidgeon, of Saugerties, $26,879; Geneva-Canandaigua Rd., H. N. Cowles, of Rochester, $36,530; Echo Lake-Pine Bridge Rd., McCabe & Duffy, White Plains, $27,384; Yorktown Heights-Putnam County Line Rd. and Pine Bridge-Yorktown Heights Rd., Casey & Murray, Rochester, at $47,000 and $29,000 respectively; Bedford-Cross River Rd., Cross River-Turk Rd., and Turk Hill-Putnam County Line Rd., to Ganung & Hoyt, of Katonah, at $40,810, $27,634 and $51,200 respectively; Newburgh-Campbell Hill Rd. and Chester-Vails Gate Rd., to the Orange County Bd. of Supervs., at $64,450 and $50,425 respectively.

No bids were received within the appropriation for the Town Line Extension Rd., Park Bridge Rd. and Fenton Rd., all in Broome County, which will be readvertised; also Genesee Turnpike Rd. in Onondaga County, Hamilton Bridge Rd. and Seneca Turnpike Rd. in Oneida County; also Delaware River Rd. in Delaware County and Burr's Mills Rd. in Jefferson County.

Binghamton, N. Y.—Local press reports state that the following bids were received June 9 for paving with brick on Fayette, South Depot and Clinton Sts. and Prospect and Conklin Aves.: Arthur D. Osborn bid the same on all streets, as follows—Using Whalen wire cut brick, $1.94 a sq. yd.; Whalen block, $1.98; Parke wire cut, $1.97; Porter wire cut, $1.97; these bids were for broken stone concrete; for gravel concrete the prices are 8 cts. less on all bids. James M. Homer bid the same on all streets; for Parke New York standard brick, $1.93 for gravel concrete or $2.15 for broken stone concrete. A. L. Willey's for Conklin Ave.—Using Parke New York standard brick, $2.20; Syracuse standard brick, $2.07; Corning repressed, $1.95; Clearfield wire cut, $2.25; Porter wire cut, $2.01; Porter block, $2.10; Porter repressed, $2.15; these bids were for broken stone concrete; for gravel concrete the price would be 10 cts. a yard less. On the South Depot and Fayette Sts. and Prospect Ave. they were—Parke New York standard, $2.15; Syracuse, $2.03; Corning repressed, $1.91; Clearfield wire cut, $2.20; Porter wire cut, $1.97; Porter block, $2.05; Porter repressed, $2.10; for gravel concrete the prices would be 10 cts. a yd. less. On Clinton St. the same as for the previous 4 streets, except that he substituted Corning wire cut in place of Corning repressed, the prices being $1.89 and $1.79 a yard. The present Clinton St. pavement is of Corning wire cut brick.

Pleasantville, N. Y.—Bids will be received by W. S. Moore, Village Clk., until June 27 for grading, paving, guttering and curbing Wheeler and Washington Aves.

Canandaigua, N. Y.—Messrs. Brady, Smith, Sutherland and Hopson have been appointed as a committee to inquire into the advisability of improving streets connecting with the principal roads leading into the village.

Glens Falls, N. Y.—The Mack Manufacturing Co., of Philadelphia, Pa., is reported to have secured the contract to supply this city with 1,250,000 paving blocks at $31 per thousand.

Rensselaer, N. Y.—Bids will be received June 23 by City Treas. P. J. Gomph for $105,000 paving bonds.

Bids will be received July 3 by Anthony J. Hoogkamp, City Clk., for grading and paving with brick, granite block, asphalt and bituminous macadam waterproof pavement and setting granite curb on numerous streets.

Cincinnati, O.—City Engr. Stanley estimates the cost of resurfacing Race St., from 4th to Liberty Sts., with asphalt at $1.75 per sq. yd., $6 a cu. yd. for concrete, and 60 cts. per cu. yd. for grading; total, $51,643. He also estimates the cost of paving with asphalt on May St., from Oak to Fern, at $15,091.

Bowling Green, O.—It is reported that the Co. Comrs. have let contracts for $52,223 worth of new stone roads. J. B. Luckey secured the contract for constructing the Stahl Road from Bradner to Rising Sun, and the Reinbott Road from Rising Sun to the Portage Township line. The Rogers Road from Millbury to the Woodville Pike will be built by Patterson Bros.

Bids are wanted July 2 for grading, draining, macadamizing and constructing an earth or dirt road bed adjacent to macadam road bed on portions of Elliott, Halsey and Napoleon Roads. B. C. Harding, Co. Aud.

Delaware, O.—The City Council has adopted a resolution authorizing the City Engr. to prepare plans, specifications and estimate of the curb cost of curbing and paving a portion of Winter St.

Upper Sandusky, O.—Press reports state that bids will be received June 30 by the Co. Comrs. for $36,000 road bonds.

Tiffin, O.—The City Council on June 8 authorized City Engr. C. J. Peters to prepare plans and estimates for paving Hall St. with brick or block, on stone and gravel foundations.

Napoleon, O.—D. J. Fox, Co. Aud., writes that contracts for road improvements (bids opened by Co. Comrs. June 12, have been awarded as follows: To John Ryan, of Whitehouse, O., for Washington Township Rd., $23,728; D. R. McArthur & Co., Kenton, for the Damascus Township and Richfield Township Rds., at $9,091 and $10,870 respectively; and to Harmon & Baer, Napoleon, for the Napoleon Township Rd., $4,406.

Dayton, O.—Bids are wanted July 14 for curbing and paving with brick portions of Cincinnati St. and Wayne Ave. Approximate quantities, 24,980 sq. yds. paving, 11,200 lin. ft. straight curbing, etc. Wm. F. Miller, Clk. Bd. Pub. Service.

Cleveland, O.—Bids will be received July 8 by the Bd. of Co. Comrs. for improving portions of North Woodland Road in Orange Township. Julius C. Dorn, Clk.

Portsmouth, O.—Bids will be received July 7 by the Bd. of Co. Comrs. for furnishing material, repairing and improving the Portsmouth and Galena Turnpike; also raising abutments of bridge across the canal at Ohio River Road, and making approach thereto.

Lorain, O.—It is stated that bids will be received by the Bd. Pub. Service until July 10 for paving with brick on Pleasant and Bank Sts. and 3d Ave. J. J. Mahoney, Clk.

Bryan, O.—Bids are wanted July 9 for furnishing material and constructing approximately 47,167 sq. yds. of brick pavement, together with the necessary curbing and drainage on portions of 5 streets. J. W. Hoke, Village Clk.

Cleveland, O.—It is stated that bids are wanted by the Bd. of Pub. Service until July 9 for paving with asphalt on Cutler and Pleasant Sts. and Crawford Pl. W. J. Springborn, Pres.

Pittsburg, Pa.—The City Council is said to be considering the building of an asphalt plant, at a cost of about $6,000.

Uniontown, Pa.—Brown & Coates, of Rochester, Pa., are reported to have secured the contract to pave with brick on the McClelland town road, at $8,151.

Doylestown, Pa.—It is stated that Middletown Township intends selling $50,000 bonds, for the purpose of macadamizing 15 miles of roads.

Washington, Pa.—The Co. Comrs. are reported to be contemplating the improving of 42 miles of highway, at a total cost of $136,454.

Sharon, Pa.—See "Sewerage and Sewage Disposal."

Lebanon, Pa.—See "Water."

Shenandoah, Pa.—This Boro. is considering the question of paving about 6 squares of streets with brick.

Deadwood, S. D.—The City Council has passed a resolution to pave on Lee, Main and Deadwood Sts. and a portion of Sherman St., possibly with brick.

Jackson, Tenn.—The Novaculite Paving Co., St. Louis, Mo., is reported to have secured the contract to furnish gravel to be used on 50 miles of Madison Co. roads at 90 cts. per ton for unscreened gravel and $1.08 for screened gravel.

Dallas, Tex.—It is reported that the Co. Comrs. are about to offer for sale $500,000 road bonds.

Salt Lake City, Utah.—Bids will be received June 26 by the Bd. of Pub. Wks. for grading, curbing and paving portions of State St.; also repairing asphalt street pavements. Louis C. Kelsey, City Engr.

Hampton, Va.—Press reports state that bids are wanted July 1 for $25,000 street improvement bonds.

Reardan, Wash.—The building of the Reardan and Cedar Canyon Road, at a cost of about $5,000, is reported to be under consideration.

Portage, Wis.—The Com. on Finance of the Council is considering the matter of purchasing a steam roller.

Montreal, Que.—Local press reports state that the Barber Asphalt Paving Co., of N. Y. City, N. Y., has secured the contract to repair the asphalt pavements of the city at $1.91 per sq. yd.; probable total cost, $25,000.

POWER PLANTS, GAS AND ELECTRICITY.

Clayton, Ala.—J. D. Williams, Mayor, writes that bids will be received on June 26 for the construction of water works and an electric light plant.

Huntsville, Ala.—See "Electric Railways."

Montgomery, Ala.—The Citizens' Light, Heat & Power Co. has been organized, with a capital of $30,000, by Alex. Rice, C. L. Ruth and others, to manufacture and sell electricity for the purpose of supplying light, heat and power.

Prescott, Ariz.—Engineer J. G. Girard writes that it is proposed to construct an electric power plant in Cataract Creek for operating 50 miles of railroad; probable cost of work, $2,000,000.

Idaho Springs, Colo.—The Continental Electric Power & Irrigation Co. has been incorporated, with a capital of $1,000,000, by Warren A. Haggott, Wm. P. Clough and Fred G. Shaffer, to build a reservoir at the headwaters of Clear Creek, near Empire, and furnish water power for mines of Clear Creek and Gilpin Counties, and to irrigate lands in Jefferson, Adams, Weld and other counties. General offices to be at Idaho Springs.

Hartford, Conn.—The Eastern Connecticut Electric Power Co. has been organized with a capital of $100,000, for the development of several large water powers in the eastern part of the State, with a view to supplying from 5,000 to 7,000-H.-P. to electric light and street railway companies and industrial plants. F. A. Jacobs, Pres., Danielson; Thos. C. Perkins, Secy., Hartford.

Highfalls, Ga.—The Towaliga Falls Power Co., with Seaton Grantland, W. J. Kincaid, Jas. M. Brawner, and others, as directors, is stated to have applied for a charter. The company proposes converting the water power at Highfalls into electricity, and transmitting same to Griffin and other places. Principal office to be at Highfalls.

Edwardsville, Ill.—The City Council is stated to have voted an appropriation of $30,000 for city lighting. The question will be submitted to a vote of the people.

Muncie, Ind.—It is stated that the Muncie Gas Light Co. is securing bids for a natural gas reservoir.

Ft. Wayne, Ind.—The Ft. Wayne Electric Light & Power Co. is stated to have purchased the rights and privileges of the General Htg. Co., of Ft. Wayne. The latter company was recently organized by local men, with a capital of $500,000, to construct a hot water heating plant.

Fonda, Ia.—W. E. Rosemond, of Independence, Ia., is stated to have made a proposition to establish an electric light plant and flour mill.

Williams, Ia.—A. W. Ross, Town Recorder, writes that it was voted June 11 to grant a 20-year electric light franchise to F. R. Payne.

Des Moines, Ia.—Local press reports state that the Iowa Light & Power Co. will construct 6 hot water heating plants, each plant to cost from $25,000 to $50,000.

Hopkinsville, Ky.—The City Council, on application of John H. Bell, Jr., and others, has passed an ordinance ordering the sale of another electric light franchise.

Lawrenceburg, Ky.—It is stated that water works and an electric light plant are to be constructed here.

New Roads, La.—The New Roads Electric Light & Power Co., Ltd., of New Roads, La., is in the market for all machinery and material for an electric light plant of 2,000 16 c. p. lamp capacity. Also for a pumping plant of 500,000 gallons daily output, c. i. water pipe, mains, gate valves, hydrants, etc. For particulars, plans and specifications, address W. H. Fleming, 327 Hennen Bldg., New Orleans.

Ruston, La.—B. F. Thompson, Mayor, writes that the contract for improving the water works and electric light plant was not let on June 10, as the $20,000 municipal bonds have not yet been sold and will have to be disposed of before the improvement of the plant is undertaken. The city would like to figure with some contractor in position to use bonds.

New Orleans, La.—The New Orleans Rys. Co. and the Colonial Electrical Corporation have submitted proposals for electric lighting and power work. The former proposes to furnish and maintain 400 arc lamps in underground district for $90 per annum and 2,218 lamps in overhead district for $77.50 per annum (these prices being in accordance with a schedule depending on the number of lamps used), making a total of $208,705. It figures that the cost to the city, if operating from a municipal plant, would be $55 per lamp, and allowing $1,100,000 for the cost of such a plant and 5 per cent. for interest charges and 7 per cent. for depreciation, the cost for 2,627 lamps would be $277,648, $68,943 more per year than the railway proposition. Other proposals were made comprehending a less number of lamps or the maintaining of some at present in use. The latter's proposition covered a lighting and power plant at a cost of $1,480,615 if cypress poles are used, and $1,395,154 if pine poles are used, the power-house to cost $105,760 and the equipment, $405,800.

Alexandria, La.—Wm. Polk, of Alexandria, and D. C. Williams, of Chicago, Ill., have petitioned the City Council for a franchise for a gas plant; probable cost of plant, $30,000.

Hagerstown, Md.—The Hagerstown Light & Heat Co. has contracted with the United Gas Improv. Co., of Philadelphia, Pa., for a 6-ft. set of improved double superheater water gas apparatus, etc., amounting to about $14,000.

Everett, Mass.—Chas. Bruce, Mayor, writes that the contract for lighting the city by electricity (bids opened Apr. 24) has been awarded to the Maiden Electric Co., 159 Devonshire St., Boston, at $90 per yr. for 2,000 c. p. arcs, and $15.50 per yr. for 25 c. p. incandescents; total amount of contract, $17,038.

Mansfield, Mass.—The citizens are reported to have voted June 8 to issue $40,000 bonds for a municipal lighting plant. Wm. H. Lyons, Chmn. Lighting Com.

Ford, Mich.—Bids are wanted June 25 for laying water mains, pipes, etc., and for an electric light system. Geo. Clark, Village Clk.

Owosso, Mich.—See "Electric Railways."

Duluth, Minn.—See "Electric Railways."

Sauk Rapids, Minn.—The Watab Rapids Power Co. is reported incorporated to dam the Mississippi River and develop electrical power. A. J. Gillette, Pres.

Albert Lea, Minn.—The Citizens' Light & Fuel Co. is reported incorporated, to install a gas plant.

Yazoo City, Miss.—Bids will be received by the Mayor and Bd. of Aldermen until July 13 for building a 450-H.-P. Scotch marine or water-tube boilers, 200 and 100-Kw. polyphase alternators, direct-connected to compound condensing engines, switchboard, arc lamps, transformers and pole line supplies. E. J. Poursine, City Clk.; Kirkpatrick & Johnson, Engrs., Jackson, Miss.

Vicksburg, Miss.—It is stated that the Vicksburg Ry. & Light Co. will expend about $200,000 in improvements and extensions. S. S. Bullis, of Natchez, and S. R. Hughes, of Vicksburg, are among the directors.

Omaha, Neb.—A press report states that W. J. C. Kenyon, Mgr. Union Stock Yards Co., is interested in the construction of a power plant on Platte River near Fremont, to cost about $3,000,000.

Port Leyden, N. Y.—The citizens on June 12 are stated to have voted to contract for the lighting the streets by electricity for a term of 5 years. A company has been formed and the power plant will be located on Moose River a few miles from this place. The company will light both Port Leyden and Lyon Falls, and it is also reported that they will build a large manufacturing plant.

Greene, N. Y.—The Bd. of Village Trus. have awarded the following contracts for work in connection with power house (bids opened June 8) for a 60-Kw. dynamo to Westinghouse Electric Co., Syracuse, for $1,500; two 100-H.-P. fire tube boilers, Watertown Engine Co., Watertown, $2,595, and for other equipment to McKenzie, Quarrier & Ferguson, N. Y. City, for $1,785.

Niagara Falls, N. Y.—The Council is stated to have granted the Niagara Falls Hydraulic Power & Mfg. Co. permission to construct a transmission line to its new manufacturing district at the North End.

Lumberton, N. C.—W. Drummond Marrow, of Charlotte, N. C., is stated to have secured the contract for a $10,000 electric light plant for Lumberton.

Fayetteville, N. C.—The Fayetteville Gas & Electric Co. is reported incorporated, with a capital of $33,000. W. A. McKenny, of Washington, D. C., is one of the incorporators.

Weldon, N. C.—Ladshaw & Ladshaw, of Spartanburg, S. C., are stated to have secured the contract for the survey and complete development of Roanoke Rapids, on Roanoke River, near Weldon. About 20,000-H.-P. will be developed to be used to drive the street cars, lighting, etc., for Norfolk, Va., and will be transmitted to that city—a distance of 90 miles from Roanoke Rapids.

Mt. Airy, N. C.—J. A. Hadley, Mayor, writes that it is proposed to construct water works and an electric light plant, at a cost of $55,000. Contracts will probably be let about July 15.

Masontown, Pa.—The Masontown Light, Heat & Power Co. is reported to have organized, with J. V. Hoover, Pres., and W. I. Crawford, Secy. The company will install a light and power plant; capital, $10,000.

Altoona, Pa.—The Inter-State Constr. Co. and the Arrowsmith Electric Co. are reported to have closed contracts for all the outside work, erection of poles, stringing of wires, etc., for lighting Altoona by electricity. Contract reported to amount to $40,000.

Uniontown, Pa.—The Marchand Electric Light, Heat & Power Co., of Uniontown, has been incorporated, with a capital of $25,000.

Pawtucket, R. I.—A correspondent writes that there is a rumor that the J. & P. Coates Thread Co. will build a conduit for about a mile, and bring its power from the electric light plant, and discard its present steam plant. This will mean a large addition to the present electric plant.

Sisseton, S. D.—The Fowler Electric Co., of Morris, Minn., is stated to have secured a franchise for an electric light plant.

Nashville, Tenn.—The Council has passed the bill granting the Nashville Steam Htg. Co. a conduit franchise.

Houston, Tex.—It is reported that the Houston Lighting & Power Co. will expend about $180,000 in improvements.

Morlin, Tex.—B. C. Nettles, of Marlin, writes that he and J. A. Martin have secured control of Brazos River at the falls and sufficient land for development; he further states that R. D. Parker has been employed to prepare plans and estimates.

Big Stone Gap, Va.—Frank Witt, Town Clk., writes that it was voted June 9 to issue $20,000 bonds for constructing electric light plant and improving the sewerage system.

Burlington, Vt.—At a city meeting here June 11 it was voted to bond the city for not exceeding $150,000, to establish and maintain a municipal electric lighting plant.

Platteville, Wis.—The Platteville Electric Light Co. is stated to have decided to remodel its plant and put in a new boiler for heating purposes.

Benton, Wis.—The citizens are stated to have voted to issue $30,000 bonds for an electric light plant.

Ottawa, Ont.—The Private Bills Com. is stated to have adopted the report of the sub-com. on the bill to incorporate the Ontario & Quebec Power Co. to develop 20,000 H.-P. at Little Chaudiere by building a dam.

Whitby, Ont.—Jos. White, Town Clk., writes that a large number of ratepayers are interested in the construction of water works and an electric light plant.

ELECTRIC RAILWAYS.

Huntsville, Ala.—The Huntsville Ry., Light & Power Co. is to install new 150-Kw. direct-connected three-phase alternating units with about one hundred series alternating arc lamps.

Covina, Cal.—Press reports state that E. Randolph, Gen. Mgr. of the Pacific Electric Ry., has applied to the City Trus. for a franchise to construct a single or double track railway on Badillo St., and that bids for said franchise will be received by the Bd. until July 21.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Monterey, Cal.—It is stated that bids will be received by the City Trus. until July 14 for a street railway franchise.

Los Angeles, Cal.—The Los Angeles Interurban R. R. Co., with a capital of $10,000,000, has been incorporated by Henry E. Huntington and associates.

Two street railway franchises have been sold by the City Council to H. T. Hazard and M. T. Collins.

Healdsburg, Cal.—Articles of incorporation of a new electric railway company have been filed, capital $1,000,000, to build an electric railway from Santa Rosa to Sebastopol and Green Valley, and from Santa Rosa to Petaluma, and from that city on to a point on the bay, and thence by ferry steamers to San Francisco, and also to give Santa Rosa an electric street car system. Directors: Thos. Archer and Francis Cutting, of San Francisco, and Frank A. Brush, of Santa Rosa.

Whittier, Cal.—A franchise for an electric railway on Hadley St. has been sold to the Pacific Electric Ry. Co. This franchise will be used as a part of the Whittier terminus of the interurban road now under construction to Whittier from Los Angeles.

Pomona, Cal.—The City Trustees have authorized the sale of an electric railway franchise in Pomona, on application of Stoddard Jess, representing the Bd. of Trade's electric railway committee. The Pacific Electric Railway Co. proposes eventually to extend its Los Angeles-Monrovia line through Azusa and Glendora to Pomona, thence to Ontario and San Bernardino.

Los Angeles, Cal.—It is reported that the Pacific Electric Railway Company contemplates building a branch of the road now under construction to Whittier, through Olive and up the Santa Ana River to Riverside and Corona, a distance of over 30 miles.

E. P. Clark, Pres. of the Los Angeles-Pacific R. R. Co., is reported to have announced that the horse car line now operating between Santa Monica and the Soldiers' Home will be changed to an electric railway.

Denver, Colo.—The City Council has passed an ordinance granting a franchise to the Denver & Northwestern Ry. Co.

Victor, Colo.—A franchise has been granted to the Colorado Springs & Cripple Creek District Ry. to build tracks and run cars through this city.

Stonington, Conn.—The Groton & Stonington St. Ry. Co. has begun to make preliminary surveys. The company has a charter to construct a street railway from New London, Conn., to Westerly, R. I.

Middletown, Conn.—The Middletown St. Ry. Co. has acquired franchises to build various additional lines within the city and its suburbs.

DeKalb, Ill.—The DeKalb & Southwestern Electric Ry. Co. has been incorporated, with a capital of $50,000, to construct an electric railway from DeKalb to Steward, with branches from Steward to Chicago, to Rock Island and to Cairo. Incorporators: E. L. Titus, of Steward; S. D. Frost, of Amboy, and others.

Champaign, Ill.—The Danville, Urbana & Champaign Railway Company is to build a 14-mile extension of its present lines at once.

Quincy, Ill.—The locations are about completed for the Quincy & Southeastern Electric Ry. Company, and the right of way is well under way. The company plans to begin construction work at once.

Madison, Ind.—The Comrs. have granted to Yoder, Hubbard & Rominger, of Indianapolis, a franchise and right of way for an electric line from Madison, through Jefferson, to the Ripley County line.

Decatur, Ind.—A franchise has been granted to the Springfield & Ft. Wayne Interurban Ry. Co. to operate through the county.

Terre Haute, Ind.—The Terre Haute Electric Co. is stated to have decided to extend to Paris and Clinton. Stone & Webster, of Boston, Mass., are Gen. Mgrs.

Alexandria, Ind.—The Union Traction Co. has secured a franchise over E. Washington St.

Davenport, Ia.—The Tri-City Ry. Co. plans to build a 6-mile extension this season.

Davenport, Ia.—The Davenport & Suburban Ry. Co. is stated to have awarded the International Constr. Co., of Detroit, Mich., the contract for constructing its line.

Albia, Ia.—M. E. Springer, of Des Moines, is promoting a company to build an electric railway from Albia to Buxton, Hiteman, Hocking, Hilton and Hynes.

Cedar Rapids, Ia.—The Cedar Rapids & Iowa City Ry. & Light Co. has been organized for the purpose of constructing an interurban line from Cedar Rapids to Iowa City, a distance of 28 miles; capital, $2,000,000. The company will succeed the Cedar Rapids, Iowa City & Southern Ry. Stephen J. Dows, Pres.; E. E. Pinney, Secy.

New Orleans, La.—Plans have been drawn by the New Orleans Rys. Co. for enlarging the Canal St. car house; shops will probably be erected at the Canal St. car house covering four blocks. The Arabella car house will also be enlarged and the Poland St. car house will be rebuilt. The company also has in contemplation the St. Charles extension to Audubon Park.

Boston, Mass.—Bids will be received June 23 by Geo. U. Crocker, City Treas., for $1,300,000 rapid transit East Boston tunnel bonds.

Worcester, Mass.—The Worcester Consolidated St. Ry. Co. has been authorized by the State R. R. Comn. to make extensions to its line in Fitchburg.

The Worcester & Southbridge St. Ry. Co. has secured a franchise for a double-track location on Stafford St., in consideration of which the company is to widen the street at an expense of $50,000.

Southbridge, Mass.—The Willimantic & Southbridge St. Ry. Co. has been authorized by the Connecticut Legislature to increase its capital from $50,000 to $150,000. The plan of this company is to build an electric railway from Willimantic through North Windham, Chaplin and other towns to Southbridge.

Webster, Mass.—It is said that a proposition is being considered by street railway men in Webster to lease the Southbridge branch of the New York, New Haven & Hartford R. R. and convert it into an electric line.

Greenfield, Mass.—It is stated that the Greenfield & Turner's Falls St. Ry. Co. will build 3 miles of track this summer.

Owosso, Mich.—The Owosso & Corunna Electric Co., of Owosso, Mich., intends to add a 10-mile extension to its present line and to install new lighting generators and arc lamps. Frank Van Tuyl & Company, of Detroit, Mich., are Gen. Mgrs. of the company.

Marquette, Mich.—The Marquette City & Presque Isle St. Ry. Co. has in contemplation the construction of about 2 miles of new track and the reconstruction of its entire system.

Monroe, Mich.—The Ohio & Michigan Traction Co. has been incorporated at Monroe, Mich., with $1,650,000 capital stock. The company proposes to build from Toledo to Ann Arbor, Mich. J. H. Class, Pres.; L. H. Austin, Secy.

Duluth, Minn.—The Northern Power Co. and the Duluth-Superior Traction Co. have entered into a contract whereby the former agrees to furnish power on or before July 1, 1904, for the operation of the street railway system in the two cities. Numerous improvements are planned by the Trac. Co., among them being the construction of a 50-ft. addition to the power house. In the new building will be placed a 1,000-H.-P. engine. In addition to these the company will also have its two smaller engines of 600-H.-P. and 150-H.-P. The improvements, it is estimated, will cost about $150,000.

New Brunswick, N. J.—The Middlesex & Somerset Traction Co. has secured rights of way for a line from Metuchen to Plainfield.

Mount Holly, N. J.—The Burlington County Traction Co. is stated to have secured permission to equip the Mount Holly St. Ry. with electricity.

Catskill, N. Y.—Preliminary surveys have been made for the Albany & Catskill R. R., and notice is given that application has been made by the company for a franchise in Bethlehem. The company proposes constructing an electric railway between Catskill and Albany, principally along Hudson River. John M. Sheehan, of Newburgh, is the principal promoter.

Depew, N. Y.—The Buffalo & Depew Ry. Co. has secured the right of way for a 60-mile extension between Buffalo and Rochester, and will soon be in the market for rails, ties, poles, overhead materials, power-house equipment, etc.

Cortland, N. Y.—The Cortland County Traction Co. is stated to have decided to extend its lines from Homer to Little York, a distance of about 5 miles.

Penn Yan, N. Y.—The Lake Keuka & East Side R. R. Co. desires contractors to bid upon the construction of its line. It will be an electric road 13 miles long, with an extension of 19 miles in Yates and Steuben Counties. Address Morris F. Sheppard, Penn Yan, N. Y., or Burke & Sheppard, 44 Pine Street, N. Y. City.

Altamont, N. Y.—The Schenectady Ry. Co. has under consideration the running of a branch road from its main line between Albany and Schenectady to the village of Altamont. C. C. Lewis, Ch. Engr., Schenectady.

Brooklyn, N. Y.—The Bush Terminal R. R. Co. has been authorized by the State R. R. Comn. to build a street surface railway in Brooklyn, from about the 39th St. Ferry terminal westerly to 1st Ave. on the bay front; thence to 65th St., where it may connect with the Long Island R. R.

Albuquerque, N. M.—O. E. Cromwell has secured a franchise to build an electric railway in Albuquerque.

East Liverpool, O.—The United Power Co. is preparing to build an electric railway from East Liverpool to Lisbon by way of Little Beaver Valley.

Akron, O.—Engrs. of the Akron-Alliance Connecting Ry. Co. are reported to be making surveys for the proposed line. The road will touch Suffield, Mogadore, New Baltimore, Marlborough, Bolton and Alliance.

Marietta, O.—Surveys have been completed for the Marietta, Woodfield & Barnsville Electric Ry., and the work of securing the right of way has begun.

Portland, Ore.—The Council has granted the franchise of the West Side & Suburban Ry. Co. authorizing the building of an electric standard-gauge railway from 1st and Couch Sts. out past the city limits to Hillsboro.

Harrisburg, Pa.—The following companies have been chartered, with John Hartwell Hillman, Jr., of Pittsburg, Pres.: Spruce Run Street Ry. Co., 2½ miles, capital $15,000, to run from Ben Avon to Emsworth; Kilbuck St. Ry. Co., 5 miles, capital $30,000, to run from Emsworth via Glenfield, Haysville and Osborne to Sewickley; Twin Creeks St. Ry. Co., 3 miles, capital $18,000, to run from Sewickley to the boundary line of Allegheny and Beaver Counties; East Bank St. Ry. Co., 7 miles, capital $42,000, to run from the line of Allegheny and Beaver Counties via Baden, through Economy Township.

Wrightsville, Pa.—The Council is stated to have granted a franchise to the York & Wrightsville Traction Co., of York.

Trexlertown, Pa.—The Trexlertown & Alburtis St. Ry. Co., capital $18,000, has been chartered to build a 3-mile line from Trexlertown to Alburtis. H. E. Ahrens, Reading, Pres.

Greensburg, Pa.—The Greensburg & Southern Electric Ry. Co. intends to extend its line from Youngwood to Weaver's Old Stand and thence to Mt. Pleasant.

Houston, Tex.—It is stated that a company is soon to be incorporated to build an electric railway between Houston and Sylvan Beach. J. O. Ross, C. H. Milby and H. E. Fuller, of Houston, are reported interested.

Spokane, Wash.—The Spokane Southern Traction Co. has in contemplation the construction of an electric railway from the center of Spokane, by two separate city routes through two separate, well-settled portions of the city, each line being about 2½ miles long, to the southern suburbs. The road would then run in a southwesterly direction across Moran and Richland Prairies to Shea's Prairie, a distance of 10 or 12 miles. Mark F. Mendelhall, of Spokane, is promoting the project.

Fairmont, W. Va.—The Fairmont & Clarksburg Electric R. R. Co. will build 10 miles of additional lines this summer.

Toronto, Ont.—The Dirs. of the Toronto Ry. Co. have decided to increase the power plant from 6,000-H.-P. to 10,000-H.-P.

RAILROADS.

Marked Tree, Ark.—A charter has been granted to the Tyronza & St. Francis River Ry. Co. to construct a line from a point west of Earl to Marked Tree, a distance of 21 miles. Directors: E. B. Smith, Geo. W. Patterson, and others.

Little Rock, Ark.—The Little Rock & Monroe Ry. Co. has been incorporated, with a capital of $500,000, by E. A. Frost, of Texarkana; J. A. Rutherford, of Pine Bluff, and J. E. Cavanaugh, of Laplie, to build a road from Laplie, Ark., to Monroe, La., a distance of 50 miles.

Denver, Colo.—Bids will be received until June 30 by the Ch. Engr. of the Colorado Constr. Co., Rm. 717 Majestic Bldg., Denver, for constructing a railway tunnel about 2½ miles in length, through the Continental Divide, 60 miles west of Denver, together with the approach cuts and the embankments required at each end of the tunnel. S. T. Smith, Pres.

Tallahassee, Fla.—The directors of the Georgia, Florida & Alabama R. R. Co. are stated to have decided to extend its line south from Tallahassee to Jacksonville; also from Cuthbert, Ga., to Columbus, Ga. J. P. Williams, Pres., Savannah, Ga.

Fenton, Ill.—The Fenton & Thomson R. R. Co. has been incorporated, with principal office at Chicago, and a capital of $400,000, to construct a line from a point on the C., B. & Q. R. R. north of Fenton to a point on the C., B. & Q. Ry. south of Thomson, Ill., a distance of about 12 miles. Incorporators: Henry W. Weiss, Hinsdale, Ill.; Chester M. Dawes, Chicago, Ill.; Jos. A. Connell, of La Grange, Ill., and others.

Christopher, Ill.—The Christopher & Herrin R. R. Co. has been incorporated, with a capital of $10,000, to construct a line from a point on the Illinois Central R. R. near Christopher to a point near Herrin. Directors: Sidney P. Andrews, Blewett Lee, F. L. De Lay and others, all of Chicago. Principal office in Chicago.

Tupelo, Miss.—A construction company is reported as being formed to build the Helena, Tupelo & Decatur R. R. W. D. Anderson, Pres., Tupelo.

Cape Girardeau, Mo.—A certificate of incorporation has been issued to the Cape Girardeau Terminal Ry. Co., of Cape Girardeau, which proposes to build and maintain a railroad from a connection with the St. Louis, Memphis & Southeastern at or near the crossing of the Cape La Cruche Creek, into and through Cape Girardeau; capital, $40,000. F. E. Dewey, F. E. Burrough and J. H. Force are the incorporators.

Cincinnati, O.—Local press reports state that the Pennsylvania R. R. Co. has completed plans for track elevation in eastern part of city; cost reported to be about $1,500,000. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Ravenna, O.—MacArthur Bros. Co. will sublet portions of its contract on the new line of the Baltimore & Ohio R. R., between Ravenna and Cuyahoga, O., as follows: Steam shovel work, 340,000 cu. yds.; car work, 110,000 cu. yds., and 33,000 cu. yds. of rock work. W. G. Sloan, Supt., Ravenna.

Blackwell, Okla. Ter.—A charter has been granted to the Ft. Smith, Blackwell, Wellington & Northwestern R. R. Co., with a capital of $1,000,000, to construct a line from Ft. Smith n. w. through the Cherokee and Creek Counties to Cleveland, Okla., and through the Osage and Ponca Reservations to Blackwell. Incorporators: Residents of Blackwell and Wellington.

Philadelphia, Pa.—Alex. J. Cassatt, of Philadelphia, Pres. Pennsylvania R. R. Co., is stated to have authorized the expenditure of about $500,000 on improvements in the 50th St. freight yard, West Philadelphia, to include the purchase and laying of about 10 miles of new track, enlarging the yard, construction of engine houses, shops, transfer station and freight house.

Pittsburg, Pa.—It is stated that additional improvements involving an expenditure of about $750,000 are to be made along the West Penn division of the Pennsylvania R. R. during the present year. The plans are now being drawn by the Eng. Dept. and provide for the construction of a number of bridges to do away with grade crossings in many of the smaller towns along the line. W. H. Brown, Ch. Eng., Philadelphia.

According to press reports Jos. Ramsey, Jr., St. Louis, Mo., Pres. Wabash R. R., has announced that within the next 30 days contracts involving the expenditure of $10,000,000 will be awarded. The contracts will include the building of the Greene County line from Pittsburg to Bellington, W. Va.; the extension to tidewater, the line from Cumberland to Cherry

Run, and the Saw Mill branch of the local belt line. The contracts for structural steel for the Pittsburg terminus will also be awarded within the coming month.

Memphis, Tenn.—It is stated that the Illinois Central R. R. will within the next thirty days award the contract for building its cut-off between Etters and Lake View, south of Memphis; estimated cost of work, $150,000. H. U. Wallace, Ch. Engr., Chicago, Ill.

Dyersburg, Tenn.—The Illinois Central R. R. Co. is reported to have under consideration a branch line to extend from Dyersburg to Hales Point and to Ripley, a distance of 50 miles. David Sloan, Ch. Engr. of Construction. Chicago, Ill.

Vernon, Tex.—It is stated that construction will soon begin on the Vernon, Roswell & El Paso R. R. The survey for this line is now being made from Vernon to Alamagordo, N. M., a distance of about 300 miles. At Vernon the road will connect with the Blackwell, Enid & Southwestern branch of the Frisco, and at Alamogordo it will connect with the El Paso line of the Rock Island.

Georgetown, Tex.—The Missouri, Kansas & Texas R. R. Co. is locating line from Georgetown to Austin, about 50 miles, to be built within the year. J. W. Petheram, Ch. Engr., Dallas.

Phillips, Wis.—The Phillips, Kennan & Chippewa Falls R. R. Co. has been incorporated to run from Phillips through Price, Taylor and Chippewa Counties to Chippewa Falls, about 17 miles. The company has acquired the right-of-way and properties of the Phillips & La Crosse Road, from Phillips to Kennan; capital, $25,000. Incorporators: John S. Maxwell, M. A. Hoyt, and others, all of Milwaukee.

Quebec, Que.—According to press reports it is proposed to extend the Grand Trunk Ry. System (J. Hobson, Ch. Engr., Montreal) through Canada to the Pacific Coast. The project contemplates the organization of a separate company, to be known as the Grand Trunk Pacific Ry., with a capital of $75,000,000. Under this charter there will be built a line 3,860 miles long, extending from Quebec to Port Simpson, on the Pacific Ocean, with several branches.

PUBLIC BUILDINGS.

Little Rock, Ark.—Bids will be received by the Bd. of Trus. of the State Charitable Institutions at Laclede Bldg., Little Rock, until July 7 for building the Insane Asylum Annexes of the State of Arkansas. Appropriation, $140,000. Bids are to include heating, lighting and plumbing. John H. Page, Secy.

Pasadena, Cal.—Wm. Crowell, Yolo Ave. and Yale St., is stated to have received the contract for erecting the Baptist Church, for $40,000.

San Jose, Cal.—Frank Davis, 36 S. 2d St., is stated to have submitted the lowest bid for erecting a cottage for the Agnews Hospital, his bid being $37,920.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Yountville, Cal.—It is reported that bids will be received until July 2 by the Directors of the Veteran's Home of California, at 320 Sansome St., San Francisco, for erecting a hospital at Yountville. John F. Sheehan, Secy.

Chicago, Ill.—Plans are stated to have been approved for the Englewood Union Hospital to be erected at 69th St. and Stewart Ave., Englewood. The structure will be a 3-story brick building; probable cost, $120,000.

De Kalb, Ill.—It is stated that a Home for Dependent Old People will be erected here, at a cost of $150,000. I. L. Ellwood is reported interested.

Indianapolis, Ind.—A correspondent writes that the Indiana World's Fair Comn. has adopted plans prepared by Wing & Mahurin, Pixley-Long Bldg., Ft. Wayne, for the Indiana Bldg., to be built at the St. Louis Exposition, and that bids for erecting said building will be received until July 14.

Des Moines, Ia.—Bids will be received June 25 by the Bldg. Com. for erecting a brick and stone church at 12th and Maple Sts. C. C. Cross & Son, Archts., 408 Good Blk.; J. W. Day, Chmn.

Perry, Ia.—Bids will be received July 1 by the Bd. of Library Trus. for erecting a library. Sam. E. Carrell, Chmn. Bldg. Com.

Creston, Ia.—The Congregation of the Methodist Church is stated to have decided to erect an edifice, to cost about $35,000.

Denison, Ia.—M. J. Collins, Co. Aud., writes that the contract for erecting a court house (bids opened June 9) has been awarded to John F. Sparks, of St. Joseph, Mo., for $74,740.

Augusta, Me.—E. C. Stevens, Supt. Pub. Bldgs., writes that the contract for fireproofing and refinishing 3d and 4th floors of South Wing of the State Capitol (bids opened June 12) has been awarded to Woodbury & Leighton, 166 Devonshire St., Boston, Mass., for $8,750.

Boston, Mass.—Bids will be received June 24 by John B. Martin, Penal Instit. Comr. for electrical construction; also furnishing and installing 3 horizontal tubular boilers and connections at the House of Correction at Deer Island.

Bids will be received June 23 by Geo. U. Crocker, City Treas., for $50,000 Cabot St. bath-house bonds; also $50,000 North End bath-house bonds.

Marshall, Mich.—Press reports state that bids will be received July 8 by G. J. Ashley & Co., Chmn. of the Bldg. Com., for erecting a county house, to cost $25,000.

Emmetsburgh, Md.—Local press reports state that bids will be received about July 1 for erecting a 3-story brick administration building for the St. Vincent's Catholic hospital, to cost, according to reports, $125,000. Rockwell M. Milligan, Archt., St. Louis, Mo.

Farmington, Mo.—Bids will be received July 6 by the Bd. of Mgrs. of State Hospital No. 4 for erecting a 2½-story administration building. H. H. Hohenschild, Archt.; Rolla M. P. Cayce, Secy.

Rochester, N. Y.—It is stated that the Brick Church, recently destroyed by fire, will be rebuilt.

Raybrook, N. Y.—Bids will be received July 1 by Howard Townsend, Pres. Bd. of Mgrs., at the office of G. L. Heins, State Archt., in the Capitol, Albany, for erecting dormitory pavilion and connecting corridors for male and female patients; also solarium for female patients, including ventilating, heating, plumbing, gas-fitting and electric conduit work, at the N. Y. State Hospital for Tuberculosis.

Brooklyn, N. Y.—Bids will be received July 1 by J. Edw. Swanstrom, Boro. Pres., for repairs, alterations and additions to plumbing and drainage system; also ventilating and heating systems at the Kings Co. Court House.

Buffalo, N. Y.—It is stated that 2 structures will be erected at Front Ave. and Rhode Island St. for the Home for the Aged; estimated cost of both, $100,000.

Brooklyn, N. Y.—The contract for erecting and completing boiler house and disinfecting plant at the Kingston Ave. Hospital, Boro. of Brooklyn (bids opened June 9), by the Dept. of Health, N. Y. City, F. D. Bell, Ch. Clk., has been awarded to Kelly & Kelley, 45 E. 42d St., for $38,100.

New York, N. Y.—The contract for erecting a disinfecting station on pier at E. 132d St., Boro. of Bronx (bids opened June 12) has been awarded to Wm. H. Wright & Son, 3d Ave. and 148th St., for $7,158.

Bids will be received July 1 by John W. Brannan, Pres. Bd. of Trus., Bellevue and Allied Hospitals, for erecting a Harlem hospital on Lenox Ave., 136th and 137th Sts.

Bids will be received June 25 by the Bd. of Park Comrs. for furnishing material and erecting pavilion in Thos. Jefferson Park.

Bids will be received July 8 by the Dept of Bd. of Health for furnishing material and erecting a scarlet fever pavilion at the Willard Parker hospital. Ernst J. Lederle, Pres.

Bath, N. Y.—Press reports state that bids will be received June 29 by the Co. Comrs. for $25,000 court house bonds.

Cleveland, O.—It is stated that bids are wanted July 1 for completing public library at Wilson Ave. and Marquette St. C. D. Williams, Pres. Pub. Library Bd.

Wilmington, O.—Bids will be received June 30 by the Library Bd. for furnishing material and erecting a Carnegie library. W. S. Kaufman, Archt., Richmond, Ind.

Delaware, O.—Bids will be received Sept. 10 by the Trus. of the Gir's' Industrial Home near Delaware, for installing three 75-H.-P. boilers on the institution grounds. Edwin J. Brown, Clk.

Cincinnati, O.—Press reports state that bids will be received July 15 by the Co. Comrs. for $250,000 building bonds.

Kingfisher, Okla. Ter.—Bids will be received until July 8 by Fred. L. Wenner, Secy. Bd. of World's Fair Comrs. at Kingfisher, for erecting the Oklahoma Building at the La. Purchase Exposition at St. Louis, Mo.

Roseburg, Ore.—Bids are wanted June 27 for completing barracks building, hospital, also separate bid for laying water mains. Delos D. Neer, Archt.; W. W. Elder, Commandant of the Oregon Soldiers' Home.

Pittsburg, Pa.—T. D. Evans, Lewis Bldg., is stated to have submitted plans for a 2-story, 106x236-ft. Soldiers' and Sailors' Memorial Hall to be erected here, at a probable cost of $600,000.

Waco, Tex.—Bids are wanted July 1 for erecting a brick jail. G. B. Gerald, Co. Judge.

Houston, Tex.—Plans and specifications will be received July 6 by D. D. Bryan, City Secy., for erecting 2-story brick fire engine house, cost not to exceed $30,000.

Newport, Va.—The First Methodist Society is reported to be preparing to erect an edifice, to cost $20,000. Rev. J. Sidney Peters, Pastor.

Milwaukee, Wis.—The Congregation of the Summerfield M. E. Church is stated to have purchased a site at Cass St. and Juneau Ave. for the erection of an edifice, to cost about $65,000.

BUSINESS BUILDINGS AND DWELLINGS.

Los Angeles, Cal.—The Pacific Electric Ry. Co. (Geo. E. Pillsbury, Ch. Engr.) will erect a 3-story hotel on Echo Mountain; probable cost, $100,000.

Washington, D. C.—Geo. A. Fuller Co., of New York City, is stated to have received the contract for erecting an 8-story apartment house at Connecticut Ave. and M St. for D. C. Phillips; estimated cost, $400,000.

Macon, Ga.—Frank Gunn will erect a block of brick buildings at 4th and Poplar Sts. at a cost of $50,000.

Johnson, King & Co. will erect a candy factory at Poplar St., to cost about $25,000.

The Trus. of the Masonic Home are advertising for plans for a building, to cost about $40,000.

Atlanta, Ga.—It is stated that bids are wanted June 29 for erecting a 15-story brick, stone and steel office and bank building, 50x110, for the Fourth National Bank.

Macon, Ga.—P. E. Dennis, of Macon, is preparing plans for a Science building, a Y. M. C. A. building and 10 cottages for Mercer University, to cost in all $30,000.

Chicago, Ill.—It is stated that Wm. Stevenson will erect a 3-story brick apartment house at Lake Ave. and 48th Sts., at a cost of $85,000. Arthur Foster, Archt., 3903 Cottage Grove Ave.

Henry Sampson, of New York City, is reported to be considering the erection of a 16-story building at 21 Plymouth Place; estimated cost, $500,000.

Crawfordsville, Ind.—It is reported that Elijah Clore will receive bids until July 5 for erecting a flat, containing 36 suites.

Lebanon, Ind.—Carson & Neal are reported to have accepted plans prepared by L. H. Gibson, Law Bldg., Indianapolis, for a 3-story store and office building, and will receive bids for erecting said building until July 5.

Iowa Falls, Ia.—It is stated that L. E. Jones will erect a residence, to cost $30,000. Smith & Gage, of Des Moines, Archts.

Lexington, Ky.—Richards, McCarty & Bulford, of Columbus, O., are stated to have received the contract for erecting the $40,000 Y. M. C. A. building here.

Crowley, La.—C. Lewis Wilson, of Beaumont, Tex., is reported to have been selected to prepare plans for a 4-story hotel to be erected here, at a cost of $65,000.

New Orleans, La.—See "Electric Railways."

Springfield, Mass.—A. A. & S. T. Ball are arranging to build a 4-story brick and stone apartment house, 60x250 ft., on State St. Architect, W. B. Reid, of Holyoke.

McBrides, Mich.—Haug & Scheurman, of Saginaw, W. S., have prepared plans for a business block for F. Neff & Son, of McBrides.

Bay City, Mich.—Clark & Munger, of Bay City, are preparing plans for a building for the Bay City Club. It will be 50x80 ft., 3 stories, of brick and stone; steam heat, slate roof, and cost $25,000.

Detroit, Mich.—The Guaranty Fund Trust Co. is stated to have had plans prepared for a 3-story, 78x96-ft. brick building to be erected at Grand and 6th Aves.

Auburn, N. Y.—The plans of Wilkinson & Magonigle, of New York City, are stated to have been approved for the City Club building; estimated cost, $30,000. John D. Teller, Pres.

Cincinnati, O.—Patrick Farrell, of Cincinnati, is stated to have received the contract for erecting the warehouse for the Baltimore & Ohio Southwestern R. R., for $135,000.

Philadelphia, Pa.—The Elks of this city are reported to be considering the erection of a building at 1320 Arch St.; probable cost, $200,000.

Pittsburg, Pa.—It is stated that bids are being received by Geo. A. Fuller Co., New York City, for the sub-contract work on the Wabash Terminal and Passenger Station to be erected at Liberty Ave. and Ferry St. The sub-contract work will be on steel construction, brick, marble and stone, woodwork, decorating and furnishing; estimated cost of structure, $1,750,000.

A. & S. Wilson Co., 541 3d Ave., is reported to have received the contract for erecting the 8-story warehouse at Ross St. and 3d Ave. for the Baily-Farrell Mfg. Co.; estimated cost, $225,000.

Spokane, Wash.—Cutter & Malgram, Exchange Bldg., have prepared plans for a brick building for J. P. Groves, to cost $24,000.

Moundsville, W. Va.—It is stated that bids are wanted July 7 for erecting a 3-story brick and stone bank, store and office building, 60x100 ft. Address C. A. Showacre.

Milwaukee, Wis.—It is stated that the Northwestern National Insurance Co. (Alfred James, Pres.) will erect an office building at Wisconsin and Jackson Sts.; probable cost, $50,000.

La Crosse, Wis.—The Bd. of Dir. of the La Crosse Theater Assoc. are stated to have decided to rebuild the La Crosse Theater; probable cost, $30,000.

SCHOOLS.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Ft. Collins, Colo.—A. M. Hawley, Secy. State Bd. of Agriculture, writes that new bids will be received about July 15 for erecting an irrigation engineering building at the Agricultural College.

Indianapolis, Ind.—John E. Cleland, Bus. Dir. School Comrs., writes that the contract for erecting a school on Senate Ave. and Walnut St. (bids opened June 11) has been awarded to J. A. Schumacher Co., of Indianapolis, for $22,750.

The Physio-Medical College Assoc. is having plans prepared for a college building and hospital to be erected at Alabama and North Sts.; estimated cost, $100,000 and $40,000 respectively.

Franklin, Ind.—All bids for erecting the Franklin College Library have been rejected, being in excess of the estimated cost, $20,000. New bids will be submitted.

Center Point, Ia.—It is stated that bids are wanted by the Bd. of Educ. until July 1 for erecting a brick school. F. Stauffer, Pres.

Humboldt, Minn.—Allan Black & Co., of Minneapolis, are stated to have submitted the lowest bid for ventilating and heating the high school, their bid being $6,595.

Virginia, Minn.—Parmelee & Son, of Iron Mountain, Mich., are stated to have been selected to prepare plans for a high school to be erected here, at a cost of $60,000.

Hoboken, N. J.—Press reports state that bids will be received June 24 by the School Authorities for $30,000 school bonds.

Brooklyn, N. Y.—Bids will be received June 29 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric light wiring, fixtures and electric bell ayatem in School No. 119; also ventilating and heating apparatus and alterations in School No. 84; also sanitary work in School No. 123.

Long Island City, N. Y.—Bids will be received June 29 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for erecting an addition to School No. 57, Boro. Queens.

New Brighton, N. Y.—Bids will be received June 29 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for erecting School No. 26, Boro. Richmond.

Yonkers, N. Y.—Bids will be received by the Bd. of Educ. until June 22 for erecting a 16-room school on Park Hill Ave. H. W. Bertholf, Chmn. Com. on Architecture.

New York, N. Y.—Bids will be received June 23 by Alrick H. Man, Chmn. Executive Com., Normal College, for repairs and alterations to the Normal College buildings.

Bids will be received June 29 by C. B. J. Snyder, Supt. School Bldgs., for sanitary work in Schools No. 19 and 32, Boro. Bronx; also for erecting addition to the Truant School on 21st St., Boro. Manhattan.

Barberton, O.—W. G. High, Clk. Bd. Educ., writes that it was voted May 29 to issue $40,000 bonds for erecting a school.

Troy, O.—Chas. T. Ramsells, City Aud., writes that it was voted June 13 to erect a school, to cost $30,000.

Youngstown, O.—Bids will be received July 6 by the Bd. of Educ. for plumbing and sewer work at the Shelby, South Ave. and Oak St. school. W. N. Ashbaugh, Clk.

Wilmington, O.—Bids are wanted July 11 for erecting a school in Centerville. W. D. Jarrell, Clk. Bd. of Educ.

Springfield, O.—Bids are wanted July 6 for furnishing material and repairing the Lagonda school. Robt. C. Gotwald, Archt.; Oliver H. Miller, Clk. Bd. of Educ.

Pittsburg, Pa.—Bids will be received June 29 by the Bd. of Educ. for erecting fireproof addition to school in 37th Ward. Address F. Fuhrer, Secy., Baxter St., Wilkinsburg Station, Pittsburg.

Bids are wanted June 29 for $48,000 school bonds. Address F. C. Fuhrer, 105 Baxter St., Station D, Pittsburg.

Morganza, Pa.—Bids will be received June 23 by A. G. Harper, Chmn. of Bldg. Com. for erecting a girls' building at the Pennsylvania Reform School, at Morganza.

Columbia, Pa.—C. Emlen Urban, of Lancaster, is preparing plans for a $25,000 school for Columbia.

Centerville, S. Dak.—It is stated that bids are wanted by the Bd. of Educ. until June 25 for erecting a school. W. R. Parsons & Son Co., Archts., Des Moines, Ia.

Memphis, Tenn.—The Bd. of Educ. has voted to construct 2 schools, to cost $22,000 and $22,500 respectively. Architect, W. C. Jones, 260 2d St.

Humboldt, Tenn.—The citizens are stated to have voted to issue $28,000 bonds for the erection of a Normal School.

Spokane, Wash.—School Dist. No. 81 has ordered plans for addition to McKinley School; cost, $35,000. Architect, L. L. Rand, Rookery Bldg.

Grafton, W. Va.—The citizens are stated to have voted to erect a school on the west side, to cost $35,000.

Triadelphia, W. Va.—Bids are wanted June 29 for erecting a school at Leatherwood, Triadelphia Dist., including stone, brick, slate roofing and steel ceiling. Chas. D. McCarty, Rielly Bldg., Wheeling; N. N. Hervey, Pres. Bd. of Educ.

Madison, Wis.—It is stated that plans are being prepared for a Chemistry building for the University of Wisconsin; estimated cost, $100,000.

STREET CLEANING AND GARBAGE DISPOSAL.

San Francisco, Cal.—The Bd. of Wks. is stated to have awarded contracts as follows for the coming year: J. G. Harney, for sweeping in the 1st, 2d and 4th districts, at 99 cts. for first-class streets in the 1st district and 35 cts. in classes 2 to 7; in the 2d dist., 32 cts. per 1,000 sq. yds., and in the 4th dist., 39 cts. For sprinkling in the same districts, 22½ cts. per 1,000 lin. ft. In the 3d dist., Peter and Felix McHugh for sweeping, at 25 cts. per 1,000 sq. yds. In sprinkling dists. Nos. 1 and 2, Gray Bros., at 27 cts. per 1,000 lin. ft.

Bridgeport, Conn.—It is stated that a fire on June 4 destroyed the rendering plant of the Plumb & Winton Co. and the garbage reduction plant of the Connecticut Abattoir & Oil Co.

Burlington, Ia.—Local press reports state that the Council will provide for a levy of one mill to be devoted to the erection of a garbage crematory.

Great Falls, Mont.—Bids are wanted July 6 for furnishing f. o. b. cars one 2-horse street sweeper. W. H. Smith, City Clk.

New Brighton, S. I., N. Y.—Bids will be received June 26 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing material and labor required for the transportation of ashes, garbage and light refuse in the Boro. Richmond.

Long Island City, L. I., N. Y.—The Mayor has approved a resolution authorizing the issue of $23,450 corporate stock for the acquisition and construction of new stock and plant for the Bureau of St. Cleaning in the Boro. of Queens.

Buffalo, N. Y.—The Com. on Sanitary Measures of the Bd. of Aldermen on June 13 voted to award the contract for the collection and disposal of ashes, garbage and refuse to the Buffalo Sanitary Co. for $164,000.

Martins Ferry, O.—The Bd. of Health is stated to have decided to recommend to Council the construction of a garbage crematory.

Dayton, O.—Bids are wanted June 26 for sprinkling portions of Sunset Ave. and Jasper St. Wm. F. Miller, Clk. Bd. of Pub. Service.

Pittsburg, Pa.—Bids are wanted June 24 for the collection, removal and disposal of garbage, offal, dead animals, etc., from July 1, 1903, to Jan. 31, 1904. Harry Moore, Dir. Dept. of Pub. Safety.

GOVERNMENT WORK.

San Francisco, Cal.—Jas. Campbell, Flood Bldg., has secured the contract for constructing brick quarters for officers and an additional building for the general hospital, at the Presidio of San Francisco.

Waterbury, Conn.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until July 16 for construction (excepting heating apparatus, electric wiring and conduits) of the U. S. Post Office at Waterbury.

Washington Barracks, D. C.—Capt. John Stephen Sewell, Acting Q. M., U. S. A., writes that contracts have been awarded as follows (bids opened Apr. 30): For Portland cement to S. Dana Lincoln and the Atlas Portland Cement Co., of New York, N. Y., at $1.89 and $1.97 per bbl. respectively; building and concrete sand and gravel, to Columbian Nati. Sand Dredging Co., at $1.25 per cu. yd.; to Cranford Paving Co., for grading, $32,000; for roads to the Brennan Constr. Co., $40,000; for sidewalks, Colburn Paving Co., $5,950; and for a sewerage system, a drainage system and a water supply system to E. J. Hannon, at $15,934, $3,125 and $16,380 respectively. Contractors of Washington, D. C., unless otherwise mentioned.

Jacksonville, Fla.—It. G. Ross, of Jacksonville, is stated to have submitted the lowest bid, at $164,062, for the construction of a training wall in St. Johns River under the project of obtaining a water way 24 ft. deep from Jacksonville to the Ocean. Bids opened by Capt. F. R. Shunk, Corps Engrs., U. S. A., June 9.

Rossfork, Idaho.—Bids will be received July 23 by the Comrs. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material and constructing stone dormitory, mess hall, employees' quarters, school building, laundry; also water and sewer system at the boarding school, Ft. Hall Agency. For further information apply to A. J. Caldwell, U. S. Indian Agent, Rossfork.

Paducah, Ky.—The following bids were opened in Washington, D. C., June 11 for constructing an extension to U. S. Post Office at Paducah: W. H. Bailey, Henderson, $57,709; Geo. Moore & Son, Nashville, Tenn., $59,890; Chamblin & Murray, Paducah, $63,375; Forbes Mfg. Co., Hopkinsville, $65,800; Congress Constr. Co., Chicago, Ill., $68,943.

The following are the lowest bids opened in Washington, D. C., June 9 for ventilating and heating the U. S. Post Office at Paducah: C. R. Watts & Co., Louisville, $3,387; J. O'Donnell, Evansville, $4,370, and J. E. Coulson, Paducah, $4,403.

Annapolis, Md.—Bids are wanted June 24 for a chapel, also officers' quarters, at the U. S. Naval Academy, Annapolis. Ernest Flagg, Archt., 35 Wall St., New York, N. Y.; H. C. Taylor, Ch. Bureau of Navigation, Navy Dept., Washington, D. C.

Ft. Snelling, Minn.—Geo. J. Grant, 61 E. 9th St., St. Paul, is stated to have secured the contract for constructing the post exchange at Ft. Snelling, for $26,881.

St. Paul, Minn.—The following bids were opened in Washington, D. C., on June 10 for alterations to the U. S. Custom House at St. Paul: Butler Bros., $25,000; P. M. Hennessey, $35,675; J. W. Mills, $42,392; T. Riordon, $36,431; J. A. Donohue, $30,387; Louis Langer, $35,700; Congress Constr. Co., Chicago, Ill., $37,583. Bidders of St. Paul, unless otherwise mentioned.

Jefferson Barracks, Mo.—Bids will be received July 8 by John W. Pullman, Ch. Q. M., for installing shower baths in both barracks and guard house, and making necessary sewer connections therefor.

Jefferson Barracks, Mo.—Capt. W. C. R. Colquhoun, Q. M., U. S. A., of St. Louis, writes that all bids received June 10 for improving the water supply at Jefferson Barracks have been rejected.

Ft. Missoula, Mont.—The following bids are reported to have been opened June 6 by Col. Geo. E. Pond, Ch. Q. M., at St. Paul, Minn., for the construction of (*a*) water works and (*b*) sewerage system at Ft. Missoula: Missoula Mercantile Co., *a*, $11,840; *b*, $9,730. Louis Johnson, Helena, *a*, $10,909; *b*, $7,309. Allan Black, St. Paul, Minn., *a*, $9,988; *b*, $6,698, or $16,500 for both.

Bids are wanted June 24 for house connections and installing interior plumbing in buildings; also for constructing wooden water tank and wooden trestle at this post. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

West Point, N. Y.—Bids are wanted June 29 for completing sea wall at the river front. Address J. B. Bellinger, Q. M., U. S. M. A.

Ft. Michie, N. Y.—Bids are wanted July 11 for repairs and addition to wharf and removing bowlder at this post. Address Constructing Quartermaster, 27 Granite St., New London, Conn.

Ft. Totten, Willets Point, N. Y.—Bids are wanted June 22 for water service and other plumbing in chemical laboratory at this post. Address G. H. McManus, Constructing Q. M., Ft. Totten.

Bids are wanted June 22 for extending sea wall at Ft. Totten. Address G. H. McManus, Constructing Q. M.

Cleveland, O.—The following bids were opened at Washington, D. C., June 6 for general construction of U. S. Post Office, Custom House and Court House at Cleveland: Doyle & Doak, Philadelphia, Pa. (4 bids), $1,159,550 to $1,827,550; Wm. Miller & Sons, Pittsburg, Pa. (3 bids), from $1,178,508 to $1,864,545; Wm. Bradley & Son, N. Y. City, N. Y. (5 bids), from $1,049,222 to $1,929,959; Andrew Dall, Cleveland, $1,178,000; A. B. Stannard, N. Y. City, N. Y. (4 bids), $1,132,000 to $1,740,000; Chas. McCaul Co., Philadelphia, Pa. (2 bids), $1,357,292 and $1,407,292; Hankins Bros. Constr. Co., Cleveland (4 bids), $1,318,359 to $1,907,650; and John Gill & Son, Cleveland (8 bids), $1,293,000 to $1,798,596.

Ft. Stevens, Ore.—Bids are wanted July 11 for repairing hospital at this post. Address F. H. Hathaway, Ch. Q. M., Vancouver Barracks, Wash.

Philadelphia, Pa.—The following bids were opened June 12 for erecting the shrapnel shop at Frankford Arsenal: Geo. W. Pierson, Lippincott Bldg., $38,800; Cramp & Co., $39,350; Edw. Fay, $41,625; A. Harris, $41,750; Henderson & Co., $43,776; Hoover & Son, $44,017; E. A. Fonda, $44,990; J. H. Jordan, $45,380; Penn Bridge Co., $51,000.

Bids will be received June 27 by Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a coaling pier at the Navy Yard, League Island.

Chattanooga, Tenn.—The contract for the construction of a water and sewage system at Chickamauga Park is stated to have been awarded to the T. J. Mooney Co., of Nashville, for $31,800.

Norfolk, Va.—Capt. E. Eveleth Winslow, Corps Engr., U. S. A., writes that contracts for furnishing and delivering Portland cement and broken stone at Ft. Wood, Va. (bids opened May 27) has been awarded to the General Supply Co., Norfolk, and Chas. G. Smith & Son, Washington, D. C., at $2,568 and $1,844 respectively.

The following bids for dredging Edenton Bay, N. C., were opened at the U. S. Engr.'s Office, Norfolk, on June 15, price given per cu. yd.: W. H. French, Berkley, Va., 29½ cts.; Jno. Z. Guin, Philadelphia, Pa., 34½ cts.

Vancouver Barracks, Wash.—Bids are wanted July 7 for erecting a hospital at this place. Address F. H. Hathaway, Ch. Q. M.

Port Townsend, Wash.—Capt. Geo. H. Penrose, Q. M., U. S. A., writes that the following contracts have been awarded (bids opened June 2) to Jas. Lee & Co., Tacoma, for a sewerage system at Ft. Casey, $7,950; to E. M. More, of Tacoma, for a sewerage system at Ft. Worden, $6,900, and to H. J. McInnis, of Ft. Casey, for roads and walks at Ft. Casey.

Superior, Wis.—A press report states that the Supervising Archt., Washington, D. C., is about to ask for plans from architects in Minneapolis and Duluth, Minn., and Superior for a public building for Superior.

NEW INDUSTRIAL PLANTS.

The Bluff City Oil Co., Pine Bluff, Ark., will erect a 280x80-ft. seed house and a 230x60-ft. machinery building. The company is in the market for a 300-H.-P. power plant. A. H. D. Perkins, Pres., Memphis, Tenn.

W. D. Morgan, President of the Bank of Georgetown, Georgetown, S. C., is interested in the organization of a company to erect a 20-ton cottonseed-oil mill.

The Railway Steel-Spring Co., Oswego, N. Y., intends to replace its present wooden building with one of steel and brick construction, to be about 336x180 ft., with a separate power house.

The Hollenbeck Press, Indianapolis, Ind., will erect a 180x220-ft. factory building with saw-tooth roof construction, a 40x180-ft. power house and a 2-story, 45x40-ft. office building. A power plant of about 150-H.-P. capacity, motors, and a blower system for heating will be installed.

The Texas City, Tex., Terminal Co. has let contracts to the Barnett & Record Co., Minneapolis, Minn., for the construction of a 500x1,200-ft. pier of creosoted material, two warehouses with a combined ground area of 150,000 sq. ft., a fireproof elevator of circular tank pattern constructed with tile and enclosing steel banks, and a 50x110-ft. power house of brick with a steel and tile roof and a 110-ft. brick stack. The power house will contain the power plant for the elevator, two electrical units for lighting the pier and sheds, and pumps for a water works and sprinkler system. A small machine shop will also be erected. The pier and warehouses will be equipped with freight handling devices.

The Aberdeen, Miss., Clothing Co. is erecting a 2-story, 60x120-ft. brick building, and will install a 40-H.-P. return tubular boiler, a 30-H.-P. engine, a 15-Kw. direct-current dynamo and a hand freight elevator.

The Michigan Sand-Lime Brick Co., 3 Chase Block, Saginaw, Mich., expects to have its plants in Detroit and Saginaw in operation within a few days, after which the erection of other factories will be begun.

The Birmingham, Ala., Boiler Works will erect a 75x100-ft. building at Gadsden, Ala., to help complete the steel plant and furnaces that they have in hand for the Alabama Steel & Wire Co.

Prices are wanted on 200 ft. of 2 7/16-in. shafting and drop hangers for same.

MISCELLANEOUS.

Chicago, Ill.—The Drainage Bd. is stated to have instructed Ch. Engr. Randolph to prepare plans for the improvement of north branch of Chicago River between Belmont and Lawrence Aves. The channel will be straightened, widened and deepened; cost of improvement, $225,000. The Bd. is also stated to have approved plans for deepening the west fork of south branch of river 2 ft.

Nevada, Ia.—O. B. Peterson, Co. Aud., writes that the contract for constructing a drain ditch in Grant Township (bids opened June 9) has been awarded to C. E. Elzy, of Nevada, at 17 cts. per cu. yd.

Boston, Mass.—Bids are wanted July 7 for constructing Section F of East Boston Tunnel, as advertised in The Engineering Record.

Bids will be received June 23 by Geo. U. Crocker, City Treas., for $849,000 various municipal bonds.

Charleston, Mo.—Bids are wanted July 6 for constructing the "Rowe Ditch" for Drainage Dist. No. 4 of Mississippi Co., being about 130,000 cu. yds. of dirt to be removed; said ditch to have an average depth of 5½ ft. and about 10 ft. wide at the bottom. J. G. Heggie, Co. Clk.

Minnesota, Minn.—Bids are wanted June 30 for constructing State ditches in Roseau, Marshall, Norman, Clay and Otter Tail Counties; estimated number of cu. yds., 125,000. Geo. A. Ralph, Engr. for State Drainage Comn.

New York, N. Y.—Bids will be received June 24 by McDougall Hawkes, Comr. of Docks, for furnishing material and delivering sand and broken stone; also for constructing a pier with appurtenances to be known as Pier No. 19, or Peck Slip Pier West.

Brooklyn, N. Y.—Mayor Low has approved the resolution authorizing the Controller to issue $150,000 corporate stock for the improvement of parks, parkways and driveways in Boroughs of Brooklyn and Queens.

Buffalo, N. Y.—The Council on June 10 passed an order providing for the issue of $350,000 bonds for improving Buffalo River.

Lorain, O.—It is stated that bids are wanted July 8 for widening, deepening and straightening Black River. Geo. Wickens, Chmn. Bd. Pub. Service.

Woonsocket, R. I.—The lowest bid received for building bank wall and for grading Elbow St. has been submitted by Cendella Bros., of Milford, Mass., for $3,972.

Ellensburg, Wash.—Bids will be received July 6 by the Co. Comrs. for a breakwater.

Regina, N. W. Ter.—It is stated that bids are wanted June 25 for 2,500 bbls. of Portland cement. B. J. Saunders, Deputy Comr. of Pub. Wks.

BUSINESS NOTES.

Henion & Hubbell, 61-69 N. Jefferson St., Chicago, report that the recent floods in the west brought some rush orders for pumps for drainage purposes, among them being one for a 6,000,000-gal. centrifugal pump directly connected to a vertical engine, for Swift & Co. Within seven hours of the receipt of the order, the plant complete, dismantled for express shipment and ready for connection to steam, was ready for shipment, and it reached its destination within 24 hours.

J. M. Dashiell, who has represented the Harrison Safety Boiler Works, Philadelphia, in New England under the title of the Dashiell Engineering Co., 1103 Paddock Bldg., Boston, has been placed in charge of the Baltimore section. The New England office will be continued at the same address under the name of the Harrison Safety Boiler Works, with John Hickey as representative.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Windsor, Colo., Sugar Co., two self-oiling engines of 150-H.-P., direct-connected to Crocker-Wheeler generators; Longmont, Colo., Beet Sugar Co., three self-oiling engines of 725-H.-P., direct-connected to Crocker-Wheeler generators.

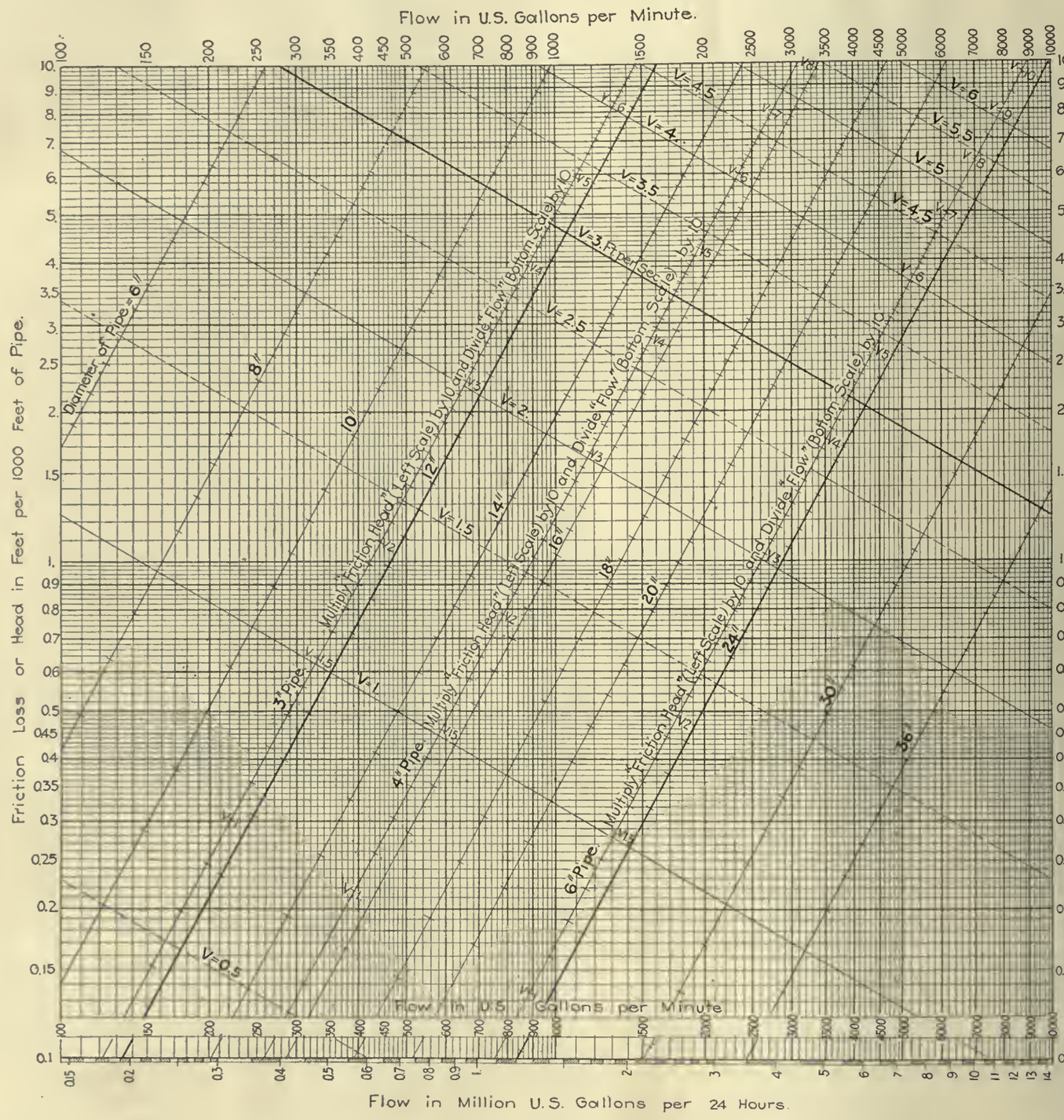
The Allis-Chalmers Co. reports closing what it believes is the largest individual cement machinery contract ever placed at one time with any one concern. The contract refers to the grinding machinery and rotary kilns for the 4,000 and 2,000-bbl. cement plants which are being erected by the United States Steel Corporation at its Illinois Steel Co. plant at South Chicago and its Carnegie Steel Co. plant at Pittsburg. The order consists of twenty-eight No. 8 Gates ball mills, thirty-nine 5x22-ft. Gates tube mills, and twenty-four rotary kilns of special design. The company also reports the following among its sales for May, the engines being Reynolds-Corliss unless otherwise stated: Northwestern Elevated Ry. Co., Chicago, Ill., 34 and 70x60-in. heavy duty horizontal cross-compound direct-coupled; Takata & Co., New York, 15x36-in. heavy duty horizontal direct-coupled; Tintic Mining & Developing Co., Salt Lake City, 12x30-in. heavy duty; Geo. M. Moulton & Co., Chicago, Ill., Reynolds heater; Madison Cotton Oil Co., Vicksburg, Miss., 18x42-in. heavy duty; Delaware & Hudson Co., Scranton, Pa., two 16x36-in. girder frame; Munising, Mich., Paper Co., two 20 and 40x42-in. heavy duty cross-compound direct-coupled; North Carolina Cotton Oil Co., Charlotte, N. C., 20x42-in. girder frame; Illinois Steel Co., Chicago, Ill., two 24 and 60x48-in. duplex combined vertical and horizontal direct-coupled; Paul L. Reinke, Stangelville, Wis., 12x30-in. girder frame; East Rockford, Ill., Mantel Co., 22x48-in. girder frame; Chas. B. Pride, Appleton, Wis., two 14x36-in. and one 16x36-in. heavy duty, and 14 and 28x36-in. tandem compound; G. W. Falson, Jr., Shaw, Miss., 16x36-in. girder frame; Cananea Consolidated Copper Co., New York, 16 and 30x36-in. tandem compound heavy duty; Gluck Mills, Anderson, S. C., 18 and 38x48-in. heavy duty cross-compound; The Martin-Barriss Co., Cleveland, O., 20x42-in. heavy duty; St. Louis Exposition, St. Louis, Mo., 44 and 94x60-in. combined vertical and horizontal direct-coupled; National Tube Co., Pittsburg, Pa., three vertical triple expansion pumping engines, 15,000,000 gal. capacity each; Calumet & Arizona Mining Co., Arizona, 12x15-in. geared hoisting engine; Board of Public Works, Kansas City, Mo., Kansas City Water Works, duplex double-acting Riedler pump, 18½x42-in. stroke, with a four-cylinder triple-expansion Corliss engine 24, 42 and two 50-in. diam. by 42-in. stroke, with auxiliary machinery, consisting of two special suction surface condensers, condenser piping and air pumps, air pump piping and separator drain pumps.

The Shepherd Engineering Co., manufacturer of Shepherd steam engines, will, after July 1, have its general offices and works at Franklin, Pa., where it has secured the plant constructed a few years ago by the Grant Tool Co. This plant will enable the company to take care of its greatly increased business, and will also enable it to make prompt deliveries on future work.

The C. W. Hunt Co., of West Brighton, S. I., has shipped what will probably be the first electric locomotive in Africa to the order of the De Beers Consolidated Mines, Ltd., for use on one of their plants. It is of the latest storage battery type, standard throughout, with the exception of the gauge of the wheels, which is special, to suit the track now in use at the mines.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Jun. 22.	Pittsburg, Pa.	Jun. 13
Jun. 23.	Gouverneur, N. Y., Adv. Jun. 6 to 20	Jun. 6
Jun. 24.	Maxwell, Ia.	Jun. 13
Jun. 25.	Cincinnati, O.	Jun. 20
Jun. 25.	Ford, Mich.	Jun. 20
Jun. 25.	Port Arthur, Ont.	Jun. 13
Jun. 25.	Niagara Falls, Ont., Adv. Jun. 6 to 20	Jun. 6
Jun. 26.	Clayton, Ala.	Jun. 20
Jun. 26.	Saratoga Springs, N. Y.	Jun. 20
Jun. 26.	Saranac Lake, N. Y.	Jun. 20
Jun. 27.	Berlin, Pa.	Jun. 20
Jun. 27.	Erie, Pa. (2 Prop.), Adv. Jun. 6, 13	Jun. 6
Jun. 29.	Dillon, Mont.	Jun. 20
Jun. 30.	Hanley Falls, Minn.	Jun. 20
Jun. 30.	New Bremen, O.	Jun. 20
Jul. 1.	Alexander City, Ala.	Jun. 20
Jul. 1.	Richmond, Va.	Jun. 20
Jul. 1.	Battle Creek, Ia.	Jun. 20
Jul. 1.	Pump, etc., Sioux City, Ia.	Jun. 13
Jul. 1.	West Point, Va.	May 23
Jul. 6.	Sacramento, Cal., Adv. Jun. 13	Jun. 13
Jul. 7.	Weissport, Pa.	Jun. 20
Jul. 7.	Santa Rosa, Cal.	Jun. 20
Jul. 7.	Reading, Pa., Adv. Jun. 6 to 20	Jun. 6
Jul. 10.	Exira, Ia.	Jun. 20
Jul. 10.	Sioux City, Ia., Adv. Jun. 13, 20	Jun. 20
Jul. 13.	Yazoo City, Miss.	Jun. 20
Jul. 15.	Mt. Airy, N. C.	Jun. 20
Jul. 15.	Dallas, Tex., Adv. Jun. 20	Jun. 20
Jul. 15.	San Antonio, Tex.	Jun. 20
Jul. 15.	Irrig. Work, Reno, Nev. Adv. Jun. 13, 20.	Jun. 13
Jul. 15.	Halsted, Minn.	May 30
Jul. —	West Manchester, O.	May 30
Aug. 8.	Washington, D. C.	Jun. 20
———	Pickens, Miss.	Jun. 20
———	Horseheads, N. Y.	Jun. 13
	SEWERAGE AND SEWAGE DISPOSAL.	
Jun. 22.	Corry, Pa.	Jun. 20
Jun. 23.	Rockford, Ill., Adv. Jun. 13	Jun. 13
Jun. 24.	Westfield, Mass., Adv. Jun. 20	Jun. 20
Jun. 24.	Warren, Pa.	Jun. 20
Jun. 24.	Brooklyn, N. Y.	Jun. 20
Jun. 24.	Jersey Shore, Pa., Adv. Jun. 6 to 20	Jun. 6
Jun. 24.	Chicago, Ill.	Jun. 20
Jun. 24.	Norristown, Pa.	Jun. 13
Jun. 25.	Port Arthur, Ont.	Jun. 13
Jun. 26.	New Brighton, N. Y.	Jun. 20
Jun. 26.	Milton, Pa.	Jun. 13
Jun. 26.	Shreveport, La. Adv. May 30 to Jun. 20.	May 30
Jun. 27.	Milton, Mass.	Jun. 20
Jun. 27.	Delaware, O.	Jun. 13
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. 30.	New York, N. Y.	Jun. 20
Jun. —	Little Rock, Ark.	May 30
Jun. —	Ballard, Wash.	May 9
Jul. 1.	Geneva, O.	May 30
Jul. 2.	Geneva, O.	Jun. 20
Jul. 2.	Cleveland, O.	Jun. 20
Jul. 6.	Johnstown, N. Y.	Jun. 20
Jul. 13.	Yazoo City, Miss.	Jun. 20
Jul. 13.	Wabash, Ind.	Jun. 13
Jul. 20.	Atlanta, Ga., Adv. Jun. 13, 20	Jun. 13
———	Greensboro, N. C.	May 30
	BRIDGES.	
Jun. 24.	Bluffton, Ind.	Jun. 20
Jun. 25.	Columbus, O.	Jun. 6
Jun. 26.	Anoka, Minn.	Jun. 20
Jun. 27.	Grand Rapids, Mich., Adv. Jun. 6	Jun. 6
Jun. 30.	Newark, N. J., Adv. Jun. 20	Jun. 20
Jun. 30.	Pikeville, Ky.	Jun. 13
Jul. 1.	Cleveland, O.	Jun. 13
Jul. 1.	Hartford, Conn., Adv. Jun. 13	Jun. 13
Jul. 1.	Ottawa, O.	Jun. 6
Jul. 2.	Duluth, Minn.	Jun. 20
Jul. 2.	New York, N. Y.	Jun. 20
Jul. 3.	Deerfield, Mich.	Jun. 20
Jul. 6.	Natchez, Miss.	Jun. 20
Jul. 7.	Anderson, Ind.	Jun. 20
Jul. 8.	Vale, Ore.	Jun. 20
Jul. 8.	McKeesport, Pa.	Jun. 20
Jul. 10.	Castlewood, S. D.	May 2
Jul. 25.	Washington, D. C., Adv. Jun. 20	Jun. 13
	PAVING AND ROADMAKING.	
Jun. 22.	Terra Haute, Ind.	Jun. 20
Jun. 22.	Elgin, Ill.	Jun. 20
Jun. 23.	Columbus, O.	Jun. 13
Jun. 23.	New York, N. Y.	Jun. 13
Jun. 23.	Hartford City, Ind.	Jun. 13
Jun. 23.	La Crosse, Wis.	May 30
Jun. 24.	Chicago, Ill.	Jun. 20
Jun. 24.	Leavenworth, Kan. (3 Prop.) Adv. Jun. 20.	Jun. 20
Jun. 24.	Hoboken, N. J.	Jun. 13
Jun. 24.	Cincinnati, O.	May 30
Jun. 25.	New York, N. Y.	Jun. 20
Jun. 25.	Evanston, Ill.	Jun. 20
Jun. 25.	Anderson, S. C., Adv. Jun. 13, 20	Jun. 13
Jun. 26.	New Brighton, S. I., N. Y.	Jun. 20
Jun. 26.	Salt Lake City, Utah.	Jun. 20
Jun. 26.	Indianapolis, Ind.	Jun. 6
Jun. 26.	Shreveport, La. Adv. May 30 to Jun. 20.	May 30
Jun. 27.	Pleasantville, N. Y.	Jun. 20
Jun. 29.	Paterson, N. J.	Jun. 20
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. 30.	Three Rivers, Mich., Adv. Jun. 20	Jun. 20
Jun. —	Charlevoix, Mich.	May 30
Jul. 1.	New Brunswick, N. J.	Jun. 20
Jul. 1.	Cleveland, O.	Jun. 6
Jul. 2.	Bowling Green, O.	Jun. 20
Jul. 2.	Oshkosh, Wis.	Jun. 13
Jul. 2.	Roanoke, Va.	Jun. 13
Jul. 3.	Rensselaer, N. Y.	Jun. 20
Jul. 6.	Michigan City, Ind.	Jun. 20
Jul. 6.	Menominee, Mich., Adv. Jun. 20	Jun. 20
Jul. 6.	Columbus, Ind.	Jun. 20
Jul. 6.	Niagara Falls, Ont., Adv. Jun. 13	Jun. 13
Jul. 7.	Portsmouth, O.	Jun. 20
Jul. 7.	Paoli, Ind.	Jun. 20
Jul. 7.	Alexandria, La.	Jun. 20
Jul. 7.	Versailles, Ind.	Jun. 13
Jul. 8.	Cleveland, O.	Jun. 20
Jul. 9.	Bryan, O.	Jun. 20
Jul. 9.	Cleveland, O.	Jun. 20
Jul. 10.	Lorain, O.	Jun. 20
Jul. 10.	Rensselaer, Ind.	Jun. 13
Jul. 13.	Wabash, Ind.	Jun. 13
Jul. 14.	Dayton, O.	Jun. 20
Jul. 15.	Kane, Pa., Adv. Jun. 20	Jun. 20
———	Hamburg, N. Y.	Jun. 13
	POWER, GAS AND ELECTRICITY.	
Jun. 23.	New York, N. Y.	Jun. 13
Jun. 23.	Grantsburg, Wis.	Jun. 13
Jun. 25.	Ford, Mich.	Jun. 20
Jun. 26.	Clayton, Ala.	Jun. 20
Jul. 6.	Salem, Ore.	Jun. 6
Jul. 7.	Mifflinburg, Pa.	Jun. 13
Jul. 10.	Winder, Ga.	Jun. 13
Jul. 13.	Yazoo City, Miss.	Jun. 20
Jul. 14.	Toronto, Ont., Adv. Jun. 13, 20	Jun. 13
Jul. 15.	Mt. Airy, N. C.	Jun. 20
Sep. 1.	Corona, Cal.	May 16
———	Horseheads, N. Y.	Jun. 13
———	Toronto, Ont.	Jun. 6
———	Caledonia, Minn.	May 23
	GOVERNMENT WORK.	
Jun. 22.	Plumb'g, Ft. Tot'n, Wil'ts Pt., L.I., N.Y.	Jun. 20
Jun. 22.	Sea Wall, Ft. Totten Willets Pt., N.Y.	Jun. 20
Jun. 22.	Washington, D. C.	Jun. 13
Jun. 22.	Ft. Ethan Allen, Vt., Adv. Jun. 6, 13.	Jun. 6
Jun. 22.	Stillwater, Minn., Adv. May 23, 30	May 23
Jun. 22.	Baltimore, Md. Adv. May 23 to Jun. 13.	May 23
Jun. 22.	New Haven, Conn. Adv. May 23 to Jun. 13.	May 23
Jun. 23.	Washington, D. C.	Jun. 13
Jun. 23.	Chattanooga, Tenn., Adv. Jun. 13, 20	Jun. 13
Jun. 23.	Ft. D. A. Russell, Wyo.	May 23
Jun. 24.	Ft. Missoula, Mont.	Jun. 20
Jun. 24.	Annapolis, Md.	Jun. 20
Jun. 24.	Petoskey, Mich. Adv. May 30 to Jun. 20.	May 30
Jun. 24.	Tompkinsville, N. Y. Adv. May 23 to Jun. 13.	May 23
Jun. 25.	Ft. Ethan Allen, Vt. Adv. May 30 to Jun. 20.	May 30
Jun. 25.	Leadville, Colo.	May 23
Jun. 26.	Philadelphia, Pa.	Jun. 6
Jun. 26.	Mobile, Ala.	May 30
Jun. 27.	Philadelphia, Pa.	Jun. 20
Jun. 27.	Ft. Greble, R. I., Adv. Jun. 13, 20	Jun. 13
Jun. 27.	Chicago, Ill., Adv. Jun. 6 to 20	Jun. 6
Jun. 27.	New Orleans, La.	May 30
Jun. 29.	West Point, N. Y.	Jun. 20
Jun. 30.	Philadelphia, Pa. Adv. May 16, 23, Jun. 13, 20.	May 16
Jun. 30.	New Orleans, La. Adv. May 9, 16, Jun. 20.	May 9
Jul. 1.	Memphis, Tenn., Adv. Jun. 6, 13	Jun. 6
Jul. 1.	New Orleans, La.	Jun. 6
Jul. 6.	Norwich, Conn.	Jun. 13
Jul. 6.	Benicia, Cal.	Jun. 13
Jul. 6.	Watervliet, N. Y.	Jun. 13
Jul. 7.	Washington, D. C., Adv. Jun. 20	Jun. 20
Jul. 7.	Johnson City, Tenn., Adv. Jun. 13, 20	Jun. 13
Jul. 7.	Vancouver Barracks, Wash.	Jun. 20
Jul. 8.	Jefferson Barracks, Mo.	Jun. 20
Jul. 8.	Waco, Tex.,	Jun. 13
Jul. 9.	Ft. McPherson, Ga., Adv. Jun. 13, 20	Jun. 13
Jul. 9.	Ft. D. A. Russell, Wyo.	Jun. 13
Jul. 10.	New York, N. Y., Adv. Jun. 13, 20	Jun. 13
Jul. 11.	Ft. Mitchie, N. Y.	Jun. 20
Jul. 11.	Ft. Stevens, Ore.	Jun. 20
Jul. 13.	Wilmington, Del., Adv. Jun. 20	Jun. 20
Jul. 14.	Winston, N. C., Adv. Jun. 13, 20	Jun. 13
Jul. 15.	Ft. Des Moines, Ia., Adv. Jun. 20	Jun. 20
Jul. 15	Ft. Bradford, R. I.	Jun. 13
Jul. 16.	Norfolk, Va., Adv. Jun. 20	Jun. 20
Jul. 16.	Waterbury, Conn.	Jun. 20
Jul. 17.	Ashtabula, O., Adv. Jun. 20	Jun. 20
Jul. 17.	Ft. Douglas, Utah.	Jun. 13
Jul. 18.	Detroit, Mich., Adv. Jun. 20	Jun. 20
Jul. 18.	Philadelphia, Pa., Adv. Jun. 20	Jun. 20
Jul. 20.	National Military Home, Kan.	Jun. 13
Jul. 23.	Rossfork, Idaho	Jun. 20
Jul. 25.	Washington, D. C., Adv. Jun. 20	Jun. 13
Jul. 25.	Norfolk, Va.	Jun. 13
Sep. 14.	Providence, R. I.	May 30
	BUILDINGS.	
Jun. 22.	School, Yonkers, N. Y.	Jun. 20
Jun. 22.	School, Brockton, Mass.	Jun. 13
Jun. 22.	School, New York, N. Y.	Jun. 13
Jun. 22.	School, Brooklyn, N. Y.	Jun. 13
Jun. 22.	School, New Brighton, S. I., N. Y.	Jun. 13
Jun. 22.	School, Cleveland, O.	Jun. 6
Jun. 22.	Hospital, New York, N. Y.	Jun. 6
Jun. 23.	College, New York, N. Y.	Jun. 20
Jun. 23.	School, Morganza, Pa.	Jun. 20
Jun. 23.	Court house, Yankton, S. D.	Jun. 13
Jun. 24.	Pub. Bldg., Boston, Mass.	Jun. 20
Jun. 24.	Infirmary, Dayton, O.	Jun. 6
Jun. 25.	Pavilion, New York, N. Y.	Jun. 20
Jun. 25.	School, Centerville, S. D.	Jun. 20
Jun. 25.	Church, Des Moines, Ia.	Jun. 20
Jun. 25.	Hosp. Boiler Plant, Indianapolis, Ind. Adv. Jun. 6 to 20.	Jun. 6
Jun. 25.	Church, Granville, N. Y.	Jun. 6
Jun. 27.	School, Thackery, O.	Jun. 13
Jun. 27.	Pub. Bldgs., Roseburg, Ore.	Jun. 20
Jun. 29.	School, Pittsburg, Pa.	Jun. 20
Jun. 29.	School, Triadelphia, W. Va.	Jun. 20
Jun. 29.	School, New Brighton, N. Y.	Jun. 20
Jun. 29.	School, Long Island City, N. Y.	Jun. 20
Jun. 29.	School, New York, N. Y.	Jun. 20
Jun. 29.	School, Brooklyn, N. Y.	Jun. 20
Jun. 29.	Bank, Atlanta, Ga.	Jun. 20
Jun. 29.	School, Glenville, O.	Jun. 6
Jun. 30.	Library, Wilmington, O.	Jun. 20
Jun. 30.	School, Mansfield, O.	Jun. 13
Jun. 30.	School, Plainview, Minn.	Jun. 6
Jun. —	Hotel, La Crosse, Wis.	May 23
Jul. 1.	Hospital, Utica, N. Y.	Jun. 20
Jul. 1.	Jail, Waco, Tex.	Jun. 20
Jul. 1.	Church, Emmetsburgh, Md.	Jun. 20
Jul. 1.	School, Center Point, Ia.	Jun. 20
Jul. 1.	Library, Cleveland, O.	Jun. 20
Jul. 1.	Library, Perry, Ia.	Jun. 20
Jul. 1.	Court house, Brooklyn, N. Y.	Jun. 20
Jul. 1.	Hospital, New York, N. Y.	Jun. 20
Jul. 1.	Hospital, Rochester, N. Y. Adv. June 13, 20.	Jun. 13
Jul. 1.	Hospital, Raybrook, N. Y.	Jun. 20
Jul. 1.	Police Station, Newark, N. J.	Jun. 13
Jul. 1.	Bus. Bldg., Toledo, O.	Jun. 13
Jul. 1.	Library, Binghamton, N. Y. Adv. Jun. 6 to 20.	Jun. 6
Jul. 1.	Court house, Boonville, Ind.	May 30
Jul. 1.	Court house, Carnesville, Ga.	May 30
Jul. 2.	Hospital, Yountville, Cal.	Jun. 20
Jul. 2.	School, Springfield, O.	Jun. 13
Jul. 5.	Flat, Crawfordsville, Ind.	Jun. 20
Jul. 5.	Store, Lebanon, Ind.	Jun. 20
Jul. 6.	School, Springfield, Mass.	Jun. 20
Jul. 6.	School, Youngstown, O.	Jun. 20
Jul. 6.	Engine House, Houston, Tex.	Jun. 20
Jul. 6.	Administrat'n Bldg., Farmington, Mo.	Jun. 20
Jul. 7.	Asylum, Little Rock, Ark.	Jun. 20
Jul. 7.	Bank, Moundsville, W. Va.	Jun. 20
Jul. 8.	Pavilion, New York, N. Y.	Jun. 20
Jul. 8.	County House, Marshall, Mich.	Jun. 20
Jul. 8.	Pub. Bldg., Kingfisher, Okla. Ter.	Jun. 20
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jul. 11.	School, Wilmington, O.	Jun. 20
Jul. 13.	Court House, La Grange, Ga.	May 9
Jul. 14.	Pub. Bldgs., Indianapolis, Ind.	Jun. 20
Jul. 15.	College, Ft. Collins, Colo.	Jun. 20
Jul. 15.	Court house, Booneville, Ind.	Jun. 13
Jul. 15.	School plans, Washington, D. C.	Jun. 13
Jul. —	Jail, Jackson, Miss.	Jun. 6
Sep. 10.	Industrial Home, Delaware, O.	Jun. 20
	MISCELLANEOUS.	
Jun. 23.	Piles, New York, N. Y.	Jun. 13
Jun. 24.	Pier, etc., New York, N. Y.	Jun. 20
Jun. 24.	Garb. Disp., Pittsburg, Pa.	Jun. 20
Jun. 26.	Garb. Disp., New Brighton, N. Y.	Jun. 20
Jun. 26.	St. Sprinkling, Dayton, N. Y.	Jun. 20
Jun. 29.	Ditch, Jefferson, Ia.	Jun.
Jun. 30.	Ditches, Minnesota, Minn.	Jun. 20
Jun. 30.	Cement, Regina, N. W. T.	Jun. 20
Jul. 6.	Breakwater, Ellensburg, Wash.	Jun. 20
Jul. 6.	Ditch, Charleston, Mo.	Jun. 20
Jul. 7.	El. Ry., San Jose, Cal.	Jun. 13
Jul. 7.	Tunnel, Boston, Mass., Adv. Jun. 20	Jun. 20
Jul. 8.	River Work, Lorain, O.	Jun. 20
Jul. 6.	St. Sweeper, Great Falls, Mont.	Jun. 20
Jul. 14.	Steel shed, New Orleans, La. Adv. Jun. 20.	Jun. 20
Jul. 14.	St. Ry. franchise, Monterey, Cal.	Jun. 20
Jul. 21.	El. Ry., Covina, Cal.	Jun. 20
Jul. —	Levee, West Memphis, Ark.	Jun. 6
Jul. —	Removal of earth, Camden, N. J.	May 30
Dec. 15.	R. R. work, Santiago De Chili, Chili	Jun. 13
———	El. Ry. work, Columbia, Mo.	May 30
———	Ry. Work, Ravenna, O.	Jun. 20
May 2,	'04. R. R., Oodnadatta, So. Australia	Feb. 21



Discharge Diagram **H**, for Tuberculated Cast-Iron Pipe, by the Hazen-Williams Formula.
C = 100.

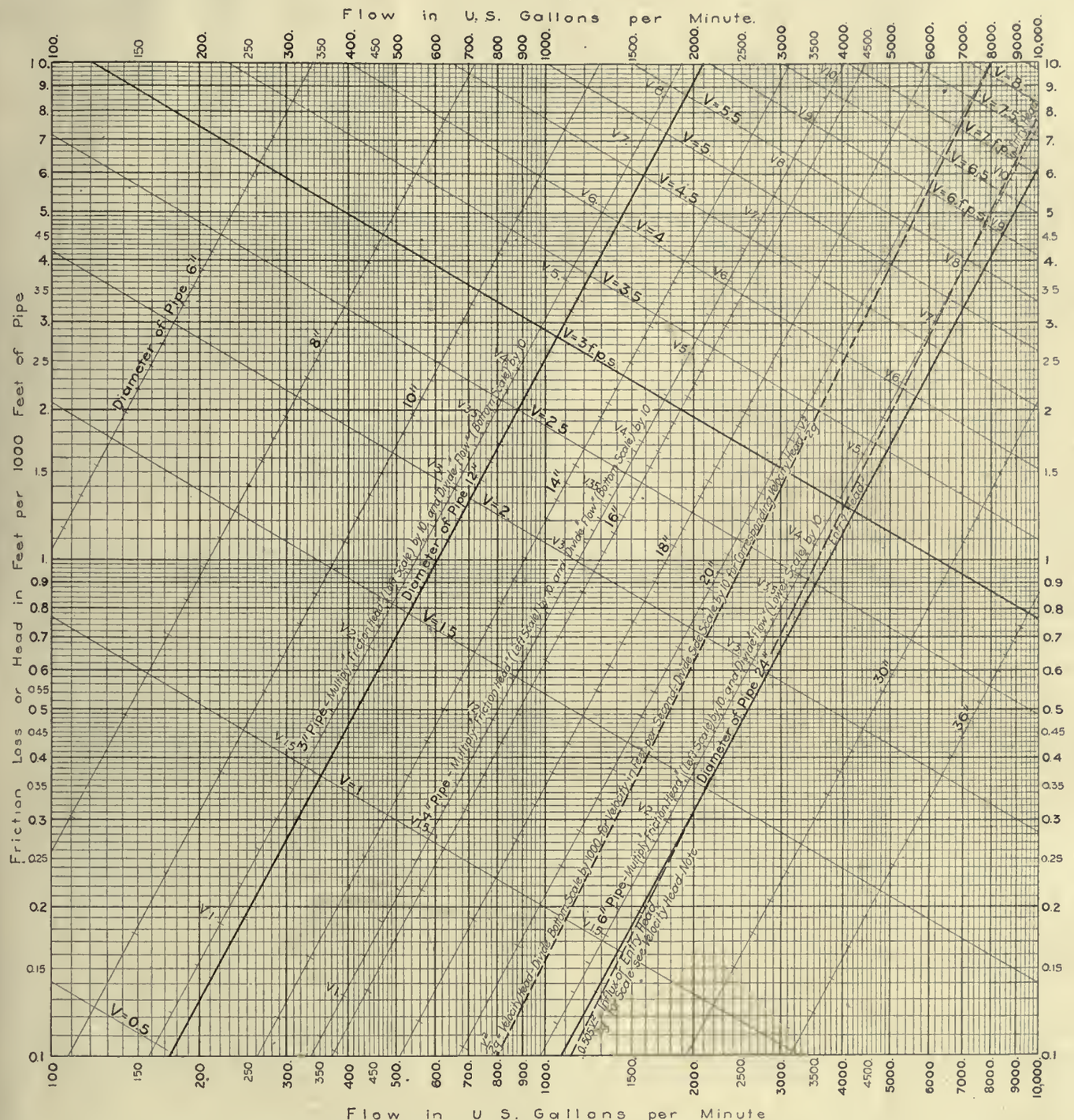
THE ENGINEERING RECORD.

TABLE B.—FLOW OF WATER IN PIPES—HY

	No. 3	Logar.	No. 4	Logar.	No. 6	Logar.	No. 8	Logar.	No. 10	Logar.	No. 12	Logar.	No. 14	Logar.	No. 16	Logar.
Diameter of pipe, inches....																
Area of pipe, square feet..	0.0491	8.6910	0.0873	8.9408	0.1964	9.2930	0.3491	9.5429	0.5454	9.7367	0.7854	9.8951	1.0690	0.0290	1.3963	0.1450
Content, U. S. gals. per ft..	0.3672	9.5649	0.6528	9.8148	1.4688	0.1670	2.6112	0.4168	4.0800	0.6107	5.8752	0.7690	7.9968	0.9029	10.4485	1.0189
Discharge U. S. gals. per min., vel. 1 ft. per sec...	22.03	1.3431	39.17	1.5929	88.13	1.9451	156.67	2.1950	244.80	2.3888	352.51	2.5472	479.81	2.6811	626.68	2.7970
Discharge U. S. gals. per 24 hrs., vel. 1 ft. per sec....	31,726	4.5014	56,402	4.7513	126,904	5.1035	225,607	5.3534	352,510	5.5472	507,615	5.7055	690,920	5.8394	902,427	5.9554
Friction head per 1,000 ft:																
Vel. 1 ft. per sec.....	1.85	0.2679	1.33	0.1221	0.83	9.9167	0.59	9.7709	0.46	9.6578	0.37	9.5655	0.31	9.4874	0.26	9.4197
Vel. 2 ft. per sec.....	6.69	0.8253	4.78	0.6796	2.98	0.4741	2.13	0.3284	1.64	0.2153	1.33	0.1229	1.11	9.0448	0.95	9.9772
Vel. 3 ft. per sec.....	14.17	1.1514	10.13	1.0057	6.31	0.8002	4.51	0.6545	3.48	0.5414	2.81	0.4490	2.35	0.3709	2.01	0.3033
Vel. 4 ft. per sec.....	24.14	1.3828	17.26	1.2370	10.75	1.0316	7.69	0.8858	5.93	0.7728	4.79	0.6804	4.00	0.6023	3.43	0.5346
Vel. 5 ft. per sec.....	36.50	1.5623	26.09	1.4165	16.26	1.2111	11.62	1.0653	8.96	0.9522	7.24	0.8599	6.05	0.7818	5.18	0.7141
Vel. 6 ft. per sec.....	51.16	1.7089	36.57	1.5631	22.79	1.3577	16.29	1.2119	12.56	1.0989	10.15	1.0065	8.48	0.9284	7.26	0.8607
Discharge U. S. gals. per min., vel. 3 ft. per sec...	66.00	....	117.+	....	264.	....	470.	....	734.	....	1,057.+	....	1,439	....	1,880	....
Discharge U. S. gals. per 24 hrs., vel. 3 ft. per sec....	95,180	....	169,200	....	380,700	....	676,800	....	1,057,500	....	1,522,800	....	2,072,800	....	2,707,300	....

NOTE.—Friction loss computed

DIAGRAMS AND HYDRAULIC DATA RELATING TO THE FLOW OF WATER IN



Diagrom **D**, Discharges of Cast-Iron Pipes with Corresponding Velocities, Velocity Heads and Entry Heads.
For generol use with Clean Pipe, — **C = 130.**

THE ENGINEERING RECORD.

DATA FREQUENTLY USED IN COMPUTATIONS.

ogar.	No.	Logar.	No.	Logar	No.	Logar.	No.	Logar.	No.	Logar.	No.	Logar.	No.	Logar.	No.	Logar.
	20		24		30		36		42		48		54		60	
.2473	2.1817	0.3388	3.1416	0.4971	4.9087	0.6910	7.0686	0.8493	9.6211	0.9832	12.566	1.0992	15.904	1.2015	19.635	1.2930
.1212	16.320	1.2127	23.501	1.3711	36.720	1.5649	52.877	1.7233	71.971	1.8572	94.003	1.9731	118.97	2.0754	146.88	2.1670
.8994	979.20	2.9909	1,410.0	3.1492	2,203.2	3.3431	3,172.6	3.5014	4,318.3	3.6353	5,640.2	3.7513	7,138.3	3.8536	8,812.8	3.9451
.0577	1,410,041	6.1492	2,030,460	6.3076	3,172,594	6.5014	4,568,535	6.6598	6,218,283	6.7937	8,121,837	6.9097	10,279,204	7.0120	12,690,372	7.1035
.3600	0.20	9.3066	0.16	9.2143	0.13	9.1012	0.10	9.0088	0.09	8.9307	0.07	8.8631	0.06	8.8034	0.06	8.7500
.9175	0.73	9.8641	0.59	9.7717	0.46	9.6587	0.37	9.5663	0.31	9.4882	0.26	9.4205	0.23	9.3609	0.20	9.3075
.2436	1.55	0.1902	1.25	0.0978	0.97	9.9848	0.78	9.8924	0.65	9.8143	0.56	9.7466	0.49	9.6869	0.43	9.6336
.4750	2.64	0.4216	2.13	0.3292	1.65	0.2161	1.33	0.1238	1.11	0.0457	0.95	9.9780	0.83	9.9183	0.73	9.8649
.6544	3.99	0.6010	3.23	0.5087	2.49	0.3956	2.01	0.3032	1.68	0.2251	1.44	0.1575	1.25	0.0978	1.11	0.0444
.8011	5.59	0.7477	4.52	0.6553	3.49	0.5422	2.82	0.4499	2.36	0.3717	2.01	0.3041	1.76	0.2444	1.55	0.1910
....	2,938.—	....	4,230	....	6,609	....	9,518	....	12,955	....	16,920	....	21,415	....	26,438	....
....	4,230,100	....	6,091,400	....	9,517,800	....	13,705,600	....	18,654,800	....	24,365,500	....	30,837,600	....	38,071,100	....

Williams formula with c = 130.

RON PIPES.—BY LEONARD METCALF, ASSOC. M. AM. SOC. C. E., BOSTON, MASS.

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Bonding Engineers.

An esteemed correspondent who has been asked to give bonds for the faithful performance of his duties as engineer of a small municipal undertaking requests the opinion of The Engineering Record on such a procedure. This journal must decline to express its complete unabridged views of the professional bonding proposition except behind closed doors, certainly not in print. The general proposition is an old one, however, and there seems to be no reason for changing those views stated many times in the last quarter century.

The engineer is not a fiscal agent. Sums of money, large and small, are not placed in his hands for disbursement. He is simply employed to perform the technical service of an engineer, just as a lawyer or other professional man is ordinarily retained to render the special assistance for which his education and experience have fitted him. If there is any reason for requiring a bond from a lawyer or physician, centuries have failed to reveal it.

Public experience has repeatedly shown and is constantly demonstrating the fact that the responsibility of a financial obligation will not deter many unscrupulous and incompetent persons from seeking positions they are unfitted to fill. It is no purpose of a bond to relieve the appointing power from an earnest effort, exhausting the means at its command, to secure competent and trustworthy appointees. One of the specific duties of a committee placed in general charge of public work is to decide on a responsible and reliable engineer, and it cannot shirk such a duty by calling for a bond.

Moreover, it is not possible to see how any self-respecting professional man can be induced to accept an appointment coupled with such a condition. It is not difficult for an intelligent committee to find a number of engineers competent to perform any professional service. All of them will be human, however, and if some unforeseen contingency, against which no reasonable precaution will suffice, arises to increase the cost or time of completion of the work, the municipality should accept the inevitable. The law says that no city can be held responsible for damages caused by the defective operation of its structures under conditions which it is unreasonable to expect, and the city should take the same view of its relations with a consulting engineer.

Finally, there is a very personal aspect of the question which arises when a decision is needed as to the proper rendering of professional services. Who shall be the judge? Is it the body which, in its ignorance, cannot determine whether its appointee is or is not competent? If so, by what hocus-pocus is it to render a really proper judgment? Any member of the committee competent to pass an opinion on the work is manifestly competent to judge an engineer from the record of his previous services. If the case is to go to a referee, there is no reason whatever for not letting the referee make the appointment in the first case. The bonding principle is obnoxious and pernicious in every respect.

Flue Temperatures and Boiler Economy.

The contribution by Mr. Kenneth Torrance on pumping station management in The Engineering Record of last week called particular and deserved attention to the fire room as the place where most of the money of a steam plant is spent. Engine efficiency is of course highly desirable, but good men who will work the fires intelligently are just as desirable. Possibly one of the reasons that good firemen are so rare is the fact that so few conveniences are provided for their assistance. They have little incentive for well doing. Their understanding of the character of their services must be obtained largely from the steam gauge and the complaints of the men who pay the coal bills. They are forced to rely on the trained judgment that comes from experience, while their pay does not warrant much mental effort to obtain this training.

There are a number of comparatively inexpensive accessories, which would enable the head fireman to do better work more economically than is usually the case. One of them, to which this journal has previously called attention, refers to the regulation of flue temperatures. There are many boilers which waste into the chimney a large amount of heat, owing to the deficiency or inefficiency of the heating surface. The claim is made for some of these boilers that the high flue temperatures do not indicate a waste caused by a low efficiency. If a high flue temperature is preceded by a high furnace temperature, the loss measured by their ratio may be no greater, it is asserted, than is the case when the flue and furnace temperatures are both low. The force of these claims depends on the actual simultaneous occurrence of high furnace and flue temperatures, and careful observation fails to reveal any such conditions. Boiler trials made under skilful direction show that where there is a high degree of heat in the flue the rate of evaporation is below the standard of good practice whatever may be claimed regarding the design of the furnace, the perfection of combustion or the efficiency of the heating surface. A few trials may have had results contrary to this, but the experience of consulting experts is as stated.

The standard practice for evaporation with the superior grades of Cumberland, Pocahontas or similar bituminous coals of the best quality, is 12 pounds of water per pound of combustible from and at 212 degrees. This may be obtained with a flue temperature ranging between 450 and 500 degrees. If that temperature rises much over 500 degrees, experience indicates that economy of operation is decreasing. It is a fact, however, that the flue temperature of a boiler plant in regular service rarely receives any attention, and few firemen have any appreciation of the importance of observing it regularly.

It would add much to the information of the firemen, to say nothing of the saving in coal, if a flue thermometer or other instrument for determining the temperature, could be regularly used as a part of the equipment. The records of this instrument would go to the office with the daily reports of coal consumption and engine operation. The particular service of these daily records would be their indication of the condition of the heating surfaces. As these surfaces become covered with soot on the outside and scale on the inside, their efficiency in transmitting the heat of the coal becomes diminished and the thermometer in the flue at once reveals an increase of temperature. By watching these records, the man in charge of the plant knows positively when the boilers must be cleaned, and this work is not determined by judgment or opinion or mere guess.

The cost of such a thermometer is inconsiderable compared with the saving in coal that its intelligent use will effect. An increase of 100 degrees in the temperature of the flue represents a loss of at least 5 per cent. of the heat furnished by the coal. This is equivalent to no inconsiderable sum in a steam plant of any but the smallest size. There is also the saving, uncertain in amount but nevertheless important, which will follow the proper cleaning of the boilers.

An Engineering View of Industrial Combinations.

A few days ago a rather unusual address was made before the graduating class of Stevens Institute by Mr. Charles F. Scott, chief electrician of the Westinghouse Electric & Manufacturing Company. It was an address that gave an inspiring picture of the humanitarian possibilities of engineering, when its principles have been better recognized and its capabilities better understood. To the older men who heard it, its value lay mainly in the view taken of the future of industrial combinations, a view that may be considered visionary by many, yet one which would work great benefits were it to find realization. And while it may seem Utopian at first thought, the longer it is considered the more probable will it appear that along some such line the fate of industrial combinations will eventually be fixed.

The great result of engineering, according to Mr. Scott, is increased efficiency. It provides the instruments and the means and the methods by which the results of human activity are enormously increased. The construction of a new bridge, a more economical engine, or a more convenient office building is a very essential feature of the development of the intricate machinery of modern life. Engineering viewed in this way, above the details of its lit-

tle subdivisions, offers the inspiration of great possibilities tending toward the advantage of all people. Hence it will be attractive to young men of broad views, youths of promise and purpose.

The future of the engineer in industrial combinations depends on this characteristic of his work in increasing efficiency. These combinations require the best work of picked men, and Mr. Scott quotes on this subject a part of an address at the University of Minnesota by James B. Dill, Esq., who has been called the "father of trusts" on account of his professional connection with so many of them. Mr. Dill said: "I believe that the tendency to organization, to combination, has put a demand on the college-trained minds, has put a premium upon the service of such men, and has made it easier than formerly for the college graduate to get started and to succeed in the world. . . . When the trust movement shall have steadied itself and when it shall have eradicated those tendencies which are, apparently, in the wrong direction, when it shall have increased and strengthened those elements which are right, then the men in charge of the great combinations and in executive positions will be the men who not only have a knowledge of the business but whose minds have been broadly trained and whose characters have been formed within university halls."

In another aspect, the tendency of these combinations is not considered so clear by Mr. Scott. It is gradually becoming the prevailing view that these mergers are sound from a commercial standpoint but are not sound from the social point of view. While they may lead to economies in production, they do not tend toward general individual advancement and personal freedom. It is felt that the tendency is to elevate a few leaders, to group men into masses and treat them in the aggregate and not as individuals. That these apprehensions are really unfounded and need not be feared save during the transitory period of combinations, Mr. Scott believes is a consequence of, first, the need of well-trained men of education in the great corporations; second, the efficiency which the engineer attains as part of his training; third, the engineer's necessary reliance upon absolute truth for success in conducting his duties. The fate of the trust depends in no small measure, it was intimated, on this third fact. It is a fact often mentioned before by enquirers into the causes of success in the engineer. The engineer must know and respect physical laws, for failure is the certain consequence of false data or bad methods, and physical truths are the same as social truths.

The successful civil engineer must therefore be a man trained to recognize truth and skilled in applying its lessons judiciously. His aim is construction, just as that of the old-time military engineer was destruction. It is said that business is warfare, but who, Mr. Scott asked, can picture the transformation which will result from supplanting the principle of war in the management of these great industrial combinations with the principle of the civil engineer, the increase of efficiency.

The substance of this address is that in the evolution of trust management the same principle of the survival of the fittest that obtains in all natural changes must be the governing influence. Mr. Dill testifies from his wide experience that the executive men must be broadly educated, which is true of most prominent engineers. The whole aim of trusts is an increase in efficiency without an increase in cost, which is Mr. Scott's very striking definition of the aim of engineering. These two facts point to the engineer as the best executive officer for great industrial corporations. Assuming that these inferences find realization, is it not reasonable to expect that the engineer's training will make his administration more wholesome, less marked by greed, than that of the man whose training has been wholly along the line of greatest profits and least expenses? Will not such an administration be more likely to reduce the public suspicion of great aggregations of capital? These are the leading questions which Mr. Scott's address presents, and a careful observer of recent developments in the latest industrial and railway consolidations will probably answer in the affirmative. The lesson taught by the Pennsylvania Railroad Company for many years is gradually being recognized, and little by little the engineer is being advanced to those high executive positions for which his training eminently fits him.

The Spier Falls Power Development.

As hydro-electric power developments go in these latter days a 20,000 or 40,000-horse-power plant is not startling large, but still is large enough to arrest attention, especially when there is involved the construction of a masonry dam with a maximum section 154 feet high. When, moreover, the dam is built across a river which has flood flows of 40,000 to 50,000 cubic feet per second, the temporary works required also attain an interesting magnitude. The leading article in this issue, for the reasons just intimated and because it is a good description of the installation at Spier Falls on the Hudson River and of the construction methods employed under the direct supervision of the engineers, is particularly instructive to engineers connected with the design and construction of similar works. The full description of the unusually complete "contractor's" plant is one of the important features of the article. The extensive use of cableways and stiff-leg derricks, and the convenient arrangement of the concrete plant are noteworthy.

Notes and Comments.

The Society for Testing Materials which meets at the Delaware Water Gap on July 1 to 3 has arranged a diversified programme of interest to structural engineers, foundrymen, steel makers, and users of cement and asphalt. While the organization is a small one, its objects are very important, and its meetings will prove profitable to all who attend.

Concrete-Steel Sewer Construction is fast growing in favor, the latest report advocating it being one by Mr. Samuel M. Gray to the authorities of Lancaster, Pa. The report advises the use of concrete reinforced with expanded metal as being cheaper than brick, although for the construction to be successful it must be executed by experienced men. Should brick sewers be adopted, they must be made two inches larger, Mr. Gray states, because the friction losses in a brick conduit are larger than those in one of concrete.

The Engineering Editors of daily papers in several cities have contributed some interesting lucubrations to technical literature on the wonderful value of ozone for purifying municipal water supplies. Many experiments with ozone, some on a fairly large scale, have demonstrated that the gas can be employed successfully as a sterilizing agent. The process has hitherto been so expensive as to be impracticable commercially, however, although the cost is being gradually reduced. Sterilization is merely one feature of purification, and the use of ozone at Cincinnati, St. Louis or New Orleans would be about as successful as treatment with castoria or some other efficient household reagent. The purification needed in these places is the removal of turbidity, which only sedimentation and filtration will accomplish.

The Reported Explosion in the East Boston tunnel on June 19, in which one man was killed, five somewhat injured and possibly another killed, was a blow-out at the south heading of Section B, where work was progressing under air pressure. The air first escaped for about 10 seconds, then stopped for about a second, and finally blew out again for a period variously stated as 5 to 15 minutes, until atmospheric pressure prevailed. The air escaped through the earth at an opening for the tunnel at the Atlantic Chambers, a rectangular structure about 40x60 feet in plan and 50 to 60 feet deep. The earth had a timber bracing, which was more or less knocked down, allowing the earth outside the Chambers to slump into it through the opening, resulting in a 10-foot settlement of the street above. The one man known to be killed was found in the hole where the air escaped above the drift. It is supposed that he and the man who is missing were both blown into the crevice through which the air was escaping. The south drift where the blow-out occurred was 11½ feet from the wall of the Chambers. There has been no serious injury to the tunnel and, aside from the loss of life, the accident is not of any apparent importance.

Knowledge and Wisdom are very different, as Mr. P. M. Lincoln pointed out at the recent convention of the Canadian Electrical Association. For example, the young graduate of a technical school has sufficient knowledge to compute the distance between the conductors of a high tension transmission line. But it is only the wisdom based on experience which will convince him that the final determination of the space should depend on the average length and ohmic resistance of cats, the spread of wing of owls and the average length of scrap baling wire combined with the muzzle velocity of a small boy's throwing arm. Similarly the young man may have a highly commendable appreciation of efficiency in a transmission line, but wisdom based on experience will soon teach him that efficiency is a vanishing quantity when compared to continuity of operation, and that economy is not in the same class with good service. Mr. Lincoln did not intend any adverse reflection on technical education in these remarks, for he takes pains to say that nothing else will so well supply the power of initiative which the engineer for high-tension work must possess to be successful.

A Compressed-Air Central Station will be installed at North Amherst, O., operated by the Cleveland Stone Company. The building will be 80x130 feet, practically all the mechanical plant being furnished in running order by the Ingersoll-Sergeant Drill Company. There will be three 258-horse-power Stirling boilers with Roney stokers and mechanical draft, a water purifying plant, and two Corliss condensing compressors having a combined capacity of 9,215 cubic feet of free air per minute. The station will supply compressed air to 9 hoisting engines, 22 derricks, 15 channelers, 15 drills, pumps, steam hammer, shop engine, grindstone and forges. It is expected that the new plant and proposed change in the quarrying system will increase the output 25 to 50 per cent. with the same labor force, and cut down coal consumption materially.

Still Another Case of hazardous work for the public welfare deserves to be mentioned in con-

nection with these floods. When the Kansas City bridges were swept away it was necessary to put up immediately some kind of a support to carry the water mains across the river. The city's water supply was cut off and its renewal at the earliest possible moment was imperative. Messrs. Waddell & Hedrick undertook this dangerous task with a gang of inexperienced men, and such supplies as could be readily procured. They built a suspension bridge for the purpose, risking their lives with their men in order to urge on the work. The anchorage on one side had to be constructed under several feet of water, and the work involved the strengthening of part of an old bridge which threatened every minute to fall into the rushing waters attacking it. The handling of the supplies was fraught with peril at first, but the work was finally finished in less than a week without accident, resulting in a remarkably stiff structure. Mr. Bernard Corrigan, the well-known Kansas City contractor, very clearly stated the case when he said that "the engineers are entitled to the most hearty thanks of the people. They would not have done that kind of work for a private corporation, but they did it for the city because of the city's calamity."

Street Pavement Inspection of an astonishing kind has been revealed in an investigation in Detroit. One inspector testified that when he was appointed he could not tell whether concrete was properly mixed or not, and he did not know even when examined whether cement, sand or stone was put on the mixing board first. Worst of all, he had never seen the specifications governing the work. In laying wooden blocks, he testified that he tried to keep the tar cool enough to prevent its running down between the blocks and being wasted. Another inspector testified that the sand used for concrete on one of his streets was taken from below the old wood block pavement which had been torn up. It is only right to add that the witness did not believe this sand should be used, for it had a tendency to kill the concrete, but he passed it under orders from his chief. The city's choice between two such inspectors is merely Hobson's choice, for its interests suffer equally under either. It makes no difference whether a man is ignorant or whether he is lazy or lacking in backbone, if the work suffers. The only way to get good work is to have good specifications and to insist on their fulfilment. This cannot be done until the people elect men to office who are certain to discharge their trusts properly. Such inspection as Detroit has had reflects directly on the voters of the city, for putting men in office who would permit it.

Advice from Manufacturers is the subject of some recent statements by Dr. A. B. W. Kennedy that are worth quoting for their interest, apart from their value as the opinion of an eminent engineer. "I have not infrequently found that a manufacturer," he said, "who knew perfectly well that he could design a better machine than I could design, deduced from that the conclusion that he knew better what kind of a machine I wanted than I did myself. But this does not follow for many reasons. We have to use the machinery, and we know how it works in a way which very seldom comes within the manufacturer's cognizance. The experience and knowledge of the engineer and manufacturer are quite different, and they must not be confounded. More than once manufacturers of the highest rank have proved to me absolutely that the things I wanted could not be done, at least with any satisfaction, and that it was of no use asking for such things; while I have known all the time, not only that the things could be done, but that they had already been done with complete success. On the other hand it will never do to underrate a manufacturer's knowledge of the details of what he does himself. There are probably ten different ways of making every detail, and it is really difficult to prove that any one is very definitely better than the others. If you want to live a happy life as consulting engineers, you must take advantage of all the knowledge and experience of the contractors who are carrying out your work, and be ready to add to this all the experience that you can get on the other side yourselves."

The Compensation of Engineers is a very tender subject, which has to be treated with "assurances of distinguished consideration" when discussed among ourselves. But in a general way, it seems desirable to make plain a few facts for the benefit of parents contemplating a technical education for their sons. One such was recently dumbfounded to learn that a course in such a school would not ensure an annual income of several thousand dollars to his young hopeful soon after graduation. The reality is evident from the calls for men received by a firm making a specialty of supplying engineering assistants. There were recently over forty calls for mechanical draftsmen, the pay offered ranging from $10 a week for tracers to $150 a month for men able to design, the average compensation being from $75 to $100. Instrument men on railway work were offered $75 to $100 per month; bridge and structural draftsmen, $65 to $125; architectural draftsmen, $50 to $100. Several engineers for small bridge shops were wanted at salaries around $2,000 a year. The pay offered for instructors in engineering subjects by several schools was from $600 to $1,200 a year. There was an offer of $2,500 for a contracting engineer, "a good mixer and business getter, able to meet municipal bodies in behalf of company." From $4,000 to $6,000 was offered for a man to take charge of a technical school in the West. These market quotations should suffice to show the error of his ways to any parent who believes that a technical school graduate can step from the portals of his alma mater into a position with a considerable salary. As a matter of fact, engineering, like the other professions, does not offer such large pecuniary prizes as commercial pursuits.

Union Engineering Building.

A formal organization of the joint committee representing the various bodies which have taken action with respect to the gift of one million dollars of Mr. Andrew Carnegie for a union building, was effected on the evening of June 18. The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Engineers' Club have taken final action and appointed their representatives upon a joint committee for accepting the gift. The American Institute of Mining Engineers has likewise taken action so far as its rules permit. The council has appointed representatives subject to changes in the rules of the organization which have been proposed by the council for adoption at the next general meeting. At the present time a letter ballot for ascertaining the attitude of the members is being taken, which is stated to show an overwhelming majority in favor of the plans proposed by the council.

The American Society of Civil Engineers at its recent meeting in Asheville referred the matter to its board of directors for consideration and directed that the matter be then presented to the members of the Society for letter ballot, if satisfactory to the board.

At the meeting on June 18, the following were announced as representatives of the several bodies upon the joint committee:

American Institute of Mechanical Engineers, James M. Dodge, F. R. Hutton, Charles Wallace Hunt.

American Institute of Electrical Engineers, Charles F. Scott, B. J. Arnold, S. S. Wheeler.

American Institute of Mining Engineers, A. R. Ledoux, Charles Kirchoff, Timothy Dwight.

Engineers' Club, John C. Kafer, W. H. Fletcher, W. A. Redding.

Representatives of the American Society of Civil Engineers are requested to meet with the joint committee and take part in deliberations with regard to the plans to be adopted. The representatives who have served upon the conference committee are Alfred Noble, W. J. Wilgus, George H. Pegram.

The joint committee was organized by the election of the following officers: Chairman, Charles F. Scott; secretary, Professor F. R. Hutton. The chairman was directed to indicate to Mr. Carnegie the acceptance of his gift by the joint committee representing the several organizations. The joint committee placed the immediate work of developing plans upon an executive committee of five, consisting of one member from each of the five organizations named in Mr. Carnegie's letter as follows: American Society of Civil Engineers, Mr. Alfred Noble; American Society of Mechanical Engineers, Prof. F. R. Hutton; American Institute of Mining Engineers, Mr. A. R. Ledoux; American Institute of Electrical Engineers, Mr. Charles F. Scott; Engineers' Club, Mr. W. H. Fletcher.

The executive committee met on May 19 and organized by the election of Charles F. Scott, chairman, and F. R. Hutton, secretary. The committee laid out certain work to be undertaken by its several members, and will have meetings from time to time during the summer.

The following cablegram has been sent to Mr. Carnegie: "Joint committee four organizations formally accepts generous gift Union Building. Executive committee in session sends greeting and reports progress.—Scott."

The following resolutions were passed this week by the American Society of Mechanical Engineers:

"The American Society of Mechanical Engineers assembled in general session at its 47th meeting in Saratoga, N. Y., has learned with the greatest interest of the proposed gift to the profession of engineering by Mr. Andrew Carnegie, member of the Society, of a million dollars for an engineering building.

"The Society has also been informed of the action taken by its Council in reference to making this gift available and serviceable to the needs of this society. Wherefore:

"Be it Resolved, That this Society desires to place on record its appreciation of the purpose of Mr. Carnegie, in seeking to advance by this means the interests of the profession of engineering,

"Resolved, That by embodying this purpose in the form of a great and noble building for the uses of those organizations whose aims are to foster the development of engineering, the donor has taken a step which will notably advance these interests;

"Resolved, That the Society approves the prompt response of its Council to the opportunity offered to favor and further the interests of the Society which are involved in that progress of the profession which lies at the base of the Carnegie gift;

"Resolved, That it be referred to the Council with power to transmit by cablegram and letter to Mr. Carnegie the action of the Society, and to carry out by further action, the details necessary to realize Mr. Carnegie's generous purpose."

THE SPIER FALLS DAM AND POWER PLANT

OF THE HUDSON RIVER WATER POWER COMPANY.

By George E. Howe, Assistant Engineer.

There is now building across the Hudson River at Spier Falls, from Mount McGregor to the Luzerne Mountains, a large masonry dam for power development purposes. This dam, from which power will be obtained by midsummer, and which will be completed within a year, is being constructed with day labor, by the Hudson River Water Power Company, of which Mr. Eugene L. Ashley, of Glens Falls, N. Y., is president, and Mr. E. H. Gay, of Boston, Mass., treasurer. The structures when finished will consist of an overfall section, on the Warren County side of the river, 817 feet long; a section across the river, 10 and 12 feet higher than the overfall, 552 feet long; and, at right angles to the Saratoga County end of the river section, a dam forming one side of the intake canal, and extending in an easterly direction 403 feet to an overfall across the end of the canal. From the intake canal, ten penstocks carry the water down to the power house, which extends along the river bank, with one end on the dam.

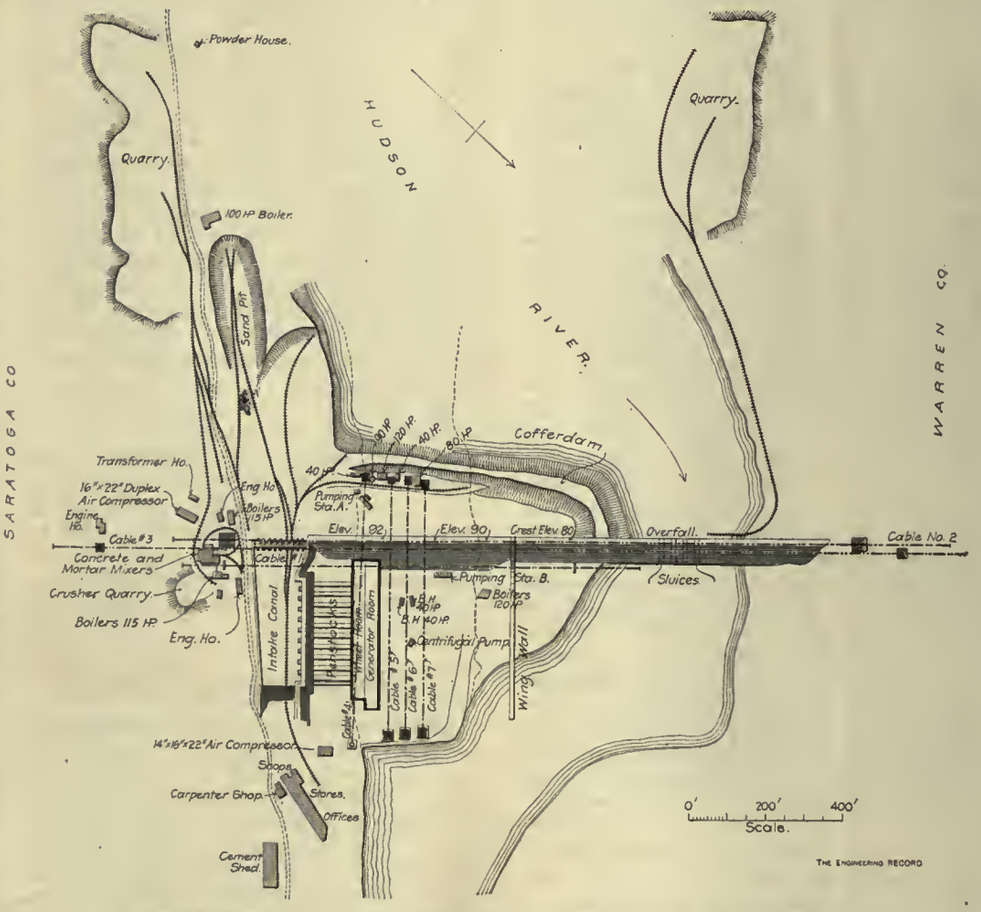
The dam forms a reservoir 5½ miles long and about ½ mile wide, and one foot draft on it will furnish about 100,000 horse-power-hours. The head will be 80 feet, and at low water, using the storage furnished by the dam, 20,000 horse-power can be developed on a twelve-hour basis. When the storage of the upper Hudson is developed the plant can be run to its full capacity, 40,000 horse-power, the year round. A preliminary description of this plant was printed in The Engineering Record of March 8, 1902; but as numerous changes have been made since that date in the design of the dam and power house, revised cuts have been made to accompany this article.

The overfall section of the dam is built on a terrace about 30 feet above the river level. The profile of its downstream face is an ogee curve and the upstream face is slightly battered. Its interior is of rubble masonry, consisting of the granite rock, quarried near the site, laid in 1:2½ Portland cement mortar. No specifications as to the sizes of the stones have been made, the only requirements being that the stones should be clean and free from seams. The downstream face is of random range ashlar, cut to ½-inch joints, having 1½-inch face projections. The joints in this face work, as well as those in the face work of the main dam where the batter was more than about .25 foot per foot, have been made with a Portland cement grout, mixed 1 to 1, very thick, and well worked down by iron blades into the joints. The upstream face is of hammered rubble. All face work is well tied to the interior masonry with headers. The joints on both faces are raked out and pointed with 1:1 mortar. Special stones were cut for the toe and crest. These stones range from 1½ to 3 cubic yards, and are cramped to each other and to the adjoining courses with 1½-inch iron cramps, grouted in.

The remainder of the dam is built of concrete rubble and faced with hammered rubble roughly coursed and laid in 1:2½ Portland cement mortar. The concrete is mixed of Portland cement 1:3:5, stone crushed to pass through a 2½-inch ring, the run of the crusher being used. The concrete is mixed rather wet, and worked in place with heavy, long-handled spades. When thoroughly placed, and in a mushy condition, large stones are placed in it and worked about with bars until well bedded. The spaces between the larger stones are filled with spawls and more concrete.

Between the overfall and the river section and extending down the river about 500 feet, is placed a wing wall 10 feet wide, the object of which is to prevent the water coming over the spillway from running into the tail bay and raising the height of the tail water. This wall is built of rubble, faced on the side next the overfall with the same material as the downstream side of the overfall.

The dam along the canal is built in the same manner as the main dam, except the face on the canal side, which is finished in concrete, on account of the many grooves, projections and the flaring entrances to the penstocks. Especial care was taken with this to procure a smooth piece of work, and the results are very satisfactory. The ten 12-foot steel penstocks pierce this wall with their bottoms at elevation 53. At the upper end they are 7/16 inch and at the lower end ½ inch thick. Around each



General Plan of the Hudson River Power Company's Plant at Spier Falls.

section passing through the intake wall are four flanges of 4x6-inch angles. Between the intake wall and the power house the penstocks are carried on masonry piers forming saddles which extend up around the tubes for a height of 4 feet. These piers are 4x13 feet in horizontal section and are placed 4 feet apart in the clear. The mouth of each tube flares to a diameter of 13 feet, the flare being formed in the concrete. Around this mouth is bedded a frame of 12x14-inch hard pine timber, on which is a strip of cast iron 1 inch thick forming the seat for the gate.

These gates 12 inches thick are built of selected Georgia pine sticks, carefully jointed, splined and held together with four 1½-inch bolts. They are raised by a screw hoist, designed and built by the Coffin Valve Company, of Neponset, Mass., driven by an electric motor. The hoists are so designed that any gate may be thrown in or out of gear, and operated by hand. Wicket gates, 16x20 inches in size, are provided to relieve the pressure on the large gates when opening or closing them. Stop-log grooves are also provided in front of these gates so that repairs may be made to any individual gate. Just in front of these gates are the racks, carried on a frame of heavy steel beams, built out from the small piers between the tubes. These racks are of ¼x3-inch iron placed 1¼ inches apart in the clear and bolted together with spacers, in sections of 27 bars. They extend continuously in front of the ten penstocks, and from elevation 52 to elevation 86, 6 feet above the normal water level. Provision is made for disposing of the rubbish from them at the easterly end of the canal.

At the mouth of the canal, which is designed to carry 6,000 cubic feet per second with a velocity slightly in excess of 3 feet per second, are the regulating gates. Here are piers and arches forming ten openings, 10 feet wide and 18 feet high. These openings are closed by double-leaf gates, built in a similar manner to those over the penstocks, of 10-inch Georgia pine. These gates run in cast-iron grooves set in the concrete of the piers. The gate stems are fastened to the lower leaf, and as it is raised a cast-iron lug on it strikes the bottom of the upper leaf and lifts that. The gates are fitted with cast-iron rubbing strips, and raised by a rack-and-pinion hoist designed and built by the S. Morgan Smith Company, of York, Pa. These hoists, also, are driven by an electric motor from a common shaft, and can be operated individually if so desired. Grooves are provided for stop logs on each side of these gates in order to make repairs on them.

The depth of water in the canal is to be 20 feet and the minimum section has about 2,000 square feet area at that depth. There is a re-

taining wall of concrete along the southerly side of the canal to support the highway. At the end of the canal is a spillway similar in form to that of the main dam, but built 2 feet higher, to elevation 82, the intention being to use it only in freshet time. This is crossed by an I-beam bridge of three 25-foot spans.

The foundations of the dam were in all cases carried to a clean firm rock, free from seams. This necessitated a very extensive rock excavation under the spillway, as the rock here was very seamy. In one place the cut was 28 feet deep. In the bed of the river a glacial drift was encountered over the rock. This material extended down as low as 64 feet below the datum, water level in the river, causing the dam to have a maximum section 154 feet in height with a base width of 116 feet. This extreme depth was carried for nearly 150 feet along the dam. Excavation in this material was exceedingly difficult. The best way to work it seemed to be in breasts, driving a row of steel bars in about 5 feet, pulling them and dropping a couple of sticks of dynamite into each hole. After shooting, the material was sufficiently loosened to be handled with pick and shovel. At best it was more expensive to excavate than a similar quantity of rock. Nearly 50,000 cubic yards had to be taken out.

The power house is a brick building 70 feet 10 inches by 392 feet inside. It is divided by brick walls into three rooms. Across the upper end of the building is the transformer and switchboard room, and the remainder of the building is divided by the longitudinal wall into the generator and wheel rooms. The foundations are of concrete, and the rock is excavated under the building so as to give a depth of 14 feet of tail water. The river wall of the building is carried on a concrete wall 3 feet wide at the top and battering 1 inch to the foot.

The ten generators are carried on a row of piers 3 feet 6 inches wide and 23 feet 4 inches long, built 10 feet 6 inches apart in the clear. These openings are arched over. Between the arches and the river wall is a space 13 feet 5 inches wide spanned by 10-inch 25-pound I-beams, 4 feet 8 inches center to center, carrying a concrete and expanded metal floor. Between the arches and the river wall of the building is the wheel pit, 21 feet 6 inches wide and 297 feet long. The wheels are carried over this on box girders, the floor of the wheel room being at elevation 14.67, the generator room at 15.75. The wall through which the penstocks enter is a rubble masonry retaining wall, faced with brick on the inside of the building, and serving to hold the earth filling over the penstocks. The penstocks are to be covered 3 feet deep to protect them during freezing weather. The building will have a slate roof carried on trusses spaced 14 feet center to center. There will be 10-ton traveling cranes in the wheel and transformer rooms, and a 20-ton crane in the generator room.

Of the generators, eight are 2,500-kilowatts and two 2,000-kilowatts General Electric Company's 3-phase 2,000-volt 40-cycle revolving field alternators, direct-connected to ten pairs of turbines on horizontal shafts. These wheels are 54 inches and 42 inches in diameter. The penstocks end in the wheel cases, and the wheels discharging into draft tubes. The wheels were built by the S. Morgan Smith Company, of York, Pa., and the Swain Manufacturing Company, of Lowell, Mass., and are rated at 5,300 gross horse-power for the 54-inch wheels, and 4,500 gross horse-power for the 42-inch wheels, under a head of 75 feet. They are to have an 80 per cent. efficiency, and are governed by Lombard and Sturgis governors. The generators are capable of sustaining a 25 per cent. overload indefinitely and are to have an efficiency of 95 per cent. at full load. There are two 125-volt 150-kilowatt exciters and one 125-volt 300-kilowatt, each driven by a separate wheel supplied with water from the casings of the large wheels. Ducts for cables lead from the machines to a room beneath the floor, at the upstream end of the building under the transformer room. In this room is the low-potential switchboard equipped with the standard General Electric Company's appliances and the bus bars. From this room the lines run to an air-tight chamber under the transformers, and to the transformers above.



View Showing Cross-Section of the Spier Falls Dam.

There are thirty 833-kilowatt and seven 670-kilowatt General Electric air-cooled transformers. Beyond these are the high-potential, transformer, selector, and bus sectionalizing switches, and the line oil switches. Along the river side of the building is an operating board, and here are placed the various meters for each machine and the different feeder lines. There are also auxiliary switches operating electrically the switches on the low-potential board and in the high-potential chamber, so that the whole plant is under the control of one man. In addition to these there are switches placed on an operating stand by each machine so that any machine may be cut in or out by the floor man. The building will be lighted by current from the exciters.

At the downstream end of the building is a machine shop for light repair work, and a boiler for furnishing steam for heating, for thawing out gates, and similar purposes.

The transmission lines will eventually consist of five circuits designed for a 30,000-volt potential. They are of No. 000 wire, strung on heavy porcelain insulators, placed equilaterally on locust cross-arms. The poles are chestnut and are spaced 90 feet apart. Each pole line carries two circuits.

One line leads to Glens Falls and the others to Schenectady, where another line from a plant owned by the same company at Mechanicville comes in. Other lines run from Mechanicville to Saratoga Springs, connecting with the Spier Falls lines there, and to Albany. The longest line is to Albany via Mechanicville, 44 miles.

Construction Methods.—A contract was let and construction begun in June, 1900, but the contractors abandoned the work at the beginning of winter, and the company then decided to carry it on by day labor. The winter of 1900 was spent in organizing a force and collecting a plant, so that work might be in full swing by spring; since April, 1901, the work has been carried on without intermission.

The principal problem in constructing this dam has been handling the flow of the river, which is from a drainage area of 2,700 square miles, having steep slopes and a rapid run-off. The lowest rate of discharge since construction started has been 1,000 cubic feet per second, while in times of freshet it has risen to between 40,000 and 50,000. Owing to the depth of excavation necessary in the river bed, there was not room to sluice this water there, and a coffer dam had to be built to divert the water over the terrace on which the overfall is built. Four archways 7x10 feet were built through the overfall section, their bottoms being at elevation 30. These are able to handle the extreme dry weather flow, and can be closed with gates, after which it is intended to fill the openings with masonry. Grout pipes were run up through the masonry in order that the filling might be made thoroughly tight.

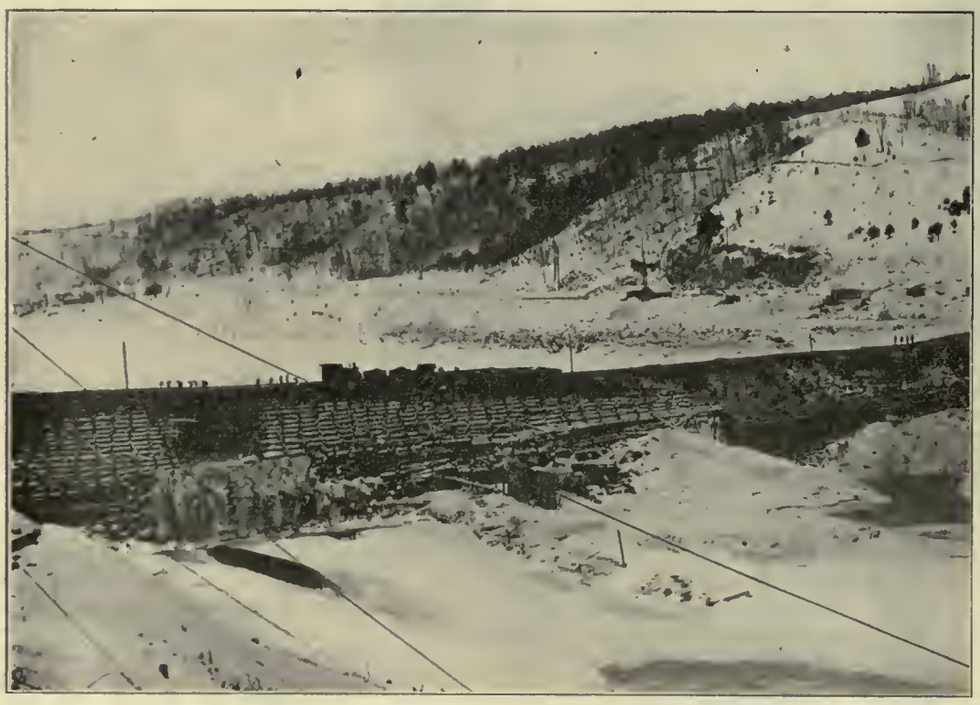
In addition to these archways, a gap 90 feet wide has been left through the overfall, at elevation 40. This has proved sufficient to take care of the past spring freshets. When the plant is advanced far enough to run the first five wheels, a bulkhead will be thrown across the canal at the lower end and water turned into the first five penstocks. This will require the main dam to be raised to elevation 68, eight feet above the level of the mouth of the canal. Advantage has been taken of the recent dry season to fill the large opening in the overfall. The masonry was carried across May 26, 5 feet high, and the gap closed.

The main coffer dam was built of logs, laid cob-house fashion, about 6 feet apart at each crossing. The logs were notched and spiked with ⅝-inch square iron spikes. The wells were filled with stone from cars run out on the crib from either shore. After the crib was

filled, a fill of stones was made on the upstream face of the dam, and over this a heavy gravel fill. All the material excavated from the river section was placed on top of this. As finished, the coffer dam has a length of about 900 feet, and at the middle of the river is 90 feet high. Its width at elevation 50, the top of the cribbing, is 100 feet; at the middle of the river the cribbing has a bottom width of 80 feet. This coffer dam was started in 1900 from the Warren County side of the river, and built out half-way across the river. At right angles to the river end a small dam was run down the river, and inside of this excavation was commenced.

This small dam was twice carried away, first by the spring freshet of April, 1901, and again by the December freshet of the same year. It was not replaced after that.

During the summer of 1901, the main coffer dam was extended across the river to the Saratoga County shore, and the cribbing raised to elevation 50. The method of closing was unique. During low water the cribbing was built out from either shore to the middle of the river, leaving a narrow wedge-shaped piece, 8 feet wide on the downstream face and flaring upstream. This cribbing was partially filled with stone and then a wedge-shaped piece was built of green timber just above the water, but in position in the opening, and was hung with hemp ropes. At a signal all the ropes were cut and the wedge dropped and sank to the bottom, where it was loaded with stone. Two sluiceways 30 feet wide were provided, and what water did not leak through the dam was readily cared for in one of them, except after rains, when both would be in use. These sluices were raised alternately 6 feet at a time to about elevation 40. Then the rock and gravel fills on the upstream side were started, while the cribbing was being carried on up, and the water was successfully diverted through the archways and the opening in the overfall.



Spier Falls Dam: Complete Crib Work for Main Coffer Dam.

In December, 1901, the structure had just reached this stage and that portion next the overfall had not been completely filled with stone, when a week's thaw culminating in a warm rain, caused the river to rise 11 feet. The uncompleted portions of the coffer dam were carried out and the excavation in the river bed, 60 feet deep, was filled in with stone and gravel. Nearly 10,000 cubic yards had to be re-excavated and masonry work in the river bed discontinued. By the early part of February this break was nearly repaired, and a sluiceway 60 feet wide left in this portion of the dam; it being thought that it would be better to trip the sluice than to risk water running over the cribbing.

In spite of this sluice, and before the portion of the crib next the overfall was wholly filled, in the middle of March, 1902, the regular spring freshet, a month earlier than usual, came on and took away again that portion of the coffer dam next the overfall, leaving the larger part of the dam intact. This was repaired as fast as the water went down, and in the latter part of May all but a sluiceway 70 feet wide was closed and well filled with stone. This sluice was filled in the following manner: A log crib was built just wide enough to enter the sluice and two ears were left on the upstream side so that the upstream side was about 20 feet wider than the downstream side. It was built of dry chestnut timber and thoroughly braced with diagonal sticks. When completed it was floated into the sluice, guided and held by wire cables fastened to a ledge about 200 feet upstream. As soon as it was in position it was filled with stone and a gravel fill brought up on top. The structure has successfully stood the test of the recent spring freshet, an unusually severe one.



Spier Falls Dam: Method of Building Crib across River for Coffer Dam.

The leakage, due to a 65-foot head on the coffer dam was easily handled by two units of Lawrence centrifugal pumps, each unit consisting of one 10x10x8-inch and one 7x7x8-inch direct-connected pumps, working tandem. When the head became reduced to 45 feet one unit was able to handle this leakage.

The downstream coffer dam is a light structure built of 2-inch plank held by rows of 10x10-inch timber placed 10 feet apart, the space between being packed with gravel. It is about 700 feet down the river from the large coffer dam. The leakage from it is handled by a unit of Lawrence pumps similar to that mentioned above.

Cableways have been freely used in the construction, and, indeed, have been a necessity owing not only to the topography of the valley, but also to the desire of the company to expedite the work in every possible way. There are seven, furnished by the Lidgerwood Manufacturing Company. Three convey materials across the river, along the length of the dam. One has a span of 1,000 feet between towers, one 1,670 feet and one 2,140 feet of 2, 2¼, and 2½ feet rope respectively. The last is claimed by the Lidgerwood Company to be the longest in the world used for heavy loads (up to 10 tons). The other four extend up and downstream across the dam and are of 670-feet span of 2-inch rope, and are placed over the deepest portion of the river bed, one being over the power house. These run under the first three. The cableways along the dam have been used to handle mortar, concrete and dressed stone, while the up and down river cableways handled excavated material and stone for rubble ma-

sonry to and from the cars on the coffer dam and from the power house site.

The stone for masonry has been brought on flat cars hauled by contractors' locomotives, over a 3-foot gauge track, from quarries situated on either side of the river, a little over ¼ mile upstream from the dam. The stone is very hard granite, bluish and pinkish in color, weighing 168 pounds per cubic foot. It is worked with difficulty, and for that reason but little cutting has been done, the greater part of the cut stone coming from a quarry owned by the company at Hadley, about 17 miles up the river from the dam. The stone there is a light colored granite fairly easily worked and of splendid quality. The tracks were run out on the Saratoga County side of the river over the coffer dam just in front of the cable towers, and from the Warren County side, on a trestle parallel to and 8 feet away from the upstream face of the overfall, where stone could be raised by derricks and swung onto the work. The construction plant and quarries are shown on the plan.



Spier Falls Dam: View of the Power House and the Derrick Plant.

Stiff-leg derricks have had to be used along the main dam in order to clear the cableways. As a rule they had 40-foot masts and 60 or 70-foot booms. As the work progressed those on the dam were raised on platforms, built of timber placed on the downstream face of the dam. Stiff legs as long as 114 feet have been successfully used in this work.

The mortar mixing plant is situated on the Saratoga County side of the river just behind the towers of the 1,000 and 1,670-foot cableways, on a level dug and blasted out from the mountain side. It consists of three No. 5 Ransome rotary mixers, one of which is used solely for mortar, placed directly beneath the bins containing stone, sand, and cement, so arranged that a charge may be measured in hoppers while another is being mixed; and directly after a charge is dumped, the one already measured goes into the mixer. These mixers do not require to be stopped while dumping or charging. Behind the bins is a quarry, where the stone for a No. 6 Gates crusher is gotten out and by means of a derrick is swung directly on the crusher platform. There is also a No. 2 Climax jaw crusher for breaking the rejects of the screens.

Sand is found in a large bed near the main quarry, and brought in cars to the mixer, where there is a hopper holding about 10 yards. From this hopper the sand is elevated to a revolving screen of ¾-inch mesh over the large bin. Rejections from the screen go to the crusher platform. The sand bin has a capacity of 100 cubic yards, and the stone bin 150 cubic yards. A 28-inch gauge track furnished with flat cars carrying 1½ and 2-yard buckets, leads from under the mixers out in front of the cable towers on a slight descending grade. This track continues around behind and under the mixers again, forming a complete circuit. Mules are used to pull the empty buckets back to the mixers. The cement is taken from wagons to a rubber conveying belt, which elevates it to the bin floor. All cement used on the work has been of the Atlas or Iron Clad brands. This mixing plant has proved very successful. It has a capacity of about 400 cubic yards of concrete daily, besides producing all the mortar necessary. Various makes of self-feeding continuous mixers have been tried, but it has been found that a slight difference in the size of the stone or the moisture in the sand and stone will cause their rate of feed to change, and to thus change the proportions of the resulting mixture.

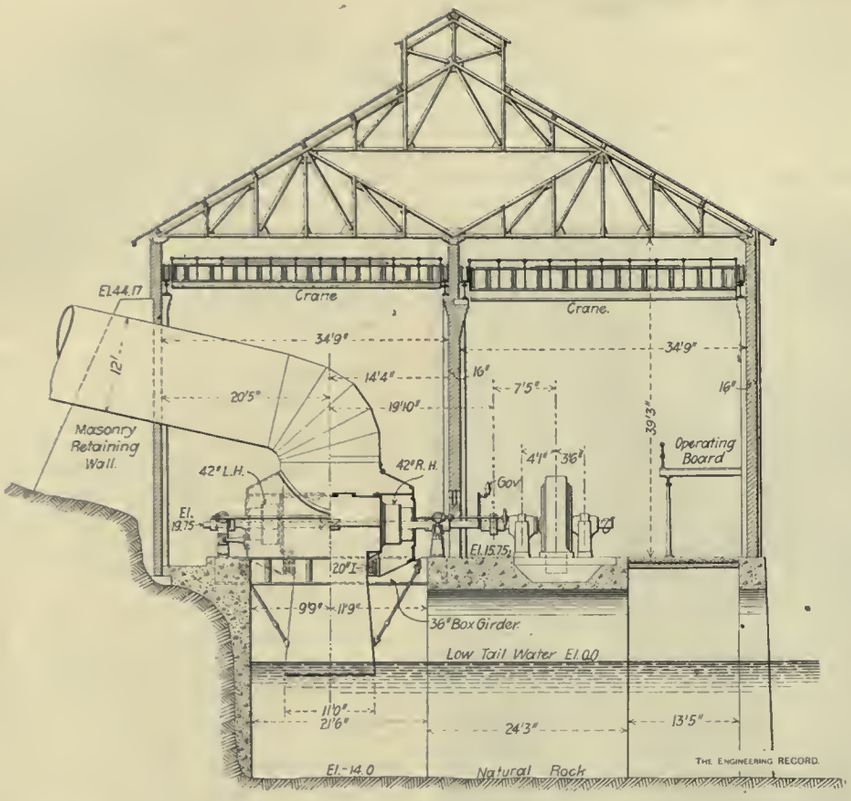
All cement, as well as other materials, has to be teamed from Glens Falls, a distance of 11 miles, and the heavy machinery has been teamed during the winter months on sleds, and in the summer on especially designed trucks. Owing to the bad condition of the roads in the early spring, materials for that season have to be teamed during the winter. Consequently storage room has been provided for 10,000 barrels of cement.

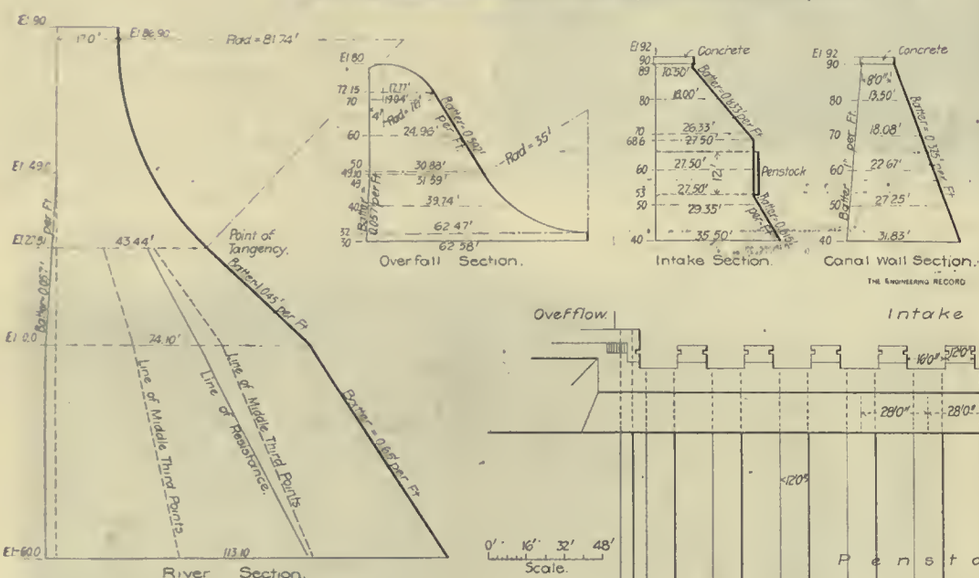
The power used up to this last winter was steam, but on account of the cost of coal, the company, which last year acquired the plant of the Hudson River Power Transmission Company at Mechanicville, has put in air compressors electrically driven with power from Mechanicville. The plant consists of two 27 and 17x30-inch and one 14 and 22x16-inch duplex, two-stage Rand compressors driven by General Electric synchronous motors and furnishing air at 80 pounds pressure. A transformer house contains two 670-kilowatt air-cooled transformers which reduce the voltage from 12,000 to 2,200, at which potential the current is used by the motors. The compressors are all rope driven. Eight-inch main air lines lead to various parts of the work, from which the smaller lines are tapped and carried to the various pumps, hoisting engines, etc. Each small line is provided with reheating stoves.

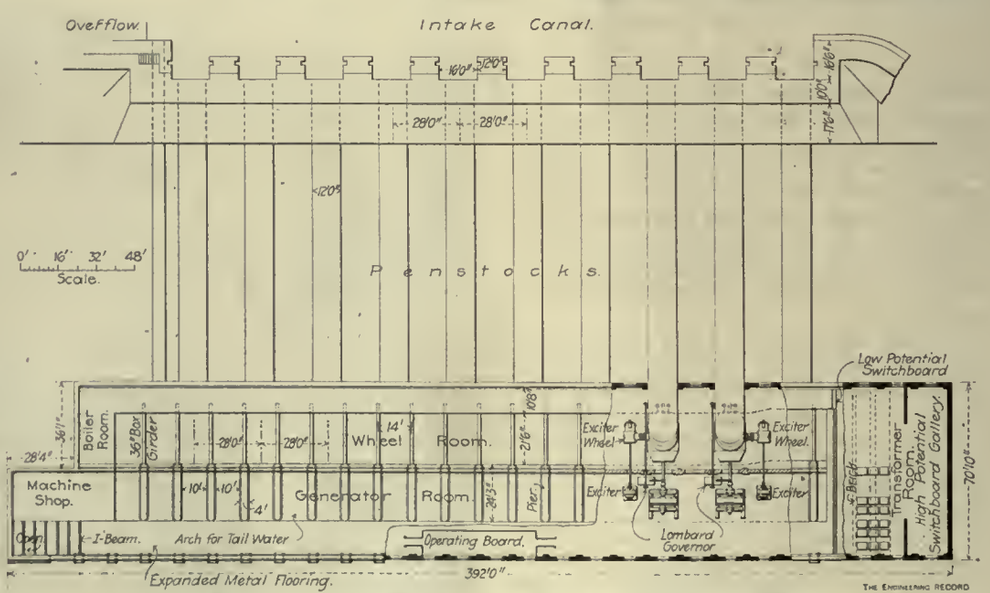


Spier Falls Dam: General View of the Dam, Power House and Construction Plant.

Work has gone on at all seasons of the year, the only delays being those caused by floods and extremely low temperatures. Masonry has







Plan and Section of Spier Falls Power House and Sections of Dam.

been laid in winter at all times when the temperature has been above 20 degrees Fahrenheit. Salt and warm water are used in mixing mortar and concrete, and salt is used to sprinkle over newly laid masonry. Canvas covers are also spread at night. No trouble has been noticed from masonry laid in cold weather. There will be about 190,000 cubic yards of masonry in the completed plant, and it will have required about 270,000 cubic yards of earth and rock excavation.

The plant as built has been largely designed by Mr. Geo. E. Evans, of Boston, Mass., who has acted as consulting engineer, and by Mr. Charles E. Parsons, of Glens Falls, N. Y., the chief engineer. From them much of the information used in the preparation of the article has been obtained.

Strawboard Wastes are among the worst sources of pollution of rivers, and it is gratifying to notice that the U. S. Geological Survey has undertaken an investigation of methods of purifying these liquors. The work will be under the general charge of Mr. M. O. Leighton, assisted by eminent chemists.

The New Shops of the American Locomotive Company at Schenectady.

By Lindsay Duncan, Construction Engineer.

The American Locomotive Company now owns and operates eight different plants, the largest of which is located in Schenectady, N. Y. For some time, as in other manufacturing establishments, orders have largely exceeded the normal output. To meet economically the increased demands the directors of the company decided to enlarge several of the works, particularly those at Schenectady, since they were considered better adapted to that purpose than the other plants. One of the reasons for the selection of these works is their popularity among the railroads, some of which in giving orders specify that the locomotives shall be built in Schenectady. The idea was to consolidate most of the heavy work in Schenectady on account of the better facilities there. The company already possessed a tract of land of about fifty acres, situated a quarter of a mile from the existing shops, but affording an excellent opportunity for systematic enlargement. The relation of the capacity of the existing shops to the demand necessitated practically doubling the shop capacity in order to meet the demand economically. The scheme of expansion finally adopted was that of putting up a set of large modern buildings, each rather more than twice the size of the corresponding one already in use, and whenever a shop was completed and the machinery installed, the abandoned shop was remodeled and used in relieving the congestion which existed in the other departments. As can readily be seen, this problem was by no means an easy one, and the final solution, as worked out by Mr. Dalton, the chief engineer, was a most comprehensive one.

The programme of construction adopted was as follows: First a blacksmith shop was built, the cylinder work being placed in the vacated shop. Next followed a hammer shop, boiler shop, iron foundry, drop forge shop and tank shop in the order named, the buildings formerly used for the boiler shop and iron foundry being slightly remodeled and fitted up to take care of the frame and wheel work respectively, thus relieving the overcrowded machine shop of about one-half of its work. The hammer shop, a wooden building, had been partially destroyed by fire and was torn down on the completion of the new shop, the space being afterwards utilized for the construction of a

Another Old Canal, once the scene of thriving commerce, is apparently doomed to disappear. This is the old Erie and Beaver canal, formerly the chief waterway between the Ohio River and Lake Erie. It was constructed by the State of Pennsylvania and built up the Shenango and Beaver valleys. It has been unused since 1871, and has relapsed into a succession of stagnant pools that have fallen under the ban of the health officers. They propose to compel the Erie Railroad to fill these holes, but there is some question as to their power to do so.

storehouse. The land upon which the drop forge shop was situated having been sold, the building was taken down and removed to a new site across the canal and 144 feet added to its length.

The principal consideration was that of expeditiously constructing and getting into operation the new shops, and all other considerations were regarded as secondary to this end. The location chosen was a piece of meadow land, about 8 feet below high water mark of the Mohawk River, the soil being very compressible, and this fact, in view of the heavy crane loads proposed for some of the buildings rendered the design of suitable foundations a matter of some difficulty. It was not thought practicable to drive piles in view of the excessive fluctuations of the ground water level. Consequently foundations consisting of concrete footing courses, rubble piers and concrete caps were decided upon. A large amount of filling being necessary, a contract was made with the Delaware & Hudson Canal Company to furnish 100,000 yards of sand, at 20 cents per yard. The accompanying plan shows the general layout of the works.



Spier Falls Dam: View of the Upstream Side Showing the Coffer Dam.

Foundations.—The character of the soil upon which the new shops were erected was practically the same for all the buildings, the changes in the substructures being due to different conditions of loading and to the experience gained. The foundations generally are of a simple character. The boiler shop is one of the largest buildings and has large live loads.

Three 35-ton cranes having a 67-foot span were to be placed in the center aisle, and three 10-ton cranes in one bay and one in the other, the span in both cases being 47 feet. Besides these the riveting tower was to contain four 20-ton cranes, the upper two with a span of 30 feet and the lower two with a span of 33 feet. The area of the footings were proportioned so as to give the soil a load of only 1,000 pounds per square foot. Moreover the concrete footing was made continuous throughout an entire row of columns, so that the loads should be more evenly distributed. A trench 15 feet wide and 2 feet deep was dug under each of the two rows of main columns, and three layers of concrete put in each a foot thick, the widths being 15, 13 and 10 feet. Under the riveting tower the footing was put in 21 feet wide and 4 feet thick, the idea in this method being that the crane load transmitted from one column would be transferred to a comparatively long strip of soil, the concrete being computed as a cantilever beam loaded uniformly, the soil reactions constituting the load.

The side columns in the boiler shop and the entire substructure in the foundry were designed in a similar manner, the problem being less serious as the crane loads were less. Two difficulties were met in the foundations of these two shops, one of which was foreseen and the other was not. The first was a brook flowing along the east wall of the boiler shop for two-thirds of its length and then crossing in a diagonal direction passing under the southeast corner of the foundry. This brook was diverted and arched over. The bed, however, consisted of a fine black silt at least 20 or 25 feet deep. The channel was excavated and foundations put in 3 feet wider at the points of crossing. Immediately after the cranes were installed and before the shop was completely finished a number of locomotives for the Cape Government Railroad were sent down to the boiler shop to be packed. It so happened that the available space was directly over where the brook had formerly passed and so for two weeks the 35-ton cranes worked steadily in that position. The result was a greater settlement there than elsewhere in the building. Another cause which probably contributed, but which could not have been guarded against was a record-breaking freshet of the Mohawk River, which flooded the place, the foundry having 8 feet of water inside and outside. This, of course, was bound to injure newly laid foundations, as the water probably followed up the old bed of the creek and ran underneath the walls.

The tank shop foundations were similar to those of the foundry and boiler shop, the only unusual feature being caused by the two 24-inch main outlet sewers from the city spaced 3 feet 6 inches from center to center and passing diagonally across the shop site about 3 feet below the level at which it was desired to place the footing courses. The ground was dug out on each side of the sewers for 3 feet below their inverts and the excavation made wide enough to take the loads at the same unit pressures as were given to the other portions of the foundations. The piers were formed of concrete and a concrete steel arch spanned the openings preventing any tendency to overturn. These arches were about 10 feet span, the steel consisting of 4-foot rods ½ inch in diameter with 2x6-inch plates on their ends, which were upset, placed staggering upon the intrados of the arches at intervals of about 18 inches.

Water Supply and Drainage.—The water furnished by the city of Schenectady is of excellent quality, but, on account of the expense, is not used except for drinking purposes and for hydraulic machinery supply. Mohawk River water is used for all other purposes about the yard. The intake crib is located about 50 feet out in the stream and the pumping station is situated in the extreme southwest corner of the grounds. The equipment consists of two Worthington pumps working under a steam pressure of 90 pounds, and having per diem capacities of 500,000 and 300,000 gallons, respectively, maintaining a water pressure of 100 pounds throughout the system. About 500,000 gallons are supplied daily. No standpipe or other means for regulating the pressure is in use. The pumps were found to give a much better service after the air had been removed from the air chamber than when it was filled. This may have been due to the small size of the air chamber compared to the amount of water under pressure. The mains are of 8-inch cast-iron pipe with 6-inch branches. Mr. Joseph Clements was the contractor for the pipe laying.

In the problem of drainage, one of the most important factors was a brook which flowed directly through the locations chosen for two of the principal buildings. This brook drained a watershed of about 1½ square miles, approximately one-third of which was built up. The discharge in times of sudden heavy rains was estimated at 240 cubic feet per second. The data for this estimate were obtained from weir measurements taken during an abnormally heavy shower in August, 1902. A new channel was dug and an arched culvert laid extending 700 feet through the yard within 50 feet of the river. In constructing this culvert the bed of the ditch was levelled off and given a grade of 0.8 per cent., then 3x4-inch hemlock nailing pieces laid parallel to the direction of the flow. A total width of 14 feet was floored with 3x8-inch North Carolina pine, laid transversely. Rubble side walls were run up for 3½ feet, and then a semi-circular arch, also of rubble, was turned. The arch was designed to support the weight of yard locomotives drawing heavy train loads, tracks being laid across it in a number of places. All roof and surface drainage as well as waste water of all kinds from the shops were led into the culvert.

Two tile sewers diminishing gradually from 24 to 6-inch were laid inside the boiler shop and similar lines inside the iron foundry, all roof drainage coming down inside the buildings, thus eliminating entirely dripping over the eaves, icicles, etc. This device has proven very satisfactory in every respect. In addition to the drainage system mentioned, an 8-inch sanitary sewer was run into the river at a point 1,400 feet below the pumping station. A substantial one-story concrete and brick building 75x20 feet was constructed for a lavatory and water closets. It had concrete floors and walls up to the water table, brick the rest of the way, wooden roof trusses and a slate roof. This building was located between the iron foundry and the

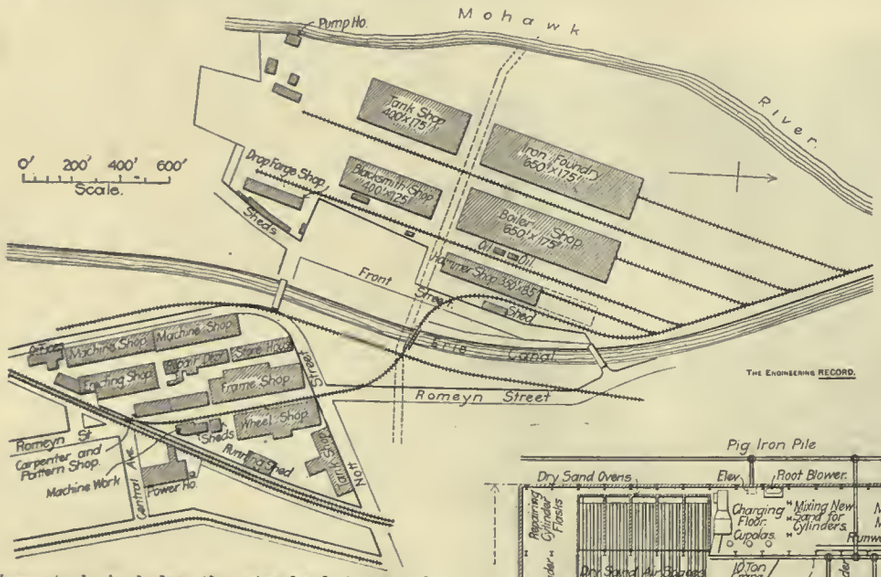
boiler shop, the sewer running directly underneath the foundry.

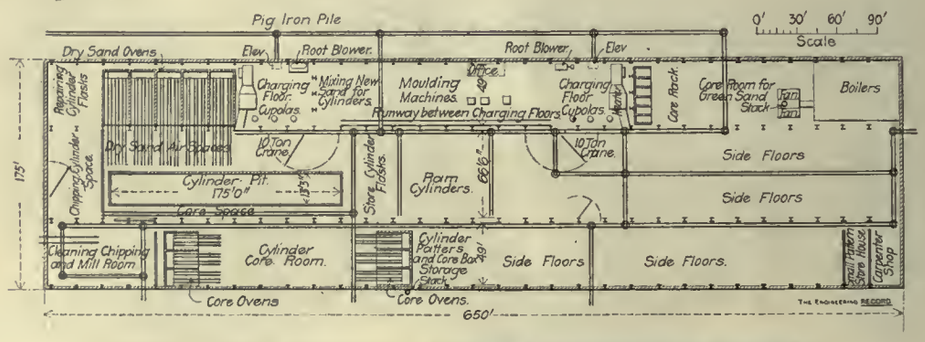
Transportation.—The additional demands for transportation facilities created by the enlargement of the works divide themselves into two classes: temporary—incident to construction, and permanent—transportation of the partially finished product from one shop to another and between different parts of the same shop. During the construction of the first two shops, (the smith shop and the hammer shop), teams were the only means of conveying material. This method of course was inadequate for work of any magnitude and hence when the construction programme was definitely decided upon, steps were at once taken to improve the facilities.

A track was laid through Romeyn Street, connecting with the New York Central and the Delaware & Hudson on the southeast side of the yard enclosure, and spurs were laid, as the occasion demanded, into the various shops and along the spaces between the buildings. The rolling stock includes the standard types of freight cars drawn by the company's switching engines. The latter were of the four-wheeled saddle tank variety, the weight being 40,000 pounds, with the tank filled and have been able to run the sharp curves of the yard track without difficulty. During the fall of 1901 the roadbed was prepared, the filling being done by teaming and tracks laid on both sides of the canal; as soon as navigation closed a pile trestle was built which afterwards served for falsework in erecting the bridge.

The canal is spanned by a plate girder swing bridge 111 feet 2 inches over all, the two arms being 37 feet ½ inch and 74 feet ½ inch long, respectively. The limiting features of the design were the clear channel span of 60 feet required by the state of New York, and the close proximity of the Delaware & Hudson Railroad. The girders are 14 feet 6 inches apart and the floor system consists of transverse 18-inch I-beams, spaced at 10-foot intervals with 12-inch I-beams framed into them as longitudinals. No cross ties are used, but instead the rails are bolted directly to the longitudinals, ¾-inch holes being drilled, staggering, every 18 inches and bolts with bevelled cast washers used to secure them. The bridge is rotated by means of two 10-horse-power General Electric motors, and a third motor of 5-horse-power operates the wedging and locking device. The time required to draw the wedges is 40 seconds, and to swing the bridge through an arc of 90 degrees requires 50 seconds more; thus the total time taken in opening is only a minute and a half. This rapidity of action is of great advantage in that the traffic either along the canal or over the bridge is rarely delayed. As soon as the general features for this bridge were decided upon, the substructure was designed and the construction at once started. This was necessary as the work could be performed to much better advantage during the period of closed navigation than at any other time. The substructure consisted of a pivot pier 20 feet 6 inches in diameter and two abutment piers 4 feet 6 inches by 21 feet. These were formed entirely of concrete, and as the work was done while there was very little water in the canal, it was possible to put in the abutments without interference from the water.

For the pivot pier, which extended only about 10 feet below the bed of the canal, a cofferdam consisting of tongued and grooved sheet piling was found sufficient to prevent any inflow. The pier was cylindrical in form and built solid throughout to within 2 feet 6 inches of the water line. A circular parapet of concrete 14 inches thick and 2 feet 9 inches high was then added and two walls of brick 2 feet 6 inches thick and 2 feet 10 inches high were built in the form of a cross, supporting the pivot casting, at their intersection, and also the wedge seats. The object of this peculiar construction was to enable the grade of the bridge to be lowered 2 feet 10 inches in case the projected elevation of grade of the Delaware & Hudson Railroad within the city limits of Schenectady should take place. In this event the company's tracks would cross underneath the Delaware & Hudson tracks instead of at grade, as is now the case. The two main girders were shipped entire, side by side in cradles, on three cars, the weight being taken by the two end cars, the middle one being used only as a spacer. These girders each weighed 20 tons, and were unloaded and set by pushing the loaded cars underneath the street cranes, which run above the tracks between the frame and wheel shops, the hook of a 10-ton crane being made fast to either extremity of a girder. As soon as the girder swung clear of its support the cars were withdrawn and the girder lowered, on its side, upon two hand cars. These were then run out on the falsework and the girder skidded off to its proper position by the aid of jacks..





General Plan and Plan of Foundry, American Locomotive Works, Schenectady.

During the summer preceding the construction of the bridge a system of tracks had been laid out upon the "flats," and thus the building materials for all except the first two buildings were delivered by rail, and practically no teaming was required. Temporary jib cranes and hoisting engines were used by the contractors in unloading structural steel from the cars while brick, stone, sand and cement were delivered so close to the work that wheelbarrows were used almost entirely. The general location of these tracks can be seen on the plan, most of the buildings having at least one standard-gauge track laid inside throughout their entire length and all of them having a track paralleling them at a distance of 50 feet. A coal siding extended for 300 feet close to the east side of the hammer shop, enabling coal to be shovelled directly from the cars into bins alongside the heating furnaces. All the shops except the drop forge shops are provided with a number of jib cranes, and the boiler shop, foundry and tank shop have travelling cranes as well.

The foundry is supplied with a set of narrow-gauge tracks crossing each other at right angles, having turntables at their intersections. No street cranes of any type are in operation in the new portion of the plant, although sketches and estimates were made for one between the foundry and boiler shop. Another project which has not yet been put into operation is that of an overhead trackage system between the hammer shop and smith shop, the conveying of the materials between the shops now being done by hand trucks, an obviously un-economical process where the amount of material is at all large and constant in volume.

Power Distribution.—The power plant installed at the time of construction consisted of a battery of Franklin water tube boilers, aggregating 1,000 horse-power, made by the Franklin Boiler Works Company, of Troy, N. Y., and a 20x30x40-inch 500-horse-power tandem compound Corliss engine built by Webster, Camp & Lane, direct-connected to a 300-kilowatt General Electric Company generator. This equipment was designed so as to be duplicated whenever conditions warranted, foundations being prepared for another battery of boilers and space provided for an additional engine of similar type. The boiler room is in the southeast corner of the foundry building, while the engines, generators and air-compressors are in the boiler shop. The boilers are fitted with Roney mechanical stokers, and provision was made for installing conveyer machinery in the future. With that end in view a frame work was erected over the boiler room to support a sheet iron U-shaped coal bin with a capacity of 50 tons. The main steam pipes run along the top of this framing and pass across to the boiler shop on frames set at intervals of 20 feet.

The feed water supply is maintained by a belted pump 5½x8-inch, built by the Deming Company, located near the engine, which is

rated so as to supply a slightly smaller amount of water than is evaporated by the boilers, the difference being furnished by an injector in the boiler room. This gave the economical advantage of the pump together with the convenience of an injector. The engine is designed to furnish 500 horse-power running at the rate of 40 revolutions per minute. A part of the power is taken up in operating the 300-kilowatt generator and the remainder in driving belted pumps, air compressors and a portion of the shafting.

There are two air compressors, one an Ingersoll-Sergeant with a 12½x14-inch cylinder, which is belted to the jack shaft, and a Corliss cross compound two-stage compressor built by the Laidlaw-Dunn-Gordon Company with 30 and 18-inch air cylinders, 18 and 30-inch steam cylinders and a 36-inch stroke. The air is delivered at 90 pounds pressure and is used to operate the small pneumatic riveting and caulking hammers in the boiler shop, the chipping hammers and moulding machines in the foundry. The pumping outfit, exclusive of the feed pump already mentioned, consists of two Worthington hydraulic pumps, a Deane 3x12-inch triplex, and a 3x16-inch Gould triplex. The last two pumps are belted and, with the exception of one Worthington pump, all the pumps are new. It is estimated that about 100 horse-power are required to drive the belted pumps, air compressors and one line shaft, leaving 400 horse-power available for the generator.



Interior View of Foundry during Construction, American Locomotive Works.

The shafting in the boiler shop is divided into seven sections, one of which is driven by belt from the engine and the others by motors, of which there are two 60 horse-power and four 35 horse-power. One of the machines, a No. 6 Bement-Miles bending roll, is electrically operated, having two motors connected to it. A line wire runs to the swing bridge and from there to the power house on the east side of the canal, thus securing an auxiliary source of power in case of emergency. Another line passes to the blacksmith and drop forge shops, also extending on to the power house. The blacksmith shop is operated by an 80-horse-power Buffalo engine, supplied with steam from the foundry boilers. The drop forge shop, however, is run entirely by motors.

The plant was designed and its construction was supervised under the direction of Mr. William Dalton, chief engineer. The principal contracts were awarded to Mr. John McDermott for stone, brick and concrete masonry; to Messrs. Weder & Brown for carpenter work, and to the Phoenix Iron Company for the structural steel and swing bridge.

The Warren Rotary Engine.

The accompanying illustrations show the general arrangement and construction of a rotary engine that represents the results of several years of study and a prolonged series of practical experiments, during which time the records of the U. S. Patent Office were worked over to determine the nature of the difficulties to be overcome as indicated in the design of former prime motors of the rotary type. The principal trouble in these engines appeared to lie in the method employed to effect a tight steam joint, and as a result the scheme to obtain steam tightness in the present engine is one of its most interesting features. Mr. E. C. Warren, of Philadelphia, is the inventor of the engine, which is being built by the Rotary Engine Company, 135 South Second Street, that city.

The engine uses a concentric piston wheel and shaft mounted between oppositely placed rotary abutments. The piston wheel carries a broad flange at either end, between which, across the face of the drum of the wheel, the vanes, or, as they may for convenience be termed, the pistons, are mounted on the outer edge of the blade being turned off in line with the peripheral surface of the flanges, thus adapting these surfaces to run in close contact with the surrounding casing.

It will be noticed that the main bore of the casing has a slight taper from end to end, and that the periphery of the flanges and pistons is similarly tapered to fit the bore; and it is by this expedient that the desired condition of continuously maintained so-called pressureless contact is established between the moving flanges and pistons and the surrounding casing. Owing to the slight difference of diameter between the two ends of the tapered wheel which are exposed to the pressure of steam introduced into the interior of the wheel—the web being perforated in order to establish uniformity of pressure throughout—a moderate end thrust upon the wheel and main shaft is created, the tendency of which is to force the tapered wheel further into the tapered bore, thus closing the joint between flanges, pistons, and casing. In order to prevent the wheel from jamming forcibly into the tapered bore and sticking fast, a small thrust bearing is mounted upon the shaft outside the casing, with provision for adjustment along the axis of the shaft, to make it possible to locate definitely the piston wheel in any desired plane relative to the casing. It is desired that by this means the wheel may be set to run within an infinitesimal distance from the interior surface of the shell and that through the normal wear on the thrust bearing any deviation from this original plane will be in the direction insuring increasingly intimate contact between the surfaces engaged. It has been found that in continuous operation under service conditions, the wheel will rotate smoothly at the highest desired speed, i. e., up to 5,000 feet per minute peripheral speed, while maintained in such intimate contact with the casing that a mirror-like polish is imparted to all the contact surfaces.

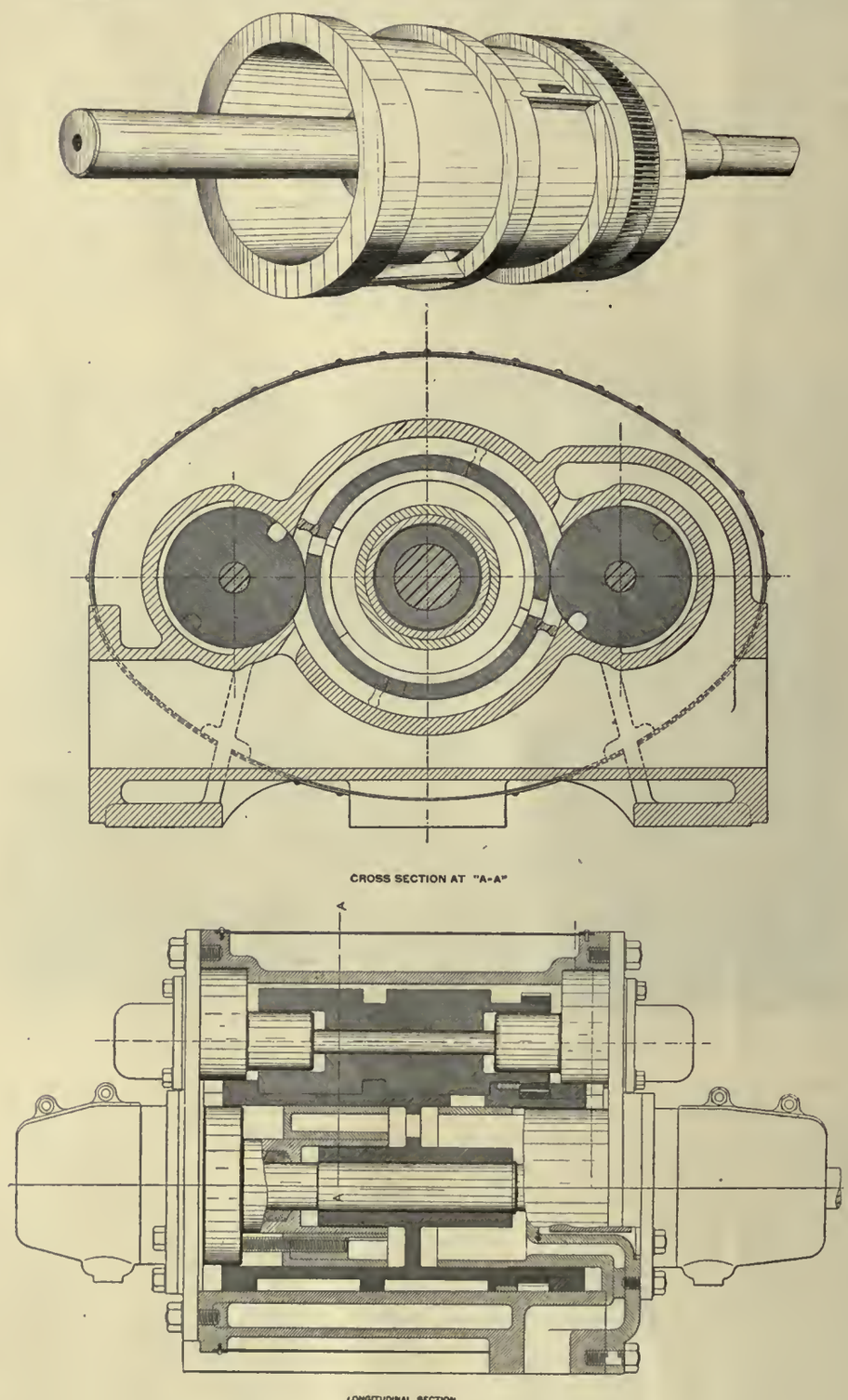
Lateral steam pressures on the wheel and shaft are balanced, as equal areas at diametrically opposite points are in all cases exposed to equal pressures. The main journals are both lubricated. The rotary abutments are provided with a peripheral notch or groove extending from end to end and adapted to admit of the passage of the wing pistons. These grooves have a sufficient cross-section to allow ample clearance for the passage of the pistons and the abutments are connected for rotation with the main wheel through the medium of toothed rings or gears giving a ratio of two turns of abutment to one of the wheel. The abutments are mechanically balanced by drilling opposite the groove and are tested on a speed lathe for centrifugal balance. They are mounted on shafts having bearings formed in the counterbored end-plates of the abutment chamber or bore. Provision is made in these bearings for the application of elastic pressure toward the center of the main shaft, this pressure applied upon small pistons or diaphragms taking steam from the interior of the engine. The pressure exerted by these pistons varies, of course, with the variations of the working steam pressure, but leaves a moderate unbalanced force tending to seat the abutment in its bore and close the joint between the periphery of the abutment and the drum of the wheel. The abutment does not merely roll upon the surface of the main wheel but, owing to the fact that the respective diameters of drum and abutment do not exactly coincide with the pitch diameters of the gears, a difference of surface speed is established amounting to about 600 feet per minute at normal speed. In this way a sliding contact is created which will cause the two rotating surfaces to wear each other away in harmony with the advance of the abutment due to the normal wear upon its journals.

Similarly the seat formed by the bore of the abutment is designed so that it will wear at a slow rate and thus establish between abutment and wheel and casing the same condition of pressureless contact described as existing between the main wheel and the casing. The abutments, being mounted between the flanges on the main wheel, and being free to move on their bearings and seats in a line parallel with the axis of the main shaft, are allowed to follow the longitudinal movement of the wheel in adjustment and normal wear.

In the steam cycle, in either the simple or compound form, admission and cutoff are

equally quick. Steam is admitted into the interior of the drum-shaped piston wheel and enters the working steam chambers through the ports shown in the perspective drawing, in the drum of the wheel; the engine shown is of the type designated as duplex simple, that is, the single expansion chamber is divided by an intermediate flange into two equal compartments having pistons set 90 degrees apart to insure uniform turning effort. The two drum valves are mounted upon inwardly projecting hubs cast as an extension of the casing heads, and, in the simple form of engine shown, are made fast to these hubs, giving a fixed cutoff; governing, when required, being accomplished by throttling. In the larger sizes and in compounds the drum valves are arranged to be shifted upon the hubs and are controlled by a special governor which regulates the speed of the engine by varying the point of cut-off in the high-pressure cylinder. It is not considered necessary to maintain a perfectly tight joint between the drum valve and the interior surface of the piston wheel as any leakage past the valve results in raising the expansion line in the working chamber and adding a slight super-heat during the latter stages of expansion. The valve is fitted simply with a close running fit.

The engines so far built are said to have used 10 to 15 per cent. less steam than required by reciprocating steam engines of equal power. The reproduction of a photograph is a view of a tandem compound generating unit, but the makers state that owing to the requirement that it should develop full power at a boiler pressure of 80 pounds, operating non-condensing, and at a speed of 1,200 revolutions per minute, which is 20 per cent. lower than the rated speed for the engine capacity, the engine appears larger in comparison with the dynamo than it would under ordinary conditions. The cross-section drawing is the design of a 9-inch single-expansion engine for direct attachment to a 33-kilowatt dynamo at a speed of 1,680 revolutions, the set weighing 3,000 pounds. It should be pointed out, in concluding, that the engine is reversible.



Some Details of the Warren Rotary Engine.

A Comparison of Eyebar Chains with Steel Wire Cables for the Manhattan Bridge.

As the readers of this journal are aware, there are three great bridges in course of construction in New York City across the East River from the Borough of Manhattan to Long Island. The Manhattan Bridge, which was briefly described and illustrated in The Engineering Record of February 21, is to be a suspension bridge with nickel-steel eyebar chains instead of wire cable. The main span of this bridge is to be 1,470 feet, as shown in the illustrations of the article mentioned. About three months ago Mayor Low appointed a board of bridge experts, Messrs. George S. Morison, Theodore Cooper, G. C. Schneider, Prof. Mansfield Merriman, Henry W. Hodge, to examine the designs for the bridge prepared by Mr. Gustav Lindenthal, commissioner of bridges. A preliminary report has been made by this board, but the final report is delayed by the illness of the chairman, Mr. Morison. In the meantime some extracts from a statement of the comparative merits of eyebar chains and steel wire cables for suspension bridges, prepared by Mr. Lindenthal for the board, are of timely interest.

"The comparison is based on the design and system of stiffening adopted for the Manhattan bridge. The eyebars are assumed to be of annealed nickel steel, having an elastic limit of not less than 48,000 pounds per square inch, and an ultimate limit of not less than 85,000. The eyebars will be 18 inches wide. The steel wire for the cables is assumed to have an elastic limit of not less than 150,000 and an ultimate limit of not less than 190,000 pounds per square inch for No. 7 Birmingham gauge. The extreme live load of 16,000 pounds per linear foot of bridge, or 4,000 pounds per chain or cable, as recommended by the board of engineers, will strain the eyebars to 39,000 pounds per square inch. But that load could be produced only by special preparation and may never occur. The so-called working load is assumed at half the extreme load, and may happen a few times a year. The four steel wire cables will each be assumed to be stressed from the same live load to 84,000 pounds per square inch.

"In the eyebars and in the wire cables the maximum stress will therefore approximate from 44 to 46 per cent. of the ultimate breaking strength. In both the maxima are far within the elastic limit. That the working stress from live load may be assumed much higher in large heavy structures than in lighter structures of smaller span is a principle too familiar for discussion. It is the universal practice to express the degree of safety of a structure in terms of the breaking strength (or ultimate limit) of the material. It is, however, well understood that the maximum working stress must under all conditions be well within the elastic limit of such material. There are good reasons for adhering to this practice in comparing the strength of eyebars and of steel wire. The differences in the physical condition of these two materials are radical and a

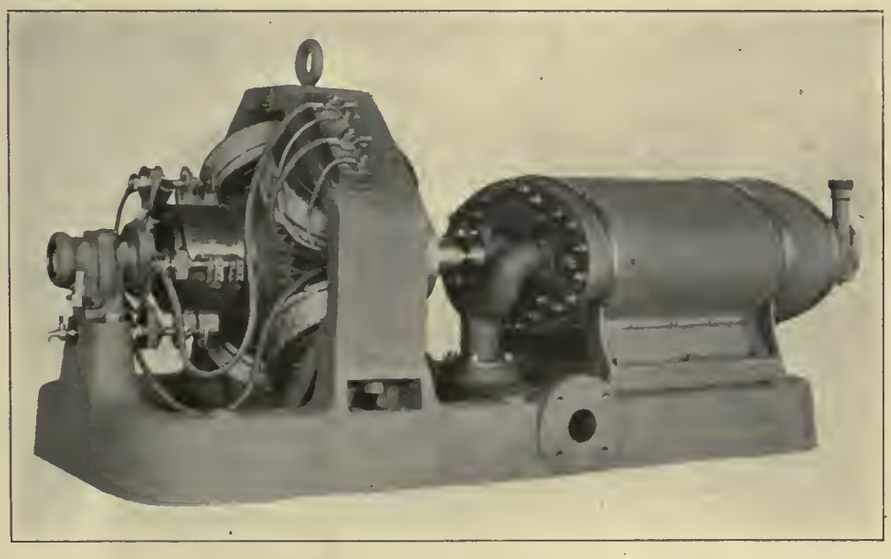
comparison of strength, based on their elastic limit alone, would be misleading.

"A steel eye bar, which has been annealed, is in a natural physical condition, not materially affected thereafter by re-heating. But if such an eyebar is strained beyond the elastic limit, say to 70,000 pounds per square inch, and if then the strain be reduced to say 23,000, which is within the elastic limit, and allowed to rest with that strain, or without any strain, then in that case, as we know from tests, both the elastic limit and breaking strength of the steel are considerably increased. The steel has been elongated and received a set. A higher tenacity has been artificially imparted to it by alternating over-stress with rest. This is precisely the process by which a higher tenacity is produced in the wire. But this higher tenacity in both the bar and the wire can be annulled by re-heating or annealing, which brings the metal back to its first natural condition. The annealed eyebar may be exposed to accidental heating without material injury. The wire cannot be so exposed. The annealed bar will elongate 9 to 10 per cent. before breaking; the wire only 3 to 4 per cent. The degree of safety of both is therefore not alike under all conditions, although the modulus of elasticity is practically the same in both materials. The margin of strength between the maximum working stress (which, as already said, must be within the elastic limit in any event) and the breaking or ultimate limit, constitutes

COMPARISON OF EYEBAR CHAINS AND STEEL WIRE CABLES.

	Eyebar chain.	Steel wire cable.
1. Length of spans, feet	725, 1,470, 725	725, 1,470 725
2. Capacity, 4 elevated R. R. tracks for electric cars, 4 trolley tracks, 1 roadway, 35 feet 6 inches; 2 promenades, each 11 feet 6 inches,		
3. Width of superstructure, feet	124	124
4. Suspension system, 4 planes of stiffening system shown on plan, middle span having 1/9 deflection.		
5. Weight of floor complete per linear ft., including buckle plates, flooring, ties, rails, etc., pounds	16,100	16,100
6. Weight of suspenders and overhead bracing (ordinary steel), pounds.	1,400	1,400
7. Weight of steel required for stiffening, comprising bottom chords, diagonals and extra weight of verticals (ordinary steel), average per lin. ft., pounds	5,250	8,130
Note.—The greater weight of steel for stiffening required for cable is by reason of the greater deflections of the wire cable under loads, causing larger bending moments (see item 15).		
8. Weight of 4 eyebar chains, including heads and pins (nickel steel), average per linear foot, pounds	9,500	....
9. Weight of 4 steel wire cables, including wrapping, covers and steel bands, pounds	....	4,120
10. Total dead load, average per linear ft. in middle span, pounds	32,250	29,750
11. Unit stress in chain or cable from dead load alone, lbs. per sq. inch.	23,000	46,000
12. Unit stress from dead load + 8,000 live load, lbs. per square inch	30,000	65,000
13. Unit stress from dead load + 16,000 live load, which is the extreme loading, pounds per square inch	39,000	84,000
Note.—For both chains and cables the maxima include temperature and bending from partial loads.		
14. Horizontal component from dead load and extreme live load on 4 chains or cables, pounds	66,212,000	57,176,000
15. Deflection under extreme live load in middle span (end spans not loaded), feet	1.93	2.96
16. Cross-section of 4 chains, maximum, square inches	2,440	....
Cross-section of 4 chains, minimum, square inches	1,872	....
17. Cross-section of 4 cables, maximum occurs in end spans in the 4th panel from tower, square inches	....	1,070
18. Total weight of chains or cables, pounds	29,040,000	12,034,000
19. Cost of cable at 15 cents per pound	....	$1,805,100
20. Cost of eyebar chain at 6½ cents per pound	$1,887,600	....
21. Cost of additional ordinary steel in the stiffening for wire cables at 5 cents for 6,270,000 pounds	....	$313,500
22. Cost of additional ordinary steel (166 sq. ins. additional section in each tower) in both towers for eyebar chains at 5 cents for 372,000 pounds	$18,600	....
23. Cost of additional masonry (5,000 cu. yds. in each anchorage) in both anchorages for eyebar chains, 10,000 cu. yds. at $7.00	$70,000	....
24. Totals	$1,976,200	$2,118,600
25. Difference	$142,400	....

the cost for one and the other kind of material and partly by the facilities of manufacture and erection, saving of time in construction, and



The Warren Rotary Engine Direct-Connected to a Dynamo.

therefore that reserve strength in the eyebar and in the wire which, while differing in character and behavior, is otherwise of equal protective value against such local higher or uneven stresses as may be caused by unavoidable imperfections of work or by unforeseen accidents.

"It is considered good practice for eyebars in a chain of accurate workmanship and having a large margin between the elastic limit and the breaking limit, to be strained much nearer to the elastic limit than wires in a cable, where such margin is less than half as large, and where the same accuracy of adjustment and workmanship is not so certain. The eyebar with an elongation three times greater than that of wire before breaking would, moreover, give earlier warning of failure, if failure could ever come through overloading, which, under the assumed conditions, is impossible. Wire is the only practicable material for very long spans. In fact there is no choice there. But in spans of the length of the Manhattan bridge, the choice will be determined partly by the cost and facility of maintenance thereafter.

"The greater mass of the eye bar cable over the wire cable is an advantage in respect of rigidity and durability not to be underrated even in a heavy structure like the Manhattan bridge, in which the dead load is twice the extreme live load. Nickel steel may be obtained of much greater strength than above specified. So may steel wire be obtained of greater strength than assumed. It will, however, not affect the comparison materially, as the cost of both materials would be correspondingly higher.

"As the masonry and foundation for the towers are already contracted for and partly built, they do not enter here into the comparison of cost, being the same for chain and cable. The price of 15 cents per pound of cable is based on the cost of that work in the Williamsburg suspension bridge. (Only one bid was received for those cables.) It is believed that the price of 6½ cents for the chains of nickel steel eyebars is higher than will obtain in the bids for this work. The difference in cost between the two designs, one with the nickel steel eyebars, and the other with steel wire cables is therefore $142,400 in favor of the eyebar chains; but rapid manufacture and erection, and thereafter greater facility of maintenance, are further advantages not to be underrated. For the cable it is assumed that adequate sleeve connections can be made for the web members depending upon friction. But it is doubtful whether that could be done for the large shearing stresses to be transmitted to the cable from the stiffening system. It is a detail not approved by good practice. As regards time of erection, it may be observed that the eyebars can be manufactured in advance, and can be ready for erection when the towers are completed, by the same contractor. When the chains are completed, no further work is required on them. Wire cables must be spun in place, a process which requires longer time than the erection of the eyebar chains. After spinning, the cables must be compacted, wrapped, covered and have the steel bands put on, all of which causes more delay in the erection of the suspended structure."

At the suggestion of the board, Mr. Lindenthal inquired of all the prominent steel works in the country whether they could furnish the desired quality of nickel steel. The large number replied, in effect, that they saw no difficulty in making the desired quality of nickel steel and the eyebars.

Over-Exposed Blueprints can, in many cases, be restored by immersing them in a bath of weak ammonia, using about two spoonfuls of ammonia to a tumblerful of water. This will cause the print to turn first purple, then pink and after a time nearly white. When it has reached the pink stage, rinse the print and immerse in a bath composed of water, 1 tumblerful, muriatic acid, 1 teaspoonful. The blue color will then return much brighter than before, but this time the lines will be white and clear. Wash thoroughly before drying. Stains on tracings caused by blueprint water can, also, be removed, according to the "American Machinist," by painting the spot with a camelshair brush dipped in a 10 per cent. solution of oxalate of potash. This same solution may be used for making white lines on blueprints. Almost any alkali will bleach a blueprint, but this solution will turn the blue to a pure white.

Tests of a Steam Turbine Plant and Electric Driven Shops.

Abridgment of a paper read before the American Society of Mechanical Engineers by Fred. A. Waldron, Superintendent of the power plant, Yale & Towne Mfg. Co., Stamford, Conn.

The steam turbine which this paper will describe is installed at the works of the Yale & Towne Manufacturing Company, Stamford, Conn., and is the first one of its size (outside of those operated by the builders) to be put into practical operation in this country. The generating outfit consists of a two-phase, 240-volt alternator, of 400 kilowatts capacity (when the turbine was running condensing, and the power factor of the alternator was from 90 to 100 per cent.), 7,200 alternations, running at 3,600 revolutions per minute, with a separate, direct-connected exciter set. The alternator is of the revolving field type, and the surface speed of the field is 22,137 feet per minute. The weight of the outfit is 33,200 pounds, and occupies a floor space 19 feet by 4½ feet. The guaranteed economy was 16½ pounds of water per electrical horse-power at the switchboard, with 28 inches of vacuum, 40 degrees Fahrenheit superheat, and 155 pounds gauge pressure.

The electrical end of the machine is not compounded, and the variation in voltage depends entirely, within certain limits, upon the load and position of rheostats. Speed regulation is very close and perfectly satisfactory. A true kilowatt overload of 33⅓ per cent. has been carried for five consecutive hours, without apparent injury to the machine. Owing to the low power factor, however, the heat developed in the field and terminals was much higher than is allowable in good practice. When thus overloaded, the volt meter had to be closely watched, in order to care for any suddenly applied load with the rheostat.

At present, the condenser plant consists of a surface condenser, containing 1,100 square feet of cooling surface, with independent air and circulating pumps. The air-pump is of the simplex, twin beam, vertical type, making about 90 single strokes per minute. The average vacuum obtained with this outfit, with plenty of circulating water, is about 27.4 inches. Steam is furnished by eight Manning boilers.

Motors.—Sixty-four induction motors (with varying loads), ranging from ½ to 40 horse-power, are distributed throughout the works. With the exception of the elevator motors, the entire plant is arranged on the group system. With this arrangement, the power factor will range from 82 to 86 per cent., depending on the motor loads. The only precaution to take, in order to prevent frequent shut-downs, with the induction motor, is to have the main circuits fused heavy enough to withstand the influx of current from the line, due to starting.

The Turbine and Its Generator.—The turbine end of this machine has received very little attention in the past year, and has required no renewals or repairs to any of its parts. It was found necessary, when assembling the machine, over a year ago, to remove from the bearings, with a fine oil-stone, some burrs which had been thrown up in handling, and also a little rust which had accumulated; upon examination of the same, one year later, these marks had not been worn out.

Occasional longitudinal adjustment, to check the clearance between the blades in the case and the revolving element, is necessary. The wear and tear on other parts of the machine have been practically nil, and if the oil is kept in constant circulation and properly cooled, there is no need of a hot box, and the amount of oil used is extremely small; the consumption of this particular machine being ½ gallon of cylinder oil per week, and from 3 to 5 per cent. of the lubricating oil on the bearings may be said to be wasted. It is necessary to remove the top of the case of the turbine once in three months, as red lead or other foreign substances in the pipes are liable to clog the smaller blades. The principal trouble with the steam end is its liability to shut down, when running from three-fourths to full load, because the vacuum is destroyed. This can be prevented, if the engineer is on hand.

Questions that have been asked of the author are answered in the paper as a matter of record. The windage is more than from a slow speed generator, yet, as a whole, is not disagreeable. For continuous running and high vacuums, the dry condenser system, with a two-stage air-pump, will probably maintain higher average vacuums than any other system. The turbine has supplied 25,000 square feet of direct radiating surface and 7,500 square feet of blower-stack surface, and maintained a temperature of from 60 to 70 degrees Fahrenheit in all buildings, when generating 520 kilowatts, and with a temperature of 220 degrees in the exhaust chamber of the turbine. The difference in pressure was produced by 10 inches of vacuum on the power house end of the drips for the heating system. The writer has also found that the temperature in the exhaust chamber of the turbine varies with the different loads, and at full load and overload, there is more or less superheat, whether running condensing or non-condensing. A 50 per cent. overload has been maintained at full speed, for five hours, without apparent injury to the machine. The turbine can be changed from condensing to non-condensing, and *vice versa*, when running. As to confidence in the machine, his best reply is that a second outfit has been ordered. Upon the basis of strictly competitive prices, the turbine, ready to run, costs from 10 to 15 per cent. less than the same sized reciprocating engine outfit. The cost of the power house, per square foot, per kilowatt, would be about 35 per cent. less for a turbo-generator outfit than for a reciprocating engine of the same power and economy. The cost of foundations is taken into account, in the cost of the engine and turbine. The author considers that, unless it is possible to balance a lead pencil on the outboard bearing and allow it to remain there for a minute, the machine is vibrating more than it should, and while there are no foundation bolts to hold the ma-

Test of the Boiler Plant.

Dimensions of one boiler—	
Horse-power	135
Grate surface, square ft.	28.27
Heating surface, square ft., 1388.42; superheating, 467.56; total	1855.98
Ratio of G. S. to water H. S.	1 : 49.11
Ratio of G. S. to super H. S.	1 : 16.54
Ratio of G. S. to total	1 : 65.65
Length of tubes, ins.	179
Diameter of tubes, ins.	2½
Number of tubes	180
Economizer, 144 tubes, 4 in., 6 tubes wide.	
Heating surf., econ., sq. ft.	1,728
Induced draft—	
Size of fan, diam., 9 ft.; width, 4 ft. 6 in.; outlet, 62x54 ins.; inlet, 100x46 ins.	
Size of engine, 8x10 ins., revs. per min.	114.3
Test of Seven Boilers—	
Duration of trial, in hours	11
Moisture in coal, per cent	.8
Ash, per cent	.10
Dry coal per sq. ft. of grate per hr., lbs.	12.97
Equiv. evap. per hr. per sq. ft. of water heat. surface, lbs.	2.938
Steam presure, gauge, lbs.	151.00
Temp. feed-water entering boiler, deg. Fahr.	148.07
Temp. gases, deg Fahr.	469.20
Draft between damper and boiler, ins.	0.23
Superheat deg. Fahr.	21.08
Rated horse-power developed, per cent	83.6
Water evaporated per lb. of coal, lbs.	8.707
Equiv. evap. per lb. coal, lbs.	10.240
Equiv. evap. per lb. combustible, lbs.	12.370
Cost of coal per long ton in boiler room	$3.53
Cost of coal for evaporation of 1,000 lbs. of water, from and at 212 degrees, cents	15.39

Tests of the 400-Kilowatt Turbine-Generator Unit.

Tests.	150-kilowatts.	300-kilowatts.	Running load.	400-kilowatts.	Overload.
Voltage	227.5	227.5	227.5	227.5	238.70
Revolutions per minute	3600	3600	3600	3600	3600
Maximum speed variation, per cent	0.5	0.5	0.5	0.5	0.5
Average load, kilowatts	152	323	375	397.11	490
Duration, hours	3	3	4	3	5
Steam pressure, gauge, lbs.	144.85	153.3	152	150.92	152.7
Superheat, degrees Fahr.	....	3.44	6.46	19.66	18.2
Average vacuum, inches	27.34	27.64	27.43	26.95	27.55
Water per kilowatt per hr., lbs.	28.05	22.34	22.29	22.16	21.7
Water per brake H.-P. per hr. (Gen. eff. 0.91), lbs.	19.03	15.17	15.13	15.04	14.72

Tabulation of the Motor Tests.

No. of test.	Building.	Size B. & S. gauge.	Length per phase, ft.	Switchboard A, kilowatts.	Input B, kilowatts.	Output C, kilowatts.	Motor rating, horse-power.	Line loss, kilowatts.	Motor loss, kilowatts.	Shafting, kilowatts.	Shafting and machines idle, kilowatts.	Line $B \div A$.	Motor $C \div B$.	Electrical $C \div A$.	Water per hr., motor pulley, horse-power.	Coal per hr., motor pulley, horse-power.	Comb. per hr., motor pulley, horse-power.	H.-P. per ft. shafting.
7	17	No. 00	250	34.4	33.2	26.85	27.5	1.2	6.35	12.9	21.6	96.3	81	78	21.3	2.45	2.03	.029
		No. 4	300															
8	10	No. 0000	520	13.35	13	11.05	15	.35	1.95	5.6	16.4	97.5	85	82.8	20.2	2.31	1.92	.020
		No. 6	150															
9	19	No. 00	250	36	34.5	28.5	40	1.5	6	...	23.5	95.8	82.5	79	21.1	2.42	2.00	.041
		No. 0	700															
10	24	No. 000	1,400	31.2	30	24.85	30	.8	5.15	...	2.4	96.2	83	80	20.8	2.39	1.98	...
11	2	No. 00	390	5.14	5	4.05	10	.14	.95	...	.93	97.3	81	79	21.1	2.42	2.00	...
		No. 6	270															
12	4	No. 0000	500	33.1	32.5	28.2	40	.6	4.3	21.1	22.7	98.2	87	85.2	19.5	2.24	1.86	.091
		No. 0	120															
13	2	No. 00	390	27.2	26.5	22.55	30	.7	3.95	12.3	17.9	97.6	85	83	20	2.3	1.91	.063
		No. 2	100															
14	4	No. 0000	400	26.42	25.7	20.7	30	.72	5	...	...	97.5	80.5	78.4	21.3	2.44	2.02	...
		No. 2	200															
15	2	No. 4	350	27.2	26.56	21.36	20	.64	5.2	...	...	97.7	80.5	78.7	21.2	2.43	2.02	...
16	10	No. 0000	520	25.8	24.4	19.9	20	1.4	4.5	...	...	94.8	81.5	77.2	21.6	2.47	2.05	...
		No. 4	80															
		No. 8	240															
17	18	No. 00	250	18.47	18.1	15.65	30	.37	2.45	...	15	97.8	86.5	84.5	19.7	2.26	1.88	...
		No. 0	100															
		No. 2	300															
18	4	No. 0000	500	22.3	22	19	40	.3	3	...	5.6	98.6	86.5	85.2	19.5	2.24	1.86	...
		No. 0	140															
19	17	No. 00	310	36	35.6	28.8	30	.4	6.8	14.9	33.5	98.5	81	80	20.8	2.39	1.98	.026
														Ave...	20.62	2.37	1.96	

(As supplementary to the table of motor tests, the accompanying tabulation has been made from plans of the shafting in the various buildings. The kind of work performed is as follows, by numbers of the tests: 7, automatic screw machinery; 8 and 9, general machinery; 10, cupola blower and heating system; 11, plating dynamos and exciter; 12 and 13, polishing and buffing; 14 and 15, ventilating system; 16, heating system; 17, drop forging; 18, plating dynamos; 19, tool making and press work.)

No. of test.	No. lines shaft.	Length shafting, ft.	Diam., ins.	Revs. per min.	Roller bearings.	Ring oil bearings.
7	4	582	1 15/16	200	42	41
8	5	258	1 15/16	215	..	41
9	4	450	2 3/16	...	38	*38
10	3	58	2 7/16	...	..	13
11	..	...	.....	...	..	..
12	..	312	1 15/16	403	..	70
13	3	256	1 15/16	...	..	80
14	1	21	2 7/16	300	..	6
15	1	...	2 7/16	1,120	..	12
16	1	9	2 7/16	300	..	3
17	2	119	1 15/16	173	9	*12
18	1	185	2 3/16	307	..	4
19	..	...	.....	...	..	..

* Plain bearings.

chine down, there has been no tendency for it to creep on its foundations.

The foundation of Turbine No. 1 cost $188.60, at the current prices of cement, sand and broken stone, in 1901-2. It is advisable to leave the foundations with a tunnel through the center, transversely, as there are many ways in which these tunnels can be utilized, either for piping or ducts for electrical wiring.

With respect to the boiler tests it should be said that they were made under daily running conditions, without attempt to scrape the tubes of the boilers, or to bring the economy to a phenomenally high point. What is known as the Society's alternate method is used. The calorific power of the coal was 13,338. The usual precautions as to calibration of gauges, leakage from pumps, etc., were observed.

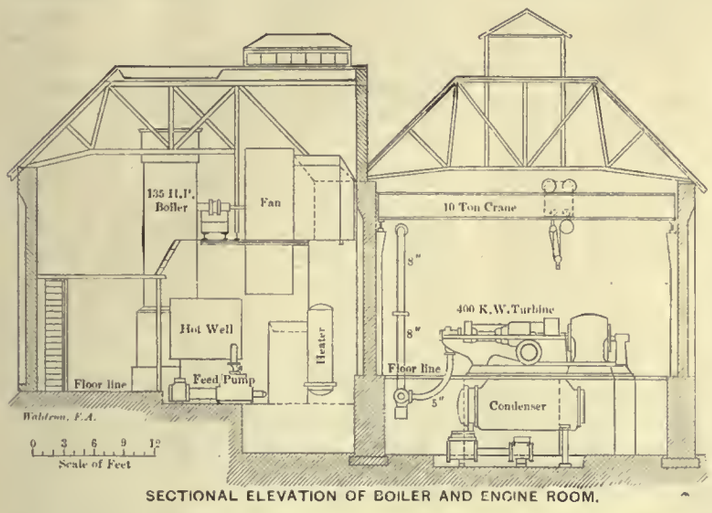
The condenser was tested for leakage, and all water was measured from the air-pump discharge. The power for the exciter (10.8 kilowatts) was determined in a separate test. The exhaust from the exciter engine is used for heating purposes. Shop tests on the turbine made eighteen months before the test of this paper, showed an economy of 14.47 pounds of water per brake horse-power with a load of 607 brake horse-power and 16.43 pounds of water per brake horse-power, with a load of 263 brake horse-power (200 kilowatts). These tests were under approximately the same conditions as to pressure, vacuum and superheat as those in this paper.

The tests on motors are intended to present detailed losses of power transmission, as applied to the group system, with different arrangements of line shafting and belting, as well as different applications of the electric motor to factory work.

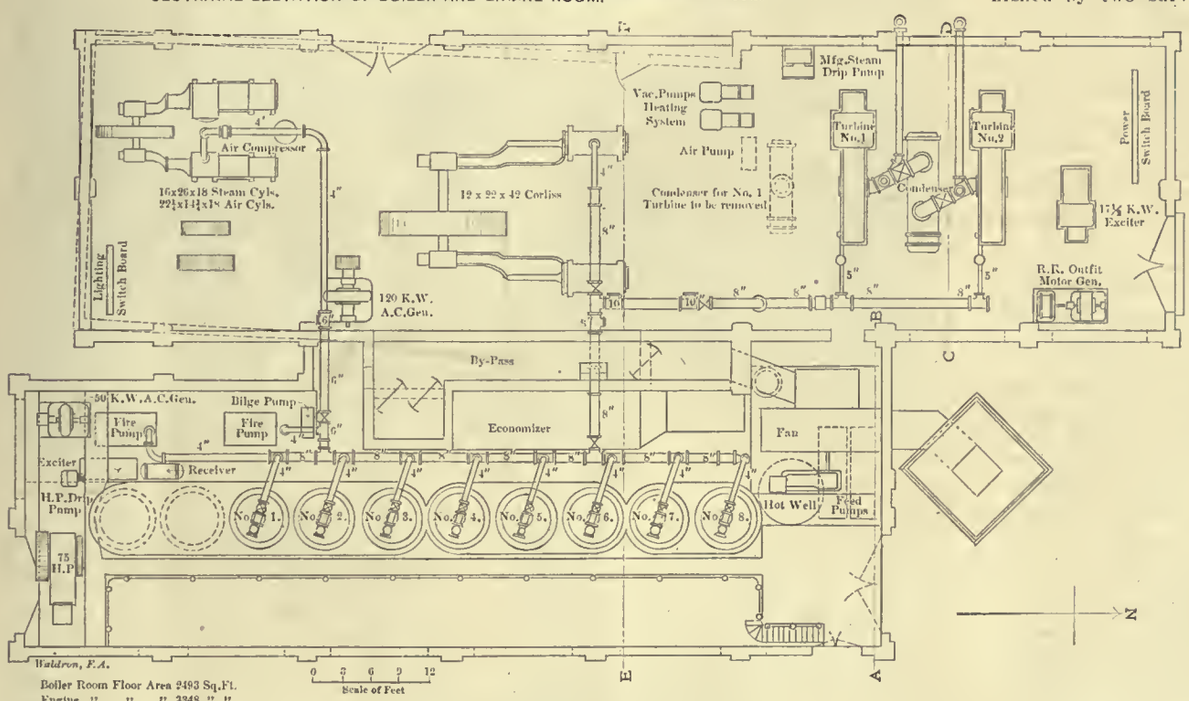
The principal points brought out by the tests are: (a) Difference in frictional losses, depending on speed and arrangements of shafting in the different rooms; (b) The power utilized by the machinery, when running idle; (c) The shafting, machinery and total power used by the useful work; (d) Efficiency of electric transmission.

The tests were made under actual running conditions; the test for each room being continued for one half day, with regular working load, and readings of the watt meter were taken every two minutes. The efficiency of the motors (under their different loads) was taken from the curves furnished by the builders.

The analysis of the tests would indicate that, with the turbo-generator driving induction motors, and with an evaporation of 8.707 pounds of water, per pound of coal, a brake horse-power can be delivered from the pulley of the motor for about 2½ pounds of coal with a turbine of this size runniug under average economy. (This allows 5 per cent. for banking.) Under the same evaporative conditions, the average non-condensing engines, distributed through the different rooms in the plant, would require 7.5 pounds of coal per brake horse-power at the fly-wheel, or three times that quantity required for the electrical drive. The tests described are of practical and timely interest.



SECTIONAL ELEVATION OF BOILER AND ENGINE ROOM.



PLAN OF BOILER AND POWER HOUSE.

Plan and Cross-Section of the Power Plant of the Yale & Towne Manufacturing Company.

Convention of the American Society of Civil Engineers.

(Continued from page 676.)

THE EFFICIENCY OF THE MISSISSIPPI LEVEES.

It is hardly fair to ask if the theory of the levees of the Lower Mississippi is justified by experience, in the opinton of Major B. M. Harrod, who introduced the discussion on this topic. At the present time the application of the theory is incomplete, for the works have neither the grade, section or length considered necessary, nor more than two-thirds the cubic contents required to satisfy the present standards. The justification of the levee theory must be sought in the results. If the river bed rises as a result of their construction, or the capacity of the channel is otherwise reduced by continuing causes, the completion of the works will be prolonged or become interminable. If the waterway is not diminished by a rise of the bed or otherwise, or is improved, then the problem is simple and certain, though large.

The Mississippi River Commission, of which Major Harrod is a member, has given careful attention to changes in the river which will settle this question. These changes are marked and constant. A cross-section line established over a bar may, in a few years, lie through a pool, or the river may have slipped to one side leaving the line on dry ground. Hence the data for a decision on this question must be very numerous, carefully verified, and well studied. The data at present available were mainly furnished by two surveys covering 472 miles of river. The first was made in 1881-3, with about four cross-sections to each mile of river and 75 soundings on each cross-section. The second survey was made in 1894-6, with greater detail so that it would be of more use for future comparisons. The results show that during this period there has been a tendency toward a channel of more uniformity and greater capacity.

In such studies, the low-water surface of the river may be assumed to conform with the river bed, and any elevation or depression of the latter will be indicated by the gauge readings. Some of the effects of levee building can therefore be studied by a comparison of the successive low-water stages at reaches where such improvements have been greatest, with similar stages at Cairo where no influence of the kind has been detected. Such a comparison will show has been detected. Such a comparison will show the following reductions of the low-water stages, referred to the Cairo stages: Fulton, 0.74 foot; Memphis, 0.68 foot; Greenville, 1.60 foot; Lake Providence, 1.89 foot. These reductions indicate a lowering of the river bed proportionate to the duration and degree of levee work in the vicinity of the gauge stations.

In addition to these extensive comparative observations, there are others of a local character made near crevasses or temporary outlets. Whenever a resurvey was made after the occurrence of such an outlet, it showed a reduction

of the cross-sectional area below; when made after a closure, an enlargement has been observed.

The result of all observations seems to show a general tendency to an enlargement of the stream, that its capacity for flood discharge has been more than maintained, and that the apprehension of its deterioration from natural causes or levee building may be dismissed as, at least, unproved if not disproved.

The engineers engaged in the reclamation of the Mississippi valley from overflow know more about levee building than they have yet had an opportunity for putting in practice. They are quite aware of many and much needed improvements, both in their construction and in their care and preservation. Up to the present time the compelling need has been, and will be for several years, continuity of line, higher grades and standard sections. Those provisionally used are everywhere below those considered safe for great floods.

The paper, of which the above report gives only a bare outline, was not discussed orally, but communications on the subject from Messrs. L. M. Haupt and L. W. Brown were received and ordered printed without being read. A communication from Col. J. A. Ockerson was read by the secretary. The writer, who is a member of the Mississippi River Commission and was in charge of the surveys mentioned by Major Harrod, stated that no engineer would be surprised that the construction of levees was followed by an increase in the heights of flood discharges. Such an increase was inevitable and provision could be made for it. The question to be settled was whether an increase in these flood heights was attended by a rising of the river bed. This question was partly answered by the results of the surveys already mentioned. They showed that at about half of the cross-sections, the bed was considerably lower after the levees were built, while at the other places it had not changed or was a trifle higher.

The best proof of the value of the levees was to be seen during a trip down the river during a flood. Where the land on either side would have been a swamp or wholly submerged under the old conditions, the traveler would now see men at work in the fields without inconvenience, railway lines would be open for traffic, and all the occupations of the people would be carried on without a thought of the floods in the river, which would formerly have injured or destroyed the country. No one who has had such a scene spread before his eyes can conscientiously question the effectiveness of levees.

Concrete.

The technical proceedings were continued by a discussion of methods of making concrete impervious to water. Mr. J. J. R. Croes mentioned the use of cement pipes, which are impervious, and considered that their success demonstrated the possibility of making water-tight masonry. The usual source of leakage in a concrete structure was along the seams, where the batches of concrete joined. It was comparatively easy to make small masses impervious, but it was difficult to bring them together in such a manner that the completed work would be tight.

Mr. J. W. Schaub believed that concrete itself could not be made impervious, and he referred to M. Considere's well-known experiments confirming that opinion. The concrete could be made tight by plastering it with cement mortar, however, the less sand in the mortar the better the result. In building cisterns he used such a plaster for heads not exceeding 10 feet; for greater heads he covered the plaster with asphalt, and in some cases protected the asphalt with a second cement plaster coat. The asphalt was particularly useful where the concrete was strengthened with steel, as French experiments, already described in The Engineering Record, have shown that water will reach the embedded metal through the concrete.

Mr. Bernard R. Green pointed out that most building stones absorbed water, the amount depending on their character. Hence he could not understand how, by crushing such stone and making it into a concrete with sand and cement, a waterproof mass could be obtained. Mr. R. W. Lesley stated that the impervious properties of the product would largely depend on the use of a very fine cement, with suitable sand and stone of proper size, and on the care taken in making and placing the concrete.

Mr. Oscar Lowinson referred briefly to the preservative processes of Mr. Max Toch, explained in The Engineering Record of March 14, which he had used successfully in recent buildings to protect iron bedded in concrete. He also referred to a remarkable experience in constructing a water-tight floor for a 40x70-foot building in New York. The floor was originally planned with 6 inches of concrete, then a course of asphalt waterproofing, and then 24 inches of concrete. For six weeks, the work remained tight, then a little sweating was observed, and finally about a cubic foot of water a day came through. The concrete was mixed 1:2:4, using good Portland cement and fine stone; the top 2 inches were 1:1 mortar. The sweating was traced through the pores of the concrete for 18 feet to an imperfect place in the asphalt. The work was rebuilt, and the same thing occurred again. Finally the asphalt and top course of concrete were entirely removed, the 6-inch base was covered carefully with new waterproofing, and a layer of brick was laid flat on it in bituminous mortar. This was covered with 15 inches of concrete, and since then the floor has remained dry.

Mr. J. H. Harlow sent a report from one of his assistants on some experiments to determine the effect of adding soap and alum to the concrete on the mixing board. A test pipe of concrete prepared in this way proved so much more impervious than one of the same dimensions prepared without the soap and alum, that these materials were added in making concrete for a reservoir lining. This lining has proved entirely satisfactory. The use of soap and alum as a wash to render brickwork and concrete impervious has been in vogue for years under the name of Sylvester's wash, but the incorporation of these materials in the body of the masonry is very rare.

Prof. W. K. Hatt described some experiments with slabs of concrete made of 2 parts of cement to 5 of fine bituminous ash, strengthened by poultry netting. He found that the addition of silicate of soda to both ash and sand mortars reduces their strength more than 50 per cent.; it reduces the absorption of the ash mortar about 50 per cent. Solutions of soap and alum mixed with ash mortar strengthen it about 50 per cent. and reduce its absorption about the same amount. A soap solution alone diminishes the absorption but does not affect the strength. The addition of soap and alum to sand mortar does not affect the strength noticeably but reduces the absorption about one-half. The impervious concrete is made by first preparing a 5 per cent. solution of ground alum and a 7 per cent. solution of soap. The former is mixed with the mortar in an amount equal to half the quantity of water ordinarily used for gauging. Enough of the soap solution is finally added to bring the mortar to the desired degree of plasticity.

Before any extensive use was made of mortar gauged with such solutions, Mr. Robert W. Lesley advised making a careful investigation of their effect on the concrete. It was possible that injurious chemical reactions might occur through the presence of the alum, which has properties well known in the cement trade. The parian cement, for example, which is employed in imitation marble work, owes its peculiarities to alum. The use of steel in concrete, to which some reference had been made, had become so important that a joint committee of representatives of the American Society for Testing Materials and of steel makers had been appointed to investigate the subject. The importance of the work of such a committee was discussed by several of the members, and it was finally decided on motion of Mr. J. W. Schaub, to refer to the Board of Direction the question of appointing a committee to investigate the subject of steel-concrete and to confer with similar committees of other organizations as well as with private parties and manufacturers interested in such construction.

Bridge Loadings.

The last professional topic to be discussed was the loadings for which railroad bridges should be designed in view of the increasing weights of rolling stock. It was opened with a paper prepared by Mr. Henry W. Hodge, who wrote that so little attention was paid to the subject that one railroad had ordered bridges for the same line for three different loadings within a period of two years. The first bridges were overstrained 33⅓ per cent. within two years of their erection.

The increase in the loading, he stated, was due, first, to the use of large cars to diminish the cost of transportation, and, second, to the use of large locomotives in order to handle the heaviest trains possible. The limit of increase will be reached when the locomotive can no longer be carried safely by the roadbed or when it is impracticable to impose more weight on the drivers.

The supporting power of the roadbed is limited by that of the ballast, the earth subgrade and the joints, and not by that of the rails. Ties are now spaced as close as possible and still permit proper tamping. The ties must be lengthened if more bearing surface is needed. The static pressure on the earth subgrade imposed by a driving axle loaded with 60,000 pounds is about 1,200 ponnds per square foot. Impact will double this amount, but even then the pressure is not so much as well-compacted earth can support. It is therefore safe to assume that the maximum live loads on a railroad will not be limited by the supporting power of the roadbed.

The decisive factor, Mr. Hodge stated, would probably be found in the maximum weight that a driving axle will carry. In order to place all possible weight on the drivers and still keep the locomotive within the clearance height of the bridges and tunnels, the stack and steam dome have been reduced to insignificant size. The width of locomotives is similarly limited, and unless the clearances, vertical and horizontal, are increased by practically rebuilding the roads, it is difficult to see how much more weight can be placed on the drivers. An increase of 15 per cent. is as much as can be expected, in the opinion of locomotive designers, with which Mr. Hodge agrees. On this basis, the heaviest locomotive will have four driving axles loaded with 65,000 pounds each, a forward truck axle with 32,000 pounds, and a tender weighing 168,000 pounds. The wheel spacing will be about the same as for the maximum engines of to-day, save that the distance from the last driver to the first tender axle may be increased from 8 or 9 feet to 14 or 15 feet.

The heaviest cars now used are probably those of the Algoma Central Railway, with a total loaded weight of 144,000 pounds on a length of 24 feet over all. If this is increased

15 per cent., the maximum uniform load will be about 7,000 pounds per linear foot.

Such loads are probable on a few lines only, and Mr. Hodge's purpose in suggesting the possibility of their occurrence was to point out the need of more foresight in ordering new bridges. It is better to build heavier bridges than are needed for the present traffic than to rebuild them every few years, as loads increase.

In the discussion, Mr. J. W. Schaub objected to designing bridges for such heavy loads, which he considered problematical. Cooper's E 50 specification covered everything, in his opinion, that it was safe to run over the present roadbeds. Bridges constructed in accordance with that specification can be safely subjected occasionally to a heavier load, as every bridge engineer is familiar with numerous structures carrying loads considerably in excess of those for which they were designed. It is only necessary to have the structures well built from good plans, to secure an ample margin of safety.

Mr. Emil Swensson referred to an instance when one of the heavy locomotives mentioned by Mr. Hodge had crossed a bridge safely but proved too heavy for the adjoining track, which failed under its weight. In his opinion, the track was often much inferior in strength to the bridges, and was the factor determining the greatest locomotive weights possible.

Mr. T. L. Condron believed that provision for heavy loads could be best made by variations in working stresses rather than in loads. He referred to a table showing the bridge loadings of many railways as well as the unit stresses adopted by them, which showed very clearly that in the practice of the present time the unit stresses play the greater part in fixing the weights of finished bridges.

EXCURSIONS AND SOCIAL FEATURES.

The address of welcome to the Society by General T. F. Davidson, at the opening session, was marked by a tone of appreciation of the value of engineering work which is rarely heard and is correspondingly pleasing. "The world waits upon you," he said in closing, "confident that in the future as in the past, you will ever be in the forefront of every movement for the advancement of knowledge, the progress of civilization, the happiness of mankind."

Gov. Charles B. Aycock's welcome to the Society in behalf of the state of North Carolina was marked by graceful witticisms which were thoroughly appreciated even when made at the members' expense, as in the hint that it might prove useful for those in attendance to remember that the pardoning power of the Governor of North Carolina was remarkably free from restriction. He spoke with evident pride of the famous events in the history of the state and with even greater pride of its natural resources which, he said, were awaiting the engineer's work in order to become a source of great wealth. The size of the state was rarely appreciated, and could be indicated somewhat by the fact that if it was swung around its western extremity as a pivot, its present eastern point would rest on the tract of land that Chicago now tries to occupy. The Governor particularly dwelt on the undeveloped character of the mineral and timber wealth of this great territory, which is practically unknown as yet.

The members and their guests had an opportunity for inspecting the initial section of a railroad intended to develop the timber lands near Asheville. This is the Asheville & Craggy Mountain Railroad. It was originally built for excursion traffic to the summit of Sunset Mountain, the view from which is equaled by few of those that have made Switzerland famous. Through the courtesy of Mr. Richard S. Howland, president of the company, and under the guidance of his son and Mr. R. H. Tingley, M. Am. Soc. C. E., contractor for the reconstruction of the road, the Society paid a most enjoyable visit to the summit, where Mr. Howland had prepared a barbecue under the direction of a famous Georgia expert in such affairs.

The section of the road to the mountain top, operated electrically, is 2.28 miles long, with an average grade of 3.24 per cent. and a maximum grade of 5.5 per cent., which is reached in many places. The sharpest curve has a 150-foot radius. Most of the curves of less than 250-foot radius have a guard rail bolted to the inside of the inside rail and spaced out by separators every 30 inches. The track construction is unusually heavy. The passenger business is merely incidental, as the traffic for which the line is mainly intended is the handling of timber and quarry products. At the top of the mountain, the steam-operated sections begin, one running to the quarries and the other toward large tracts of virgin timber lands. The latter branch is under construction, and now has a finished length of 1.56 miles. The company has trackage rights for freight and passenger cars over the road of the Asheville Street Railway Company, which also tendered the Society an enjoyable excursion over its lines, enabling them to see the city thoroughly and comfortably.

The first great private estate to be developed in this country was "Biltmore," the home of George W. Vanderbilt. Here, under the direction of R. M. Hunt and F. L. Olmsted, a monumental chateau has been built in a setting of gardens, parks, forests and fields, which rival in beauty the famous estates of the Old World. The Society had the pleasure of driving through the grounds and inspecting some of the buildings, thereby acquiring an impression of the beauty of this famous property and the business principles on which its affairs are managed.

The Swannanoa Country Club, one of the leading organizations of this nature in the South, extended the courtesy of its house and grounds to the Society, which took much pleasure in its visits there. The local committee of arrangements gave two handsome cups for prizes in a golf competition; that for the lowest gross score was won by Robert W. Lesley, and that for the lowest net score by Chas. Warren Hunt, Jr.

The opinion of all who attended the convention was unanimously one of deep gratitude to the gentlemen of the local committee, and particularly to Mr. J. L. Ludlow, the chairman, for the many courtesies and entertainments which were enjoyed. "Southern hospitality" will hereafter be a term of very pleasant meaning to all the members at the convention. A word of acknowledgment is also due to the proprietor and manager of the Battery Park Hotel, whose evident aim to make the Society thoroughly at home was frequently mentioned by their guests.



Special Car for Heavy Castings, Bethlehem Steel Company.

A Private Car for the Bethlehem Steel Company.

In connection with the report on page 699 of the discussion on bridge loadings at the recent convention of the American Society of Civil Engineers, The Engineering Record desires to call attention to a private car recently built by the Bethlehem Steel Company for its own use. The company is supplying some very large castings for a 12,000 ton forging press for the Carnegie Steel Company, and this car is for their transportation. Both iron and steel castings are being supplied, some of the latter being of extraordinary size. One of them requires about 325,000 pounds of steel and six 40-ton open-hearth furnaces are employed to provide the metal for it.

This car has two sixteen-wheel trucks connected by bridge trusses, 66 feet 10 inches long and 6 feet deep at the center. The distance between the king bolts is 64 feet. The car is 103 feet 10½ inches long over the couplers, 10 feet 2¼ inches high and 9 feet 9 inches wide. It weighs 196,420 pounds and has a rated capacity of 300,000 pounds.

The largest car hitherto constructed was probably that used by the Pennsylvania Railroad for transporting a Krupp gun to the Columbian Exposition. It also had thirty-two wheels, but its rated capacity was somewhat less than that of the new car.

The Continuation of Steel Prices for 1904 at the same rates as are now in force, which has been announced by the United States Steel Corporation, is of particular interest because those prices make it profitable for German rails to be sold on the Pacific coast. The Oregon lines of the Southern Pacific Company are now being relaid on the mountain divisions with 80-pound rails from that country.

Pneumatic and Electric Revolving Cranes.

The accompanying illustrations furnish general diagrams of two types of revolving traveling cranes recently constructed by the Garry Iron & Steel Company, of Cleveland, Ohio. The pneumatic crane is typical of the general design of a number of such appliances of 2,000 to 10,000 pounds capacity, although its dimensions depart from the standards adopted by the makers. As a rule, the reach is 12 feet, the lift of the hook 12½ feet, and the total height from the rail to the top of the boom 15 feet 8 inches. They can be mounted on a fixed foundation if desired, but are generally employed on a flat car of standard gauge. The cars are usually provided with rail clamps to prevent their overturning while lifting a heavy load, as they are not sufficiently heavy of themselves for this purpose. If desired, however, they have a counterweight on the turntable, as in the illustration, to obviate the use of the rail clamps.

The crane base is bolted directly to the car and has a machined ball race or track around its upper edge, which contains 193 ground steel balls. The base is machined inside to receive the pivot, guides, and the operating cylinder and rack, while outside it has a projecting ring with its lower surface machined as a bearing for the rollers and brake attached to the turntable. The brake is operated by a foot valve with the stem rising through the turntable as indicated in the drawing.

The hoisting device consists of a boom of trussed channels, either hinged or riveted to the supporting framework as the purchaser desires, and a pneumatic cylinder attached to the inboard end of the boom. The cable is ordinarily rove in two parts for a 12½-foot lift, although this can be modified for other lifts. The air is applied in such a manner that the operator can control all the movements of the crane from one position on the turntable.

The crane is also supplied with a fixed horizontal boom, if desired, on which a trolley racks in and out, thus affording four applications of power. If it is desired to have the car self-shifting it can be supplied with a motor or with a hand-power traversing gear. Such self-contained cranes are employed for loading canal boats, freight cars and similar purposes by a number of railway companies, although designed primarily for use in industrial establishments where heavy lifting has to be done at so many places that fixed cranes are hardly applicable. In the smallest cranes of this type, the operations are entirely performed by hand but the general arrangement is the same as that illustrated.

The electric crane shown in the second illustration was built for a malleable iron foundry, where it is employed for removing the plug from the top of the furnace for charging. The load is hoisted and racked in and out, the turntable is revolved and the car is traversed on its track by electricity. Owing to the limited head-room, the boom is of special design and is provided with a counterweight to offset partially the load to be lifted. The gauge of the track about the annealing furnace is 18 inches and the car is accordingly provided with four small wheels or casters, which clear the plate floor but prevent the crane from tipping when traveling about the works on such a narrow gauge. The crane is also useful for charging the furnace by means of long dump buckets, instead of by hand.

When possible the track should be of broader gauge and the car wider and of greater wheel base than is here shown. The crane illustrated was designed to fit the existing industrial tracks and turntables, which accounts for the scant dimensions.

Letters to the Editor.

Web Members in Indeterminate Frames.

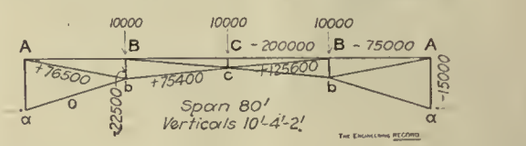
Sir:—I am glad that Mr. G. M. Braune, in your issue of May 9, has pointed out at least one source of a more or less common notion about the insignificance of web members in indeterminate frames. Stoney thought he had proven that web members in a simple truss may be disregarded in the deflections, but Prof. Johnson shows his proof to be valueless. He had used a shallow Warren truss in his demonstration, where the web members are short and the chords are stressed relatively high. It may be true in a two-hinged arch with one chord a parabola, under uniform load, that the web members and even the straight chord will have little effect in determining the horizontal reaction, since the equilibrium polygon will probably follow approximately the curved chord and the other members will have little stress.

1	2	3	4	5
Member.	p	l	$\frac{1000000\ p\ l}{E}$	Area.
Aa	+ .30	120	+ 1.241	4
AB	+ 1.50	240	+ 12.410	8
BC	+ 4.00	240	+ 33.100	20
ab	— 1.04	251	— 9.000	4
bc	— 2.51	241	— 20.860	8
Ab	— 1.53	245	— 12.930	6
Bb	— .25	48	— .414	4
Bc	+ 2.51	241	+ 20.860	12
			Totals	

6	7	8	9
Vertical loads.	$\frac{1000\times p\ u\ l}{E}$	1000 lbs. Hor. at a.	$\frac{1000\times p\ u\ l}{E}$
u	E	u	E
— 3750	— 4.654	+ .075	+ .093
— 9375	— 116.350	+ .188	+ 2.333
— 10000	— 331.000	+ .200	+ 6.620
0	.0	— .260	+ 2.340
+ 9425	— 196.600	— .314	+ 6.550
+ 12750	— 164.850	— .255	+ 3.300
— 5625	+ 2.329	— .063	+ .026
+ 10467	+ 218.300	+ .209	+ 4.360
	— 592.825		+ 25.622

As Mr. Braune states, Prof. Mueller-Breslau finds that to count in the web members in finding the horizontal reaction for temperature stresses gives considerable difference in the result. In this case the equilibrium polygon is a straight line and the diagonals take a larger share of the stress. For unsymmetrical loading the equilibrium polygon will also take a different line than the chord of the truss, and it will not always follow the chord for uniform loading.

It seems to me, therefore, that in finding this difference in the horizontal reaction for temperature stresses, Prof. Mueller-Breslau proves himself the incorrectness of his statement in italics that the web members may be disregarded. One case shown to agree with that statement can have a meaning only when applied to an arch of similar outlines and loaded in a similar manner. One case shown not to

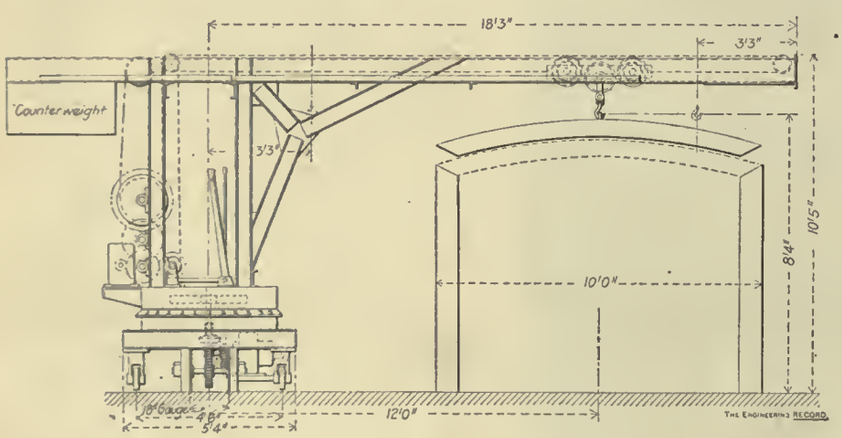


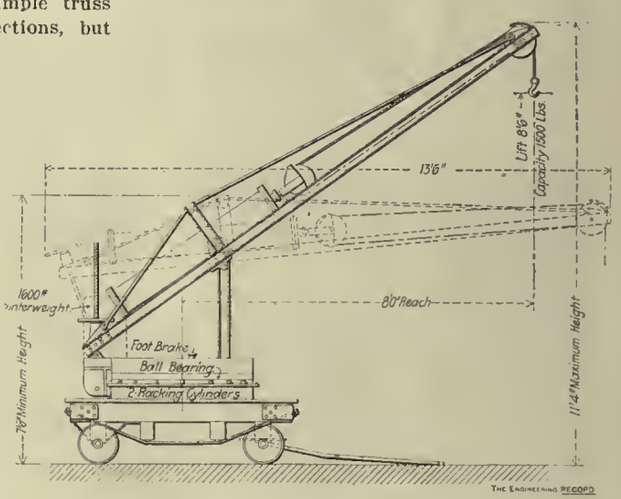
agree with it breaks down entirely its claim to general applicability.

The accompanying table shows the calculations by the deflection method of the horizontal reaction of the arch shown in the figure. Columns 7 and 9 give the partial deflections for stresses due to the given vertical loading and for 1,000 pounds applied horizontally at *a* respectively. The deflection for 1,000 pounds at *a* is .0256 inch, and the "kick out" for the vertical loading is .5928, considering the arch as a simple truss. To bring point *a* back to its normal position will therefore require a horizontal reaction of 23,140 pounds. Taking out the values in columns 7 and 9 for the chords only this reaction would be 36,090 pounds. Only one-half of the members are considered in the above on account of the symmetry.

Yours truly, Edward Godfrey.

Pittsburg, Pa., June 8, 1903.





Revolving Traveling Electric and Pneumatic Cranes.

An Opportunity.

Sir:—I require a gentleman, who is able and willing to invest $150 towards incorporation of a Great Electric Elevated Road Company. He will get a position with salary and shares for it. Do you know someone? Eventually a man, who is an expert in steel-bridge work, he would get a position as technical adviser. I don't want a rich man. $50,000 in cash have been offered by a great concern for the right to control the stock of the new company, but we refused.

It is an improved trolley-car system for most

rapid interurban traffic. Patented in U. S. and Canada. Approved besides by committee of experts and European academies.

If you desire a commission for your efforts, please state it. But I pay no commission in advance.

Respectfully yours, DR. A. BRODBECK,
Inventor and Patentee of Air-Cars.
32 S. Second East.
Salt Lake City, Utah, June 3, 1903.

The Floods in the Mississippi Valley.

From a number of sources The Engineering Record has received notes concerning the effect of the recent floods in the Mississippi River valley on engineering works, some of which are of general interest. Mr. Charles S. Denman, secretary and manager of the Des Moines Water Works Company, wrote that his pumping station was nearly submerged. The water was held back by a levee within a few feet of the building, and the river surface was at one time 8 feet 5 inches above the engine room floor. The suction well is also located back of the levee and the head of water in it was 4 feet above its top, putting an upward pressure on the cover. As the well is 50 feet in diameter it may be understood without trouble that this upward pressure had a considerable total amount. There was a 6-foot head on the suction pipes. The levee was held in place only by the most strenuous effort, and there was a large amount of seepage through it and the ground behind. The experience was worse than anything before encountered, and the company is now casting about to determine the best method of rendering the plant safe in case of another such flood.

Mr. W. B. Storey, Jr., chief engineer of the Atchison, Topeka & Santa Fe Railway, writes that so far as the railways are concerned, the greatest damage was done in Kansas City, Kan., where thousands of box cars loaded with freight were flooded, tracks washed out, buildings demolished and bridges washed away. In his company's yards a hole 300 feet long, 150 feet wide and nearly oval in plan, was scoured to a depth of over 20 feet, evidently by some whirlpool motion of the water. When the letter was sent, his company had already found four locomotives and two coaches in this hole and had not then reached the bottom. The soil had been excavated from under the tracks, allowing the locomotives and coaches to drop into the pit, where they lay mixed up with debris and track material. Between Topeka and Kansas City, a distance of 66 miles, the road was under water for 60 miles, at some places to a depth of 12 feet.

Mr. A. A. Trocon, of the Midland Bridge Company of Kansas City, Mo., wrote that the rise in the Missouri River reached an elevation of 35 feet above low water, several feet higher than the flood of 1881 and within 2 feet of that of 1844, the highest on record. Mr. C. C. Hughes, of the engineering staff of the Metropolitan Street Railway Company of Kansas City, stated that measurements indicated a rise in the Kaw (or Kansas) River 10 feet above that in the Missouri; so that it must have gone several feet higher than in 1844. This extreme height was caused by the Kaw valley being built up with large substantial buildings used for packing plants, wholesale houses and manufacturing establishments, which acted as dams to obstruct the flow of the water.

The Kaw River rose out of its banks some distance west of Topeka, reaching to bluffs or higher ground on either side and forming a stream several miles wide in many places. This flood of water reached Argentine, Armourdale and the two Kansas Cities, all heavily populated, where the swollen stream swept the buildings at a swift rate into the Missouri. The latter river, being 10 feet lower, acted as a spillway and caused the waters of the Kaw to flow with a high velocity. It was this current which caused most of the loss of life and destruction of property. Of the seventeen bridges over the Kaw in the vicinity, but one is standing. The others were carried off their piers and abutments by the wreckage which floated down on them and lodged against them until they broke away. The one structure which did not go out was a heavy double-track bridge built about a year ago by the Missouri Pacific Railway, which weighted it with a number of locomotives. It is possible that some of the foundations of its piers may be undermined, but it is impossible to determine this until the waters recede.



The Melan Bridge at Topeka during High Water Last Year.

It is fortunate, as Mr. Trocon points out, that the June rise of the Missouri River, caused by the melting snows in the mountains, was somewhat retarded this year by the lateness of the season. The weather has continued cold in that territory so that the snow has not melted fast. The results of the simultaneous occurrence of the two floods would have been terrible beyond imagination.

The situation at Topeka is described in a letter from Mr. John A. Dailey of the engineering department of the Atchison, Topeka & Santa Fe Railway, who ascribes much of the disaster to injudicious bridge construction, restricting the waterway of the Kaw River. The river had been spanned by a bow-string structure for all classes of traffic. This became overstrained by the increasing weight of the traffic and it was decided to construct a new bridge, two new bridges, in fact, for the street railway company refused to join with the city in building a union structure and erected one for its own service. The city, in Mr. Dailey's opinion, sacrificed an unobstructed waterway for an ornamental structure on the Melan system. Its appearance during the high water of last year is shown in the accompanying cut. It was an expensive structure, and with a view of reducing the cost as much as possible, it was decided to reduce the number of arches originally planned and fill in a portion of the waterway to form an approach. The total amount of the restriction of the channel brought about in this manner is stated by Mr. Dailey to have reached the surprising total of forty per cent.

The street railway company built a simple pile trestle some 15 feet above the Melan bridge which masked the upper face of the latter and imposed an additional obstruction in the river channel. The bents of this bridge can be seen below the arches in the illustration, and are assumed to have added ten per cent. more obstruction to the flow of water.

These encroachments on the river were followed by the action of the Chicago, Rock Island & Pacific Railway in removing a shore span of its bridge and substituting a filled approach. The shore was filled out, a roundhouse built upon the land thus reclaimed and the construction of an extensive yard was nearly finished when the floods occurred. The result of these changes is stated as follows by Mr. Dailey:

"The obstruction of the Melan arch and its approaches so impeded the stream that the water rose to the chords of the Rock Island bridge, which, being weighted down by heavily loaded cars, resisted the rushing flood and formed a second and auxiliary dam with the accumulated drift. These two obstructions raised the water for miles upstream. The banks of the south side being high and precipitous, the water flowed over a low place on the north bank at a point about a mile and a half above and swept with irresistible force over the old channel, overwhelming all North Topeka, and joined with Solder Creek near its mouth. Meanwhile the immense volume of water had risen so that the drift had lodged against the Santa Fe bridge and a third dam was added; these three dams retained an immense volume of water so that the fall of the flood was very slow."

Additional Water-Works for Glasgow, Scotland.

The water-works of American cities are not the only ones which have difficulty in keeping up with the rapid increase in per capita as well as in total consumption. Even so well regulated a municipality as Glasgow has found that the limit of supplies has been reached some years in advance of the time expected. The principal supply has for years been taken by an aqueduct from Loch Katrine. It is supplemented by a second aqueduct built in 1885 from the loch to Mugdock reservoir near the city. It was anticipated that this provision would last for at least 30 years, but, according to the Glasgow "Herald," the consumption increases at the rate of 2,000,000 gallons per day and the available supply will soon be exhausted. The quantity of water sent to the city is now about 60,000,000 gallons per day. It is now proposed to dam the stream flowing from Loch Arklet at a point about 1½ miles west of the loch and to connect the loch as thus enlarged with Loch Katrine by a tunnel through the divide, about ¾ mile long. It is expected that this work will add 4,120 acres to the drainage area and 10,000,000 gallons per day to the supply, after providing for compensation water. This development, it is believed, will be sufficient for about 15 or 20 years. About 15 years have passed since authority was granted for the works now proposed. At this rate, the studies for further extensions will have to be taken up within a few years.

Book Notes.

American Street Railway Investments—Tenth Year. Published annually by the "Street Railway Journal." New York: McGraw Publishing Company. 305 pages, 9½x13 inches, illustrated. Price, $5. This is the tenth annual volume. This edition contains reports of 1,361 companies showing in detail the financial and physical condition of the properties. Of this number nearly 1,300 reports are of an official character, the information being furnished by the railroad companies themselves. These figures include both operating and leased roads, and include data of all new roads. The figures given are for all important consolidations during the year. The reports of companies are this year arranged by states, instead of alphabetically by towns as heretofore. The book contains about 25 folding maps, some in colors, of the most important street railway systems in the United States. It also contains a table showing by comparison the gross receipts of all companies earning $25,000 or more for the years 1901 and 1902. The report in each case is followed by the date of the information as supplied by the street railway company making the report. This is an important feature to any one who desires accurate information.

The new edition of the "Handbook" of the Passaic Steel Co., prepared by its chief engineer, Mr. George H. Blakeley, is a manual containing in addition to the usual illustrations and tables of steel shapes rolled by the publishers, an unusually complete collection of tables and data useful to the structural engineer. Particular attention has been paid to the design of built members, foundations and simple roof and bridge trusses, and tables and diagrams are given for facilitating their calculation. The book is issued for free distribution to the company's patrons; to others the charge is $2, in accordance with the usual custom concerning such books. (New York, Passaic Steel Co., 7x4 inches, 324 pp., flexible leather binding).

The "Proceedings" of the Brooklyn Engineers' Club for 1902 contain the following papers: The Nernst Lamp, by Calvin W. Rice; Electric Welding, by Charles Ekstrand; Some Designs for Mechanical Filtration Plants, by R. D. Chase; Movements of the Sea and Their Effects, by J. Calvin Locke; Clay Conduits for Electrical Cables, by Frederick S. Woodward; Public Works in the Tropics, by O. F. Nichols, and Engineering Notes on Hawaii, by Arthur S. Tuttle. (Brooklyn, The Brooklyn Engineers' Club; 9x6 inches, 163 pp., $2).

A Memorial to Charles Eliot, Landscape Architect.

There have been many monuments erected to perpetuate the memories of individuals, for various reasons. One of the simplest and most appropriate has recently been suggested in honor of the man who was one of the foremost leaders in securing and improving for the Boston metropolitan district the reservations which now form its beautiful park system. Mr. Eliot did, also, a wider public service "in arousing an intelligent general interest in the opportunities for making the earth beautiful instead of ugly when adapting it to the use of man." Instead of building a monument, it is proposed by the Metropolitan Park Commission and a special committee to construct a "Charles Eliot Path"' around the summit of Great Blue Hill, from which some of the finest views of the district are to be had. At one place where there is a broad outlook, the path will cross a small ravine, which it is suggested to span with a rustic stone arch bridge. Against a rock forming one abutment of the parapet is to be placed a bronze tablet "dedicating to the memory of Charles Eliot, the bridge, the path, and the landscape itself, a monument of a grandeur unapproachable by any human construction."

Directory of National Engineering Societies.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th Street, New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st Street, New York.

American Institute of Electrical Engineers. Annual convention at Niagara Falls, N. Y., June 29 to July 3. Secretary, R. W. Pope, 95 Liberty Street, New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John Street, New York.

American Water Works Association. Secretary, J. M. Diven, Elmira, N. Y.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth Street, Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Convention at Niagara Falls, N. Y., July 17 and 18. Secretary, W. M. Mackay, 235 Water Street, New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester Street, Montreal.

Society for the Promotion of Engineering Education. Convention at Niagara Falls, N. Y., July 1 to 3. Secretary, Prof. C. A. Waldo, Purdue University, Lafayette, Ind.

American Society for Testing Materials. Convention at Delaware Water Gap, N. J., July 1 to 3. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

Personal Notes.

Mr. C. G. Locke has been appointed assistant to the city engineer of Cleveland, O.

Mr. C. W. Swearingen has moved his offices from Great Falls, where he was city engineer for some years, to Kalispell, Mont.

Professor Walter D. Blair has been appointed professor in charge of design in the College of Architecture, Cornell University.

Mr. Joseph Hofman has been appointed assistant to Mr. F. I. Consaul, chief engineer of the engineering department of Toledo, O.

Mr. T. F. Manville, of the H. W. Johns-Manville Company, has sailed for Europe, with his family, to attend to business of the London branch of the company.

Prof. Forrest R. Jones, professor of machine design at the Worcester Polytechnic Institute, has been elected to a similar chair in Sibley College, Cornell University.

Prof. Charles Derleth, for some time at the University of Colorado, has accepted the position of assistant professor of civil engineering at the University of California.

Mr. W. T. Jackson, of the Cincinnati office of G. M. Gest, has been making a tour of the northeastern States to examine the conduit construction by his principal in that territory.

Mr. L. K. Sherman has resigned from the bridge department of the Atchison, Topeka & Santa Fe Railway to become engineer of the Geisel Construction Company of St. Louis.

Messrs. E. T. D. Myers, Jr., John H. Finney and Hugh S. Morrison have formed a partnership under the firm name of Myers, Finney & Morrison and have opened offices in Richmond and Washington.

Mr. E. LaLonde has resigned the superintendency of the Antigo, Wis., Water Co., after thirteen years' service, and is succeeded by Mr. R. N. Kutchins, formerly in the employ of the Oshkosh Water Works.

Prof. Albert Kingsbury, M. Am. Soc. M. E., has resigned as professor of applied mechanics at the Worcester Polytechnic Institute to take up mechanical engineering work for the Westinghouse Electric & Mfg. Co., at East Pittsburg.

Mr. William Burlingham has accepted an appointment as chief engine-designer with the B.F. Sturtevant Co., of Hyde Park, Mass., resigning a position in the United States Inspection Office with the Wm. R. Trigg Co., of Richmond.

Mr. Wesley Steele, M. E., formerly with the Perth Amboy Terra Cotta Co. at the Perth Amboy works, has taken a position in the sales department of the A. D. Granger Co., contracting engineers at the New York office, 95 Liberty Street.

Mr. Charles F. McKim has been awarded the King's gold medal by the Royal Institute of British Architects. The presentation was made a notable function. Mr. McKim, in his acceptance, stated that he regarded the award as a tribute to the entire architectural profession in America rather than a personal distinction.

Mr. Stephen W. Baldwin, who for over 20 years has ably represented the Pennsylvania Steel Co. in New York as sales agent, will retire from active service on July 1, although he will retain a connection with the company in an advisory capacity. Mr. A. E. Aeby, who has long been connected with the New York office, will succeed Mr. Baldwin.

Mr. B. E. Palmer, recently appointed superintendent of the Rocky Mountain division of the Northern Pacific Ry., was born in Pennsylvania in 1866. Since 1887 he has been employed in railway engineering in the Northwest, most of the time with the road which has lately transferred him to the operating department. He has been on location, construction, maintenance and bridge work, being for a while resident engineer of the division of which he is now superintendent. His headquarters will be at Missoula, Mont.

Capt. Charles W. Rae, who has already been announced as the successor of Rear-Admiral George W. Melville, when he goes on the retired list in August, has been nominated by President Roosevelt. He is a native of Connecticut, entered the navy in 1866 and was assigned to the engineer department. He reached the grade of commander in 1899 and recently was made captain. Since May, 1900, he has been stationed in Washington as a member of the naval examining board, rendering signal service during the Spanish war.

Col. Alexander Mackenzie, for many years the principal assistant in the office of the Chief of Engineers, U. S. A., has been assigned to the General Staff, and will be succeeded by Major Harry F. Hodges. Capt. William V. Judson has been appointed the latter's chief assistant and Capt. Charles W. Kutz has been appointed disbursing officer at the Corps headquarters. Capt. Mason M. Patrick, at present in the last position, has been transferred to West Point as instructor in military engineering and commander of the detachment of engineers there. He will have charge of the construction of the new water-works and possibly of other improvements.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.
ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

For Proposals see pages 27, 28, 29 and 33.

WATER.

Oakland, Cal.—City Engr. Turner has about completed an estimate for a salt water sprinkling plant covering nearly the whole city and using c. i. pipe. He is also preparing an alternative plan, using wooden pipes, but covering a somewhat smaller area.

Sausalito, Cal.—A press report states that the Tamalpais Land & Water Co. is about to reorganize for the purpose of extending its mains and supplying water to Tiburon, Belvedere and Sausalito; the new company will be known as the Mill Valley Water Co. and have a capital of $500,000.

Los Angeles, Cal.—At a meeting of the Water Comrs., June 15, Supt. Mulholand advised the purchase of a site for another reservoir, to replace the Angeleno Heights basin.

**San Jose, Cal.*—T. S. Montgomery, Secy. Bd. Mgrs., writes that the contract for erecting a steel water tower at Agnews State Hospital (bids opened June 10) has been awarded to Clark & Henery, of Stockton, for $8,493.

Redlands, Cal.—The Bear Valley Mutual Water Co. is reported incorporated, with a capital of $2,000,000. The company proposes purchasing from A. G. Hubbard the reservoir and dam site on Fillare flats, in Santa Ana Canyon. On this property a reservoir will be constructed to increase the water supply of Redlands and surrounding country.

San Bernardino, Cal.—H. Allison, City Clk., writes that it is proposed to construct water works. J. J. Hanford and C. F. Riley are among the water works trustees. E. A. Rasor, City Engr.

Portersville, Cal.—The City Clk. writes that the Pioneer Land Co. proposes installing a new system of water works. He further states that there is talk of municipal water works.

Denver, Colo.—The State Land Bd. is stated to have granted a site of 400 acres on Dolorea River to the Montezuma Valley Irrigation Co. for a reservoir.

Lamar, Colo.—Geo. S. Henry, of Denver, writes that it is proposed to construct an irrigation system near Lamar, to cost about $750,000, to be known as the Chaquaqua Irrigation system.

Hotchkiss, Colo.—According to press reports, Gordon Kimball estimates the cost of constructing water works for Hotchkiss at $30,000. A vote will soon be taken on question.

**Grand Junction, Colo.*—Frank G. Leslie, City Clk., writes that Geo. R. Barton has secured the contract for a skimming system and larger reservoirs for the water works, at $8,000.

Fountain, Colo.—It is stated that a chain of reservoirs is to be built near Fountain, for irrigation purposes, by a syndicate headed by W. C. Johnson, of Denver.

Glenwood Springs, Colo.—See "Power Plants, Gas and Electricity."

Summerville, Ga.—It is stated that bids are wanted July 8 for $25,000 water and sewer extension bonds. I. I. Hickman, Treas.

Sandersville, Ga.—See "Power Plants, Gas and Electricity."

Augusta, Ga.—The citizens on June 22 voted to accept the act incorporating the Augusta Water District. W. B. Getchell, City Engr.

**Atlanta, Ga.*—The Holly Mfg. Co., of Lockport, N. Y., is stated to have secured the contract for a pump to be erected at the Chattahoochee pumping station. It will have a daily capacity of 18,000,000 gals. and coat about $98,000

Griffin, Ga.—See "Power Plants, Gas and Electricity."

Sand Point, Idaho.—See "Power Plants, Gas and Electricity."

Chicago, Ill.—Bids are wanted July 2 for furnishing material and removing existing foundations of enginea, furnishing and driving necessary steel sheeting, sinking and constructing a 7-ft. shaft and 5-ft. tunnel, and constructing new concrete foundation for a 25,000,000 gal. Riedler pump at the Chicago Ave. pumping station. F. W. Blockl, Comr. Pub. Wks.

Bids are wanted June 30 for 26 pieces flanged water pipe 36 in. in diameter, with necessary bolts and washers. F. W. Blockl, Comr. Pub. Wks.

Sioux City, Ia.—The lowest bid received on June 15 for 74,000 lin. ft. of c. i. water pipe was submitted by the U. S. Cast Iron Pipe & Fdry. Co., of Minneapolis, Minn., at $34.20 per ton for 4 in.; $32.70 and $31.70 for 6 in.; $31.70 and $31 for 8 in.; $31 for 12 and 16 in., and 3 cts. per lb. for 30-in. c. i. pipe flanged.

Shellsburg, Ia.—H. Dickinson, Chmn. Water Com., writes that it is proposed to construct water works to coat about $4,000.

Aurelia, Ia.—The citizens are reported to have voted to construct water works.

Fredericksburg, Ia.—Bids are wanted July 1 for constructing water works, including steel tower and tank, furnishing and laying pipe, specials, hydrants and gates, pumping station, gasoline engine and deep well pump. H. B. Carpenter, Mayor.

Hedrick, Ia.—It is reported that the Iowa Central will build a reservoir here. Howard Kelley, Ch. Engr., Minneapolis, Minn.

Horton, Kan.—See "Power Plants, Gas and Electricity."

Missoula, Mont.—See "Power Plants, Gas and Electricity."

South Deerfield, Mass.—Bids are wanted June 30 for constructing water works. J. B. Bridges, Chmn. Water Comrs.

Kiester, Minn.—Bids are wanted July 16 for constructing water works. C. W. Teutena, Village Recorder.

Kansas City, Mo.—Mayor Reed, of Kansas City, Mo., and Mayor Gilbert, of Kansas City, Kan., have signed an agreement which provides that Kansas City, Mo., will build a 30-in. main across the flow line suspension bridge. This main will be loaned to Kansas City, Kan., for a period of nine months, at the end of which time it will revert to Kansas City, Mo.

Philipsburg, Mont.—The citizens are reported to have voted to issue $10,000 bonds for water works.

**Great Falls, Mont.*—D. L. Ellis, City Engr., writes that the following bids were opened on June 15 for valves, hydrants, etc.: Hoge & Swift, Portland, Ore., $2,108 (awarded contract); Crane Ordway Co., St. Paul, Minn., $2,351; J. B. Clow & Sons, Chicago, Ill., $2,282; A. M. Ozburn, Chicago, Ill., $1,974; Kennedy Valve Mfg. Co., N. Y. City, N. Y., $2,199; Chas. C. Moore & Co., San Francisco, Cal., $2,765; R. D. Wood & Co., Philadelphia, Pa., $2,276.

Bids will be called for about July 15 for labor necessary for laying about 4 miles of 6 and 8-in. water mains, the city to furnish the material, the contractor to furnish all labor and tools necessary; probable cost of work, $10,000. There is an opening here for a good contractor.

Stuart, Neb.—It is stated that bids are wanted July 6 for constructing water works, to include a 12x 28-ft. brick pumping station, 20-H.-P. gasoline engine, 5½x8-in. valve boxes, etc. Address F. R. Stearns.

Hampton, Neb.—E. L. Ingalls, Village Clk., writes that the citizens will be asked to vote on the question of issuing bonds for the construction of water works.

Jersey City, N. J.—Bids will be received June 30 by the Bd. of Street and Water Comrs. for furnishing and delivering c. i. water pipe. Engineer's estimate about 200 lengths 4-in. pipe, to weigh 20.3 lbs. per lin. ft.; 200 lengths 6-in. pipe, to weigh 33 lbs. per lin. ft.; 500 lengths 8-in. pipe, to weigh 48 lbs. per lin. ft., and 25 lengths 20-in. pipe, to weigh 175 lbs. per lin. ft. Geo. T. Bouton, Clk.

New Village, N. J.—The New Village Land & Improv. Co. has been incorporated, with a capital of $10,000, by Johnston Cornish, of Washington; R. S. Young, of Easton, Pa., and others. It is proposed to furnish New Village and Stewartsville with water.

Long Island City, L. I., N. Y.—Mayor Low has approved the resolution of the Bd. of Estimate and the Bd. of Aldermen authorizing an appropriation of $200,000 for improvements to the water supply of Queens Boro.

Riverhead, L. I., N. Y.—A committee of Supervisors with Mr. Hauser as Chmn. is reported to be in favor of the county establishing an independent water system.

Alexandria Bay, N. Y.—Bids will be received July 8 by the Village Bd. of Trus. for constructing water works and sewers, as advertised in The Engineering Record.

New York, N. Y.—The lowest bid opened on June 18 by Robt. Grier Monroe, Comr. of Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains in Lenox, Park and Vanderbilt Aves., in 39th, 42d, 51st, Centre and Spruce Sts., and in Bway. and Park Row, was submitted by John Cornwell, Jr., 69 E. 127th St., for $72,382. He bid for 710 tons straight pipe, $34 per ton; 35 tons of branches and castings, $62 per ton; for laying 15,115 lin. ft. 24, 20, 16, 12 and 6-in. pipe, $1, 80 cts., 65 cts., 50 cts. and 35 cts. per lin. ft.; for 3,020 sq. yds. asphalt pavements and artificial stone sidewalk, $3.50 per sq. yd., and 1,310 sq. yds. granite block on concrete foundation, $1 per sq. yd.

New York, N. Y.—See "Paving and Roadmaking."

Schenectady, N. Y.—The Schenectady Ry. Co. has made a proposition to the Water Comrs. to install a new electric pumping plant at the site of the present wells in Rotterdam for increasing the water supply of the city. R. H. Fraser, Gen. Mgr., Schenectady.

Brooklyn, N. Y.—The following are the principal items of bids received June 16 by the Dept. of Water Supply, Gas and Electricity for laying a 48-inch trunk water main at Ridgewood reservoir—*a*, Lloyd Collis; *b*, N. Y.-Continental-Jewell Filtration Co.; *c*, Isaac Harris:

	a	*b*	*c*
Cast iron pipe, 5,400 tons	$32.50	$31.00	$33.75
Special castings, 60 tons	70.00	65.00	60.00
Laying 48-in. pipe, 16,000 ft.	4.25	3.00	4.50
Laying 36-in. pipe, 100 ft.	3.00	3.00	2.25
Laying 30-in. pipe, 50 ft.	3.00	3.00	2.25
Laying 20-in. pipe, 100 ft.	2.00	3.00	1.00
Laying 12-in. pipe, 150 ft.	1.50	3.00	.60
Excavation, 1,000 cu. yd.	1.00	1.00	2.00
Stopcocks, 12—36-in., 17, total	5,200	4,700	3,915
Macadam, relay, 4,000 sq. yd.	.50	1.00	.25
Block pavt., relay, 6,500 sq. yd.	.45	.30	.25
Cobblestone, relay, 2,000 sq. yd.	.45	.25	.15

Wayland, N. Y.—C. C. Hopkins, of Rome, is stated to be preparing plans for the proposed water works to cost $25,000. F. A. De Graw, Village Clk.

Lexington, N. C.—See "Power Plants, Gas and Electricity."

Youngstown, O.—This city will probably erect another standpipe in the 2d Ward. Wils Hamilton, Supt. Water Wks.

Ottawa, O.—It is stated that water works will be constructed here, to cost about $50,000.

Oklahoma, Okla. Ter.—Chas. S. Wadsworth, City Engr., writes that an election will soon be held to vote on issuing $100,000 bonds for water extensions, and $150,000 for brick and tile sewer construction. D. A. Johnston, Supt. Water Dept.

Ione, Ore.—It is reported that bids are wanted by the City Recorder for the purchase of $9,000 water bonds.

Coopersburg, Pa.—Bolton G. Coon, of Kingston, Pa., is stated to have submitted the lowest bid for constructing water works, at $18,676.

Harrisburg, Pa.—Jas. H. Fuertes, of New York, N. Y., is stated to have completed plans for the proposed filtration plant.

Titusville, Pa.—The City Council on June 15 authorized the Com. on Water and Light to secure bids for a 150-H.-P. boiler for the water and light plant. W. M. Dame, City Clk.

Uniontown, Pa.—The Marchland Water Co., of Uniontown, has been incorporated, with a capital of $25,000.

Shippensburg, Pa.—B. F. Landis, Supt. Water Wks., writes that it is proposed to construct a reservoir, to cost about $8,000. Engineer, Mr. Dechant, of Reading.

**Meadville, Pa.*—Palm & Nipple, of Meadville, secured the contract for pump, boiler house and foundation for $10,621, and J. R. Dimmick & Co., of Pittsburg, for pipe at $29.15 per net ton (bids opened June 16). Geo. S. Cullum, Supt. Water Comrs.

McKeesport, Pa.—It is reported that the Bd. of Water Comrs. has recommended the issue of $150,000 bonds, for an improved water supply.

Lennox, S. D.—H. C. Newendorp, Town Clk., writes that the citizens voted June 17 to issue $8,000 bonds for water works. Mr. Howe, of Sioux Falls, S. D., is the engineer.

Sioux Falls, S. D.—Bids will be received by the Bd. of Water Comrs. until July 11 for constructing a water works distribution pipe system requiring approximately 21½ miles of 4 to 20-in. c. i. pipe, 1½ miles of 1½-in. galvanized wrought iron pipe, 30 5-in. and 113 4-in. fire hydrants, 93 gate valves and boxes from 4 to 20-in. in size and 38 1½-in. valves. Lowcth & Wolff, Engrs., First Nat. Bank Bldg., St. Paul, Minn.; W. R. Marshall, Secy. of Bd.

Beaumont, Tex.—The Arroyo Canal Co. is reported incorporated, with a capital of $250,000, to construct an irrigation system; also a large rice mill. F. J. Hooks, of Lountze; A. F. Hester, of Brownsville, and J. B. Douchette, of Woodville, are among the incorporators.

Charleston, Utah.—The Pioneer Irrigation Co. has been incorporated, with a capital of $4,160. Geo. H. Bagley, Pres.; James Ritchie, Sec.; office to be at Charleston.

Provo, Utah.—A press report states an estimate of the cost of connecting the Provo water works with the upper falls in Provo Canyon has been presented by the Telluride Power Co. to City Council; cost estimated at $130,528.

Tacoma, Wash.—The Mt. Tacoma Water Supply Co. has been incorporated to supply Orting and Puyallup with water. A pipe line will also be laid to Tacoma. Geo. Browne and J. W. Browne, of Tacoma, and Wm. Colegrove, of Orting, are the incorporators. It will get its water supply from Crater Lake on the northern side of Mt. Rainier.

**Tacoma, Wash.*—The following bids were opened June 16 for the middle service city reservoir: C. A. Sayre, $17,480; Geo. Milton Savage & Co., $17,275; Northwest Bridge Co., $17,991; Rydstrom & Bihler, $16,890; F. A. Keasal, 1004 N. O St., $15,774 (awarded contract); John Huntington, $15,850. The work embraces 28,270 cu. yds. of excav.; 5,784 sq. yds. lining, 4-in. concrete and ¾-in. mortar coat, with asphalt joints; 30 cu. yds. concrete and brick masonry; 4 manholes for outside gate valves, 16 ft. deep and a small house for a telehydrobarometer. N. L. Taylor, City Engr.

Spencer, W. Va.—The Town Council is stated to have granted the Cryatal Water & Power Co. a franchise for water works.

Chetek, Wis.—Fred. Hanson, Town Clk., writes that it was voted June 17th to issue $6,000 bonds for water works.

Cody, Wyo.—Prof. Ahern, of the geological survey, and a party of engineers, are reported to be making surveys for the Big Piney and Lake De Smet reservoir and irrigation enterprises, which are to be built by the general government.

The citizens are reported to have voted to issue bonds for the construction of water works; probable cost, $50,000.

Brooklyn, N. Y.—The following bids were opened on June 18 by Robt. Grier Monroe, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying a 48-in. c. i. force main from Ridgewood pumping station to the Mt. Prospect high service tower—*a*, N. Y. Continental-Jewell Filtration Co., N. Y. City; *b*, Norton & Dalton, N. Y. City; *c*, Lloyd Collis, N. Y. City; *d*, M. J. Dady, Brooklyn; *e*, Isaac Harris, Brooklyn; *f*, John J. Cashman, Brooklyn:

	a	*b*	*c*	*d*	*e*	*f*
Cast iron pipe, 10,300 tons	$31.50	$32.20	$32.50	$30.50	$32.00	$30.00
Special castings, 120 tons	70.00	65.00	70.00	60.00	60.00	60.00
Laying 48-in. pipe, 2,700 ft.	3.00	3.50	4.20	2.93	2.75	3.20
Laying 36-in. pipe, 400 ft.	3.00	3.00	3.00	2.93	2.25	2.50
36-in. stopcocks, 8	500.00	600.00	650.00	621.00	500.00	400.00
30-in. stopcocks, 4	300.00	400.00	350.00	375.00	325.00	275.00
20-in. stopcocks, 3	200.00	125.00	150.00	123.00	120.00	125.00
12-in. stopcocks, 7	60.00	40.00	50.00	40.00	50.00	50.00
Block pavt. and flagging, relay, 7,700 sq. yds.	.40	.01	.45	.50	.25	.25
Cobble stone pavt., relay, 9,000 sq. yds.	.25	.27	.45	.30	.15	.15
Brick masonry laid in cement, 300 cu. yds.	15.00	10.00	12.00	15.00	15.00	10.00
Steel for I-beams, etc., 10,000 lbs.	.05	.03	.035	.08	.05	.035
Totals	$429,280	$461,272	$482,920	$428,707	$424,270	$422,757

*Items marked thus give the names of parties awarded contracts.

Cowley, Wyo.—The Big Horn Basin Colonization Co. is stated to have secured a permit to construct canals and reclaim the Whistle Creek tract, embracing 25,000 acres of fertile land in this vicinity.

North Sydney, N. S.—It is stated that bids are wanted June 30 for $45,000 water works extension bonds. J. N. Armstrong, Town Clk.

Calgary, N. W. Ter.—See "Sewerage and Sewage Disposal"; also see "Paving and Roadmaking."

SEWERAGE AND SEWAGE DISPOSAL.

Birmingham, Ala.—Bids will be received by Julian Kendrick, Ch. Engr., Jefferson County Sanitary Comn., on July 7 for 240,000 ft. of 4-ft. brick sewer, average cut 8 ft.

Marysville, Cal.—The citizens are stated to have voted June 15 to issue $64,000 bonds for the construction of a sewerage system, including a pumping plant.

Long Beach, Cal.—A press report states that bids are wanted by the City Clk. for constructing the lower end of the outfall sewer. W. A. Foster, City Engr.

**Hartford, Conn.*—The following bids were opened by the Street Comrs. June 17 for constructing the Cemetery Brook extension of the Interception Sewer: Michael O'Neil, $23,665 (swarded contract); Chas. H. Slocomb, $23,983, and Hartford Paving & Constr. Co., $24,107. Bidders all of Hartford. This work includes 2,203 ft. brick sewers, 1,893 ft. tile sewers, 25 yds. concrete, 1,325 yds. rock and 20 manholes.

Michael O'Neill also secured the contract for the extension of the Franklin Ave. sewer outlet into Connecticut River for $5,520. This work includes 554 ft. 20-in. c. i. pipe, 150 yds. rock, 2 yds. concrete, 150 yds. filling, removing dam, etc.

Hartford, Conn.—Bids are wanted July 1 (readvertisement) for constructing the Franklin Ave. storm water overflows and the Maple Ave. sewer; probable cost of work, $80,000. Jos. Buths, Pres. Bd. St. Comrs.

Wilmington, Del.—Sewer bonds amounting to $90,000 are reported sold.

Summerville, Ga.—See "Water."

Griffin, Ga.—See "Power Plants, Gas and Electricity."

Paris, Ill.—D. H. Sawyer, City Engr, writes that the following bids for sewer work were received by Bd. of Local Improv. June 20: J. Robertson, Terre Haute, Ind., $6,679; J. M. Healy, Chicago, Ill., $6,218; W. H. Harris, Terre Haute, Ind., $5,465; Thompson & Case, Peoria, $5,180; J. Busher, Paris, $5,047; P. Simons, Quincy, $6,167. This work includes 8,980 ft. of pipe sewers from 8 to 10 in. in diameter, 20 manholes and 8 flush tanks. The trench is expected to average 8—10 ft. in depth, and will be excavated in loam.

Fairmount, Ind.—Bids will be received July 6 by the Bd. of Trus. of Fairmount Township for constructing sewer in portions of 6th St.; also storm sewer in portions of 8th St. Jacob Briles, Town Clk.

Anderson, Ind.—A press report states that it is proposed to sewer Green Creek, at a cost of about $100,000.

North Vernon, Ind.—Press reports state that bids are wanted July 10 for constructing 6,038 ft. sewer mains.

Wagoner, Ind. Ter.—J. W. Ruble, City Recorder, writes that it is proposed to construct a sewerage system, to cost $30,000. Engineer, H. H. Heilen, of Wagoner.

Burlington, Ia.—The Burlington Construction Co. is stated to have submitted the lowest bids for the Hawkeye and Stony Lonesome sewers, at $20,690 and $44,946, respectively. (Bids opened June 15.)

Des Moines, Ia.—The Council has passed resolution providing for the construction of sewers in Jefferson, 23d and 22d Sts. and Washington Ave.

Emmetsburg, Ia.—It is stated that bids are wanted July 8 for constructing about 16,170 ft. of 8 to 20-in. sewer, 49 manholes and 3 flush tanks. A. J. Burt, City Clk.

Louisville, Ky.—Judge S. Miller is stated to have declared valid the $250,000 bonds voted at the November election for sewerage purposes.

Detroit, Mich.—See "Paving and Roadmaking."

**Houghton, Mich.*—J. H. Green & Son, of Appleton, Wis., have secured the contract for constructing sewer on Sheldon St. for $17,663.

St. Paul, Minn.—Contracts will soon be let for the Stryker Ave. extension of the S. Wabasha St. sewerage system; probable cost of work, $20,000.

Winona, Minn.—The following bids for (*a*) brick sewer and (*b*) pipe sewer were received by City Council June 22 (G. P. Coleman, City Engr.): Thos. Green, Winona, *a*, $9,700; *b*, $9,748. John Lohse & Co., Winona, *a*, $9,675; *b*, $9,825. R. C. De La Hunt, Cedar Rapids, Ia., *a*, $9,112; *b*, $9,337. John Degnan, Winona, *a*, $8,494; *b*, $8,584. This work includes 2,300 ft. of brick or pipe sewers from 10 to 36 in. in diameter, 7 manholes and 22 catch basins. The trench is expected to average 9 ft. in depth, and will be excavated in sand.

**St. Louis, Mo.*—Fred. Hoffmann & Co. are stated to have received the contract for repair work on sewers for the ensuing year; estimated cost, $28,000.

Harrison, N. J.—Bids will be received July 7 by the Com. on Sewers of the Common Council for constructing a pipe sewer in portions of Kingsland Ave. Approximate amount of work and material, 500 lin. ft. open ditch, 1,680 lin. ft. 24-in. vitrified pipe, 6 junction manholes, 9 manholes, 1 double flushing tank complete, and 1 catch basin complete. B. P. Walsh, Town Clk.

**Millburn, N. J.*—John Driscoll, of Orange, has secured the contract for constructing the Short Hills sewer in Millburn Township, for $15,238.

**Newark, N. J.*—Wm. J. McCloud & Co. are stated to have secured the contract for a sewer in the S. Orange Ave. Dist. of the joint outlet sewer for $12,537; this company also submitted the lowest bid for the N. J. R. R. Ave. sewer for $18,017 (bids opened by Bd. of Wks. June 18).

Cuba, N. Y.—The following bids are reported to have been opened on June 2 for a sewerage system: Contractor Cookman, Niagara Falls, for about $43,000; Dean & Havens, of Olean, $49,000; Jas. Gray, of Hornellsville, $49,290; Thos. Marshall, of Chicago, Ill., $52,000, and Contractor Fuller, New York, $61,000. According to press reports new bids will be received, as all were in excess of the appropriation.

New York, N. Y.—See "Paving and Roadmaking."

New York, N. Y.—Bids will be received July 1 by Louis F. Haffen, Pres. Boro. Bronx, for constructing sewers and appurtenances in portions of numerous streets. Engineer's estimate, 3,450 lin. ft. 12, 15 and 18-in. pipe sewer, 4,495 cu. yds. rock excavated and removed, etc.

East Syracuse, N. Y.—Sewer bonds to the amount of $55,000 are reported sold.

Alexandria Bay, N. Y.—See "Water."

Syracuse, N. Y.—City Engr. Schnauber estimates the cost of constructing a sewerage system in 2d N. St., at $16,000; in Spring, Wolf and other streets, $16,000; in 3d N. and Wolf Sts., $8,000, and in Carbon, Bear and other streets, $12,000.

Cobleskill, N. Y.—See "Paving and Roadmaking."

**Rochester, N. Y.*—Wm. Fuller, 16 State St., is stated to have secured the contract for sewers in Union, Wangman and Hebard Sts., for $19,594.

**Whitesboro, N. Y.*—John C. Eberley, City Clk., writes that the contract for completing the sewerage system (bids opened June 17) has been awarded to Geo. Miller & Co., of Oneida, N. Y., for $6,950.

**Greensboro, N. C.*—Guild & Co., of Chattanooga, Tenn., is stated to have secured the contract for constructing 3 trunk lines of sewers 7.7 miles long, 12 to 24-in. pipe, for $28,990. The city will furnish the pipe, which will cost $20,000 additional.

Devils Lake, N. D.—Bids are wanted July 6 for constructing a sewer on portions of 5th St. and Minnewauken Ave. Ole Skratass, City Aud.

Bond Hill, O.—Bids will be received July 13 by A. J. Kiphart, Village Clk., at the office of Earnshaw & Punshon, Village Engrs., Glenn Bldg., Cincinnati, O., for furnishing material for constructing sewers in said village.

Cleveland, O.—The Council on June 15 passed resolutions providing for the construction of sewers in numerous streets. Peter Witt, City Clk.

Oklahoma, Okla. Ter.—See "Water."

Hood River, Ore.—Paget & Clark, of Portland, are stated to have completed plans for a sewerage system, to be about 10 miles in length.

Williamsport, Pa.—Bids will be received by the Highway & Sewer Com. of Councils until July 1 for constructing house sewers, of 10-in. terra cotta vitrified pipe, on 1st and 2d Sts. Jas. F. Fisher, City Engr.

Uniontown, Pa.—Bids will be received July 4 by Chas. F. Kefover, Boro. Att. and Clk. of Council, for constructing a 20-in. sewer in portions of Center or Jefferson St. and Pennsylvania Ave.

Ingram, Pa.—The citizens are stated to have voted to issue $30,000 bonds to build sewers and improve the streets.

Coatesville, Pa.—A press report states that T. Chalkley Hatton, of Wilmington, Del., will prepare new plans for a sewer along Gibbons Run.

Ashland, Wis.—See "Paving and Roadmaking."

**Beloit, Wis.*—The following bids were opened on June 12 for 15, 8 and 6-in. pipe sewers (Robt. Caldwell, City Engr.): G. Mafaolis, Rockford, Ill., $9,035; J. H. Green & Sons, Appleton, $8,446; Barstow & Allen, Waukegon, Ill., $9,912; Jas. Healey, Morgan Park, Ill., $10,825; Harding & Nelson, Racine, $8,488, and S. Vandewalker, Belvidere, Ill. (awarded contract), $8,845.

Mondovi, Wis.—The City Council is stated to have decided to construct a sewerage system.

Oshkosh, Wis.—It is stated that bids are wanted by the Bd. of Pub. Wks. until July 2 for constructing sewer for the relief of the Bowen and North Park sewers. M. Coffey, Chmn.

**Calgary, Alberta, N. W. Ter.*—T. W. Thorold, City Engr., writes that the following bids for constructing about 13,500 lin. ft. of sewers and laying 9,000 lin. ft. of c. i. water pipe were opened on June 10: Frost & Irish, Calgary, $23,375; Dobson, Jackson & Fry, Winnipeg, Man., $15,495 (awarded contract); John F. Connolly, Toronto, Ont., $25,950. These bids include all labor and material except pipe, valves, boxes and hydrants.

Port Arthur, Ont.—J. McTeigue, City Clk., writes that bids are wanted July 2 for the construction of a sewerage system, to cost about $62,000. Engineer, Willis Chipman, Toronto.

BRIDGES.

San Jose, Cal.—Bids will be received by John Roll, Chmn. Bd. Superv., on July 7 for a combination bridge over Siagua Creek on Edwardson Ave. J. G. McMillan, Co. Surv.

San Rafael, Cal.—It is stated that bids are wanted July 8 for constructing a drawbridge between Tiburon and Belvidere, estimated to cost $6,200. Robt. B. Graham, Co. Clk.

Stockton, Cal.—It is stated that bids are wanted July 7 for constructing a steel span bridge across Mokelumne River, near Woodbridge. E. D. Graham, Co. Clk.

Rockville, Ind.—A correspondent writes that bids will be received July 9 by the Co. Comrs. for reconstructing Ambury bridge in Washington Township; also constructing a 45-ft. steel bridge in Raccoon Township. Henry Gruble, Co. Aud.

Bluffton, Ind.—A correspondent writes that bids will be received July 15 by W. A. Marsh, Co. Aud., for constructing a 70-ft. span iron bridge in Liberty Township; also constructing stone arch on the gravel road, in said Township.

**Terre Haute, Ind.*—Press reports state that the Lafayette Engineering Co., of Lafayette, Ind., has secured the contract to build a bridge over Wabash River at Main St., for $271,200.

Madison, Ind.—It is stated that bids are wanted July 8 for constructing the masonry and fills for 3 steel bridges and for 1 stone arch bridge. G. F. Grozier, Co. Aud.

Newport, Ind.—Bids will be received July 6 by the Bd. of Co. Comrs. for constructing a bridge and abutments over Spring Creek in Highland Township. Wm. P. Bell, Co. Aud.

Mishawaka, Ind.—Bids will be received July 21 (resdvertisement) by the Bd. of Co. Comrs. for constructing a 375-ft. bridge over St. Joseph River at Cedar St. Bids will be received on either a 5-span plate-girder bridge, with stone or concrete piers and abutments, or on a 3-span concrete Melan arch bridge. John M. Brown, Co. Aud.

Indianapolis, Ind.—See "Electric Railways."

Westshoals, Ind.—Bids will be received July 6 by the Bd. of Co. Comrs. for constructing abutments for bridge over Haw Creek in Rutherford Township.

**Marion, Ind.*—A. R. Smith, Bridge Engr., writes that contracts for a bridge across Mississinewa River in Mill Township (bids opened June 20) have been awarded as follows: Superstructure to the Indiana Bridge Co., Muncie, $9,649, and sub-structure to Emmet Hover, Marion, at $9.50 per yd.

Sioux City, Ia.—It is stated that bids are wanted June 30 for constructing a steel arch concrete bridge over Perry Creek at 4th and W. 3d Sts. I. N. Stone, Chmn. St. Com.

Burlington, Ia.—The Jas. B. Dixon Bridge Co., of Keokuk, is reported to have submitted the lowest bid for constructing the superstructure of 6th St. viaduct at $6,500, and Cameron, McManus & Joyce, of Keokuk, the lowest for constructing the substructure at $3,237.

Marshalltown, Ia.—It is reported that the building of a viaduct in this city is being considered.

**Derby, Kan.*—The Canton Bridge Co., Canton, O., is reported to have secured the contract to construct a 4-span (each span 78 ft. long) iron bridge across Arkansas River, at Derby, for $5,500.

**Baltimore, Md.*—Press reports state that the Western Maryland R. R. Co. has awarded a contract to the Maryland Steel Co., 71 Broadway, N. Y. City, to build 5 bridges on the tidewater extension. This includes a steel drawbridge across the middle branch of Patapsco River near Locust Point. The contract price is reported to be about $125,000.

Boston, Mass.—Bids will be received July 2 by Wm. Jackson, City Engr., for constructing steel superstructure of Atlantic Ave. bridge.

Fall River, Mass.—A bill has passed the House and Senate authorizing the building of a bridge across Taunton River, between Fall River and Somerset.

Fairmount, Minn.—Press reports state that bids will be received about July 13 by the Bd. of Co. Comrs. for constructing a 150-ft. steel bridge over 10 Mile Creek in Lake Belt and Tenhassen Townships. H. P. Edwards, Co. Aud.

Minneapolis, Minn.—The Council Com. on Roads and Bridges recommends that the Northern Pacific R. R. be requested to build a bridge over its tracks at Harvard St. S. E.

Kansas City, Mo.—It is reported that the Kansas City Belt Line Ry. Co. may construct a viaduct, 1,800 ft. long, from the Southwest Boule. to 25th St.

Chinook, Mont.—Local press reports state that A. E. Peppard submitted the lowest bid for constructing a bridge across Mills River, near Chinook, at $6,474.

Claremont, N. H.—Press reports state that the building of a $35,000 bridge between Claremont and Weathersfield, Vt., is being considered.

New York, N. Y.—Bids will be received July 1 by Louis F. Haffen, Pres. Boro. Bronx, for constructing a bridge over Bronx River; also approaches to a bridge over New York & Halem R. R. at East 233d St.

Binghamton, N. Y.—The City Engr. has been directed to prepare plans and specifications for a steel truss bridge with a 30-ft. roadway, one street car track in the center with wooden flooring and to submit estimates of the cost of construction.

Portage, N. Y.—Press reports state that the historic bridge on the Erie R. R. at Portage is to be repaired at a cost of about $100,000.

Chillicothe, O.—It is stated that bids are wanted July 13 for constructing the superstructure of a bridge at State Mills; also for extending or rebuilding the masonry. John H. Miller, Co. Aud.

Cincinnati, O.—Bids will be received July 25 by the Bd. of Co. Comrs. for constructing bridges, drains and approaches thereto, on Johnson Road, between Ryboits and Gorbacks, Green Township. Eugene L. Lewis, Co. Aud.

Bellaire, O.—The Baltimore & Ohio R. R. is reported to be about to build a $500,000 viaduct in this city, to connect with the Cleveland, Lorain & Wheeling R. R. J. M. Graham, Ch. Engr., Baltimore, Md.

**New Philadelphia, O.*—C. C. Fernsell, Co. Aud., writes that J. B. Westhafer, of New Philadelphia, has secured the contract for a bridge over Tuscarawas River at Zoar Station (bids opened June 15) for $7,550.

East Liverpool, O.—The government engineers have reported favorably on the application for permission to build a bridge from East Liverpool to Newell, W. Va., across Ohio River.

Dayton, O.—The building of a concrete bridge at 3d St. is reported to be under consideration.

Barnesboro, Pa.—The Co. Comrs. have decided to build a bridge across Susquehanna River, in Barnesboro, to have a 90-ft. span and to be 60 ft. wide.

*Items marked thus give the names of parties awarded contracts.

Allentown, Pa.—The Bd. of Viewers on the bridge to be built across Lehigh River have filed a report with the Dauphin Co. Court recommending the building of a steel bridge, 42 ft. wide, and estimated to cost $110,000. The bridge is to consist of 4 truss spans, each 135 ft. long and 1 girder span 65 ft. long, the piers and abutments to be of stone or concrete.

Hellerstown, Pa.—Press reports state that the center pier of the Philadelphia & Reading R. R. bridge across Silver Creek near Hellerstown, was washed away by the recent flood.

Stroudsburg, Pa.—The viewers appointed by the State to investigate the necessity of constructing a bridge between Stroudsburg and East Stroudsburg, across Brodhead's Creek, are reported to be in favor of constructing said structure at a cost of about $60,000.

Ardmore, Pa.—The Co. Comrs., according to reports, have decided to construct a bridge across Mill Creek, in Lower Merion Township.

Sunbury, Pa.—The viewers appointed to investigate the necessity of building bridges near Sunbury have reported to the Comrs. at Harrisburg, recommending the building of a $12,000 bridge across Shamokin Creek and a $60,000 bridge across Broadhead's Creek.

Greenville, S. C.—It is reported that the loss, through the recent flood, to bridges in this county, is $25,000.

Spartanburg, S. C.—The Co. Comrs. are reported to be contemplating borrowing $50,000 with which to replace the bridges recently washed away by the flood.

Montesano, Wash.—It is stated that bids are wanted July 6 for constructing a 108-ft. trestle bridge across Hamilton Guich on Wishkah Road. W. D. Campbell, Co. Aud.

Spokane, Wash.—The property owners in the vicinity of Astor St. have petitioned the Council to construct a bridge at this street.

Deeks & Deeks are stated to have submitted the lowest bid for building concrete abutments for the Monroe St. bridge, at $7,700.

Olympia, Wash.—Bids, including plans and specifications, will be received July 15 by the City Council for constructing a 120-ft. drawbridge having a 44-ft. opening. V. A. Milroy, City Clk.

Waupaca, Wis.—Bids are wanted July 1 for constructing a stone bridge over Crystal River on Berlin St. J. B. McNaughton, City Clk.

Vancouver, B. C.—Press reports state that the Dominion Government Department of Railways has approved the plans of the Great Northern Ry. for a bridge to be built across False Creek, on the extension between Westminster and this city. The bridge will be about 4,000 ft. long, and will have a center span 120 ft. long. A. H. Hoagland, Ch. Engr., St. Paul, Minn.

Winnipeg, Man.—Bids are wanted June 30 for constructing 2 bridges, one 100, the other 130 ft. long. Address Frank Ness.

Tampico, Mex.—The Mexican Congress is stated to have recently authorized the expenditure of $94,770 for the construction of a steel viaduct to connect the city of Tampico with the wharf and the customs house.

Carleton, N. B.—Press reports state that the General Com. of the Common Council has decided to recommend to the Council that an engineer be engaged to report on the cost of a bridge at Navy Island, and that a committee be appointed to confer with the engineer and look into the cost of the bridge, the approaches and the land damages.

North Easthope, Ont.—It is stated that bids are wanted July 4 for constructing the superstructure of 2 steel highway bridges, span 120 ft.; also for concrete abutments. Angus Smith, C. E., Stratford, Ont.

PAVING AND ROADMAKING.

Denver, Colo.—The Bd. of Pub. Wks., according to local press reports, has adopted specifications for grading East Denver Improvement Dist., at an estimated cost of $122,136.

Wilmington, Del.—Bids will be received July 7 by the Delaware State Highway Comn. for macadamizing Hare's Corner road, a distance of about 2 miles. Cornelius J. Horrigan, Chmn.

**Washington, D. C.*—Col. John Biddle, the Engineer Comr., is reported to have approved the recommendation of the engineer of highways awarding to the Brennan Construction Co., Loan & Trust Bldg., for a term of 4 years the contract to repair asphalt pavements in the District. The contract price is reported to be $92,850 per year.

Bids are wanted July 3 for paving with sheet asphalt; also on same date for laying asphalt block pavements, as advertised in The Engineering Record.

Rock Island, Ill.—The Council has passed ordinances providing for brick paving on 29th St., at a cost of $6,808, and 17th St., at a cost of $24,500. Wallace Treichler, City Engr.

Jacksonville, Ill.—It is proposed to pave Grove, Westminster, Prospect and Park Sts. with brick. Contract will probably be let in July.

**La Grange, Ill.*—John A. Dillon, Village Clk., writes that the contract for constructing 12,000 sq. ft. of cement sidewalks (bids opened June 13) has been awarded to W. C. Dawkins, of La Grange, at 13 cts. a ft.

**Streator, Ill.*—John S. Baer is reported to have received the contract to pave portions of La Salle and Lundy Sts. at $5,244 and $3,998 respectively.

Chicago, Ill.—An ordinance is reported to have passed the Council providing for the paving of La Salle St., from Archer Ave. to 39th St., with asphalt, at an estimated cost of $128,000.

Bids are wanted July 1 for constructing cement walks in several streets. John A. May, Secy. Bd. Local Improv.

New Albany, Ind.—Bids will be received July 6 by the Common Council for improving with asphalt portions of 8 streets. Eugene L. Brisby, City Clk.

Delphi, Ind.—Press reports state that bids will be received July 9 by Jas. D. Smock, Co. Aud., for constructing about 26 miles gravel road in Deer Creek Township.

Indianapolis, Ind.—Bids will be received July 3 by the Bd. of Pub. Wks. for improving by grading and paving with brick portions of 1st alley west of Capitol Ave.; also grading and paving with cement the sidewalks on portions of Evison St. Harold C. Megrew, Chmn.

Princeton, Ind.—Reports state that Patoka Township, Gibson Co., has voted in favor of constructing 29 miles of rock roads.

South Bend, Ind.—Bids are wanted July 7 for excavating, curbing, and paving with brick portions of 3 streets; estimated quantities, 24,786 sq. yds. brick, 6,709 yds. excavation, and 4,670 ft. cement curb. A. J. Hammond, City Engr.

Columbus, Ind.—A correspondent writes that bids will be received about July 15 for paving with brick 2 of the principal streets of the city at an estimated cost of $75,000.

Salem, Ind.—Press reports state that Washington Township has voted to construct 22 miles of gravel roads, at a cost of $52,013, and Franklin Township has voted to construct 17 miles of gravel roads at a cost of $25,440.

English, Ind.—Bids will be received July 6 by the Co. Comrs. for improving certain streets in Sterling and English Townships by grading, draining and macadamizing. Saml. E. McFall, Co. Aud.

Burlington, Ia.—Local press reports state that Geo. Kreichbaum, of Burlington, submitted the lowest bid for paving Franklin St., at $12,365.

Council Bluffs, Ia.—The City Council is reported to have under consideration the paving of portions of several streets.

Des Moines, Ia.—The City Council has ordered the paving of a portion of W. 13th St.

Davenport, Ia.—Bids will be received June 30 by the Bd. of Pub. Wks. for paving a portion of 12th St., about 2,133 sq. yds., with 1 course vitrified brick on 5-in. concrete foundation. Thos. Murray, City Engr.

Le Mars, Ia.—The City Council has passed resolutions to pave Main and 6th Sts. Brick on a concrete foundation is reported to be favored.

**Louisville, Ky.*—L. R. Figg, 453 W. Jefferson St., is reported to have secured the contract to pave portions of St. Xavier, 4th, 30th and 28th Sts., O St. from 3d to 4th Sts., and G. W. Gosnell, 327 5th St., the contract to pave portions of Kentucky and 18th Sts., O St. from 4th to 6th Sts., and Stein Court. It is reported that these contracts cover about 24,000 sq. yds. to be paved with vitrified brick blocks, and the total cost is stated to be $49,000.

Local press reports state that the Barber Asphalt Paving Co., Louisville Trust Bldg., submitted the lowest bid for paving Broadway, a distance of about 6,710 ft., at $90,000.

Covington, Ky.—This city will soon be ready to let contracts for repairs to asphalt paving, to cost about $20,000. W. E. Gunn, City Engr.

Pittsfield, Mass.—City Engr. Langan estimates the cost of paving with brick on Main St. at $12,609.

Reading, Mass.—M. F. Charles, Town Clk., writes that it is proposed to macadamize Main St. at a cost of about $9,000. The Mass. State Highway Comn. has charge of the work.

Taunton, Mass.—The Com. on Streets is reported to have under consideration the expenditure of $40,000 for street improvements.

West Boylston, Mass.—The following bids were opened by the Metropolitan Water Bd. at Boston, June 10, for excavating soil from Wachusett reservoir and building a road from Howe to Pleasant St., West Boylston: Auguste Saucier, South Framingham, $9,060 (awarded contract); Wm. J. McCarthy, Somerville, $11,036; Newell & Snowling Cons. Co., Uxbridge, $11,721; McBride & Co., Brighton, $11,931; T. H. Gill & Co., Somerville, $12,135; Rowe & Perini, South Framingham, $12,183; Meskill Bros. & Leahy, West Boylston, $12,326; Boylston Cons. Co., West Boylston, $13,086; John F. Magee & Co., Taunton, $13,094; Cenedella Bros., Milford, $13,205; Bruno & Milano, Boston, $14,798; Fred T. Ley & Co., Springfield, $16,047.

Detroit, Mich.—Local press reports state that the following are the lowest bids received June 8 for paving: Alexandrine Ave., from Woodward to 3d, with asphalt, Cleveland Trinidad Paving Co., Cleveland, O., at $2.15 per yd.—total, $15,702; Alexandrine, Woodward to Brush, sheet asphalt, Jas. Hanley, $2.10 per yd.—total, $8,208; Antoine, Gratiot to Adams, with brick, A. Grant, Detroit, Malvern, $2.14, and Nelsonville, $2.21 per yd.—total, $3,879; Beaubien, Division to Erskine, with brick, Conn, Brainard & Co., $2.07 per yd.—total, $7,439; Scott St., Aubin to Grandy, cedar, F. R. Gartner, $1.56 per yd.—total, $7,166; Dix Ave., Clark to Junction, brick, Wm. Lappin, Detroit, $13,371. It is reported that Dix St. may have to be readvertised, as the specifications did not include concrete behind curb.

Robt. H. McCormick, of Detroit, has submitted to the Springwells Township Bd. plans for constructing a sewer and paving a distance of about 1½ miles on Michigan Ave., and estimates the cost at $50,000.

Local press reports state that the Barber Asphalt Paving Co., of Detroit, is reported to have submitted the lowest bid for patching sheet asphalt in this city, at $1.23 per sq. yd.; $55,000 has been appropriated for this work.

Albert Lea, Minn.—The City Council is reported to be contemplating the purchase of a 5-ton road roller.

At the special election held recently it was voted to pave Broadway from Water to Pearl Sts.

St. Paul, Minn.—Local press reports state that the building of a boulevard to Ft. Snelling is being considered. Probable cost, $50,000. The plans under consideration provide for a curbed boulevard along the center of the street, estimated to cost $9,750, and the building of a 20-ft. wide macadamized roadway on each side of the central boulevard and a wide boulevard along each side.

**Duluth, Minn.*—The following bids were opened on June 15 for paving Michigan St. with sandstone block, to be placed on present Telford foundation: Norris & Fitzgerald, $11,259; P. McDonald, $9,496; Alex. Saug, $9,668, and J. W. Preston, $9,233 (awarded contract). Bidders all of Duluth. The detail bid of the successful bidder is as follows: Old pavement removed, 3,921 sq. yds., 15 cts. per sq. yd.; curb reset, 1,974 lin. ft., 15 cts.; crushed rock fill, 450 cu. yds., $2; new granite curb, 60 lin. ft., $1.10, and sandstone paving with sand filler, 3,021 sq. yds., $1.87.

Leakesville, Miss.—It is reported that the citizens have voted in favor of issuing $10,000 for street improvements.

Savannah, Mo.—The Bd. of Aldermen has passed resolutions to pave with vitrified brick on a sand or broken stone and concrete foundation on portions of several streets.

Webster Groves, Mo.—Bids will be received July 6 by A. B. Kauffman, Street Com., for grading, macadamizing and gravelling portions of Maple Ave., Sylvester Ave. and Jackson Road.

Warrensburg, Mo.—It is stated that bids are wanted July 6 for paving about 16,000 sq. yds. with macadam and 4,000 sq. yds. with brick. S. P. Tyler, City Clk.

Portsmouth, N. H.—Press reports state that the Com. appointed to estimate the cost and distance of widening and rebuilding the Sandy Point Ave. road have reported the distance to be 4,250 ft. and the cost as $7,000.

**Freehold, N. J.*—Local press reports state that the Bd. of Chosen Freeholders has awarded contracts for building stone and gravel Co. roads as follows: Keansburg and Keyport road, 70 cts. per sq. yd., to P. F. Shanley, Jersey City; total cost, $5,248. Manalapan and Freehold road, 79 cts. per sq. yd., to Charles Lecompt; total cost, $23,005.

**Camden, N. J.*—Local press reports state that the Vulcanite Paving Co. has secured the contract to pave with asphalt on portions of Front from Federal to George Sts.; 5th, 4th, Arch from 2d to 3d and 4th to 5th Sts. and Penn St., at $1.84 per sq. yd., and to pave with Belgian block on portions of Front, from Market to State, Arch from Delaware Ave. to 2d St. and the W. side of Delaware Ave., at $2.69 per sq. yd. Wm. H. Sherman, 33 Haddon Ave., is reported to have received the contract to pave with Belgian block on Grant St., at $1.65 per sq. yd. It is reported that the total cost of this work will amount to about $100,000.

**Mt. Holly, N. J.*—John E. Darnell, of Masonville, Dir, Co. Bd. Freeholders, writes that J. R. Shanley, of Jersey City, has secured the contract for constructing 2½ miles of macadam road from Beverly to Bridgeboro, for $15,692 (bids opened June 20).

Montvale, N. J.—Press reports state that bids will be received June 30 for $15,000 macadam bonds.

**Buffalo, N. Y.*—The Eastern Construction Co., of Brooklyn, is stated to have received the contract to pave a portion of Lord St. at $13,343.

Bids are wanted July 2 for repairing all asphalt pavement on streets in said city (excepting those upon which the guarantee for maintenance has not expired and those beyond repair). Francis G. Ward, Comr. Pub. Wks.

**Rochester, N. Y.*—The Rochester Vulcanite Pavement Co., of Rochester, is reported to have secured the contract to pave a portion of Central Ave., at $12,897.

Newburgh, N. Y.—Bids will be received June 30 by the Co. Bd. of Superv. for improving the following public highways in Orange Co.: Newburgh-Campbell, length about 13 miles, and Chester-Valls Gate, length about 11 miles. Geo. Moshier, Chmn.

Cobleskill, N. Y.—Engr. Bowditch estimates the cost of macadamizing the village streets at $45,556. This includes a complete system of drainage, which was deemed necessary, at a cost of $12,232.

New York, N. Y.—The Bd. of Estimate has adopted a resolution apportioning among the several boroughs, as follows, the $3,100,000 corporate stock authorized to be issued for the paving of streets and avenues in the city: Manhattan, $955,000; Brooklyn, $1,640,000; The Bronx, $270,000; Queens, $148,900, and Richmond, $128,300. The resolution also apportioned as follows the $535,000 left out of the previous appropriation: Manhattan, $174,000; Brooklyn, $278,400; The Bronx, $34,800; Queens, $26,100, and Richmond, $21,700.

Bids will be received June 30 by Jacob A. Cantor, Boro. Pres., for regulating and repairing with asphalt and asphalt block portions of numerous streets. Engineer's estimate, 177,670 sq. yds. asphalt pavement, including binder course; 152,700 sq. yds. old stone pavement, relaid as foundation or in approaches, etc.; 15,680 sq. yds. asphalt block pavement, 6,485 cu. yds. concrete, 81,546 lin. ft. new curbstone, furnished and set; 11,990 lin. ft. old curbstone, redressed, rejointed and reset, etc. Also July 7 for furnishing material and extending 2d section of Riverside Drive from 135th to 145th Sts., work to include among other items 118,000 cu. yds. earth excavation for walls, etc.; 8,000 cu. yds. loose rock and 2,500 cu. yds. rock excavation, 416,000 cu. yds. filling behind walls, for park slopes, etc.; 36,500 cu. yds. concrete, in walls, arches and foundation; 46,000 cu. yds. rubble backing, 96,500 cu. ft. hammer-dressed granite for copings, mouldings, bridge piers, etc.; 35,000 sq. yds. telford macadam roadway, 12,000 sq. yds. cement walk, granitoid finish; 2,433 lin. ft. brick sewer, 787 lin. ft. circular brick sewer, 30 lin. ft. circular brick outlet sewer, 3,877 lin. ft. salt-glazed vitrified stoneware pipe drain, 440 lin. ft. salt-glazed vitrified stoneware pipe sewer, 190 tons straight water pipe, 8 tons branches and special water pipe castings, 4,500 lin. ft. 6 and 12-in. water pipe, 5,200 ft. multiple 4 duct and 21,000 ft. single duct vitrified clay conduits, etc.

Bids will be received July 1 by Louis F. Haffen, Pres. Boro. Bronx, for regulating, grading, curbing, flagging and paving with asphalt and asphalt block portions of numerous streets. Engineer's estimate, 13,950 cu. yds. earth excavation, 26,000 cu. yds. rock excavation, 3,610 sq. yds. asphalt pavement, 34,300 sq. yds. asphalt block pavement, 46,230 sq. ft. flagging, etc.

Bids will be received July 2 by the Bd. of Park Comrs. for furnishing and laying asphalt roadway on concrete foundation over rustic bridge, Highland Park. Wm. R. Willcox, Chmn.

*Items marked thus give the names of parties awarded contracts.

Rome, N. Y.—Bids will be received June 30 by K. S. Putnam, City Chamberlain, for $9,482 paving bonds.

**Ithaca, N. Y.*—E. F. McGreevy is reported to have secured the contract to pave with macadam on portions of Humboldt, W. Port and W. Seneca Sts., in all about 5,670 ft. The total cost being $8,846 in all; also the contract for paving with brick on portions of South Geneva, Tioga and Huestis Sts., requiring in all about 1,233 ft. Total cost, $12,247.

Hamburg, N. Y.—It is stated that the Village Trus. have rejected all bids recently received for macadamizing portions of Lake, Main and Union Sts.

Syracuse, N. Y.—F. J. Baker & Co., of Syracuse, is reported to have submitted the lowest bid for paving with Syracuse brick on portions of Syracuse and Fayette Sts., at $17,002, and J. W. Bustin, 405 W. Onondaga St., with Johnsonburg block, at $18,043.

It is stated that the paving with asphalt or brick on portions of Wolf and Van Rensselaer Sts. is under consideration.

**Schenectady, N. Y.*—The Schenectady Contracting Co. is reported to have secured the contract to grade, curb and pave a portion of McClellan St. at $52,890.

Brooklyn, N. Y.—Bids for a large number of contracts for paving were received by J. Edw. Swanstrom, Boro. Pres., on June 13. For asphalt paving, Cranford Co., 215 Montague St., were lowest for 17 contracts, aggregating $594,286; the Brooklyn Alcatraz Asphalt Co., 3d Ave. and 3d St., for 5 contracts, aggregating $162,537; Interstate Paving Co., 44 Court St., for 1 contract, amounting to $161,818; the Eastern Bermudez Asph. Pavg. Co., 26 Court St., for 3 contracts, aggregating $116,129. For asphalt block paving, Continental Pavg. Co., 32 Bway., N. Y. City, was lowest for contract involving 19,480 sq. yds, at $1.78; total, $62,418. For two contracts involving 16,634 sq. yds. granite block pavt. and 1 contract for 3,480 sq. yds. Medina sandstone, J. Chas. Wechsler, 300 Bway., N. Y. City, was lowest bidder, at $2.40 and $2.70 for the granite pavt. and $3 for the Medina; total of all three, $87,011. It will only be possible to give at this time the following detailed bids, the first two for asphalt on a concrete foundation and the latter two for asphalt largely on the present pavt. as foundation—*a*, Cranford Co.; *b*, Uvside Asph. Pavg. Co., 1 Bway., N. Y. City; *c*, the Bklyn. Alcatraz Asph. Co.; *d*, Eastern Bermudez Asph. Pavg. Co.: *e*, Interstate Pavg. Co.:

	Pavt., sq. yd.	Old pavt., sq. yd.	Concrete, cu. yd.	New curb, lin. ft.	Old curb, lin. ft.	Manhole covers.	Totals.
			Adelphi St.				
	20,210	140	3,360	8,630	2,050	53	
a.....	$1.23	$0.35	$5.00	$0.80	$0.35	$15.	$50,124
b.....	1.35	.30	6.00	.95	.40	18.	57,458
c.....	1.32	.35	5.50	.85	.35	15.	54,054
			Carroll St.				
	15,280	130	2,610	8,680	580	40	
b.....	$1.35	$0.40	$6.00	$0.90	$0.40	$18.	$45,104
a.....	1.30	.35	5.50	.85	.35	15.	42,446
c.....	1.28	.35	5.50	.85	.35	15.	42,140
			Arlon Place.				
	19,620	1,800	3,000	9,050	1,360	57	
a.....	$1.29	$0.35	$5.60	$0.85	$0.35	$15.	$51,763
d.....	1.30	.35	5.50	.85	.35	15.	51,660
			Bushwick Ave.				
	67,020	20,050	7,530	23,100	2,600	151	
d.....	$1.40	$0.40	$5.50	$0.85	$0.35	$15.	$166,073
a.....	1.38	.40	5.47	.95	.35	15.	166,817
e.....	1.10	.50	6.50	1.10	.50	16.	161,818

**Elmira, N. Y.*—The Bd. of Pub. Wks. is reported to have awarded contracts for paving as follows: To the Warren-Quinlan Co., Warren Bldg., Rochester, for paving with asphalt West Water St., about 10,000 sq. yds., at $2.20 a sq. yd., brick to be placed between the car tracks—total, $25,201; Church St., about 10,280 sq. yds., at $2.15 per sq. yd.—total, $24,533. For paving with brick the following streets: To J. E. Rawlins, Park Pl., about 7,600 sq. yds., at $2.01 per sq. yd., Porter Van Port wirecut brick to be used—total, $18,521; John Kelley, West Clinton St., about 2,350 sq. yds., at $1.97 per yd., Darlington wirecut block to be used—total, $5,830; Costello & Neagle, Elmira, South Main St., 3,000 sq. yds., at $1.97 per yd., McMahon-Porter wirecut brick—total, $9,458.

New York, N. Y.—The following bids for regulating and paving with asphalt block on a concrete foundation the roadway of St. Nicholas Ave. from 124th to 155th St., were received by Jacob A. Cantor, Pres. Manhattan Boro., June 23—*a*, Hastings Pavement Co., 25 Broad St.; *b*, Continental Asphalt Paving Co., 32 Bway.; *c*, J. L. Robertson, Baltimore, Md.:

	51,000 s. yd. asph. blk.	7,300 c. yd. concrete.	8,000 lin. ft. new curb.	6,700 lin. ft. old curb.	2,000 lin. ft. head. stone.	Totals.
a.....	$1.89	$6.40	$1.00	$0.50	$0.35	$155,916
b.....	1.86	7.00	1.12	.59	.45	160,517
c.....	2.12	6.00	.99	.49	.50	164,971

Greensboro, N. C.—The Co. Bd. of Highway Comrs. is reported to be contemplating the purchase of 3 complete road machinery outfits.

**A. L. Patterson & Co., Macon, Ga., are reported to have secured the contract for street construction at 7 cts. per sq. yd. for sub-grading, and 54 cts. per sq. yd. for macadamizing. This contract, it is stated, calls for 50,000 yds. of street improvement.

Cincinnati, O.—The Council is reported to have authorized the improving of Race St. at a probable cost of $51,000.

Bids will be received July 3 by the Bd. of Pub. Service for furnishing material for improving by grading and paving with brick portions of Douglas Alley and constructing retaining walls; also repairing by macadamizing portions of Delhi Ave. Geo. F. Holmes, Clk.

**Bowling Green, O.*—Ryan & Ryan are reported to have secured the contract for constructing the Snider, Scott and Keefer roads, at a total cost of $78,855.

Springfield, O.—City Engr. Sieverling estimates the cost of paving Lagonda Ave. at $78,410.

Mansfield, O.—The City Council has adopted a resolution directing the City Engr. to prepare plans and profiles for the improvement of a portion of Sherman Ave. by grading and paving with brick, block or asphalt and curbing and laying sidewalks of either cement or flag stone.

Cleveland, O.—Ordinances have been adopted in the City Council authorizing the City Engr. to prepare plans, specifications and estimates of the cost of grading, curbing and paving with brick on portions of several streets.

Canonsburg, Pa.—Bids are wanted July 6 for paving about 3½ miles of streets, as advertised in The Engineering Record.

Johnstown, Pa.—See "Electric Railways."

Shenandoah, Pa.—P. W. Bierston, Town Clk., writes that it is proposed to pave 6 squares with brick, at a cost of $12,000.

Verona, Pa.—Bids will be received July 8 by the Street Com. for grading, curbing and paving with brick, on Front St., approximately 11,800 sq. yds. Frease & Sperling, Boro. Regulators, Carl Bldg., Wilkinsburg, Pa.

Harrisburg, Pa.—According to local press reports the Warren-Quinlan Asphalt Co., of Rochester, N. Y., submitted the lowest bids for paving with sheet asphalt on portions of Washington, Chestnut, Pine, South and State Sts., from Front to 3d, and from 4th to the Pennsylvania R. R., at $1.72½ per sq. yd. The Barber Asphalt Paving Co., N. Y. City, is reported to have submitted the lowest bid for paving State St., from 13th St. to the Eastern city line, at $1.74 per sq. yd.

Ingram, Pa.—See "Sewerage and Sewage Disposal."

York, Pa.—Mayor Gibson has signed the ordinance providing for the issue of $37,000 highway improvement bonds.

Providence, R. I.—Bids will be received July 8 by the State Bd. of Pub. Roads for constructing sections of State highway in the following Townships: About 5,280 ft. in Hopkinton and Richmond, 5,280 ft. in East Greenwich, 2,640 ft. in Warwick, 2,640 ft. in Coventry, 2,640 ft. in Little Compton, 4,250 ft. in Bristol, and 5,280 ft. in Warren. John H. Edwards, Chmn.

**Sevierville, Tenn.*—I. M. Lindsey, Chmn. Co. Comrs., writes that R. L. Peters, of Knoxville, has secured the contract for rebuilding Sevierville pike, a distance of about 12 miles, for $16,000.

Texarkana, Tex.—The City Council has ordered paving with brick on a portion of State St. and grading and graveling portions of Maple and Broad Sts.

San Antonio, Tex.—Bexar County voted on June 16 to issue $500,000 bonds for macadamizing county roads. Robt. Green, Co. Judge.

Houston, Tex.—Bids will be received July 20 by D. D. Bryan, City Secy., for paving with either brick, asphalt or gravel on portions of Runnels St. F. L. Dormant, City Engr.

Seattle, Wash.—C. J. Erickson, of Seattle, is reported to have submitted the lowest bid for regrading Pike St., at $24,872.

**La Crosse, Wis.*—John Vollmar, Secy. Pub. Wks., writes that Wooley & Hanson, of La Crosse, have secured the contract for brick pavement with cement filler on portions of 3d and 5th Sts. (bids opened June 20), for $32,357. The Northwestern Constr. Co., of La Crosse, also submitted a bid for $36,400.

Ashland, Wis.—Bids will be received by the Bd. of Pub. Wks. July 13 for 15,000 sq. yds. asphalt paving, and on July 15 for 12,000 sq. yds. macadam, 8,000 lin. ft. curb and 1,500 lin. ft. storm sewer. M. T. Dozer, City Engr.

**The Barber Asphalt Paving Co., N. Y. City, is reported to have secured the contract to pave portions of Second Ave., at a total cost of about $34,000.

**T. J. McGrath, of Green Bay, is stated to have received the contract to macadamize portions of 2d, 4th and 9th Avea., at a total cost of $12,295.

Wentworth, N. S.—It is stated that the Co. Council has decided to build a system of roads, in all about 170 miles, at a probable cost of $100,000.

Calgary, Alberta, N. W. Ter.—T. W. Thorold, City Engr., writes that bids will soon be asked for 40,000 sq. yds. concrete sidewalks; also for a steel water tower, capacity 100,000 (imp.) gals.

**London, Ont.*—The Warren Bros. Co., N. Y. City, N. Y., is stated to have secured the contract to pave on a portion of York St., at $12,855.

Montreal, Que.—The Finance Com. has appropriated $26,200 for street paving as follows: Notre Dame St. east, $10,400; Roy St., $4,800; part of Visitation St., $7,000; Notre Dame west, $4,000.

POWER PLANTS, GAS AND ELECTRICITY.

Ozark, Ala.—Bids are wanted by Marion McDonald, Supt. Water Wks., for the construction of an electric light plant, to cost about $8,000. Bids will be received for the entire contract, or for all material at a specified price for the city to install.

Supai, Ariz.—J. B. Girand, of Supai, Engr. in Charge, writes that the United Gold & Platinum Mines Co. is to construct a power plant here.

San Francisco, Cal.—The California Power & Development Co. has been incorporated to supply certain sections of the State with electrical and water power; capital, $2,000,000. Directors: K. H. Plate, of San Jose; J. I. Hohn, of Oakland; H. E. Fitcher, of San Francisco, and others.

Corona, Cal.—M. W. Findlay is stated to have petitioned the City Trus. for a franchise for a gas plant, and F. C. Cooper has petitioned for a franchise for an electric light and power plant.

Trinidad, Colo.—See "Electric Railways."

Glenwood Springs, Colo.—The Colorado Power & Irrigation Co. has been incorporated with a capital of $5,000,000. It will receive its power from Shoshone Falls, 9 miles east of Glenwood Springs, and expects to secure 40,000 H.P. At first power will be supplied to Leadville, Aspen and the surrounding towns, but later power will be transmitted to Denver. Incorporators: Albert Sherwin, Leadville; J. H. De Remer and E. E. Lucas, of Glenwood Springs.

New London, Conn.—A bill has been passed in Legislature authorizing the New London Gas & Electric Co. to issue bonds to the amount of $750,000.

New Milford, Conn.—A bill has been passed in Legislature authorizing the New Milford Power Co. to erect a dam at Gaylord's Bridge on Housatonic River.

Sandersville, Ga.—It is stated that bids are wanted July 1 for $37,000 electric light and water works bonds. W. A. Bell, City Clk.

Griffin, Ga.—The citizens are stated to have voted June 10 to issue $100,000 bonds for lights, water and sewerage.

Sand Point, Idaho.—The Sand Point Electric Co. is reported incorporated, with a capital of $25,000, by T. C. Marshall, R. G. Rowland and M. R. Rutherford, to construct an electric light plant at Sand Point. The company is reported to have recently secured a franchise to install water works.

**Galesburg, Ill.*—W. H. Schott, of Chicago, is stated to have secured the contract for constructing the heating plant for Wm. McKinley, work to be completed Oct. 15.

Alton, Ill.—This city is preparing to relet the city lighting contract for another year, the contract with the Alton Ry., Gas & Electric Co. having expired. It is proposed to install a system of incandescent arc lights to take the place of the present open arc system.

Cherry Valley, Ill.—It is reported that C. K. Luhman contemplates constructing an electric light plant.

Bedford, Ind.—It is stated that the Bedford Electric Light & Power Co. contemplates extensive improvements.

Anderson, Ind.—Engineer Edgar R. Vincent, of Indianapolis, writes that bids will be received on July 10 by the Home Htg. Co. (C. K. McCullough, Secy., Anderson) for a heating plant, to cost from $20,000 to $25,000.

Des Moines, Ia.—Local press reports state that the Edison Electric Light Co. is having plans prepared for an extension to the east wing of the Center St. dam; probable cost of work, $50,000.

Wichita, Kan.—See "Electric Railways."

Horton, Kan.—The Horton Water & Light Co., of Horton, has been incorporated, with a capital of $60,000.

Ft. Leavenworth, Kan.—Maj. D. E. McCarthy, Q. M., U. S. A., writes that Gilbert Wilkes & Co., of Denver, Colo., bid for constructing the electric lighting system at Ft. Leavenworth (opened June 6) $50,400.

Jackson, Ky.—The Jackson Electric Light & Power Co. is stated to have secured a charter to build, equip, maintain and operate an electric plant to furnish electric light in Breathitt Co., Ky., and other places; capital, $25,000. Incorporators: Louis B. Dailey, M. Mitchell, and others, all of Jersey City, N. J.

Boston, Mass.—Penal Comr. John B. Martin opened the following bids June 24 for a complete electrical plant for the new House of Correction at Deer Island, Boston Harbor: A. L. Picard, $29,997; Clark & Mills Electric Co., $28,985; Lord Electric Co., $25,350; Erickson Electric Equipment Co., $25,386; Thos. W. Byrne, $27,420, and Edwin C. Lewis, $23,336. Bidders all of Boston. For 3 horizontal tubular boilers for same building, Roberts Iron Wks., Cambridge, bid $3,550, and Hodge Boiler Wks., 72 Mason Bldg., $3,586.

Greenfield, Mass.—The Greenfield Electric Light & Power Co. is stated to have purchased water power at Gardner Falls, and will expend about $75,000 in the construction of a dam, canal and power plant.

Boyne, Mich.—E. A. Stowe and C. C. Follmer, of Grand Rapids, are reported interested in the construction of an electric light and power plant at Boyne.

Ontonagon, Mich.—The Diamond Match Co. will install an electric light plant.

Alpena, Mich.—Geo. P. Smith, of Syracuse, is reported interested in the construction of a power plant on Thunder Bay River.

Houghton, Mich.—The Houghton County Gas Co. is stated to have secured franchises in Hancock, Red Jacket and other villages. The main gas plant will be constructed at Lake Linden.

St. Charles, Minn.—The lowest bid opened on June 16 for constructing the electric light plant is stated to have been submitted by the American Electric Co., of St. Paul, for $9,990. The Ft. Wayne Electric Co., of Ft. Wayne, submitted the lowest bid for electric machinery alone, at $6,495.

Fertile, Minn.—G. Kronschnabel is stated to have secured a 20-yr. franchise to operate an electric light plant.

Missoula, Mont.—The Missoula Light & Water Co. has been incorporated, with a capital of $400,000, to acquire, construct, equip and operate water works, electric light plants, etc., in Montana. Incorporators: Jos. Simon, John M. Gearin and F. R. Olin.

Newark, N. J.—Bids for lighting the city with electric lamps for 2 and 5 yrs. were received from the United Electric Co. on June 18 by the Bd. of Wks. The company offered to furnish the standard type of open lamps, such as now prevails, for 2 yrs. for $98.55 per lamp, and the more modern type of closed lamps for 5 yrs. at $95 ea.

Tuckerton, N. J.—The Tuckerton Gas Co., of Tuckerton, has been incorporated, with a capital of $25,000, by F. R. Austin, W. C. Sawyer, John H. Webb, and others.

*Items marked thus give the names of parties awarded contracts.

Niagara Falls, N. Y.—A press report states that bids are wanted by the Toronto & Niagara Power Co. for a power wheel pit. It will be 480 ft. long, 180 ft. deep, and 27 ft. wide, cut through solid rock. It will cost about $1,250,000, and will develop 225,000-H.-P.

**Brooklyn, N. Y.*—Abr. L. Saruya, 1080 Lexington Ave., N. Y. City, has secured the contract for installing electric light wiring, fixtures and electric bell system in School No. 2, Boro. Brooklyn, for $4,874 (bids opened June 22).

Penn Yan, N. Y.—The Village Trus. are reported to be considering the question of installing an electric light plant.

Troy, N. Y.—The Rensselaer Co. Bd. of Superv. is reported to be considering the question of installing an electric plant to light the county buildings.

Pulaski, N. Y.—H. M. Wistier, of Chicago, Ill., Pres. Yaryan Construction Co., is reported interested in the construction of a hot-water heating plant in Pulaski. He proposes organizing a stock company of local capitalists.

Lexington, N. C.—The Lexington Water & Light Co., of Lexington, N. C., has been incorporated to construct, operate and own water works, electric light, telephone, electric railway, power plants, generate and transmit steam, water and lights and sell the products of ice factories, refrigerator plants, etc.; capital, $75,000. Incorporators: W. G. Perry, J. B. Smith and R. L. Burkhead, of Lexington, and F. W. Siebert, of Waterbury, Conn.

Cleveland, O.—The Council Finance Com. has approved the ordinance requesting the Bd. of Pub. Service to prepare plans and estimates for a municipal electric lighting plant. The ordinance appropriates a sum not to exceed $5,000 to pay the cost of preliminary work.

Portsmouth, O.—L. E. Smith and others are stated to have petitioned for a franchise for a lighting plant.

Portland, Ore.—It is stated that the Portland General Electric Co. will expend about $250,000 in improvements.

**Lebanon, Pa.*—The Edison Co. has secured the contract for lighting the city for 10 years at $79.92 per lamp per year for arc lights and $16.80 for incandescents.

San Antonio, Tex.—W. H. Weiss has petitioned the City Council for a franchise for an electric light plant.

Kyle, Tex.—T. C Johnson, of San Marcos, writes that it is proposed to construct an electric light plant, to light oil mill property.

Petersburg, Va.—It is stated that the Virginia Passenger & Power Co. will build a dam across Appomattox River west of the dam above Ferndale Park; it will be 1,360 ft. long, 75 ft. wide at bottom, 50 ft. wide at top, and 75 ft. high.

Spokane, Wash.—Press reports state that the Washington Water Power Co. will construct an electric plant at Post Falls, to cost $500,000.

Wheeling, W. Va.—Walter Worls, City Clk., writes that the city is getting prices on a water gas plant, to be installed in place of present works.

Onalaska, Wis.—The City Council has granted the La Crosse Gas & Electric Co. a franchise to install an electric lighting system in Onalaska.

Fox Lake, Wis.—W. F. O'Connell, Village Clk., writes that it was voted June 20 to issue $7,000 bonds for a gas plant.

Independence, Wis.—The Village of Independence will receive bids July 14 for constructing a complete electric light building, pole line, 70-H.-P. boiler and engine and 40-Kw. dynamo and switchboard.

Monterey, Mex.—It is reported that the Monterey Electric Light Co. will expend about $150,000 in improvements.

ELECTRIC RAILWAYS.

Haynesville, Ala.—The Haynesville Ry. Co. has filed articles of incorporation, with a capital of $75,000, to build a railway from Haynesville to Morganville.

Trinidad, Colo.—The City Council has granted a franchise for the construction of a street railway and lighting plant to Frank P. Read, of St. Louis, Mo. It is planned to construct 5½ miles of track in the city and to connect Sopris and Starkville and other coal camps in the vicinity, making a total of 12 miles of track for the first division.

Hartford, Conn.—The Legislature has passed a resolution changing from Enfield to Hartford the corporate headquarters of the Hartford & Springfield St. Ry. Co., and granting it additional franchises.

Wallace, Idaho.—The City Council has granted to Herman J. Rossi and associates a franchise to construct and operate an electric railway.

Alton, Ill.—The Alton Gas & Electric Ry. Co. will construct an electric railway from Alton to North Alton, a distance of about 2½ miles. J. F. Porter, Pres.

Boonville, Ind.—The Town Board has granted a franchise to the Evansville, Boonville & Rockport Traction Co.

Indianapolis, Ind.—The Co. Comrs. have granted a franchise to the Indianapolis-Northern Traction Co. to enter the county and city over the new College Ave. Fall Creek bridge. In consideration, the company will make the filled approaches to the bridge, to cost $15,000

The Comrs. of Marion County have granted a franchise to Chas. L. Henry, Pres. Cincinnati & Indianapolis Traction Co., to enter the county.

New Albany, Ind.—The Louisville & Southern Indiana Traction Co. has been incorporated to construct and maintain street and interurban railways in New Albany and Jeffersonville; length of electric lines to be constructed, 200 miles. Directors: Samuel Insull, of Chicago, Ill.; Jas. W. Dunbar and J. O. English, of New Albany, and others; capital, $3,000,000.

**Muscatine, Ia.*—The International Construction Co., of Detroit, Mich., is stated to have secured the contract for constructing the Davenport & Suburban R. R., for about $800,000.

Wichita, Kan.—A charter has been granted to the Arkansas Valley Interurban Co., with headquarters in Wichita; capital, $1,000,000. The company is to build and operate an electric railway from Wichita to Winfield, Wellington, Arkansas City, and furnish light and power along the line. Z. T. Daniel, Ch. Engr.

South Haven, Mich.—A franchise has been granted by the Town Bd. to Geo. E. Bardeen and G. W. Merriman, for an electric railway through the township north and south. The construction of the line will begin in South Haven and extend to Kalamazoo.

Benton Harbor, Mich.—The Chicago, Michigan & Indiana Electric Railway Co., of Benton Harbor, with a capital of $3,000,000, has been incorporated to build an electric railway from Chicago to several points in Southwestern Michigan.

Biloxi, Miss.—The City Council has granted the Biloxi Electric St. Ry. & Power Co. an amended franchise, granting the company permission to erect poles and wires for the maintenance of an electric light plant.

East Las Vegas, N. M.—The Dirs. of the Las Vegas & Hot Springs Electric Ry., Light & Power Co. are considering a proposition from the city to extend the electric railway completely around the city.

Alamagordo, N. M.—Local capitalists have decided to commence in the near future the building and operation of an electric street railway. A. S. Greig, of Alamagordo, is reported interested.

Las Vegas, N. M.—The Directors of the Las Vegas Electric St. Ry. & Power Co. are stated to have completed arrangements with the city for the building of 5 additional miles of electric road and the installation of a new electric light plant. A. H. Duncan, Pres., St. Louis, Mo.

Owego, N. Y.—The Binghamton Ry. Co. has secured a franchise in Owego. J. P. E. Clark, Gen. Mgr., Binghamton.

Islip, N. Y.—The South Shore Traction Co. has secured a franchise in Islip. The company now has a franchise direct from the Eastern Brookhaven line to Nassau County with the exception of the village of Babylon.

New York, N. Y.—Bridge Comr. Lindenthal is stated to have selected Henry F. Hornbostel, 63 William St., to prepare plans for the railroad terminal at the Manhattan end of the Brooklyn Bridge.

Lexington, N. C.—See "Power Plants, Gas and Electricity."

Madisonville, O.—The Cincinnati Traction Co. has secured a new franchise in Madisonville. W. K. Schoepf, Gen. Mgr., Cincinnati.

Enid, Okla. Ter.—The Metropolitan Ry. Co. has secured a charter to build and operate an electric street railway at Enid; capital, $600,000. Directors: P. J. Goulding and L. C. West, of Kingfisher, and others.

McKeesport, Pa.—The McKeesport St. Ry. Co., with a capital of $42,000, has been chartered to build a 7-mile line between McKeesport and Elizabeth. T. C. Jones, Pres.

Bethlehem, Pa.—The Hanover Central Electric Ry. Co. has been incorporated by Clarence A. Wolle, of Bethlehem; Chas. A. Walbert, of Philadelphia, and others, to construct a road, 8 miles in length, from 2d and Arch Sts., Allen Township, to Rittersville, West Bethlehem and Bethlehem; capital, $48,000.

Connellsville, Pa.—The Pittsburg, McKeesport & Connellsville St. Ry. Co. has prepared plans for rebuilding the suburban division of the road and the improvement of Soisson Park.

Wayne, Pa.—The Radnor Belt Line St. Ry. Co., capital, $30,000, has been chartered to build a 5-mile line from Radnor to the intersection of the County Line Road and Spring Mill Road. W. A. Obdyke, of Wayne, Pres.

Johnstown, Pa.—The Council has passed on second reading the ordinance granting the Johnstown Passenger Ry. Co. the right to double track Maple Ave. The company must pave the street with vitrified brick and keep it in repair.

Beaver Falls, Pa.—The Loop Electric St. Ry. Co., capital $12,000, has been chartered to build a 2-mile line connecting the 7th and 8th Ave. lines of the Beaver Valley St. Ry. Co. via Fetterman Bridge and College Hill. Wm. R. Wright, of Philadelphia, Pres.

Mechanicsburg, Pa.—The Star St. Ry. Co., which is to build an electric railway between Mechanicsburg and Mt. Pleasant, a distance of 5 miles, has issued bonds to the amount of $100,000.

Philadelphia, Pa.—The Market St. Elevated Passenger Ry. Co., with $5,600,000 of authorized capital stock, has been formed by consolidation and merger of the following elevated passenger railway companies: Market St., Germantown Ave., Passyunk Ave., Ridge Ave., Frankford Elevated and the Broad St. Subway Ry. Co. The companies own franchises granted in June, 1901.

Lancaster, Pa.—The Brandywine Electric St. Ry. Co. has decided to file maps of extensions to Downingtown and Lancaster with the State Dept.

Boiling Springs, Pa.—A company has been formed to build an electric railway from Boiling Springs to Mt. Holly Springs, a distance of 5 miles; capital, $50,000. Directors: John Graybill, Jacob Foreman, and others.

West Newton, Pa.—The West Newton Northern Ry. has been consolidated with the Bellevernon-Monessen line, which is now in partial operation. The line will be extended from Fayette City to Penyopolis, Banning, Jacob's Creek, Smithdale, West Newton, Herminie and Irwin. Surveys have been begun.

Elizabeth, Pa.—The Town Council has granted a franchise to Webster & West Newton St. Ry. The line from Webster to West Newton will be 5 miles long, with a branch to McKeesport.

New Brighton, Pa.—The Town Council has passed the ordinance granting a franchise to the North Rochester St. Ry. Co.

Allentown, Pa.—The Allentown & Reading Traction Co. proposes extending its main line from Lyons to Alburtis, a distance of about 12 miles.

Chambersburg, Pa.—The Supervisors of Quincy Township have granted the Chambersburg & Gettysburg Electric Ry. a franchise, as have also the Supervisors of Washington Township and Greene Township.

Harrisburg, Pa.—The Harrisburg & Lewisberry St. Ry. Co., which has been organized to build an electric railway from New Cumberland to Lewisberry and Silver Lake, a distance of 8 miles, has issued bonds to the amount of $100,000 and stock to the amount of $50,000.

Pawtucket, R. I.—A correspondent writes that the Rhode Island Co. will expend in the Spring of 1904 about $1,000,000 in improvements. Fred. Bushnell, Ch. Engr., 170 Westminster St., Providence.

Beaumont, Tex.—The City Council has granted a franchise to the Beaumont Traction Co. to construct the Liberty-Magnolia Loop; also a franchise to extend its line on Calder Ave., and to construct a loop on 5th St.

Grafton, W. Va.—The Grafton St. Ry. Co. has been incorporated, with a capital of $50,000, to build an electric railway here.

New Cumberland, W. Va.—The Comrs. of Hancock County have granted Jas. McDonald and C. A. Smith a franchise for an electric railway from Chester, W. Va., to Congo, W. Va.

Shawano, Wis.—The Shawano & Green Bay Traction Co. is reported organized, and has secured franchises through every town between Shawano and Green Bay, a distance of 40 miles.

Edgerton, Wis.—The City Council has granted the Janesville Traction Co. a franchise for an electric railway through the city.

Sheboygan, Wis.—The Sheboygan & Calumet Ry. & Electric Co. has been organized to build an electric railway to Chilton.

Pratt, Wis.—The Superior & Southeastern Ry. Co., with a capital of $50,000, has been incorporated to build a road from Pratt to a junction with the Chippewa Valley & Northwestern Road, 60 miles. Incorporators: John E. Glover and L. A. Baker, New Richmond, and H. C. Baker, Hudson.

Honolulu, Hawaii.—The Pub. Wks. Dept. is stated to have approved the plans of the Rapid Transit Co. for its proposed street car route along the water front.

RAILROADS.

Huntsville, Ala.—It is reported that the Huntsville & Birmingham R. R. Co. will construct a railroad from Huntsville to Birmingham; probable cost of construction $2,000,000.

Ft. Smith, Ark.—The Ft. Smith, Blackwell, Wellington & Northwestern R. R. Co. has been incorporated to construct a line from Ft. Smith, Ark., through Cherokee and Creek nations to Cleveland, Okla. T., and through Osage and Ponca Reservations to Wellington, Kan. A part of the same road will be a line to Blackwell, where the headquarters of the road will be. A branch office will be opened at Wellington. Directors: Geo. H. Hunter and O. Graff, of Wellington, Kan., and Geo. R. Willit and D. S. Rose, of Blackwell, Okla. Ter.

Shelbyville, Ill.—The Springfield & Southeastern R. R. Co. of Shelbyville has been incorporated, with a capital of $25,000, to construct a line from Springfield to Shelbyville. Incorporators: John W. Maunts and Theo. F. Dove, Shelbyville; E. D. Kerr, Brunswick, Ill., and others.

Ft. Dodge, Ia.—It is reported that the Minneapolis & St. Louis R. R. Co. will expend about $50,000 on improvements in Ft. Dodge. H. G. Kelley, Ch. Engr., Minneapolis, Minn.

Council Bluffs, Ia.—It is reported that the Rock Island R. R. Co. will expend about $6,000,000 in improvements in Iowa and Nebraska. J. F. Stevens, Ch. Engr., Chicago, Ill.

Galatia, Kan.—The Kansas, Galatia & Smoky Valley Ry. Co. has been incorporated, with a capital of $500,000, to construct a line about 75 miles in length, between Lorance and Ellis County. Headquarters to be at Galatia. Directors: Jas. Armstrong, Galatia; G. L. Chapman, Great Bend; W. M. Whitelaw, Kansas City, Kan., and others.

Columbia Falls, Mont.—The Great Northern R. R. Co. is reported to be preparing plans for the construction of a new cut-off from Columbia Falls, Mont., to a point just north of Jennings, Mont., on the branch from that town to the Canadian boundary. The distance is about 100 miles. Cost of proposed work will be about $2,000,000. A. H. Hogeland, Ch. Engr., St. Paul, Minn.

Oklahoma, Okla. Ter.—The Oklahoma & Rio Grande Southern R. R. Co. is reported formed, with Liano L. W. Van Horn as Ch. Engr., to construct a railroad from Oklahoma south through Texas to the Rio Grande border. Wm. F. Harrity and Chas. E. Ingersoll, of Philadelphia, Pa., are reported interested.

McKeesport, Pa.—The Baltimore & Ohio R. R. Co. is stated to have completed plans to build a four-track system through McKeesport from Demmler station to the company's yards at Versailles. J. M. Graham, Ch. Engr., Baltimore, Md.

**Lilly, Pa.*—Wm. H. Brown, of Philadelphia, Ch. Engr. Pennsylvania R. R. Co., is stated to have awarded to McMenamin & Simms, of Philadelphia, the contract for about 5 miles of track from Lilly to Portage, Pittsburg Division, and to the Smith Constr. Co., also of Philadelphia, the contract for about 6 miles of work between McVeytown and Newton Hamilton, Middle Division. These two contracts call for an expenditure of about $2,500,000. It is also reported that an extra track will be placed on the main line from Gallitzin to Altoona, a distance of about 12 miles.

*Items marked thus give the names of parties awarded contracts.

**Brownsville, Tex.*—The contract for constructing the Brownsville R. R. from a point on the Texas-Mexican R. R. to Brownsville, Tex., a distance of 205 miles, is stated to have been awarded to Johnston Bros., of St. Elmo, Ill.; cost of road complete, including rolling stock, will be about $4,000,000.

**Whatcom, Wash.*—A. C. Goerig, of Everett, has secured the contract for the Lynden line, a branch of the Bellingham Bay & British Columbia R. R. running from Hampton to Lynden, a distance of 5½ miles. P. B. Cornwall, Pres., San Francisco, Cal. J. J. Donovan, Ch. Engr., Whatcom.

Wellsburg, W. Va.—The Buffalo Creek Ry Co., of Wellsburg, has been incorporated, to build a railroad in Brooke County; capital $300,000. Incorporators: Saml. George, Millard E. Boyd, John C. Palmer and others, all of Wellsburg.

Cheyenne, Wyo.—Governor Fenimore Chatterton is reported interested in the construction of a railroad from Guernsey west to Lander.

Cape Breton, N. S.—Bids will be received by the Mabou & Gulf Ry. Co., Ltd., for constructing 30 miles of its road, except equipment. Address J. Boardman Cann, Pres., Mabou, Cape Breton, N. S.

St. Thomas, Ont.—The Huron, Erie & Buffalo R. R. Co. is reported incorporated, to construct a railroad east from St. Thomas to the Niagara River and west to Sarnia. The company also secured permission to build a bridge over Niagara and St. Clair Rivers. The Pere Marquette R. R. Co. (F. H. Alfred, Ch. Eng., Detroit Mich.) is reported interested.

PUBLIC BUILDINGS.

Little Rock, Ark.—It is stated that bids are wanted by the State Capitol Comn. until Aug. 12 for erecting a State Capitol. J. B. McCaleb, Chmn.

Pueblo, Colo.—It is stated that an addition to the Women's Dept. and two 3-story cottages will be erected at the State Insane Asylum; appropriation available, $150,000.

Middletown, Conn.—The Assembly is stated to have provided for an appropriation of $20,000 for erecting Middlesex Hospital.

Chicago, Ill.—C. W. Stevens, 160 Washington St., is stated to have prepared plans for an edifice for the Congregation of the Sheffield Ave. Methodist Episcopal Church; estimated cost, $40,000.

Mishawaka, Ind.—C. A. Brehmer, of South Bend, is preparing plans for a City Hall for Mishawaka, to cost $20,000.

Michigan City, Ind.—The Sisters of St. Francis are receiving bids at Lafayette for a 5-story 57x163 ft. pressed brick hospital to be erected here.

Richmond, Ind.—The contract will soon be let for the erection of the Reed Hospital, in this city; estimated cost, $50,000.

Indianapolis, Ind.—Dr. W. B. Fletcher will erect a brick sanitarium at Market St. and Highland Ave.; estimated cost, $44,000.

Connersville, Ind.—The congregation of the Christian Church are receiving bids for erecting an edifice to cost $30,000. Rev. J. C. Burkhardt, Pastor.

Goshen, Ind.—Patton & Miller, 153 La Salle St., Chicago, Ill., are stated to have prepared plans for the Elkhart County Court House; estimated cost, $50,000.

**Davenport, Ia.*—The Tri-City Constr. Co., of this city, is stated to have received the contract for erecting the Ward building at the Watertown Insane Asylum, for $99,000.

*Ed. Kaufman, Vice-Pres. Bd. Trus., writes that the contract for completing the Davenport Public Library (bids opened June 22) has been awarded to A. Steckel & Sons Co., of Davenport, Ia., for $31,500.

**Des Moines, Ia.*—It is stated that the Capitol Improvement Comm. awarded the contract for ventilating, heating and electric wiring the State house to L. H. Kurtz, 312 Walnut St., for $73,306.

Lawrence, Kan.—It is stated that bids are wanted July 7 for erecting a library. G. Groenor, Pres.

New Orleans, La.—Plans are stated to have been approved for the erection of 6-story, 85x115-ft. addition to the City Hall at Carondelet and Lafayette Sts.; probable cost, $150,000.

Farmersville, La.—Bids will be received by the Police Jury of Union Parish, La., at Farmersville Township, July 13 for erecting a Court House, cost not to exceed $28,000. A. J. Bryan & Co., Archts., 1,104 Hennen Bldg., New Orleans. H. M. Lee, Clk.

New Bedford, Mass.—It is stated that bids are wanted June 30 for erecting a steam fire engine house at Kempton and Reed Sts. C. H. Brownell, Chmn.

Dedham, Mass.—Bids will be received July 7 by the Co. Comrs. for erecting a building for the Registries of Deeds and Probate and for the Probate Court. Peabody & Stearns, Archts., 919 State St. Exchange, Boston. Thos. Blanchard, Chmn.

West Roxbury, Mass.—Bids will be received July 1 by Trus. Insane Hospital of Boston for plumbing work in Insane Hospital. Wheelwright & Haven, Archts., 100 Boylston St., Boston.

Battlecreek, Mich.—Bids are wanted July 6 for erecting a county infirmary. Address G. J. Ashley.

**Marquette, Mich.*—Wm. H. Maxwell, of Port Huron, is reported to have received the contract for erecting the Peter White Public Library, for $37,346.

Corunna, Mich.—It is stated that bids are wanted July 15 for erecting a brick and stone court house, 87 x116 ft., to include plumbing and heating; probable cost, $75,000. Claire Allen, Archt., Jackson, Miss.

Newberry, Mich.—It is stated that bids are wanted by the Bd. of Trus. of the Upper Peninsula Hospital for the Insane until July 15 for erecting 3 buildings, including heating. Charlton Gilbert & Kuentzil, Archts., Marquette, Mich.

North Branch, Mich.—It is stated that bids are wanted by the Co. Comrs. until July 13 for erecting a poorhouse, including heating and plumbing. J. A. Ryatrom, Chmn. Bldg. Com.

Port Gibson, Miss.—Bids will be received July 6 by the Bd. of Co. Superv. for furnishing material and remodeling the Court House. Audrew J. Bryan & Co., Archts., New Orleans, La. R. C. McCay, Chancery Clk.

Billings, Mont.—J. W. Fish, Co. Clk., writes that the citizens voted on June 6 to issue $75,000 bonds to erect a court house and jail.

Dillon, Mont.—Bids will be received July 8 by the Bd. of Co. Comrs. for erecting a jail; separate bids will be received for heating and plumbing. John S. Baker, Clk.

Stillwater, Nev.—Bids will be received July 6 by the Bd. of Co. Comrs. for erecting a Court House in Fallon Township. Will Brown, Clk.

West Hoboken, N. J.—Bids will be received July 16 by the Bd. of Trus. of West Hoboken Free Pub. Library for erecting a library; separate bids will be received for mason work, roofing, plumbing, heating, electrical work, etc. Paul Konert, Clk.

Jersey City, N. J.—The Bd. of City Hospital Trus. are stated to have appointed C. Fred Long, 91 Montgomery St., to prepare plans for the City Hospital, to cost about $200,000. Edw. M. Watson, Pres. Bd. of Trus.

Newark, N. J.—Bids will be received July 1 by the Bldg. Com. of the Common Council for furnishing material and erecting a police station to be known as the 4th Precinct; separate bids will be received for heating, plumbing, mason, iron, electric work, etc. Hurd & Sutton, Archts., Prudential Bldg. Jas. F. Connelly, City Clk.

New York, N. Y.—Bids are wanted July 8 for erecting the 71st Regiment Armory building of the N. G. N. Y. on 4th Ave. and 34th St. Information can be obtained from the Armory Bd., 280 Bway., Stewart Bldg.

The lowest bid opened on June 17 by the Fire Dept., at 157 E. 67th St., N. Y. City, for erecting a building for Engine Co. No. 146, at Sheepshead Bay, and for a building for Engine Co. No. 145, Coney Island, was submitted by Jas. McFerran for $69,739.

Binghamton, N. Y.—Bids will be received July 1 by Israel T. Deyo, Secy. Binghamton Pub. Library, for furnishing material and erecting a fireproof library. S. O. & H. A. Lacey, Archts.

Buffalo, N. Y.—Cram, Goodhue & Ferguson, of Boston, Mass., are stated to be preparing plans for a 3-story Parish House for Trinity Church; probable cost, $40,000.

North Tonawanda, N. Y.—Archt. Joraleman, Gluck Bldg., Niagara Falls, is stated to be preparing plans for the Carnegie Library, to be erected on Goundry St., at a cost of $20,000.

**Albion, N. Y.*—G. W. Fitch, Clk., writes that contracts for jail and sheriff's residence (bids opened June 9) have been awarded as follows: Plumbing, carpenter and mason work, to Dean & Havens, of Oleau, for $27,459, and prison construction, to Dorn Iron Wks., Cleveland, O., for $19,933.

**Far Rockaway, L. I., N. Y.*—R. H. Carman, of Far Rockaway, is stated to have received the contract for erecting the Carnegie Library here, for $25,440.

New York, N. Y.—Bids will be received July 15 (extension of date) by John W. Brannan, Pres. Bd. of Trus., Bellevue and Allied Hospitals, for erecting a Harlem Hospital on Lenox Ave., 136th and 137th Sts.

Sanger, N. D.—Bids are wanted July 6 for erecting a Court House at Center, Oliver Co. Wm. V. Klebert, Co. Aud.

Delaware, O.—Bids will be received July 15 by the Trus. of the Girls' Industrial Home near Delaware for 3 75-H.-P. boilers for said home. Address Edwin J. Brown, Clk.

Cincinnati, O.—Bids will be received July 6 by the Bd. of Pub. Service for furnishing engines, generators, switchboard connections, feed water heater and elevator for City Hall. Geo. F. Holmes, Clk.

Mansfield, O.—Bids are wanted July 21 for furnishing material and installing plumbing and fixtures for 100 cells, electric light wire and fixtures for 200 cells, iron, steel, etc., for the east cell and lateral wing of the Ohio State Reformatory. C. H. Workman, Secy. Bd. of Mgrs.

Youngstown, O.—The Memorial Presbyterian Society is reported to be considering erecting an edifice, to cost about $25,000. Rev. D. H. Evans, Pastor.

Greensburg, Pa.—The Westmoreland County Commissioners are stated to have rejected all bids received for erecting the Court House. New bids will be received.

Pittsburg, Pa.—See "Schools."

Warren, Pa.—Bids are wanted July 7 for repairs and alterations to jail. F. M. Fonning, City Clk.

Hot Springs, S. D.—Bids are wanted July 28 for constructing a group of buildings at the Battle Mountain Sanitarium, Hot Springs, as advertised in The Engineering Record.

Norfolk, Va.—Bids are wanted July 2 for erecting a police station at Queen and Lincoln Sts. T. S. Fitzgibbon, Chmn. of Com. on Uptown Police Station.

Richmond, Va.—The plans of Noland & Baskerville, Chamber Commerce Bldg., have been accepted for a synagogue to be erected here at a cost of $50,000. Henry S. Hutzler, Chmn. Bldg. Com.

M. J. Dimmock, 1111 E. Main St., has prepared plans for a $20,000 edifice for Emanuel Baptist Church, to cost $20,000.

Seattle, Wash.—Plans are stated to have been prepared for the erection of a R. C. Cathedral at 9th Ave. and Marion St.; probable cost, $250,000. Rev. E. J. O'Dea is reported interested.

Seattle, Wash.—It is stated that King County will erect a 2-story brick hospital at 38th St. and Pacific Ave., at a cost of $30,000.

Bayfield, Wis.—Bids will be received July 1 by the Library Bd. for erecting a Carnegie library. A. H. Wildhagen, Archt., Ashland. O. L. Shepherd, Acting Secy.

Milwaukee, Wis.—The Congregation of the Washington Ave. M. E. Church is stated to have purchased a site at Grand Ave. and 25th St. for the erection of an edifice, to cost $50,000.

**Kewanee, Wis.*—Wm. Karsten, Chmn. Bldg. Com., writes that the contract for erecting an addition to Kewanee Court House (bids opened June 16) has been awarded to Rademacher & Lange, of Appleton, for $15,010.

Ottawa, Ont.—The House is stated to have decided to erect a Canadian Building at the La. Purchase Expos., St. Louis, Mo.; probable cost, $20,000.

BUSINESS BUILDINGS AND DWELLINGS.

Denver, Colo.—J. S. Flower is to erect a $20,000 building on 17th St. and Bway.

Marean & Norton, 206 Equitable Bldg., have prepared plans for a 3-story flat to be erected on 17th and Logan Ave. for E. L. Meaa.

F. Sterner, Jackson Bldg., has prepared plans for a brick and stone business building, to be erected on Bway. and 11th St., to cost $45,000.

**Alton, Ill.*—The Piasa Chautauqua Co. (Col. A. F. Rodgers, Pres., Upper Alton), has awarded to Bowman & Kleinschuettger, of Alton, Ill., the contract for erecting a hotel, to cost $18,317.

Hartley, Ia.—It is stated that Theo. Miller will erect an Opera House here, to cost $28,000.

Louisville, Ky.—It is stated that the Thomas Jacob estate will erect a $50,000 business building at 3d and Market Sts.

Boston, Mass.—Plans have been filed for $50,000 single dwelling for J. B. Richmond, to be located at 308 Beacon St. Architects, Peabody & Stearns, 53 State St.

**Plans have been filed for a block of 3-family apartment houses on Prospect St., Charlestown Dist., to be of brick with stone trimmings; estimated cost, $25,000. Owner and builder, J. P. O'Riordan, City Square, Charlestown, Mass. Architect, W. H. Besarick, 13 School St.

The Boston Wharf Co. is to erect a 9-story brick warehouse, 75x120 ft., on Summer St. extension, Ward 13; estimated cost, $140,000. Architect, M. D. Safford, 274 A St.

*A 6-story, 104x136 ft. brick and stone building for working in non-combustible material is to be located at East 1st and O Sts., South Boston. Owner, Walworth Mfg. Co. Builders, Connery & Wentworth, 166 Devonshire St.; estimated cost, $75,000.

Paterson, N. J.—The Paterson Hotel & Construction Co. is reported incorporated, with a capital of $312,000, to erect a hotel here, to cost about $185,000. Capt. Chas. Curie is reported interested.

Buffalo, N. Y.—The Washington Power Bldg. is reported destroyed by fire June 19.

Cleveland, O.—It is stated that the Bankers' Fraternal Union will erect a 10-story building at Superior and Bank Sts., at a cost of $400,000.

Youngstown, O.—E. R. Thompson, Diamond Blk., is stated to have prepared plans for a 9-story hotel to be erected at Boardman and Market Sts.; estimated cost, $650,000.

Ironton, O.—Plans are stated to have been prepared for a depot to be erected at 1st and Olive Sts. for the Norfolk & Western Ry. Co. (L. E. Johnson, Gen. Mgr., Roanoke, Va.); probable cost, $50,000.

Pittsburg, Pa.—The Montefeore Hall Assoc. is reported to have purchased a site at 5th Ave. and Maurice St., for the erection of a building to cost about $25,000.

Bellevue, Pa.—It is stated that a Y. M. C. A. building will be erected here, to cost $35,000. Geo. N. Baden is reported interested.

Knoxville, Tenn.—C. M. McClang & Co. have a permit to erect a 6-story brick warehouse on W. Jackson Ave., to be equipped with elevators; cost about $10,000. Architects, Bauman Bros., 612½ Gay St.

Oshkosh, Wis.—Edgar P. Sawyer, Pres. Old National Bank, is reported interested in the erection of an office building to be erected here, to cost $100,000.

SCHOOLS.

San Bernardino, Cal.—It is stated that bids are wanted July 6 for erecting a dormitory. T. H. Goff, Archt., 318 E. St.

Washington, D. C.—Preliminary plans are stated to have been prepared for the buildings to be erected at 17th St. and Virginia Ave. for the Columbian University. The first structure will be erected on 17th St. at a cost of $350,000. Dr. Chas. W. Needham, Pres.

Chicago, Ill.—The Bd. of Trus. of Northwestern University are stated to have voted to erect a Science Hall, to cost $100,000.

Columbus, Ind.—The School Bd. has decided to erect a school on the site of building No. 4, at a cost of $50,000.

Perry, Ind.—It is stated that bids are wanted July 6 for erecting annex to a school. Philip Koch, Trus.

Des Moines, Ia.—Bids will be received July 12 by Bert McKee, Secy. Independent Dist. of Capital Park, for heating High School at Capital Park.

Topeka, Kan.—Bids are wanted July 1 for erecting a 4-room addition to Potwin School; also an 8-room school in the 2d Ward. J. E. Stewart, Clk. Bd. of Educ.

Boston, Mass.—Bids will be received June 30 by the Schoolhouse Comrs. for installing, ventilating and heating system in the Girls' High School, West Newton and Pembroke St. R. Clipston Sturgis, Chmn.

Bay St. Louis, Miss.—St. Stanislaus College is reported destroyed by fire.

Oceanic, N. J.—Bids will be received by the Bd. of Educ. of Shrewsbury Township until July 9 for erecting a school at Oceanic. J. E. Bogle, Chmn. Bldg. Com., Oceanic.

Schenectady, N. Y.—Bids are wanted July 7 for $140,000 school bonds. J. H. Bernardi, City Treas.

*Items marked thus give the names of parties awarded contracts.

Long Island City, N. Y.—Bids will be received July 6 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for installing electric light wiring fixtures and electric bell system in School No. 83, Boro. Queens.

New York, N. Y.—Bids will be received July 6 by the Executive Com. of Normal College for repairs and alterations to Normal College buildings. Alrick H. Man.

Bids will be received July 6 by C. B. J. Snyder, Supt. of School Bldgs., for erecting an addition and alterations to the truant school.

**Hempstead, N. Y.*—Dr. Chas. H. Ludlum, Pres. Bd. Educ., writes that the contract for installing heating and ventilating plant in the school (bids opened June 16) has been awarded to Evans, Almirall & Co., 281 Water St., N. Y. City, for $9,464.

Buffalo, N. Y.—Bids are wanted July 3 for steel ceilings throughout School No. 15; also putting tin roof on entire building of School No. 37. Francis G. Ward, Comr. Pub. Wks.

**Richmond, S. I., N. Y.*—The following bids were opened by C. B. J. Snyder, Supt. School Bldgs, N. Y. City, on June 22, for sanitary work at Richmond Borough High School No. 1: Jas. Fay, $17,993; William C. Ormond, $22,597; Santry & Co., New Brighton, $14,900 (awarded contract).

Wahpeton, N. D.—It is stated that bids are wanted by the Bd. of Trus. of the State Academy of Science until July 25 for erecting a brick building. Schuler Bros., Archts., Wahpeton; W. R. Purdon, Secy.

**Martin's Ferry, O.*—J. A. Wilson, of this city, is stated to have received the contract for erecting the High School, for $48,876.

Mansfield, O.—Bids are wanted July 14 for furnishing material and erecting a kindergarten building on West 1st St. school grounds. Vernon Redding, Archt., Bird Bldg. H. E. Cave, Clk. Bd. of Educ.

Cleveland, O.—Bids are wanted July 13 for furnishing material and erecting annex to South High School, including ventilating, heating, plumbing, gas-fitting and sewers, fireproofing, electric wiring, structural iron and steel, mason work, etc. Starr Cadwallader, School Dir., Bd. of Educ.

Pittsburg, Pa.—The Bd. of Trus. of Carnegie Inst. are stated to have accepted the plans of Alden & Harlow, 314 4th St., for the Carnegie Polytechnic School and addition to the Carnegie Library; estimated cost of improvements, $5,000,000.

Austin, Tex.—The Bd. of Regents of the State University are stated to have appropriated $50,000 for the erection of an Engineering Building.

Tacoma, Wash.—The Puget Sound (Methodist) University has ordered plans prepared for new building, $16,000, and dormitory, $4,000. C. W. Bullard, Archt., Fidelity Bldg.; Alfred Lister, Resident member of Bd.

St. Thomas, Ont.—Bids will be received July 4 by S. O. Perry, City Treas., for $35,000 school bonds.

STREET CLEANING AND GARBAGE DISPOSAL.

**Shreveport, La.*—The Dixon Garbage Crematory Co., of Dayton, O., is stated to have secured the contract for constructing a garbage crematory for Shreveport, for $9,970.

Ft. Banks, Mass.—See "Government Work."

**Toledo, O.*—The Toledo Development Co. is stated to have secured the contract for the disposal of garbage, offal and dead animals for 10 years. The company proposes constructing a plant. C. E. B. Lamson, Pres.

GOVERNMENT WORK.

Wilmington, Del.—Local press reports state that the following bids were opened June 10 for removing wreck of steamship Uriarte, from the Atlantic Ocean off Winter Quarter Shoal, on Virginia coast: Chas. W. Johnson, Lewes, $11,300; Wm. H. Keates, Atlantic City, N. J., $13,000; Vansant & Boehm, Atlantic City, N. J., $14,800; and Lewis H. Darling, Philadelphia, Pa., $23,000.

**Ft. Rosecrans, Cal.*—The following bids were received by Capt. R. H. Rolfe, Q. M., U. S. A., San Diego, on June 1, for (*a*) sewer system, (*b*) water distributing system, (*c*) water storage cisterns, (*d*) rain water cisterns: C. D. Vincent, Oakland, Cal., *a*, $7,337; *b*, $6,137. Jos. Kelly, San Diego, *c*, $9,489.50. Chas. H. Julian, San Diego, *a*, $8,940; *b*, $6,990; *c*, $5,900; *d*, $7,140. R. C. Mattingly, 1910 Green St., San Francisco, *a*, $8,490; *b*, $6,400; *c*, $4,500; *d*, $5,466—total, $24,856 (awarded contract), and A. Kindler, San Diego, *a*, $8,886; *b*, $7,237; *c*, $10,000; *d*, $7,258.

New London, Conn.—The contract for dredging in New London Harbor (bids opened May 14) is stated to have been awarded by Maj. Charles F. Powell to the Morris & Cummings Dredging Co., of New York, N. Y., at 9 4/11 cts. per cu. yd. The estimated amount of dredging is 1,203,144 cu. yds. and an appropriation of about $80,000 is available for the work.

New Haven, Conn.—The following bids for extending breakwater at New Haven, Conn., were opened June 22 by Maj. Chas. F. Powell, Corps Engrs., U. S. A.—*a*, price per ton for estimated tonnage of 33,845; *b*, totals: John F. Donovan, 1 Madison Ave., New York, N. Y., *a*, $1.33; *b*, $45,014. Dani. McAvoy, 21 and 24 State St., New York, N. Y., *a*, $1.25; *b*, $42,306. Estate John Beattie, Leetes Island, Conn., *a*, $1.33; *b*, $45,014. E. S. Belden & Sons, Hartford, Conn., *a*, $1.17; *b*, $39,599.

Washington, D. C.—The following bids were opened by the Superv. Archt., Treas. Dept., June 17 for the plumbing system complete of the National Bureau of Standards: S. Faith & Co., Philadelphia, Pa., $12,670; J. I. Atkinson, Washington, $22,019; Jas. Nolan & Sons, Washington, $12,988; Wm. Rothwell & Sons, Washington, $20,215.

Bids were opened at the same time and place for the installation of conduit, electric wiring, and gas piping of said building: Keller, Pike & Co., Philadelphia, Pa., $9,883; Iron City Eng. Co., Pittsburg, Pa., $6,587; I. F. Buchanan & Co., Philadelphia, Pa., $8,420; McCoy Eng. Co., Baltimore, Md., $7,790; National Electric Supply Co., Washington, $8,057.

Ernest Flagg, of New York, N. Y., is stated to be preparing plans for the erection of the naval hospital at 23d and E Sts.

Centerville, Ia.—Bids will be received until July 27 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the construction (including heating apparatus and electric wiring and conduits) of the U. S. Post Office at Centerville.

Boone, Ia.—The following bids were opened at Treas. Dept., Washington, D. C., June 18, for the construction (including plumbing, heating apparatus, electric wiring and conduits of the U. S. Post Office at Boone): J. D. Watts, Omaha, Neb., $65,000; Congress Constr. Co., Chicago, Ill., $83,493; C. M. Gindele Co., Chicago, Ill., $77,954; A. H. Connor, Cedar Rapids, $81,000; W. J. McAlpine, Dixon, Ill., $79,634.

Ft. Leavenworth, Kan.—See "Government Work."

Baltimore, Md.—Col. W. A. Jones, Corps Engrs., U. S. A., writes that the following bids for dredging in Patapsco River, Md. (140,000 cu. yds.) were opened on June 22: Coastwise Dredging Co., Baltimore, 19 cts. per cu. yd.—total, $26,600, and Maryland Dredging & Contracting Co., Baltimore, 17½ cts.—total, $24,500.

Annapolis, Md.—The lowest bid received on June 17 for constructing a sea wall at Annapolis for the new naval academy is reported to have been submitted by P. J. Carlin & Co., of Brooklyn, N. Y., for $520,000.

**Ft. Banks, Mass.*—The contract for constructing a garbage crematory (bids opened May 28) has been awarded to Jarvis Eng. Co., of Boston, for $2,740.

Saugatuck, Mich.—The following bids for pier construction at Saugatuck, Mich., were opened June 17 by Lieut. Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids—*a*, Burk, Smith & Nelson, Muskegon; *b*, Bennett & Schnorbach, Muskegon; *c*, Robt. Millen & Co., Muskegon; *d*, A. J. Beauvais & Co., Muskegon; *e*, Hugo & Tims, Duluth, Minn.; *f*, Adolph Green, Green Bay, Wis.; *g*, John M. Allmendinger, Benton Harbor.

	a	*b*	*c*	*d*	*e*	*f*	*g*
Dredging for crib found	$0.75	$0.50	$0.95	$0.50	$0.75	$0.75	$0.35
Foundation piles	.50	.60	.75	.55	.55	.65	.60
White oak piles	.32	.34	.40	.35	.40	.40	.38
White oak timber	50.00	60.00	60.00	50.00	60.00	62.00	42.00
Pine or fir	33.00	32.50	33.00	36.00	40.00	38.00	39.00
Hemlock or Norway	24.00	23.50	25.00	26.00	35.00	26.00	37.00
Pine or fir planks	40.00	51.00	39.00	46.00	40.00	49.00	43.00
Pine decking	32.00	31.00	31.00	32.00	40.00	34.00	35.00
Drift bolts	.03	.03	.035	.04	.03	.04	.03
Screw bolts	.03	.04	.035	.04	.04	.05	.045
Tie rods	.03	.04	.035	.04	.04	.04	.045
Csrriage bolts	.03	.05	.035	.04	.05	.05	.06
Spikes	.03	.035	.035	.04	.04	.04	.035
Stone	6.90	7.30	8.50	8.00	9.50	8.75	10.75
Totals	$82,603	$90,518	$91,766	$92,374	$99,664	$100,801	$101,350

**Ft. Slocum, N. Y.*—The Municipal Eng. Co., of N. Y. City, has secured the contract for constructing a garbage crematory at Ft. Slocum, for $3,865.

New York, N. Y.—The following bids were opened on June 10 by Maj. W. L. Marshall, Corps Engrs., U. S. A., N. Y. City, for building a pile dock at Sandy Hook, N. J.—*a*, 650 creosoted piles per pile; *b*, 280 M. ft. yellow pine per M. ft.; *c*, 45,000 lbs. bolts, heads, dock spikes, etc., per lb.; *d*, 15,000 tons riprap per ton: Smith & Robinson, N. Y. City, *a*, $29.16 to $78; *b*, $48; *c*, 4¾ cts.; *d*, $1.25. Geo. Humphreys, Brooklyn, *a*, $26.50 to $52.50; *b*, $44.50; *c*, 6½ cts.; *d*, 87½ cts. John Monks Son, N. Y. City, *a*, $34.15 to $80; *b*, $57; *c*, 3 cts.; *d*, 85 cts. C. D. Rodermund, Tompkins Cove., *a*, $27 to $58; *b*, $39.50; *c*, 4½ cts.; *d*, 85 cts. Richard Paccott, Newburgh, *a*, $30 to $80; *b*, $65; *c*, 5 cts.; *d*, $1.20.

**Ft. Totten, Willets Point, N. Y.*—Capt. G. H. McManus, Q. M., U. S. A., writes that the contract for extending the sea wall at Ft. Totten (bids opened June 22) has been awarded to Robt. L. Christie, 103 E. 125th St., N. Y. City, for $24,375.

**Ft. Caswell, N. C.*—Lieut. Philip Yost, A. A. Q. M., writes that the contract for constructing roads here (bids opened June 16) has been awarded to A. J. Robbins, of Southport, N. C., for $7,882.

Ft. Fremont, S. C.—Bids are wanted July 19 for installing electric wiring system in administration building. Address Quartermaster.

Memphis, Tenn.—Bids are wanted July 8 for about 380,000 cu. ft. of levee enlargement work in White River Levee Dist. Capt. E. W. Van C. Lucas, Corps Engrs.

Ft. Ringgold, Tex.—Bids are wanted July 15 for sinking an artesian well at this post. John L. Clem, Ch. Q. M., San Antonio.

Ft. Douglas, Utah.—The lowest bid opened on June 15 by Capt. S. V. Ham, Constr. Q. M., for a gymnasium and post exchange, was submitted by A. McDonald, Salt Lake City, for $17,600.

NEW INDUSTRIAL PLANTS.

O. P. Shupe, Mt. Pleasant, Pa., will erect a 200x50-ft. shovel factory and install a 60-H.-P. engine and a 100-H.-P. boiler.

H. B. Milligan, President of the Lake Charles, La., Board of Trade, writes that it is expected to begin construction of a cotton mill about Sept. 1. The plans call for a power plant of 600-H.-P. A superintendent is being advertised for, and contracts will not be let until one has been secured.

The Macdonald & Kiley Co., Cincinnati, O., is preparing plans for a 5-story, 40x150-ft. brick shoe factory. An electric power plant of about 125-H.-P. will be installed.

Wm. Miller & Sons, Rochester, Pa., expect to erect a clay-working plant in the near future, but details are undecided.

The Greensville Mfg. Co., Emporia, Va., has been organized with a capital of $50,000 to make furniture by Hugh C. Risdon, P. O. Box 110, Washington, D. C., to whom correspondence regarding buildings and equipment should be addressed.

The Sessions Foundry Co., Forestville, Conn., will erect a 3-story, 50x130-ft. brick building and a 1-story building of the same dimensions. No power plant will be required.

Ground has been broken for extensive improvements to the plant of the Illinois Steel Co. at Chicago, to cost $2,000,000. A new universal mill will be erected on the plot of ground extending from 82d to 83d St., and from Ontario Ave. to the lake. The plant will include blast furnaces and rolling mills.

The Standard Food Co., Binghamton, N. Y., contemplates erecting buildings of the following dimensions to replace its recently burned plant: 3-story, 134x44-ft.; 2-story, 28x64, 22x36 and 24x34 ft. The company will be in the market for a 200-H.-P. engine and 250-H.-P. in boilers.

The Gleason-Tiebout Glass Co., 93-99 Commercial St., Brooklyn, N. Y., has let contract for mason work for new plant to John T. Woodruff, Long Island City, N. Y.; for furnaces and lehrs, to H. L. Dixon, Pittsburg; for floors of the Ransome system to the Turner Construction Co., New York, and for structural iron, to Henry C. Fisher, Brooklyn. An engine of not more than 150-H.-P. will be installed and boilers of much larger capacity.

The Magneto Electric Co., Amsterdam, N. Y., is erecting a second factory building. The new building is to be 60x200 ft. The structural steel is on the ground, and the contracts let for brick and carpenter work. The machinery is to be motor driven. It is expected that the Corliss engine and 125-Kw. generator in the present building will supply the power for the additional building.

The Gaithersburg, Md., Milling & Mfg. Co., whose plant was recently burned, will erect a 2-story, 35x100-ft. warehouse and a 90x50-ft. mill and storage building. The capacity of the plant will be 225 bbls. flour and 1,000 bu. meal.

The Grand Rapids, Mich., Engraving Co. is in the market for heating and sprinkler systems.

Plans and specifications for the foundations and superstructure of the mills of the American Sault Paper Co., Sault Ste. Marie, Mich., can be seen there or at the office of Joseph H. Wallace, Engineer, Temple Court Bldg., New York. Copies can be borrowed from the latter on deposit of $25, refunded on their return. Bids for the work, estimated to cost $750,000, will be received by Mr. Wallace until July 15.

MISCELLANEOUS.

Huntington, Ind.—The Bd. of Review, appointed by the Comrs. of Huntington and Allen Counties, have decided to recommend the construction of Little River ditch, which will drain lands along the Wabash R. R. between this city and Ft. Wayne. The course of Little River will be slightly altered, and the channel in places will be widened and broadened.

Tipton, Ind.—Bids are wanted July 11 for constructing ditch No. 303, in all about 4,100 ft. A. W. Gott, Co. Surv.

Auburn, Ind.—It is stated that plans are now ready for the construction of a large ditch in De Kalb County. H. D. Boozer, Auditor; C. P. Hammon, Engr.

Bossier City, La.—Bids will be received July 2 by the Bd. of Comrs. of Bossier Levee Dist. for constructing the following levees: Rough and Ready levee, approximately 60,000 cu. yds., and Scopini levee, approximately 80,000 cu. yds., in the Parish of Bossier. T. N. Braden, Secy., Curtis.

Haverhill, Mass.—The Standard Oil Co. will erect storage tanks, making Haverhill a distributing station.

Baltimore, Md.—Bids will be received July 1 by the Bd. of Awards for reconstructing quarantine wharf. Robt. McLane, Pres. N. H. Hutton, Harbor Engr.

New York, N. Y.—The bids opened by the Dept. of Docks and Ferries on June 15 for dredging East and Harlem Rivers, and for furnishing and delivering rip-rap stone, have been rejected; also for furnishing and delivering granite stones for bulkhead and river wall, opened June 16.

The call for bids for building a new pier, with appurtenances, near the ft. of Peck Slip, East River, to be known as Pier No. 19, which were to have been received by Dept. of Docks and Ferries on June 24, has been withdrawn.

Bids will be received July 7 by McDougall Hawkes, Comr. of Docks, for furnishing and delivering 1,000 piles.

Brooklyn, N. Y.—Bids will be received July 8 by J. Edw. Swanstrom, Boro. Pres., for dredging Gowanus Canal, 30,000 cu. yds.; Wallabout Canal, 11,000 cu. yds.; East River, foot of Division Ave., 2,000 cu. yds.; Newtown Creek, foot of Metropolitan Ave., 2,000 cu. yds.

New York, N. Y.—Bids will be received July 2 by the Bd. of Park Comrs. for furnishing and erecting wrought iron picket fences and three-rail pipe fences in Hamilton Fish Park. Wm. R. Willcox, Chmn.

Albany, N. Y.—It is stated that bids will be received until July 1 by Chas. S. Boyd, Supt. Pub. Wks., Albany, for raising and completing Battle Island dam on Oswego River.

*Items marked thus give the names of parties awarded contracts.

Buffalo, N. Y.—The Buffalo Dredging Co. has secured the contract for building the canal and slip to be constructed by the Buffalo & Susquehanna Iron Co., the Buffalo & Susquehanna Ity. Co. and the Pennsylvania R. R. The canal will be 3,900 ft. long, 200 ft. wide and 23 ft. deep; contract reported to amount to $1,000,000.

Chattanooga, Tenn.—J. F. Ferger & Bro., agents for Stone Fort Land Co., write that E. A. Wilson, of Knoxville, has secured the contract for excavating about 30,000 cu. yds. (bids opened May 12) for $21,000.

St. Thomas, Ont.—Bids will be received July 4 by S. O. Perry, City Treas., for $24,950 local improvement bonds; also $8,000 park bonds.

Montreal, Que.—The Dominion Bridge Co., of Montreal, is stated to have secured the contract for erecting the steel superstructure of St. Dennis St. subway, for $13,850.

BUSINESS NOTES.

The Commercial Electric Co., Indianapolis, Ind., has removed to its new plant at 21st St. and Northwestern Ave. The capacity of the present plant is fully four times that of the old plant, but the rapid increase in orders makes it necessary to further extend the plant as soon as possible.

Owing to a large increase in business during the past year, the Graton & Knight Mfg. Co., Worcester, Mass., belt maker, is putting up a 1½-story, 120x65-ft. leach house and a 5-story, 200x60-ft. building, both of heavy mill construction.

The Ball Engine Co., Erie, Pa., reports the following among recent orders: Collins Sugar Co., Fort Collins, Colo., three self-oiling engines of 725-H.-P., direct-connected to Crocker-Wheeler generators; S. W. Card Mfg. Co., Mansfield, Mass., a 100-H.-P. self-oiling engine for electrical purposes.

A patent has just been granted to Minneapolis engineers for maturing Portland and other hydraulic cements. The process, which is auxiliary to the present method of manufacture, is stated to be inexpensive and to enable the maker to put perfectly matured cement direct from the screens into the cars. The process is the joint invention of H. A. Gerdes, inspector of cements for the city; F. W. Cappelen and Eiftman & Cull, mining engineers.

The York Mfg. Co., York, Pa., reports the receipt of the following orders: Arkansas Cold Storage & Ice Co., Fayetteville, Ark., two 40-ton refrigerating machines and a 15-ton ice-making plant; Effingham, Ill., Cold Storage Co., a 30-ton refrigerating machine and a 10-ton ice-making plant; High Springs, Fla., Electric & Ice Mfg. Co., 10-ton ice-making plant; Weber & Klump, Perryville, Mo., 10-ton ice-making plant; Shepard Co., Providence, R. I., 10-ton refrigerating plant; Afield & Co., Snyder, Okla. T., 25-ton ice-making plant; Hershey Chocolate Co., Derry Church, Pa., two 40-ton refrigerating plants; Lorain & Elyria Ice & Coal Co., Lorain, O., 50-ton ice-making plant; Compania de Alumbrado Electrico, San Salvador, West Indies, 5-ton brine plate ice-making plant; Ager-Cross Co., Buenos Aire, 1-ton ice-making plant.

PROPOSALS OPEN.

Bids Close.	WATER WORKS.	See Eng. Record.
Jun. 30.	Jersey City, N. J.	Jun. 27
Jun. 30.	Chicago, Ill.	Jun. 27
Jun. 30.	South Deerfield, Mass.	Jun. 27
Jun. 30.	Hanley Falls, Minn.	Jun. 20
Jun. 30.	New Bremen, O.	Jun. 20
Jul. 1.	Fredericksburg, Ia.	Jun. 20
Jul. 1.	Alexander City, Ala.	Jun. 20
Jul. 1.	Richmond, Va.	Jun. 20
Jul. 1.	Battle Creek, Ia.	Jun. 20
Jul. 1.	Pump, etc., Sioux City, Ia.	Jun. 13
Jul. 1.	West Point, Va.	May 23
Jul. 2.	Chicago, Ill.	Jun. 27
Jul. 6.	Perth Amboy, N. J., Adv. Jun. 27.	Jun. 27
Jul. 6.	Stuart, Neb.	Jun. 27
Jul. 6.	Kiester, Minn.	Jun. 27
Jul. 6.	Sacramento, Cal., Adv. Jun. 13.	Jun. 13
Jul. 7.	Weissport, Pa., Adv. Jun. 27.	Jun. 27
Jul. 7.	Santa Rosa, Cal.	Jun. 20
Jul. 7.	Reading, Pa., Adv. Jun. 6 to 20.	Jun. 6
Jul. 8.	Alexandria Bay, N. Y., Adv. Jun. 27.	Jun. 27
Jul. 8.	Needham, Mass., Adv. Jun. 27.	Jun. 27
Jul. 10.	Exira, Ia.	Jun. 20
Jul. 10.	Sioux City, Ia., Adv. Jun. 13, 20.	Jun. 20
Jul. 11.	Sioux Falls, S. D.	Jun. 27
Jul. 13.	Yazoo City, Miss.	Jun. 20
Jul. 15.	Great Falls, Mont.	Jun. 27
Jul. 15.	Mt. Airy, N. C.	Jun. 20
Jul. 15.	Dallas, Tex., Adv. Jun. 20, 27.	Jun. 20
Jul. 15.	San Antonio, Tex.	Jun. 20
Jul. 15.	Irrig. Work, Reno, Nev. Adv. Jun. 13 to 27.	Jun. 13
Jul. 15.	Balsted, Minn.	May 30
Jul. —	West Manchester, O.	May 30
Aug. 8.	Washington, D. C.	Jun. 20
———	Pickens, Miss.	Jun. 20

SEWERAGE AND SEWAGE DISPOSAL.

Jun. 29.	Cincinnati, O.	Jun. 6
Jun. 30.	New York, N. Y.	Jun. 20
Jun. —	Little Rock, Ark.	May 30
Jun. —	Ballard, Wash.	May 9
Jul. 1.	Hartford, Conn.	Jun. 27
Jul. 1.	New York, N. Y.	Jun. 27
Jul. 1.	Williamsport, Pa.	Jun. 27
Jul. 1.	Geneva, O.	May 30
Jul. 2.	Port Arthur, Ont.	Jun. 27
Jul. 2.	Newark, N. J., Adv. Jun. 27.	Jun. 27
Jul. 2.	Oshkosh, Wis.	Jun. 27
Jul. 2.	Geneva, O.	Jun. 20
Jul. 2.	Cleveland, O.	Jun. 20
Jul. 3.	Millville, N. J., Adv. Jun. 27.	Jun. 27
Jul. 4.	Uniontown, Pa.	Jun. 27
Jul. 6.	Fairmount, Ind.	Jun. 27
Jul. 6.	Johnstown, N. Y., Adv. Jun. 27.	Jun. 20
Jul. 6.	Devils Lake, N. D.	Jun. 27
Jul. 7.	Summit, N. J., Adv. Jun. 20, 27.	Jun. 20
Jul. 7.	Harrison, N. J.	Jun. 27
Jul. 7.	Birmingham, Ala.	Jun. 27
Jul. 8.	Emmetsburg, Ia.	Jun. 27
Jul. 8.	Alexandria Bay, N. Y., Adv. Jun. 27.	Jun. 27
Jul. 10.	North Vernon, Ind.	Jun. 27
Jul. 13.	Bond Hill, O.	Jun. 27
Jul. 13.	Yazoo City, Miss.	Jun. 20
Jul. 13.	Wabash, Ind.	Jun. 13
Jul. 15.	Ashland, Wis. —.	Jun. 27
Jul. 20.	Atlanta, Ga., Adv., Jun. 13 to 27.	Jun. 13

BRIDGES.

Jun. 30.	Winnipeg, Man.	Jun. 27
Jun. 30.	Newark, N. J., Adv. Jun. 20, 27.	Jun. 20
Jun. 30.	Sioux City, Ia.	Jun. 27
Jun. 30.	Pikeville, Ky.	Jun. 13
Jul. 1.	Waupaca, Wis.	Jun. 27
Jul. 1.	New York, N. Y.	Jun. 27
Jul. 1.	Cleveland, O.	Jun. 13
Jul. 1.	Hartford, Conn., Adv. Jun. 13.	Jun. 13
Jul. 1.	Ottawa, O.	Jun. 6
Jul. 2.	Boston, Mass.	Jun. 27
Jul. 2.	Duluth, Minn.	Jun. 20
Jul. 2.	New York, N. Y.	Jun. 20
Jul. 3.	Deerfield, Mich.	Jun. 20
Jul. 4.	North Easthope, Ont.	Jun. 27
Jul. 6.	Westshoals, Ind.	Jun. 27
Jul. 6.	Newport, Ind.	Jun. 27
Jul. 6.	Montesano, Wash.	Jun. 27
Jul. 6.	Natchez, Miss.	Jun. 20
Jul. 7.	San Jose, Cal.	Jun. 27
Jul. 7.	Stockton, Cal.	Jun. 27
Jul. 7.	Anderson, Ind.	Jun. 20
Jul. 8.	San Rafael, Cal.	Jun. 27
Jul. 8.	Madison, Ind.	Jun. 27
Jul. 8.	Vale, Ore.	Jun. 20
Jul. 8.	McKeesport, Pa.	Jun. 20
Jul. 9.	Rockville, Ind.	Jun. 27
Jul. 10.	Castlewood, S. D.	May 2
Jul. 13.	Fairmount, Minn.	Jun. 27
Jul. 13.	Chillicothe, O.	Jun. 27
Jul. 15.	Olympia, Wash.	Jun. 27
Jul. 15.	Bluffton, Ind.	Jun. 27
Jul. 21.	Mishawaka, Ind.	Jun. 27
Jul. 25.	Washington, D. C., Adv. Jun. 20, 27.	Jun. 13
Jul. 25.	Cincinnati, O.	Jun. 27

PAVING AND ROADMAKING.

Jun. 29.	Paterson, N. J.	Jun. 20
Jun. 29.	Cincinnati, O.	Jun. 6
Jun. 30.	Newburgh, N. Y.	Jun. 27
Jun. 30.	New York, N. Y.	Jun. 30
Jun. 30.	Davenport, Ia.	Jun. 27
Jun. 30.	Three Rivers, Mich., Adv. Jun. 20.	Jun. 20
Jun. —	Charlevoix, Mich.	May 30
Jul. 1.	Chicago, Ill.	Jun. 27
Jul. 1.	New York, N. Y.	Jun. 27
Jul. 1.	New Brunswick, N. J.	Jun. 20
Jul. 1.	Cleveland, O.	Jun. 6
Jul. 2.	New York, N. Y.	Jun. 27
Jul. 2.	Buffalo, N. Y.	Jun. 27
Jul. 2.	Bowling Green, O.	Jun. 20
Jul. 2.	Oshkosh, Wis.	Jun. 13
Jul. 2.	Roanoke, Va.	Jun. 13
Jul. 3.	Washington, D. C. (2 Prop.) Adv. Jun. 27.	Jun. 27
Jul. 3.	Rensselaer, N. Y.	Jun. 20
Jul. 6.	Michigan City, Ind.	Jun. 20
Jul. 6.	English, Ind.	Jun. 27
Jul. 6.	Indianapolis, Ind.	Jun. 27
Jul. 6.	Kalamazoo, Mich., Adv. Jun. 27.	Jun. 27
Jul. 6.	Canonsburg, Pa., Adv. Jun. 27.	Jun. 27
Jul. 6.	New Albany, Ind.	Jun. 27
Jul. 6.	Webster Groves, Mo.	Jun. 27
Jul. 6.	Menominee, Mich., Adv. Jun. 20, 27.	Jun. 20
Jul. 6.	Warrensburg, Mo.	Jun. 27
Jul. 6.	Columbus, Ind.	Jun. 20
Jul. 6.	Niagara Falls, Ont., Adv. Jun. 13.	Jun. 13
Jul. 7.	New York, N. Y.	Jun. 27
Jul. 7.	Wilmington, Del.	Jun. 27
Jul. 7.	South Bend, Ind.	Jun. 27
Jul. 7.	Portsmouth, O.	Jun. 20
Jul. 7.	Paoli, Ind.	Jun. 20
Jul. 7.	Alexandria, La.	Jun. 20
Jul. 7.	Versailles, Ind.	Jun. 13
Jul. 8.	Verona, Pa.	Jun. 27
Jul. 8.	Providence, R. I.	Jun. 27
Jul. 8.	Cleveland, O.	Jun. 20
Jul. 9.	Delphi, Ind.	Jun. 27
Jul. 9.	Bryan, O.	Jun. 20
Jul. 9.	Cleveland, O.	Jun. 20
Jul. 10.	Loraln, O.	Jun. 20
Jul. 10.	Rensselaer, Ind.	Jun. 13
Jul. 13.	Ashland, Wis.	Jun. 27
Jul. 13.	Wabash, Ind.	Jun. 13
Jul. 14.	Dayton, O.	Jun. 20
Jul. 15.	Ashland, Wis.	Jun. 27
Jul. 15.	Kane, Pa., Adv. Jun. 20, 27.	Jun. 20
Jul. 15.	Columbus, Ind.	Jun. 27
Jul. 20.	Houston, Tex.	Jun. 27
Jul. —	Jacksonville, Ill.	Jun. 27

POWER, GAS AND ELECTRICITY.

Jul. 6.	Salem, Ore.	Jun. 6
Jul. 7.	Mifflinburg, Pa.	Jun. 13
Jul. 10.	Anderson, Ind.	Jun. 27
Jul. 10.	Winder, Ga.	Jun. 13
Jul. 13.	Yazoo City, Miss.	Jun. 20
Jul. 14.	Toronto, Ont., Adv. Jun. 13 to 27.	Jun. 13
Jul. 14.	Independence, Wis.	Jun. 27
Jul. 15.	Mt. Airy, N. C.	Jun. 20
Sep. 1.	Corona, Cal.	May 16
———	Ozark, Ala.	Jul. 27
———	Horseheads, N. Y.	Jun. 13

GOVERNMENT WORK.

Jun. 29.	West Point, N. Y.	Jun. 20
Jun. 30.	Philadelphia, Pa. Adv. May 16, 23, Jun. 13.	May 16
Jun. 30.	New Orleans, La. Adv. May 9, 16, Jun. 20, 27.	May 9
Jul. 1.	Memphis, Tenn., Adv. Jun. 6, 13.	Jun. 6
Jul. 1.	New Orleans, La.	Jun. 6
Jul. 6.	Norwich, Conn.	Jun. 13
Jul. 6.	Benicia, Cal.	Jun. 13
Jul. 6.	Watervliet, N. Y.	Jun. 13
Jul. 7.	Washington, D. C., Adv. Jun. 20, 27.	Jun. 20
Jul. 7.	Johnson City, Tenn. Adv. Jun. 13 to 27.	Jun. 13
Jul. 7.	Vancouver Barracks, Wash.	Jun. 20
Jul. 8.	Memphis, Tenn.	Jun. 27
Jul. 8.	Jefferson Barracks, Mo.	Jun. 20
Jul. 8.	Waco, Tex.	Jun. 13
Jul. 9.	Ft. McPherson, Ga., Adv. Jun. 13 to 27.	Jun. 13
Jul. 9.	Ft. D. A. Russell, Wyo.	Jun. 13
Jul. 10.	New York, N. Y., Adv. Jun. 13 to 27.	Jun. 13
Jul. 11.	Ft. Mitchie, N. Y.	Jun. 20
Jul. 11.	Ft. Stevens, Ore.	Jun. 20
Jul. 13.	Wilmington, Del., Adv. Jun. 20 to 27.	Jun. 20
Jul. 14.	Winston, N. C., Adv. Jun. 13, 20.	Jun. 13
Jul. 15.	Ft. Des Moines, Ia., Adv. Jun. 20, 27.	Jun. 20
Jul. 15.	Ft. Ringgold, Tex.	Jun. 27
Jul. 15	Ft. Bradford, R. I.	Jun. 13
Jul. 16.	Norfolk, Va., Jun. 20, 27.	Jun. 20
Jul. 16.	Waterbury, Conn.	Jun. 20
Jul. 17.	Ashtabula, O., Adv. Jun. 20, 27.	Jun. 20
Jul. 17.	Ft. Douglas, Utah.	Jun. 13
Jul. 18.	Detroit, Mich., Adv. Jun. 20, 27.	Jun. 20
Jul. 18.	Philadelphia, Pa., Adv. Jun. 20, 27.	Jun. 20
Jul. 19.	Ft. Fremont., S. C.	Jun. 27
Jul. 20.	Ft. McKinley, Me., Adv. Jun. 27.	Jun. 27
Jul. 20.	National Military Home, Kan.	Jun. 13
Jul. 21.	Charleston, S. C., Adv. Jun. 27.	Jun. 27
Jul. 21.	Ft. Michie, N. Y., Adv. Jun. 27.	Jun. 27
Jul. 22.	Grand Rapids, Mich., Adv. Jun. 27.	Jun. 27
Jul. 23.	Rossfork, Idaho	Jun. 20
Jul. 23.	Detroit, Mich., Adv. Jun. 27.	Jun. 27
Jul. 24.	Los Angeles, Cal., Adv. Jun. 27.	Jun. 27
Jul. 25.	Norfolk, Va.	Jun. 13
Jul. 27.	Centerville, Ia.	Jun. 27
Sep. 14.	Providence, R. I.	May 30

BUILDINGS.

Jun. 29.	School, Pittsburg, Pa.	Jun. 20
Jun. 29.	School, Triadelphia, W. Va.	Jun. 20
Jun. 29.	School, New Brighton, N. Y.	Jun. 20
Jun. 29.	School, Long Island City, N. Y.	Jun. 20
Jun. 29.	School, New York, N. Y.	Jun. 20
Jun. 29.	School, Brooklyn, N. Y.	Jun. 20
Jun. 29.	Bank, Atlanta, Ga.	Jun. 20
Jun. 29.	School, Glenville, O.	Jun. 6
Jun. 30.	School, Boston, Mass.	Jun. 27
Jun. 30.	Engine house, New Bedford, Mass.	Jun. 27
Jun. 30.	Library, Wilmington, O.	Jun. 20
Jun. 30.	School, Mansfield, O.	Jun. 13
Jun. 30.	School, Plainview, Minn.	Jun. 6
Jul. 1.	Library, Bayfield, Wis.	Jun. 27
Jul. 1.	Hospital, West Roxbury, Mass.	Jun. 27
Jul. 1.	School, Topeka, Kan.	Jun. 27
Jul. 1.	Library, Binghamton, N. Y.	Jun. 27
Jul. 1.	Hospital, Utica, N. Y.	Jun. 20
Jul. 1.	Jail, Waco, Tex.	Jun. 20
Jul. 1.	Church, Emmetsburgh, Md.	Jun. 20
Jul. 1.	School, Center Point, Ia.	Jun. 20
Jul. 1.	Library, Cleveland, O.	Jun. 20
Jul. 1.	Library, Perry, Ia.	Jun. 20
Jul. 1.	Court house, Brooklyn, N. Y.	Jun. 20
Jul. 1.	Hospital, Rochester, N. Y. Adv. June 13, 20.	Jun. 13
Jul. 1.	Hospital, Raybrook, N. Y.	Jun. 20
Jul. 1.	Police Station, Newark, N. J.	Jun. 27
Jul. 1.	Bus. Bldg., Toledo, O.	Jun. 13
Jul. 1.	Library, Binghamton, N. Y. Adv. Jun. 6 to 20.	Jun. 6
Jul. 1.	Court house, Boonville, Ind.	May 30
Jul. 1.	Court house, Carnesville, Ga.	May 30
Jul. 2.	Police Station, Norfolk, Va.	Jun. 27
Jul. 2.	Hospital, Yountville, Cal.	Jun. 20
Jul. 2.	School, Springfield, O.	Jun. 13
Jul. 3.	School, Buffalo, N. Y.	Jun. 27
Jul. 6.	Court house, Sanger, N. D.	Jun. 27
Jul. 5.	Flat, Crawfordsville, Ind.	Jun. 20
Jul. 5.	Store, Lebanon, Ind.	Jun. 20
Jul. 6.	Infirmary, Battle Creek, Mich.	Jun. 27
Jul. 6.	Court house, Port Gibson, Miss.	Jun. 27
Jul. 6.	Court house, Stillwater, Nev.	Jun. 27
Jul. 6.	City Hall, Cincinnati, O.	Jun. 27
Jul. 6.	School, Long Island City, N. Y.	Jun. 27
Jul. 6.	Dormitory, San Bernardino, Cal.	Jun. 27
Jul. 6.	School, Perry, Ind.	Jun. 27
Jul. 6.	Schools, New York, N. Y.	Jun. 27
Jul. 6.	School, Springfield, Mass.	Jun. 20
Jul. 6.	School, Youngstown, O.	Jun. 20
Jul. 6.	Engine House, Houston, Tex.	Jun. 20
Jul. 6.	Administrat'n Bldg., Farmington, Mo.	Jun. 20
Jul. 7.	Jail, Warren, Pa.	Jun. 27
Jul. 7.	Library, Lawrence, Kan.	Jun. 27
Jul. 7.	Pub. Bldg., Dedham, Mass.	Jun. 27
Jul. 7.	Asylum, Little Rock, Ark.	Jun. 20
Jul. 7.	Bank, Moundsville, W. Va.	Jun. 20
Jul. 8.	Jail, Dillon, Mont.	Jun. 27
Jul. 8.	Armory, New York, N. Y.	Jun. 27
Jul. 8.	Pavilion, New York, N. Y.	Jun. 20
Jul. 8.	County House, Marshall, Mich.	Jun. 20
Jul. 8.	Pub. Bldg., Kingfisher, Okla. Ter.	Jun. 20
Jul. 8.	Jail, Napoleon, N. D.	May 2
Jul. 9.	School, Oceanic, N. J.	Jun. 27
Jul. 11.	School, Wilmington, O.	Jun. 20
Jul. 12.	School, Des Moines, Ia.	Jun. 27
Jul. 13.	School, Cleveland, O.	Jun. 27
Jul. 13.	Court house, Farmersville, La.	Jun. 27
Jul. 13.	Poorhouse, North Branch, Minn.	Jun. 27
Jul. 13.	Court House, La Grange, Ga.	May 9
Jul. 14.	School, Mansfield, O.	Jun. 27
Jul. 14.	School, Rapid City, S. D.	Jun. 27
Jul. 14.	Pub. Bldgs., Indianapolis, Ind.	Jun. 20
Jul. 15.	Hospital, New York, N. Y.	Jun. 27
Jul. 15.	Court house, Corunna, Mich.	Jun. 27
Jul. 15.	Hospital, Newberry, Mich.	Jun. 27
Jul. 15.	Industrial Home, Delaware, O.	Jun. 27
Jul. 15.	College, Ft. Collins, Colo.	Jun. 20
Jul. 15.	Court house, Booneville, Ind.	Jun. 13
Jul. 15.	School plans, Washington, D. C.	Jun. 13
Jul. 16.	Library, West Hoboken, N. J.	Jun. 27
Jul. 21.	Reformatory, Mansfield, O.	Jun. 27
Jul. 25.	Bldgs., Wahpeton, N. D.	Jun. 27
Jul. 28.	Sanitarium, Hot Springs, S. D. Adv. Jun. 27.	Junfi 27
Jul. —	Jail, Jackson, Miss.	Jun. 6
Aug. 12.	Capitol, Bldg., Little Rock, Ark.	Jun. 27
———	Capitol Improv., Lansing, Mich. Adv. Jun. 20, 27.	Jun. 20

MISCELLANEOUS.

Jun. 29.	Ditch, Jefferson, Ia.	Jun. 6
Jun. 30.	Ditches, Minnesota, Minn.	Jun. 20
Jun. 30.	Cement, Regina, N. W. T.	Jun. 20
Jul. 1.	Wharf, Baltimore, Md.	Jun. 27
Jul. 1.	Dam, Albany, N. Y.	Jun. 27
Jul. 2.	Fences, New York, N. Y.	Jun. 27
Jul. 2.	Levees, Bossier City, La.	Jun. 27
Jul. 6.	Ditch, Charleston, Mo., Adv. Jun. 20.	Jun. 20
Jul. 6.	Breakwater, Ellensburg, Wash.	Jun. 20
Jul. 6.	St. Sweeper, Great Falls, Mont.	Jun. 20
Jul. 7.	Piles, New York, N. Y.	Jun. 27
Jul. 7.	El. Ry., San Jose, Cal.	Jun. 13
Jul. 7.	Tunnel, Boston, Mass. Adv. Jun. 20, 27.	Jun. 20
Jul. 8.	Dredging, Brooklyn, N. Y.	Jun. 27
Jul. 8.	River Work, Lorain, O.	Jun. 20
Jul. 11.	Ditch, Tipton, Ind.	Jun. 27
Jul. 14.	Steel shed, New Orleans, La. Adv. Jun. 20, 27.	Jun. 20
Jul. 14.	St. Ry. franchise, Monterey, Cal.	Jun. 20
Jul. 21.	El. Ry., Covina, Cal.	Jun. 20
Jul. —	Levee, West Memphis, Ark.	Jun. 6
Jul. —	Removal of earth, Camden, N. J.	May 30
Dec. 15.	R. R. work, Santiago De Chili, Chili.	Jun. 13
———	Ry. Work, Ravenna, O.	Jun. 20
———	R. R. Work, Cape Breton, N. S.	Jun. 27
May 2, '04.	R. R., Oodnadatta, So. Australia.	Feb. 21

*Items marked thus give the names of parties awarded contracts.

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